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NATIONAL INSTITUTE OF INDUSTRIAL PROPERTY

Final Report IP BRICS Offices

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Authors:

Luciano Lauand Viana de Paula

Marcos Patricio dos Santos Júnior

Pedro Leal de Lima Soares

Reviewers:

Arthur Henrique Goes Samary

Elias Lawrence Marques

Bernardo Seelig

Advisor:

Vagner Luis Latsch

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CONTENT

1. INTRODUCTION 4
2. OBJECTIVE 4
3. METHODOLOGY 4
4. SUMMARY OF DELIVERY 5
   4.1 Report on patent application filing trend 5
   4.2 Compilation of questionnaire answers on AI-related inventions 6
5. MAIN TOPICS RELATED TO AI 7
   5.1 Eligibility 7
   5.2 Inventive Step 8
      5.2.1 Person skilled in the art 9
      5.2.2 State of the art documents 10
      5.2.3 Obviousness for a person skilled in the art 11
   5.3 Sufficiency of Disclosure 13
      5.3.1 Database structures 14
      5.3.2 Black box 14
      5.3.3 General aspects 15
6. FINAL CONSIDERATIONS 16
7. ANNEX I - Case Studies on AI-Related Inventions 17
8. ANNEX II - Analysis of case studies on AI-Related Inventions 67
   8.1 Definition of Case Studies 67
   8.2 Eligibility Cases 68
   8.3 Inventive Step Cases 75
   8.4 Cases of sufficiency of disclosure 80

1. INTRODUCTION

IP BRICS patent offices have sought to establish discussions on the necessary adjustments to make the patent system compatible in the context of the Fourth Industrial Revolution (Industry 4.0), mainly for inventions related to artificial intelligence (AI).

In this scenario, the cooperation established between the IP BRICS members has promoted positive results in the sense of identifying which parts of the documental framework (guidelines, manuals, normative instructions, among others) have the potential for an updating process, seeking to improve the main concepts of the patent system in this new reality of the contemporary world.

This final report seeks to address the most relevant information shared among IP BRICS members throughout this project.

2. OBJECTIVE

The objective of this final report is to identify the main similarities and differences in the documentation used for the patent granting process and the examination practices in the IP BRICS patent offices, related to the area of Artificial Intelligence, in this way aiming at subsidizing future improvements of the documental framework (guidelines, manuals, normative instructions, among others). In addition, the deliverables made throughout the project will be briefly presented.

3. METHODOLOGY

The proposed methodology has an exploratory character, mainly aiming to understand the concepts related to the main topics evaluated in the technical examination of a patent application involving the thematic of artificial intelligence (AI), within the scope of the IP BRICS offices, such as: eligibility, patentability and sufficiency of disclosure. The proposed methodology can be divided into three parts, which complement one another.

The first part was carried out through an overview of the main deliverables carried out in the context of the project, such as: (i) Questionnaire on AI-Related Inventions; (ii) Report on patent application filing trend for inventions involving AI; (iii) Comparative table with information contained in the questionnaire answers.

The second part consisted of identifying the main topics related to the results covered in the first part, making it possible to carry out an overview of each of the most relevant topics: (i) Eligibility; (ii) Inventive Step; (iii) Sufficiency of Disclosure.

Lastly, the third part presented the final considerations.

4. SUMMARY OF DELIVERY

The project established, through a schedule, the delivery of some activities necessary for the fulfillment of the proposed objectives. Part of the deliveries have already been forwarded to the IP BRICS member countries, as they will be addressed in the content within items 4.1 and 4.2, and the deliveries still pending are part of this final report, which will be covered in items 5, 6 and 8.

4.1 Report on patent application filing trend

The objective of the trend report was to identify patent applications related to the area of Artificial Intelligence in the IP BRICS member countries, in order to understand the landscape of patent applications related to AI. This study was of fundamental importance to identify the current scenario and support the next steps of the project. In this context, the trend report presented the following topics:

- Number of patent applications related to Artificial Intelligence;
- The evolution of the number of AI patent applications;
- The main applicants in the field of AI;
- The most active sub-areas involving Artificial Intelligence patent applications.

The data used for the elaboration of the "Report on Trends in Patent Applications for AI-Related Inventions" were obtained through a search in the Derwent Innovation® database. In the search strategy, it focused mainly on the use of patent classification codes with Cooperative Patent Classification (CPC), International Patent Classification (IPC), File forming term (F-terms) and File Index (FI), in addition to words to mitigate the inclusion of documents unrelated to the topic.

The results obtained haven't been verified by all the partners and may present a certain degree of divergence when compared with the official data of each office and other similar reports present in the literature. This is due to several factors, such as the use of different databases, the classification system adopted in each country, the degrees of indexing of documents from each country in the database used, and some others.

Despite the possible divergence in absolute values, the trends found are in line with the result of other similar reports, such as the WIPO (World Intellectual Property Organization) report on artificial intelligence[1], which presents a study on Artificial Intelligence, involving patents, scientific publications, data on fusion/acquisition of companies and litigation in this technological area.

In the "Report on Trends in Patent Applications for AI-Related Inventions", prepared by INPI, around 480,000 patent applications related to Artificial Intelligence were identified in the five countries that make up the IP BRICS. In addition, it was possible to notice that the CNIPA (China National Intellectual Property Administration) has the largest number of patent applications, representing about 93% of the volume of patent applications related to AI. The CGPDTM

[1] WORLD INTELLECTUAL PROPERTY ORGANIZATION, "WIPO Technology Trends 2019 – Artificial Intelligence," Wipo, Geneva, 2019

(Controller General of Patents, Designs & Trade Marks – Government of India) ranks second in terms of volume of patent applications, followed by ROSPATENT (Federal Service for Intellectual Property of the Russian Federation), INPI and CIPC (Companies and Intellectual Property Commission - South African Government).

The report then performed a segmentation of the study by classification based on the subclass levels of AI-related patent applications filed in each of the IP BRICS member countries. In this scenario, it was possible to verify that the highest incidence of patent applications occurs in the following technical sectors: Electronics, Electrical, Telecommunications and Health.

In order to identify the companies and institutions that were leading the development of AI, the trend report showed the main applicants of patent applications related to AI among IP BRICS member countries. This report pointed out that the majority of applicants are foreign companies for the INPI, ROSPATENT, CGPDTM and CIPC, but this differs from the results found in the case of the CNIPA. Unlike the other members of the group, the largest applicants for patent applications related to AI in the CNIPA are national, also having relevance for universities and research centers.

Thus, through the report, a trend towards an increase in the volume of patent applications involving AI was identified. Furthermore, it was possible to infer that patent applications in the area of AI will be present in the different technical areas that exist today, that is, such patent applications will possibly permeate all technological fields.

Therefore, it was identified the need for a more robust evaluation of the documentation (guidelines, manuals, normative instructions, among others) currently used for the technical examination of patent applications. Based on the survey motivated by the trend report, a questionnaire was developed to identify how the IP BRICS member countries were incorporating AI-related issues into the documentation was considered extremely relevant.

4.2 Compilation of questionnaire answers on AI-related inventions

The questionnaire was part of the step of identifying how IP BRICS members examine patent applications related to inventions using Artificial Intelligence (AI), seeking to assess the main topics, as well as detecting the documentation that is being used to address AI-related inventions. The questions prepared were grouped into the following themes:

- General questions about AI-related inventions;
- Inventor definition;
- Identification of the person skilled in the art;
- Approach related to eligibility;
- Assessment of patentability requirements (novelty, inventive step and industrial application);
- Considerations on the condition of sufficiency of disclosure.

The results obtained with the questionnaire allowed the elaboration of a table comparing the answers provided by the IP BRICS offices, called “Comparisons Between Guidelines”. In this

table, we sought to identify the main topics used throughout the technical examination, as well as the identification of the existence/absence of guidelines for the treatment of the themes covered in the questions.

The analysis carried out, considering the compilation of the questionnaire answers, made it possible to identify the main points to be addressed during the analysis of an application for an AI-related technology, and, consequently, where it would be relevant for IP BRICS members to focus cooperation. Such topics are: eligibility; inventive step and sufficiency of disclosure. It was also possible to identify that the legal framework has different degrees of maturity in each of the topics listed.

5. MAIN TOPICS RELATED TO AI

5.1 Eligibility

The first aspect to be analyzed in a patent application is whether the matter being claimed is eligible, that is, whether it is susceptible to protection through the patent system. In this context, the industrial property laws of each country list a set of matters that cannot be protected by a patent, and these matters may vary from country to country.

Artificial intelligence (AI) encompasses mathematical concepts and models, which raises the question of eligibility regarding the possibility of being considered mathematical methods and consequently a subject excluded from protection through a patent.

Furthermore, AI can be defined as "software or hardware that can learn to solve complex problems, make predictions, or perform tasks that require human-like sensing (such as vision, speech, and touch), perception, cognition, planning, learning, communication or physical action"[2]. In this sense, considering the implementation via software, questions are raised regarding eligibility related to the framing of the subject of these patent applications as a computer program in itself, which in general is an ineligible subject.

Thus, in analyzing the eligibility of a claim on an AI-related creation, the most important items that must be checked in the claimed object are those that assess whether the claimed matter can be considered a mathematical method or computer program in itself.

In general, countries do not allow patenting of subject-matter considered to be a mathematical method or computer program. In the CNIPA, according to the exam guideline, the mathematical methods and the computer program itself are considered "rules and methods for mental activities" and not accepted according to the CNIPA patent law.

It should be noted that countries have been revising the Patent Examination Guidelines to bring greater legal reliability to the analysis of patent applications related to AI. As an example, the CNIPA (China National Intellectual Property Administration) had revised its Patent Examination Guidelines in 2019 and a new Section 6 was added into the Chapter 9, Part Ⅱ, referring to regulations about examination on patent application which contains characteristics of algorithm

[2] https://www.nist.gov/news-events/news/2019/07/nist-releases-draft-plan-federal-engagement-ai-standards-development

or business rules and methods, and this revision took effect on February 1, 2020. INPI in its latest update of the Computer Implemented Inventions (CII) Guidelines (INPI/PR nº 411/2020) (INPI-Diretrizes-CII, 2020) highlighted that: “Artificial intelligence (AI) techniques, including tools of machine learning and deep learning, among others, when applied to the solution of technical problems, can be considered an invention”.

In this context, there should be a clear difference between computer programs per se and computer implemented inventions.

Regarding mathematical methods, it was noticed at the beginning of the study that most members have mechanisms that suggest the understanding that a claim involving an AI technique needs to link a said technique to a technical field and a technical problem, in order to not be considered a mathematical method (or a rule or method for mental activity as described in the Chinese Bureau guidelines) or abstract conception, resulting in ineligibility.

With respect to computer implemented inventions, there is unanimous agreement that computer programs itself is not eligible.

- INPI – INPI PR 411 23/12/2020;
- ROSPATENT - Part II, Section V, item 2.4.1-2.4.43 Guidelines for Examination of Inventions; Art.1350 I5 Civil Code of the Russian Federation, Part II, Section V itens 2.4.34-2.4.36 – mathematical methods; 24.17-2.4.18 – mathematical methods and computer programs;
- CGPDTM – Section 3 of The Patents Act, 1970, CRI guidelines;
- CNIPA – Section 6, Chapter 9, Part II of “Guidelines for Patent Examination”;
- CIPC – Section 25(2), Section 25(3) of Patents Act.

In general, AI-related inventions use databases for training the algorithms used, and it is important to identify the limits of patent and copyright protection. Regarding data, data sets and databases (structures and/or content), the INPI's understanding is that the way in which a database is organized as well as the content of a database would be protected by the copyright law, but a method that uses a data structure or database can be considered subject-matter to patent protection. This view also seems to be supported by ROSPATENT, since from the answers obtained it indicates that databases are protected by copyright law. However, if a said database is one of the characteristics of a technical solution, the claimed matter can be protected by a patent of invention, in ROSPATENT. The CGPDTM reveals that there is no special protection in its guidelines for databases regarding their use in an Artificial Intelligence technique, while for both the CNIPA and the CIPC the legal provisions for data and databases involve laws of Copyright.

5.2 Inventive Step

In general, it is understood that for a patent to be granted, it must have a contribution to the state of the art in order to justify the granting of the right to exclude third parties from the commercialization of a given invention. Such contribution is formalized in the legal framework related to the Industrial Property of the countries in the form of the patentability requirements, especially the inventive step.

In the novelty requirement, normally, countries that adopt the concept of absolute novelty understand that a difference between the state of the art and the subject-matter claimed in the patent application is sufficient to meet the novelty requirement. Having met the novelty requirement, the difference in relation to the state of the art will be analyzed from the point of view of the inventive step requirement.

An invention will have an inventive step if, considering the documents in the state of the art, it presents a non-obvious contribution to a person skilled in the art. Thus, for the analysis of the inventive step, there are three important concepts that must be acknowledged:

- Identification of the person skilled in the art;
- Delimitation of the current state of the art; and
- Non-obviousness for a person skilled in the art.

Thus, to verify the possible impacts on the analysis of patent applications involving AI, it was considered important to verify separately whether such concepts are influenced by the presence of artificial intelligence and, later, the impacts on the analysis of the inventive step.

5.2.1 Person skilled in the art

Additionally, the CGPDTM pointed out that, in an AI-generated invention, the person skilled in the art can be considered an expert in the field of the invention being generated using AI.

Similarly, the South African office pointed out that, although this issue has not yet been decided internally, they would define the expert in the matter in relation to the same POSITA standard used for any other patent application, regardless of the field of application. The standard as defined by the EPO is currently used:

> The "person skilled in the art" should be presumed to be a skilled practitioner in the relevant field of technology, who possesses average knowledge and ability and is aware of what was common general knowledge in the art at the relevant date. They should also be presumed to have had access to everything in the "prior art", in particular the documents cited in the search report, and to have had at their disposal the means and capacity for routine work and experimentation which are normal for the field of technology in question. If the problem prompts the person skilled in the art to seek its solution in another technical field, the specialist in that field is the person qualified to solve the problem. The skilled person is involved in constant development in their technical field.

Regarding the topic, INPI, in its response, divided the topic into two possible scenarios, AI-assisted and AI-generated invention.

- AI-generated inventions - when the invention is fully generated by an AI, without human supervision.
- AI-assisted inventions - when the invention is generated by an AI, under human supervision.

Regarding AI-assisted inventions, INPI understands that the definitions of person skilled in the art are adequate. Whereas AI can be seen as "the means and capacity for routine work and experimentation" (i.e. AI is a tool used to create a new invention).

With respect to AI-generated inventions, choosing a person skilled in the art over a non-human inventor can lead to an unbalanced analysis of the patentability requirements of a patent application. However, we understand that this is a discussion for the future, as there are currently no inventions that fit into this scenario.

ROSPATENT pointed out that such aspects are not regulated by law.

In this context, the CNIPA indicated that there is no special provision for the person skilled in the art concept specific to patent applications involving AI.

Lastly, as pointed out by the CIPC, it should be noted that some researchers are of the opinion that AI can affect the level of a person skilled in the art, and that there are arguments for using a separate POSITA standard for inventions using AI, however such a separate standard could, in turn, affect the assessment of non-obviousness[3][4]. A similar understanding was presented by INPI, which indicated the need to periodically review this topic to verify that the concepts remain adequate.

5.2.2 State of the art documents

Regarding the documents belonging to the state of the art, it was questioned whether the content of the documents generated by an AI should be considered belonging to the state of the art for this field and if a problem was identified during the step of locating the documents belonging to the state of the art to such categories of patent application.

In the first topic, INPI, ROSPATENT and CNIPA pointed out that there is no reason to justify an exception of content or subject generated by AI from the state of the art. The CNIPA further highlighted that how the content or subject is generated has no direct impact on the definition of the state of the art. Whereas ROSPATENT warned that there is no method to distinguish AI-generated content from human-generated content.

On the other hand, the CGPDTM considered that such documents can be regarded as state of the art or not, depending on the specific AI being examined and under consideration. There may also be exceptions depending on the subject-matter of the patent application under analysis.

As for possible problems in surveying the state of the art for such types of patent application, INPI and CGPDTM did not identify problems. Similarly, the CIPC noted that, according to a USPTO study, most of the actors involved stated that there were no state of the art considerations

[3] pages 23-25, 37-38: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7366817/pdf/nihpp-3619069.pdf

[4] page 12: https://www.uspto.gov/sites/default/files/documents/USPTO_AI-Report_2020-10-07.pdf

unique to AI-generated inventions and that current standards were sufficient.

According to the CIPC, based on the USPTO study, a minority indicated that there are state of the art considerations unique to AI-generated inventions. In this context, examiners may also, over the course of time, need additional resources to identify and find the state of the art for inventions using AI[5].

5.2.3 Obviousness for a person skilled in the art

In the questionnaire, different scenarios were described, in which an AI technique can be implemented in a given invention, in order to try to generally identify common scenarios for patent applications that involve AI, having been presented 4 scenarios.

The first scenario sought to know whether, in the opinion of the IP BRICS offices, the mere replacement of a step already known in the state of the art by an equivalent one using AI techniques would be sufficient to confer an inventive step on a given patent application.

However, it is understood that the replacement of a known method by another with a corresponding function, without observing any unexpected technical effects, can be considered an obvious solution for a person skilled in the art and, consequently, without an inventive step.

When the closest prior art describes a similar method and the only difference for the patent application is the AI technique used, INPI assesses whether there was a need for changes in the invention due to the replacement of the AI technique. In this context, it will be verified whether such changes lead to a new technical effect capable of conferring an inventive step to a given patent application.

Such an understanding is similar to that of the CIPC, which referred to the JPO, that the mere application of AI may not be sufficient to assess an invention's inventive step, especially when it comes to the mere systematization of manually operated tasks using AI[6].

However, as pointed out by ROSPATENT, an AI technique can be a distinguishing feature of an invention if it is an essential feature for solving a technical problem and achieving a technical effect.

The second scenario sought to know whether, in the opinion of the IP BRICS offices, a better description or changes in parameters of an AI technique would be sufficient to confer inventive step to a given patent application. In this context, considering the neural network, the terms parameters and hyperparameters found in this report used as reference a dissertation from the University of São Paulo [7] and the title book "Neural Networks for Pattern Recognition"[8]:

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[5] pages 13-14:https://www.uspto.gov/sites/default/files/documents/USPTO_AI-Report_2020-10-07.pdf

[6] page 27: https://www.jpo.go.jp/e/system/laws/rule/guideline/patent/document/ai_jirei_e/jirei_tsuika_e.pdf

[7] https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiz55frk4j4AhUor5UCHWrSBlIQFnoECAQQAQ&url=https%3A%2F%2Fwww.teses.usp.br%2Fteses%2Fdisponiveis%2F8%2F8139%2Ftde-06042021-192617%2Fpublico%2F2020_AndressaVieiraESilva_VCorr.pdf&usg=AOvVaw3_jxOGcgQIAsDP3UD0j4FJ

[8] Christopher M. Bishop. Neural Networks for Pattern Recognition. 1997. p. 390-391

- Parameters – learned during training.
- Hyperparameters – pre-set for network configuration.

In this scenario, INPI pointed out that the adjustment of values for a set of parameters of an AI technique known in that particular technical field (for example, adjusting the learning rate in deep learning, adding more weights to a neural network) can be considered an obvious solution for a technical expert and intrinsically related to the training dataset.

Regarding the parameters of an AI technique, ROSPATENT has signaled that while weight values are specific to an artificial neural network, these values tend to remain within the "black box" and are not used to define the artificial neural network. However, ROSPATENT additionally points out that the difference between one artificial neural network from another can be determined based on so-called hyperparameters, such as: number of layers in an artificial neural network, types of layers, number of nodes in each layer and so forth.

In the third scenario, it was sought to know whether, in the opinion of the IP BRICS offices, the replacement of an AI method by another equivalente one would be sufficient to meet the requirements of the inventive step.

INPI understands that the mere replacement of a known AI technique by another one with a corresponding purpose, without observing any unexpected technical effects, can be considered an obvious solution for a person skilled in the art and, consequently, without inventive step. Despite this, INPI pointed out that it is necessary to consider whether the change or adaptation in AI techniques leads to a change in the technical effect, and whether such a technical effect can confer inventive step.

ROSPATENT noted that an invention using other AI techniques may be recognized as meeting the inventive step requirement if other AI techniques are not known from the prior art, or if such AI techniques are known but their use in the claimed invention provides an unexpected technical result for such use.

The fourth scenario sought to know whether, in the opinion of the IP BRICS offices, the use of a specific database for AI training would be sufficient to meet the inventive step requirement.

For INPI, the use of different training datasets with similar parameters in the input layer (for example, exchanging a database containing images of faces for another database containing different images of faces) would not be enough to confer inventive step. On the other hand, if there is a new relationship between input and output, which produces an unexpected technical effect, this relationship may be sufficient to state that the patent application has an inventive step. Furthermore, another way to check inventive step for an invention would be the addition of a pre-processing step in the training data.

ROSPATENT finds it difficult to imagine that the claims would contain all the data needed to train AI as a distinguishing feature. However, if learning data is processed in a new way that allows AI to solve a technical problem, this may be the only distinguishing feature that leads to meeting the novelty and inventive step requirements.

The CIPC, despite being in the process of implementing the Substantive Search and Examination (SSE), pointed out that some IP offices (e.g. KIPO) make a distinction in their analysis between the training model data and the learning model data, identifying in which component of AI the

data are used.[9][10].

Lastly, the CGPDTM considered that such scenarios are very subjective and it would be necessary to analyze case by case to verify whether or not patent applications have novelty/inventive step.

It should be noted that such scenarios were also addressed in the case studies, as will be described in item 6, in order to better understand the position of each IP BRICS member for the inventive step requirement.

5.3 Sufficiency of Disclosure

The basic concept of the sufficiency of disclosure condition is provided in the patent law of the IP BRICS members, mentioning that the applicant must disclose the invention in a way that all the necessary elements and means are present for a person skilled in the art to understand, perform and use the invention. In this sense, the description must not mislead the technician in the matter or encourage him to carry out undue experimentation.

It is worth noting that sufficient disclosure does not oblige the inventor to teach all the details involved in the state of the art in the field of their invention. The function of the description is not to disclose all the scientific phenomena behind the technical results, but to give all the means and details beyond the state of the art, necessary to allow a person skilled in the art to realize the invention protected by the patent.

It should be noted that the Patent Offices are constantly updating the documental framework to improve the analysis of patent applications in technological sectors where the fulfillment of sufficiency of description deserves special attention, such as Artificial Intelligence (AI).

In the case of inventions involving AI, much has been discussed about the need to establish specific criteria to guarantee the reproduction of the invention by a person skilled in the art. In this sense, patent offices have engaged in a series of activities to discuss aspects related to the technical examination of patent applications in the area of AI.

Throughout this project, it became evident the importance of putting on the agenda the discussion of sufficiency of disclosure to improve the documentation in order to encompass AI in the Industry 4.0 scenario, as well as to contribute to the technical evaluation of such condition. All through the studies carried out, some important concepts, which must be considered in the documentation when analyzing the condition of sufficiency of disclosure, were identified, such as:

> (i) Input X Output Correlation: the presumption of the existence of correlation between the input parameters with the output parameters.
>
> (ii) Database structure: the relevance of the data structure in the accomplishment of the invention by a person skilled in the art.

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[9] https://www.lexology.com/library/detail.aspx?g=cd9af394-e70f-49fc-8061-4785f57323ed

[10] http://www.nampat.co.kr/kipo-examination-guidelines-on-artificial-intelligence/?ckattempt=3

(iii) “Black Box”: the absence of specific details about the configuration or architecture of the AI model used.

In this scenario, it is evident to observe the importance of the condition of sufficiency of disclosure in the patent system, however the table that deals with the compilation of the questionnaire answers indicates that the IP BRICS members are at different times for the process of updating the documentation.

When analyzing the answers to the questionnaire, it was possible to identify that in addition to the temporal difference in the process of updating the guidelines among the IP BRICS members, to contemplate AI, the main concepts of the patent system also present different degrees of maturity. As discussed in items 5.1 and 5.2, eligibility (“first hurdle”) and inventive step (“second hurdle”) are already more outlined in the existing documentation, but the condition of sufficiency of disclosure still requires a more accurate look, seeking to leave it clearer how such a concept will consolidate in this new context of AI.

In the answers presented by all IP BRICS members, the concern to establish specific criteria to guarantee the reproduction of the invention by a person skilled in the art is evident, as the sufficiency of disclosure is a required condition since the beginning of the patent system whose correct evaluation results in carrying out the main objective of supporting the technological and economic development of a country.

5.3.1 Database structures

In the case of the data structures used in the inventions related to AI, which permeates the concept of the input X output correlation, INPI and ROSPATENT presented a similar position, indicating that the need to reveal the data structures is related to the subject-matter of the claim, that is, the amount of information about the data structure and the data set will depend on the degree of influence to carry out the invention by a person skilled in the art. In this context, INPI and ROSPATENT also pointed to an interest in avoiding barriers to innovation when the claimed matter is associated with AI-related inventions.

The CGPDTM answer used the legal framework as a basis for the concept related to data structures, mentioning that the specific detail will depend on the type of data included in the patent application. In addition, the CGPDTM indicated that in some cases the data source may be requested to guarantee the realization of the invention by a person skilled in the art.

Regarding the CNIPA, it was informed that this issue should be analyzed on a case-by-case basis.

The CIPC, on the other hand, took an approach associated with the training of a given AI technique, pointing to the importance of data in the expected result. The CIPC also highlighted the differences in companies' resources in terms of having access to data used for AI training.

5.3.2 Black box

During the analysis of the “black box” theme, it was also possible to identify a relationship with the concept of input X output correlation. According to INPI, the possibility of an invention using

a “black box” without impacting the condition of sufficiency of disclosure is linked to the technical effect, that is, if the technical effect of the invention is not directly associated with the content of the “black box”, such a feature will not be a barrier to invention.

In the case of ROSPATENT, there is a tendency in the understanding that the claimed invention using a “black box” will not be sufficiently described, breaking with the basic principle of the patent system, that is, the need for the applicant to disclose his invention sufficiently for its implementation by a person skilled in the art.

In this context, the CGPDTM mentioned that the applicant must provide the necessary information about the module that includes the "black box", and such information can be characterized by the correlation necessary to support the person skilled in the art in carrying out the invention.

In the “black box” scenario, the CNIPA also informed that this topic should be analyzed on a case-by-case basis.

The CIPC, on the other hand, took a close approach to the assessment presented by the INPI, making it possible to identify the object of protection by the way in which it is produced and not by its internal structure, that is, the input X output correlation could, in some cases, be sufficient to carry out the claimed invention. Furthermore, the CIPC mentioned that some algorithms can also be established as well-known applications in a specific field and it would not be necessary to explain the details of such algorithms.

5.3.3 General aspects

In the last part related to the condition of sufficiency of disclosure, the questionnaire sought to bring a broader view of how the IP BRICS members are dealing with such a condition of the patent system. At this point, the INPI indicated that it is necessary to mature some concepts (input X output correlation, “black box”, among others), seeking to improve the analysis of the condition of sufficiency of disclosure in the guidelines used for Computer Implemented Inventions (CII).

ROSPATENT's answer mentioned that the data is legally protected, access being linked to the permission of the copyright owner. In addition, ROSPATENT pointed to the need for the applicant to present sufficient elements to carry out the claimed invention, such as: input data, data source, information about the learning process, among others. In this context, ROSPATENT understands that a person skilled in the art must also have information on parameters that are not changed during training, as is the case with hyperparameters for neural networks.

The CGPDTM reported that it has not yet formulated guidelines for AI-related inventions, but signaled that the description must present the detail of the input data to meet the condition of sufficiency of disclosure, in order to comply with what determines the current legislation.

In the case of CNIPA, the answer to the questionnaire cited some points from the examination guidelines that are used to contemplate the analysis of AI-related inventions, making it clear that the documentation is already in the process of being updated to take into account the AI theme.

Lastly, the CIPC informed that it is in the process of changing the issue of the technical examination of the patent application, structuring its resources to carry out the SSE.

6. FINAL CONSIDERATIONS

The study carried out in this project met the objective of bringing the necessary elements to identify the main similarities and differences in the documentation used for the patent granting process and the examination practices in the IP BRICS patent offices, related to the area of Artificial Intelligence as well as the main challenges for adjustments in the documental framework to meet this new reality. In this context, the importance of continuing with the partnership between IP BRICS members to improve the documental framework (normative instruction, guidelines, and manuals) was proven.

The main considerations obtained from the path adopted in this project can be summarized in the following topics:

- To understand the landscape of AI-related patent applications, as well as identifying trends in patent applications using AI-related technology.
- To identify the main points to be addressed when analyzing an application for an AI-related technology, and consequently where it would be relevant for IP BRICS members to focus cooperation. In this context, the following topics were initially identified: eligibility, inventive step, and sufficiency of disclosure.
- To promote the analysis of case studies, aiming to point out how the offices are dealing with the following topics: eligibility, inventive step, and sufficiency of disclosure. In addition, to identify possible limitations in the documental framework (guidelines, normative instruction, manual, among others) currently available for the technical examination carried out by the examiners.

Therefore, the project sought to contribute with elements that can be used for the process of improving the documental framework used in the technical examination, with regards to the evaluation of a patent application related to artificial intelligence (AI). It is worth mentioning that the results found in this project only establish a starting point for a discussion that will still require much debate among IP BRICS members to identify the necessary updates for the patent system in this new AI scenario.

It is believed that this project has contributed to the refinement of discussions involving inventions related to AI, making it possible to bring to the center of the debate the possible adjustments that will be necessary in the patent system in the contemporary world.

7. ANNEX I - Case Studies on AI-Related Inventions

[Case 1] -- Eligibility

-- Identifying the technical features.

Title of Invention

Artificial neural network-based system for the autonomous generation of useful information

What is claimed is:

[Claim 1]

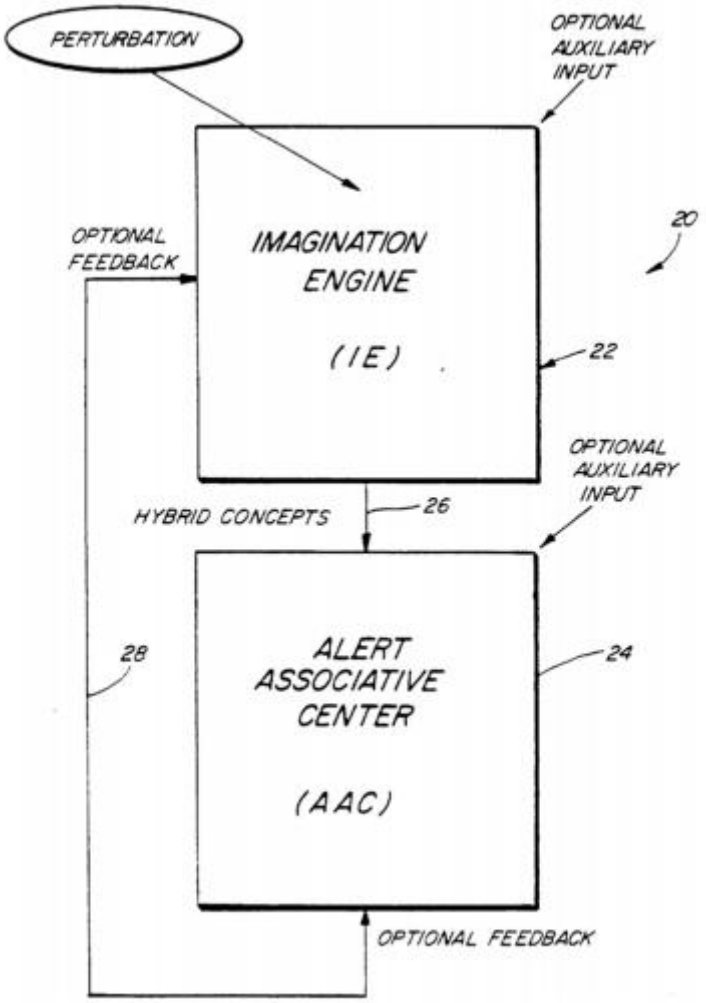
An artificial neural network-based system (20, 70,100) for determining desired concepts and relation-ships within a predefined field of endeavor, comprising

a first artificial neural network (22, 72, 102, 104) that has an input portion and an output portion and is operable in accordance with particular operation factors applicable thereto at any point in time to produce outputs at said output portion when inputs are supplied to said artificial neural network at the input portion thereof, a monitor (24, 52, 74-78, 104-108) associated with said first neural network to observe said data outputs produced at the output portion of the artificial neural network, and

means (56, 58, 72, 84-86, 90, 102, 116,120-130)for perturbing said first neural network to perturb one or more operation factors of said first artificial neural network to thereby effect changes, subject to operation factors of the artificial neural network that remain unperturbed, in the outputs produced by said first neural net-work portion at the output portion of said first neural network, characterized in that said first artificial neural network has been previously trained in a predefined field of endeavor to establish a particular knowledge domain therein and is normally operable in accordance with the operation factors embodied in its design and initially applicable to the established knowledge domain to produce established outputs in response to a pattern of inputs supplied to said previously trained artificial neural network at the input portion thereof,

the means for perturbing said first neural net-work operates in response to the production of an output by said first previously trained artificial neural network to effect another perturbation of said first previously trained artificial neural network, and

the monitor is responsive to detection of the data outputs being produced at the output portion of said first previously trained neural network to act thereupon, whereby said system is operable to establish over a period of time a plurality of input/perturbation/output mapping relation-ships, to synthesize novel concepts at the out-put of said first artificial neural network when said first artificial neural network is appropriately perturbed, and to identify, by way of said monitor, useful outputs produced by said first artificial neural network.


PERTURBATION
OPTIONAL AUXILIARY INPUT
20
OPTIONAL FEEDBACK
IMAGINATION ENGINE
(IE)
22
OPTIONAL AUXILIARY INPUT
HYBRID CONCEPTS
26
28
ALERT ASSOCIATIVE CENTER
(AAC)
24
OPTIONAL FEEDBACK

[Case 2] -- Eligibility

-- Identifying the technical features.

Title of Invention

Classification method and apparatus

What is claimed is:

[Claim 1]

A method for building a classification model for classifying unclassified documents based on the classification of a plurality of documents which respectively have been classified as belonging to one of a plurality of classes, said documents being digitally represented in a computer, said documents respectively comprising a plurality of terms which respectively comprise one or more symbols of a finite set of symbols, and said method comprising the following steps:

representing each of said plurality of documents by a vector of n dimensions, said n dimensions forming a vector space, whereas the value of each dimension of said vector corresponds to the frequency of occurrence of a certain term in the document corresponding to said vector, so that said n dimensions span up a vector space;

representing the classification of said already classified documents into classes by separating said vector space into a plurality of subspaces by one or more hyperplanes, such that each subspace comprises one or more documents as represented by their corresponding vectors in said vector space, so that said each subspace corresponds to a class.

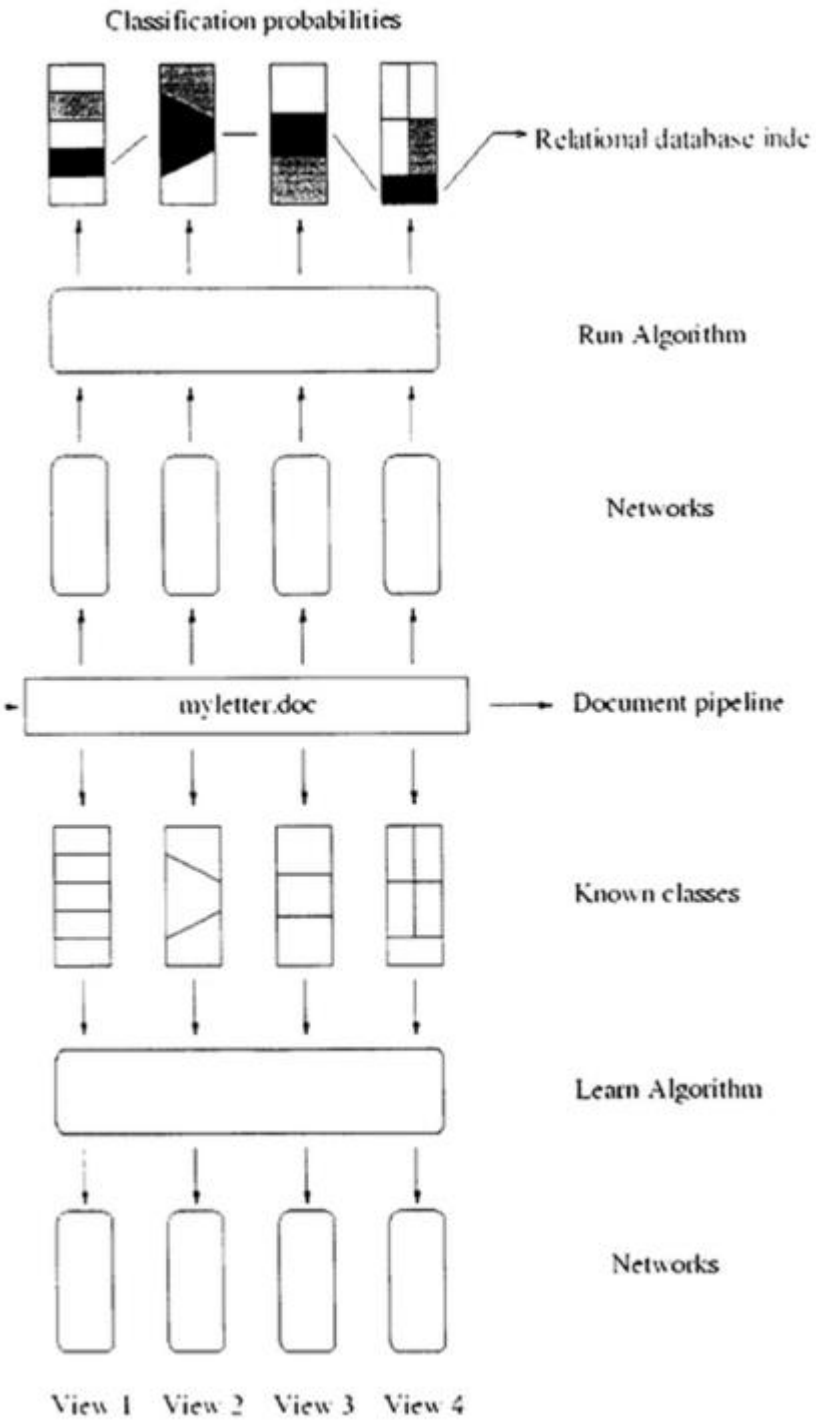

Classification probabilities
Relational database inde
Run Algorithm
Networks
myletter.doc
Document pipeline
Known classes
Learn Algorithm
Networks
View 1
View 2
View 3
View 4

Fig. 1

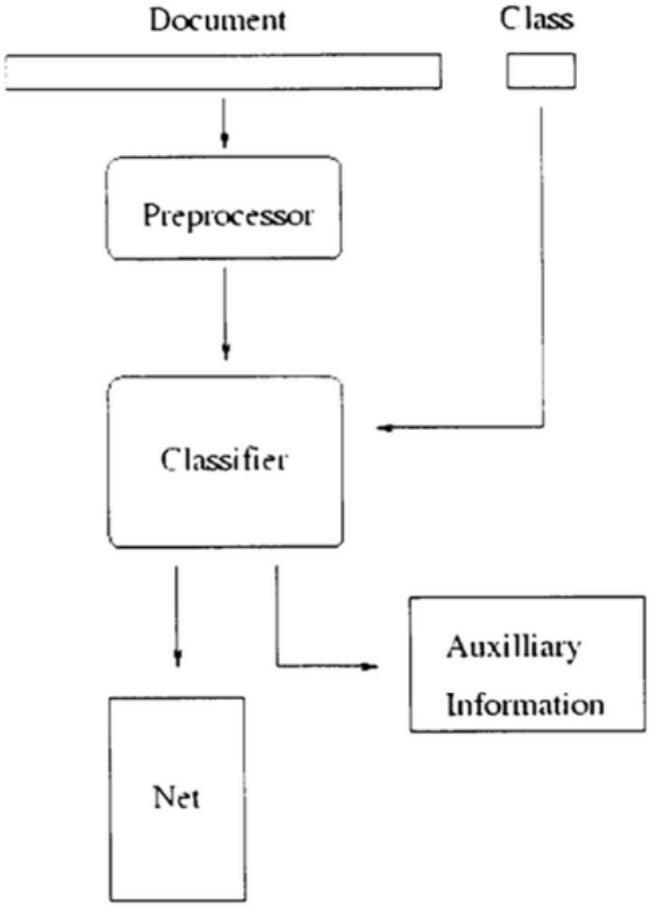

Document
Class
Preprocessor
Classifier
Auxilliary
Information
Net

Fig. 2

[Case 3] -- Eligibility

-- Identifying the technical features.

Title of Invention

A method for (re-)training a machine learning component

What is claimed is:

[Claim 1]

1. A method, comprising:

evolving a set of augmented training data (209) and training a machine learning component (204) by:

synthesizing (304) augmentation data (204) based on a set of parameter values in accordance with a parametric representation of an artifact;

generating (305) a set of augmented training data (209) by augmenting training data (203) based on the augmentation data (204);

evolving (309) the set of augmented training data (209) over generations based on evolving the set of parameter values in accordance with optimization of a fitness function, which is configured to reward a performance deficiency associated with an output produced by the machine teaming component in response to receiving augmented training data (209) as its input;

among the set of augmented training data (209), determining (310) a set of adversarial augmented training data (211) which are augmented training data in the set of augmented training data (209) that caused a performance deficiency associated with an output produced by the machine teaming component (204) in response to receiving augmented training data as its input; and

training the machine teaming (204) component based on the set of adversarial training data (211).

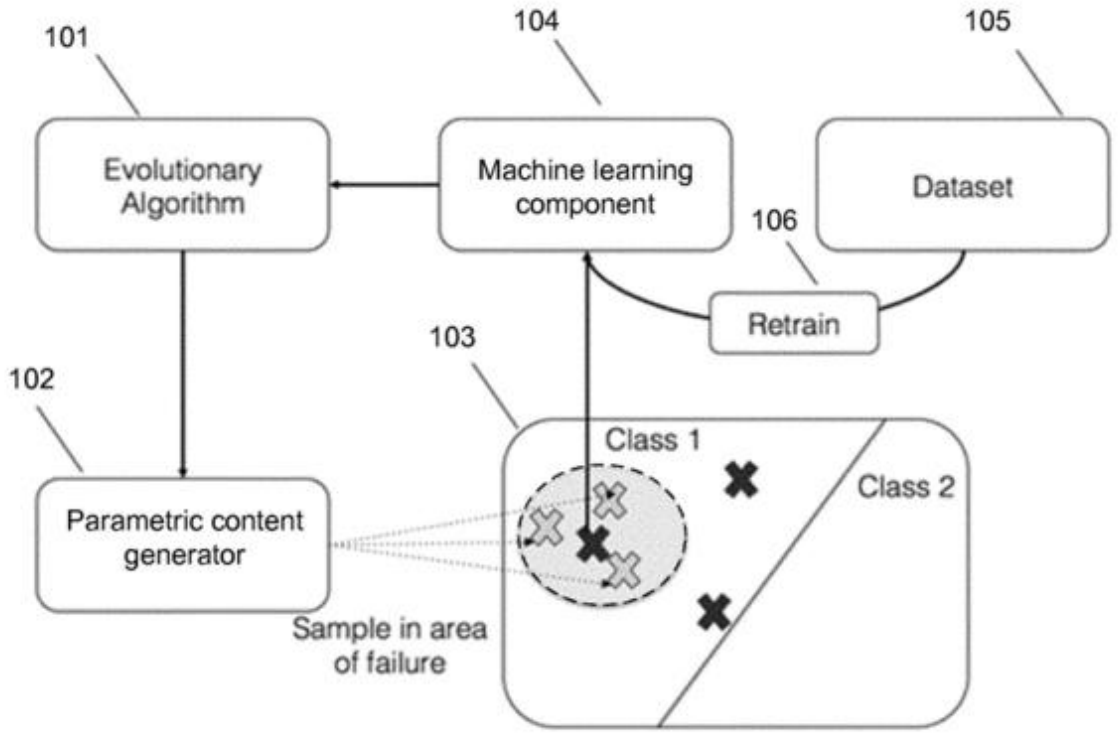

101
104
105
Evolutionary Algorithm
Machine learning component
Dataset
106
Retrain
103
102
Class 1
Class 2
Parametric content generator
Sample in area of failure

Fig. 1

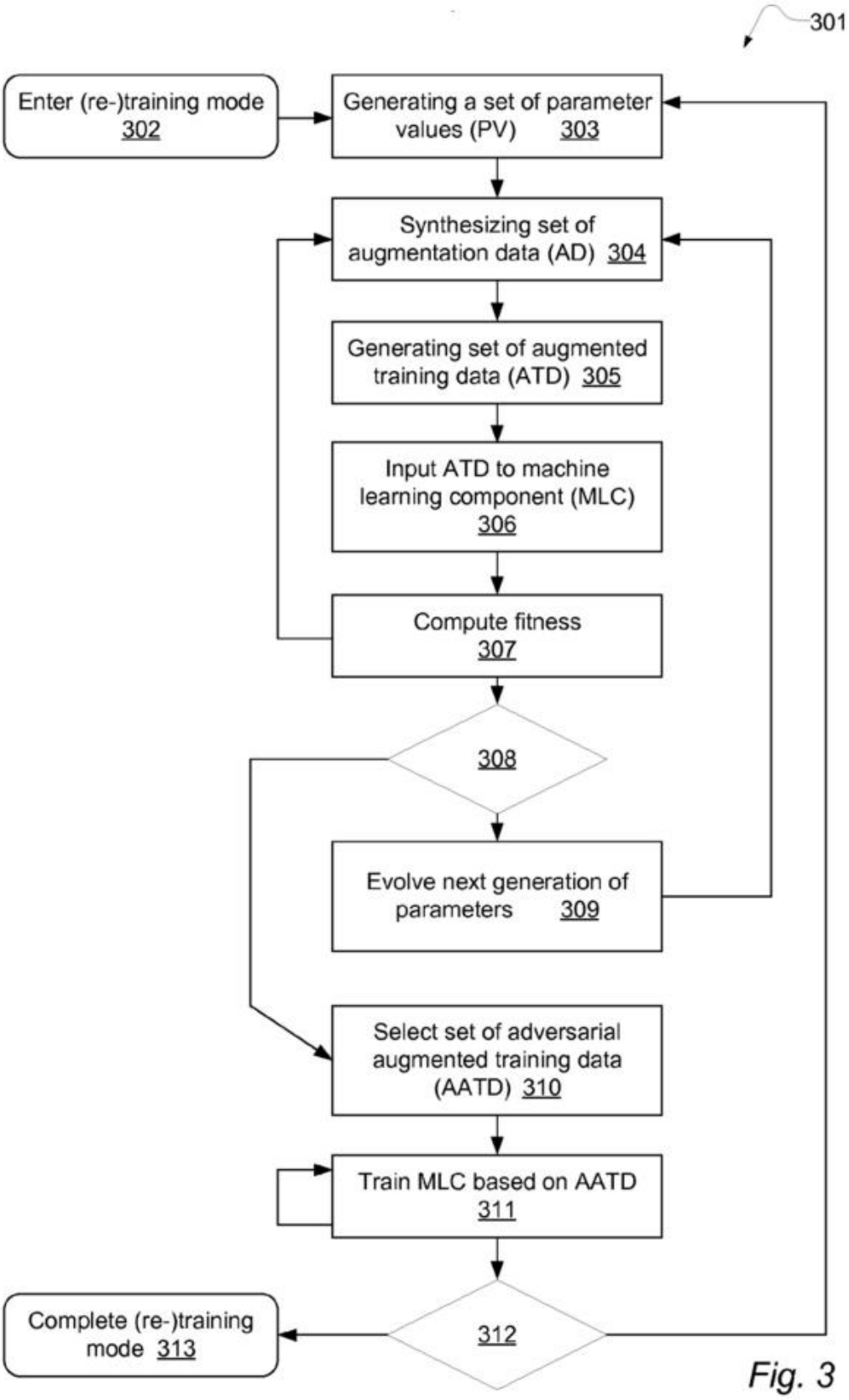

301
Enter (re-)training mode 302
Generating a set of parameter values (PV) 303
Synthesizing set of augmentation data (AD) 304
Generating set of augmented training data (ATD) 305
Input ATD to machine learning component (MLC) 306
Compute fitness 307
308
Evolve next generation of parameters 309
Select set of adversarial augmented training data (AATD) 310
Train MLC based on AATD 311
312
Complete (re-)training mode 313

Fig. 3

[Case 4] -- Eligibility

Title of Invention

Method and system for checking consistency and completeness of selection conditions in a product configuration system

What is claimed is:

[Claim 1]

A method for evaluation of selection conditions corresponding to variants of components in a configurable product, comprising:

receiving a plurality of selection conditions defining permissible combinations of values of characteristics of the product;

forming a bit matrix containing information representing combinations of the values of the characteristics;

forming bit strings by applying the selection conditions to the bit matrix, the bit strings representing the permissible combinations;

performing logical operations on the bit strings to determine whether the selection conditions permit at least one and at most one of a variant of a component to be included in the configurable product; and outputting a result to a user.

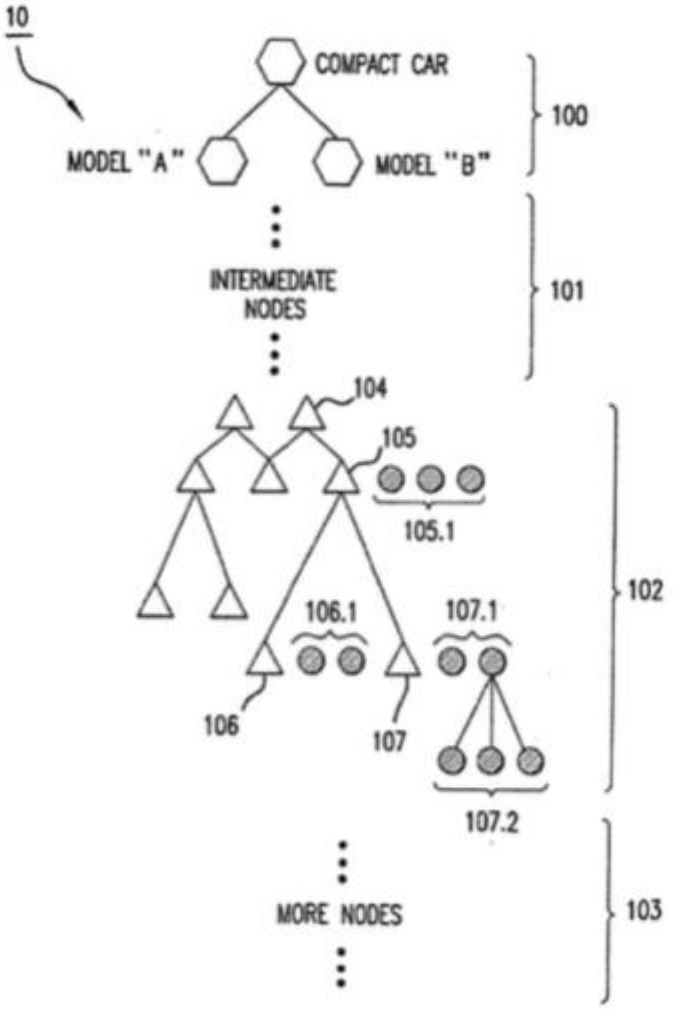

10
COMPACT CAR
MODEL "A"
MODEL "B"
100
INTERMEDIATE NODES
101
104
105
105.1
102
106.1
107.1
106
107
107.2
MORE NODES
103

FIG. 1

[Case 5] – Inventorship (DABUS Case)

(19) Europäisches Patentamt / European Patent Office / Office européen des brevets

(11) **EP 3 564 144 A1**

(12) **EUROPEAN PATENT APPLICATION**

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Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Thaler, Stephen L.**
St. Charles MO 63303 (US)

(72) Inventor: **The designation of the inventor has not yet been filed**

(74) Representative: **Williams Powell**
11 Staple Inn
London WC1V 7QH (GB)

Remarks:
•The designation of inventor does not meet the requirements laid down in Article 81 and Rule 19 EPC.
•Amended claims in accordance with Rule 137(2) EPC.

(54) **FOOD CONTAINER**

(57) A container (10) for use, for example, for beverages, has a wall (12) with and external surface (14) and an internal wall (16) of substantially uniform thickness. The wall (12) has a fractal profile which provides a series of fractal elements (18-28) on the interior and exterior surfaces (14-16), forming pits (40) and bulges (42) in the profile of the wall and in which a pit (40) as seen from one of the exterior or interior surfaces (12, 14) forms a bulge (42) on the other of the exterior or interior surfaces (12, 14). The profile enables multiple containers to be coupled together by inter-engagement of pits and bulges on corresponding ones of the containers. The profile also improves grip, as well as heat transfer into and out of the container.

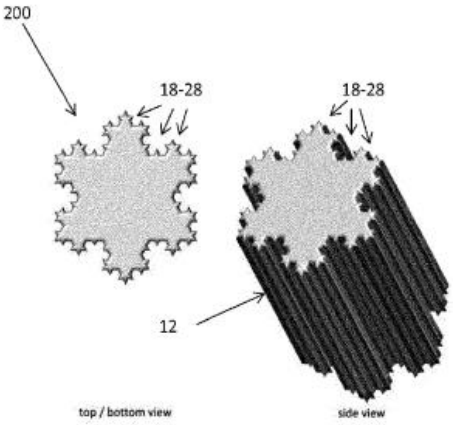


Fig. 6

EP 3 564 144 A1

Printed by Jouve, 75001 PARIS (FR)

[Case 6] -- Eligibility

Title of Invention

Sugar content data of apples and a method for predicting sugar content data of apples

What is claimed is:

[Claim 1]

Sugar content data of pre-harvest apples on trees measured by a portable sugar content sensor for apples which performs reflective near-infrared spectroscopic analyses.

[Claim 2]

The sugar content data of apples as described in Claim 1 received by a receiving unit of a server and stored in a memory unit of the said server.

[Claim 3]

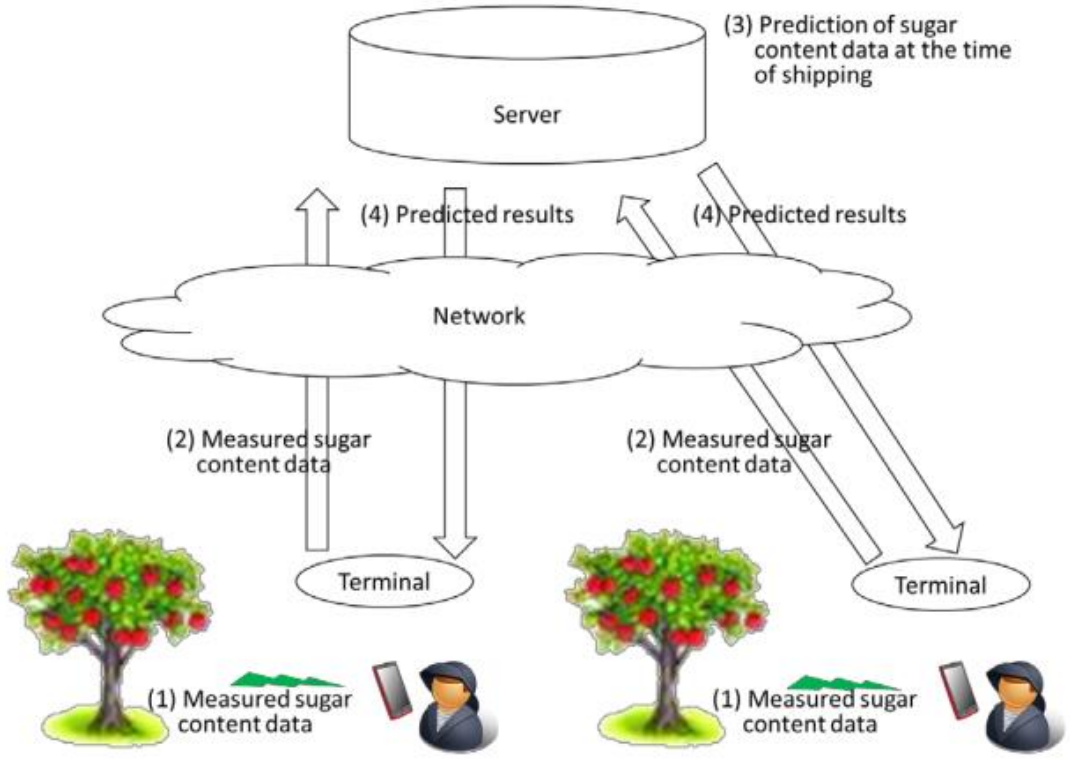
A method for predicting sugar content data of apples comprising;

a step in which an analyzing unit of the server analyzes the relationship between sugar content data of pre-harvest apples for specified periods and data on meteorological conditions, and sugar content data of apples at the time of their shipping, based on past performance;

a step in which the receiving unit of the said server receives the sugar content data of apples for specified periods as described in Claim 1; and

a step in which a prediction unit of the said server predicts and outputs sugar content data of apples at the time of future shipping using the said received sugar content data of apples for specified periods and data on past and future meteorological conditions as inputs, based on the said analyzed relationships.

Drawing



Overview of the description

[Technical Field]

The present invention relates to sugar content data of apples and a method for predicting sugar content data of apples.

[Background Art]

The sugar content of apples is an important indicator at the time of shipping apples.

Therefore, the sugar content of apples has been measured at the time of shipping. Apples are shipped after being graded based on measured sugar content and other conditions and the apple farmers change cultivation conditions of the following year as needed.

On the other hand, if sugar content data of preharvest apples on trees can be measured, it becomes possible to provide support for cultivation by predicting sugar content data of apples at the time of their shipping to push the sugar content of those apples closer to a desired level during their cultivation.

[Problems to be solved by the invention]

The present invention was created taking such circumstances into consideration and aims to provide support for cultivation based on the data to push the sugar content of those apples closer to a desired level by measuring sugar content data of preharvest apples on trees and by predicting sugar content data of apples at the time of their shipping.

[Solution for the Problem to be solved]

In the present invention sugar content data of preharvest apples on trees is measured with a portable sugar content sensor for apples. The said sugar content sensor for apples measures a sugar content of those apples by irradiating near-infrared lights on apples and performing spectroscopic analyses of reflected lights. Although this principle of measurement is the same as the conventional measurement of sugar content of apples performed at the time of their shipping, in the present invention sugar content data of preharvest apples on trees is measured since a portable sugar content sensor for apples has been developed in response to the progress of sensor technology. The said sugar content sensor for apples is equipped with the communication function and can transmit measured sugar content data to the server directly or via a terminal of an apple farmer.

This sugar content data of apples is used for analysis and prediction by the server.

The server makes analyses through the following steps (1) - (4).

(1) A step in which a receiving unit of the server receives during a specified period daily sugar content data of pre-harvest apples on trees from terminals of a plurality of apple farmers via the network.

(2) A step in which the receiving unit of the server receives data on meteorological conditions for specified periods before apples are harvested and sugar content data of apples at the time of their shipping. Meteorological conditions are selected arbitrarily from the amount of sunlight, temperature, the amount of rainfall, humidity, etc. Meteorological conditions may be those at a place where apples are cultivated or at a point or an area where the server is installed. If the place where apples are cultivated and the point where the server is installed are not so far as to cause differences in meteorological conditions, those at the point or area where the server is installed may be adopted. Moreover, sugar content data of apples at the time of their shipping is measured for grading as in the past.

(3) A step in which a memory unit of the server stores the received sugar content data of apples for specified periods and data on meteorological conditions, and the sugar content data of apples at the time of their shipping as one combination. The server accumulates a sufficient amount of data on the said combination as actual values in order to obtain adequate results of the analyses explained in (4).

(4) A step in which an analyzing unit of the server analyzes, based on the said data stored in the memory unit, the relationship between sugar content data of apples for specified periods before they are harvested and data on meteorological conditions, and sugar content data of apples at the time of their shipping by means of machine learning. An arbitrary technique such as deep learning of neural networks is used for this machine learning. For example, neural networks are configured in a way that sugar content data of apples measured prior to a point X days before their harvest and data on meteorological conditions before their harvest are input in the input layer and sugar content data of apples at the time of their shipping is output from the output layer. Weights between neurons of the neural networks are optimized by means of supervised learning using analytical data obtained by tagging the input dada in the input layer and the output data from the output layer.

Then, a prediction by the server is made through the following steps (5) - (8).

(5) A step in which the receiving unit of the server receives sugar content data of pre-harvest apples on trees for specified periods from terminals of apple fanners via the network.

(6) A step in which the receiving unit of the server receives data on past meteorological conditions to date and data on predicted meteorological conditions for the future from the present to the date of shipping. Meteorological conditions are selected arbitrarily from the amount of sunlight, temperature, the amount of rainfall, humidity, etc. in the same manner as (2) above. However, the receiving unit receives predicted future meteorological conditions in this process for the purpose of making a prediction described later.

(7) A step in which the memory unit of the server stores the received data.

(8) A step in which a prediction unit of the server, based on the relationships obtained by performing the analyses described in the process (4), predicts sugar content data of apples at the time of future shipping using data stored therein by inputting the data on measured sugar content of apples for specified periods and the data on past and future meteorological conditions. In the case of the neural networks mentioned in (4), a prediction is made by inputting sugar content data of apples measured prior to the point of X days before the harvest and data on meteorological conditions prior to the point of X days before the harvest as well as data on meteorological conditions after the said point of X days before the harvest in the input layer and by outputting sugar content data of apples at the time of their shipping from the output layer.

Then, the server transmits predicted sugar content data of apples at the time of their shipping to terminals of apple fanners via the network. The apple farmers examine if they need to change cultivation conditions, etc. based on the predicted sugar content data of apples at the time of their shipping.

[Effect of Invention]

The present invention can provide support for cultivation based on the data to push the sugar content of those apples closer to a desired level by measuring sugar content data of pre-harvest apples on trees and by predicting sugar content data of apples at the time of their shipping.

[Case 7] – Inventive Step

Title of Invention

Learning system comprising on-vehicle devices and a server

What is claimed is:

[Claim 1]

A learning system comprising a plurality of on-vehicle devices mounted on a plurality of vehicles respectively and a server that communicates with the said plurality of on-vehicle devices via a network,

wherein the said plurality of on-vehicle devices is comprised of:

an image recognition unit that executes image recognition, based on specific parameters, using image data around the vehicle taken by an on-vehicle camera;

a provision unit that provides the said server with the image data used for the said image recognition as data for learning;

an acquisition unit that acquires data to update the said parameters provided from the said server; and

an updating unit that updates the said parameters based on the said acquired data,

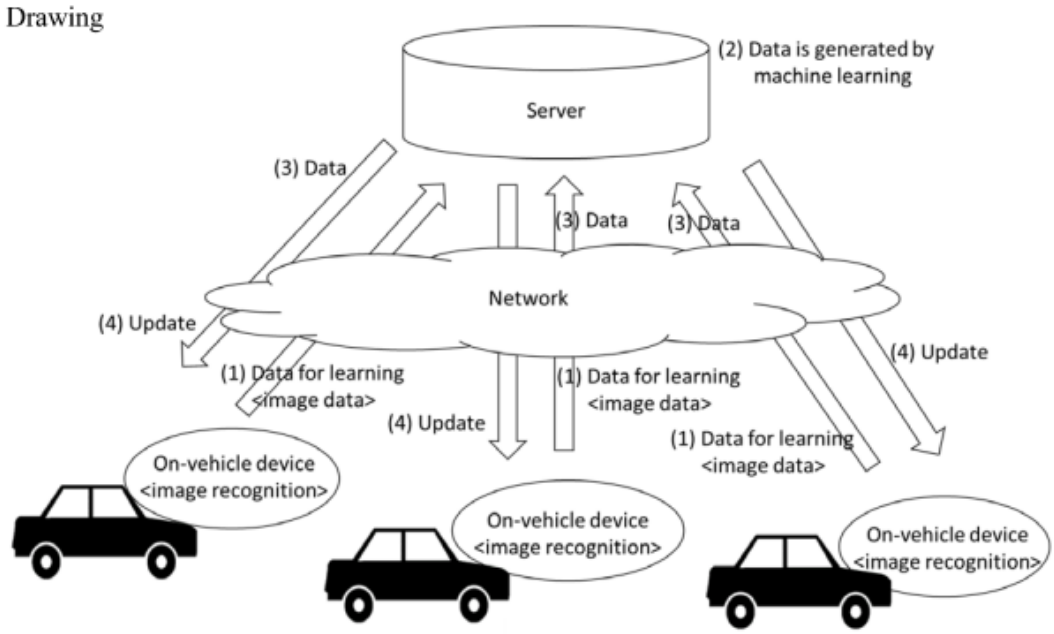
wherein, the said server is comprised of:

an acquisition unit that acquires the said data for learning provided from the said plurality of on-vehicle devices:

a learning unit that carries out machine learning based on the said data for learning and generates data for updating the said parameters; and

a provision unit that provides the said plurality of on-vehicle devices with the said data for updating.

Drawing



Overview of the description

[Background Art]

An on-vehicle device performs image recognition to recognize vehicles, pedestrians and white lines drawn on roads around their own vehicle.

[Problems to be solved by the invention]

In the development stage of these on-vehicle devices, it has been tried to improve image recognition performance by machine learning. However, after products are shipped, no effort for improving image recognition performance has been made.

The present invention has been conceived in view of the above problem and aims to provide a learning system that allows image recognition performance to be improved after the on-vehicle devices are shipped.

[Solution for the Problem to be solved]

An on-vehicle device is equipped with an image recognition unit and performs image recognition of vehicles, pedestrians and white lines drawn on roads around the vehicle based on image data around the vehicle taken by an on-vehicle camera. Image recognition is performed by algorithms such as support vector machines and neural networks that have specific parameters. Weights of these support vector machines and neural networks are updated by machine learning described later.

The on-vehicle device is equipped with a provision unit that, when it performs image recognition, provides a server with image data used for the image recognition as data for learning via a network. The frequency of provision can be set by a person skilled in the art as appropriate. The on-vehicle device provides image data, for example, every time when a certain amount of image data is accumulated.

On the other hand, the server is equipped with an acquisition unit and a learning unit that acquire data for learning provided from a plurality of the on-vehicle devices, perform machine learning to improve image recognition performance based on the data for learning and generate data to update parameters for image recognition. Machine learning is performed by means of unsupervised learning or supervised learning. In the case of unsupervised learning, a large amount of data collected from the on-vehicle devices (unsupervised data) is used to learn unsupervised features. Features refer to expressions that can express unsupervised data in the best mode (for example, linear combination of image pixels). In the case of supervised learning, it is necessary to create supervised data corresponding to each data for learning (for example, labels indicating the existence of pedestrians and the positions of white lines recognized by image recognition). Such work is carried out by operators who operate the server.

The server is equipped with a provision unit to provide each of the on-vehicle devices with data to update the said parameters via the network. The frequency of provision can be set by a person skilled in the art as appropriate. The server provides data on a regular basis, for example every week or every month.

The on-vehicle device is equipped with an acquisition unit and an updating unit to acquire data for parameters provided from the server, update parameters for image recognition based on the data and perform image recognition based on updated parameters.

Moreover, the provision unit of the on-vehicle device may generate data indicating running conditions of own vehicle such as the vehicle's speed, steering angle and tum signal control as data on running conditions and provide the server with the data on running conditions when image recognition is performed together with image data as data for learning.

In this case, the learning unit of the server classifies data for learning based on the data on running conditions and generates data for updating parameters by performing machine learning depending on each running condition. By this way, high-precision image recognition is realized in accordance with running conditions. Specifically, when the vehicle is running at high speed, changes in positions of vehicles and pedestrians there around (principally changes in positions in image in the vertical directions) become large among images taken continuously compared to the time when the vehicle is running at low speed. Similarly, when a steering angle is large, that is, a vehicle is turning around, changes in positions of vehicles and pedestrians there around (principally changes in positions in image in the lateral directions) become large among images taken continuously compared to the time when a vehicle is running straight. Furthermore, when a tum signal is controlled during high-speed running, that is, a vehicle is changing a driving lane, changes in positions of white lines become large among images taken continuously. Therefore, it is not appropriate to perform uniform image recognition without taking into account running conditions such as that the vehicle is running at high speed or low speed, turning around or running straight and/or changing a driving lane. In the present invention, in order to realize high-precision image recognition depending on running conditions, the learning unit of the server carries out the machine learning and generates data for updating parameters depending on each running condition while the acquisition unit of the on-vehicle device acquires the data and the updating unit updates parameters based on the data.

As described above, machine learning depending on each running condition has a particularly-advantageous effect in a system comprising a plurality of on-vehicle devices and a server compared to a system that performs machine learning in one on-vehicle device. That is, in the system comprising a plurality of on-vehicle devices and a server, a large amount of data for learning is provided to the server, and sufficient data for learning exists even when it is classified for each running condition. Therefore, in order to realize high-precision image recognition even in a rare running condition for some vehicles, for example, in a running condition that a vehicle that does not usually run on a highway actually runs on a highway and changes a driving lane, such a system can appropriately update parameters of image recognition parameters by means of effective machine learning.

State of the art (Prior art, well-known art, etc.)

Cited invention 1 (Invention disclosed in the cited document 1 (D1)):

A learning system comprising an on-vehicle device mounted on a vehicle, wherein the on-vehicle device is comprised of:

an image recognition unit that executes image recognition, based on specific parameters, using image data around the vehicle taken by an on-vehicle camera;

a provision unit that provides image data used for the said image recognition as data for learning;

an acquisition unit that acquires the said data for learning provided;

a learning unit that performs machine learning based on the said data for learning to update the said parameters;

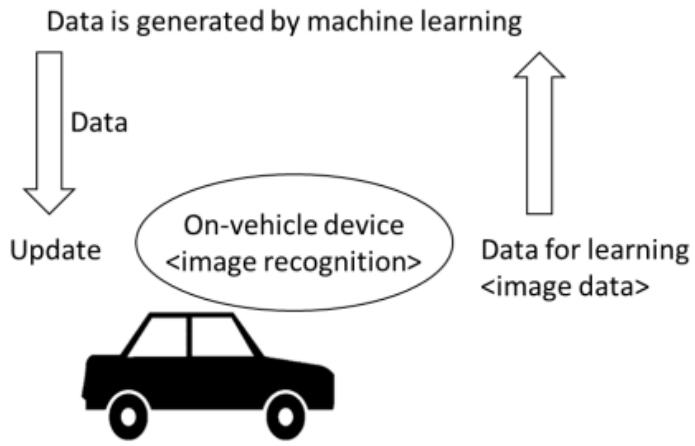
a provision unit that provides data to update the said parameters;

an acquisition unit that acquires data to update the said parameters;

an updating unit that updates the said parameters based on the said acquired data.

(Problems to be solved)

Image recognition performance is improved by updating parameters used for executing image recognition, after on-vehicle devices are shipped.

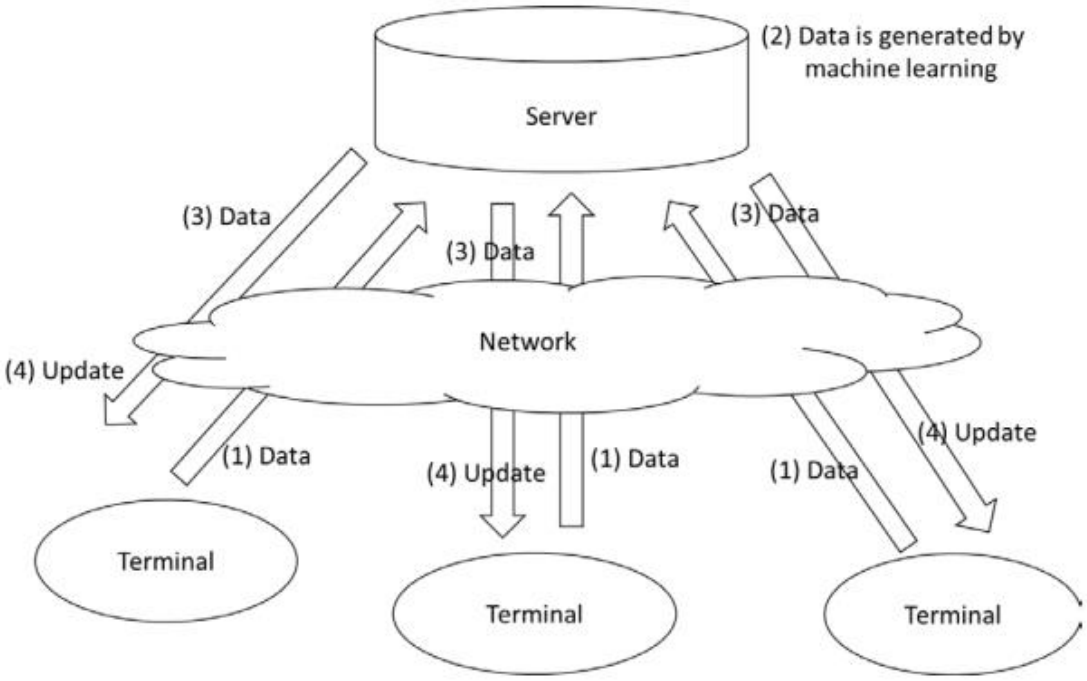


Well-known art:

For improving functions of various terminals including mobile type terminals, a server generates data for updating the computer programs or the setting values of the computer programs collectively and provides a plurality of terminals therewith by making an analysis based on data that were used for processing of the programs and were provided from the plurality of terminal devices to the server via a network.

(Problems to be solved)

Functions of computer programs are improved after terminals are shipped.


(2) Data is generated by machine learning
Server
(3) Data
(3) Data
(3) Data
Network
(4) Update
(1) Data
(4) Update
(1) Data
(1) Data
(4) Update
Terminal
Terminal
Terminal

[Case 8] – Inventive Step

Title of Invention

Quality management program of manufacturing lines

What is claimed is:

[Claim 1]

A quality management program of manufacturing lines causing a computer to realize:

a function of receiving data on inspection results of products that went through predetermined manufacturing processes and were inspected with regard to each of predetermined inspection items from inspection devices via a network and of storing it in a database;

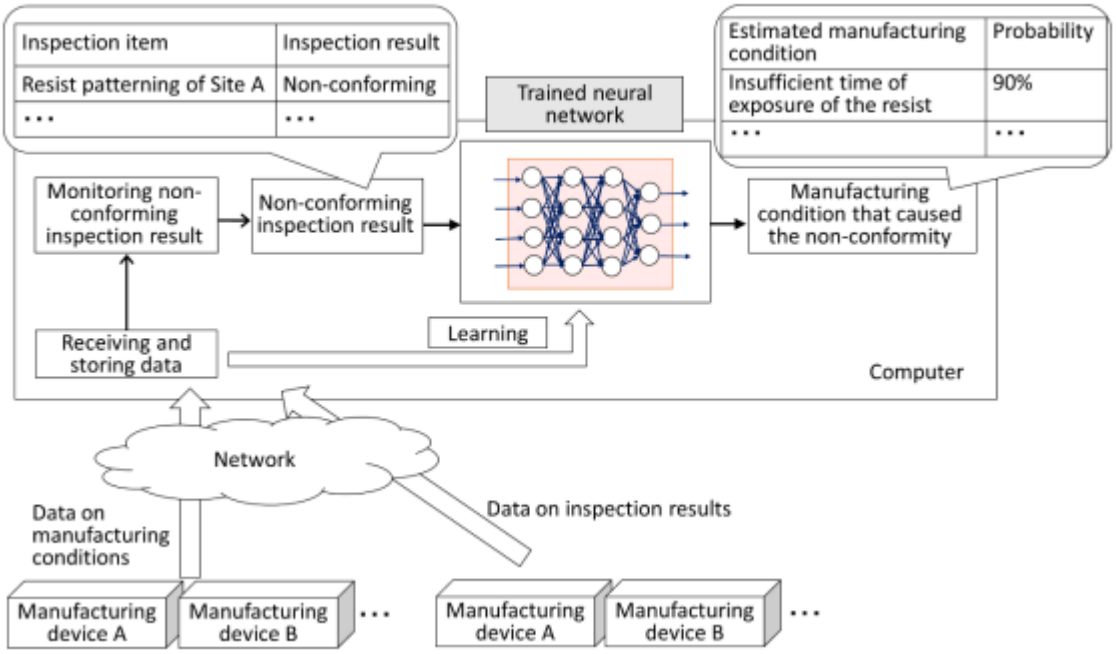
a function of receiving data on manufacturing conditions when the products were manufactured from manufacturing devices via a network and of storing it in the said database after associating it with the said data on inspection results;

a function of training a neural network by means of deep learning about a relationship between inspection results of the said data on inspection results stored in the said database and manufacturing conditions that caused non-conformity among the said data on manufacturing conditions;

a function of monitoring test results data stored in the said database; and

a function of estimating manufacturing conditions that caused the non-conformity using the said trained neural network when the non-conforming test result is found as a result of the said monitoring.

Drawing



Overview of the description

[Background Art]

Quality management of products in manufacturing lines of a variety of products is performed by sampling data of a small number of products from a large number of products manufactured and examine a relationship between their manufacturing conditions and their quality based on overall distribution and a degree of variations of sampled data of a small number of products. Currently, technologies such as monitoring network database have progressed so that it is relatively easy to integrally accumulate data on manufacturing conditions and inspection results of all products that have gone through manufacturing lines using barcodes or another type of data.

[Problems to be solved by the invention]

Though it will become possible to perform more advanced quality management by effectively using an enormous quantity of data on manufacturing histories, the data processing capabilities of humans are limited. Moreover, an analysis of non-conforming using detailed data relies largely on judgment or hunch of humans who have specific rules of thumb and skills for improvement. This inhibits effective utilization of data. Therefore, it is difficult to realize quality management through effective utilization of a large quantity of data on manufacturing histories by conventional methods relying on humans.

The present invention has been conceived in view of the above problems and aims to provide a quality management program of manufacturing lines capable of overcoming ambiguity caused by reliance on data processing capabilities, rules of thumb and hunch of humans, effectively using a large quantity of data and making highly-precise estimations.

[Solution for the Problem to be solved]

In a manufacturing line, products are manufactured based on specific manufacturing conditions. For example, in case of manufacture of semiconductor devices, the time of exposure, materials and amount of resists as well as materials, flow and pressure of process gas. Moreover, an inspection is carried out at an appropriate stage, such as after a predetermined manufacturing process completes. For example, in case of manufacture of semiconductor devices, such inspection items as patterning of the resists and the thickness of coated films are inspected.

A computer on which the quality management program of the present invention is executed receives data on inspection results of manufactured products from inspection devices and data on manufacturing conditions when the products were manufactured from manufacturing devices via a network, respectively, and they are associated to be stored in a database.

A neural network is trained by means of deep learning about a relationship between the stored data on inspection results and manufacturing conditions that caused non-conformity among data on manufacturing conditions. As the neural network is trained, weights between layers thereof are updated.

In the present invention, it is possible to multiply a variable forgetting coefficient γ by the said weights at the time of learning. A forgetting coefficient γ is set in the range of $0 < \gamma < 1$, and the closer this coefficient is to 0, the higher a degree that data is to be forgotten. A forgetting coefficient γ is set by a bivariate function of $\gamma=f(k, t1)$, wherein k quantitatively indicates the degree of change in characteristics

of manufacturing devices across the ages and t1 indicates the time elapsed from the previous maintenance. The said degree of change k is set by a bivariate function of k=g(α, t2), wherein or indicates a type of manufacturing devices and t2 indicates the total operating time thereof, since k varies depending on a type of manufacturing devices and the total operating time thereof (for example, characteristics of some manufacturing devices start to deteriorate rapidly, as the total operating time increases). The use of such a forgetting coefficient ϒ makes it possible to learn reflecting recent data to a necessary degree in accordance with the degree of change in the characteristics of devices, with regard to manufacturing devices whose characteristics are prone to change across the ages. Moreover, it makes it possible to strongly forget data before the maintenance and principally learn data after the maintenance, with regard to manufacturing devices that are shortly after maintenance. By this way, it becomes possible to establish a trained neural network closer to the current condition and make a highly-precise estimation. ((Note) It is assumed that concrete function formulas of f(k, t1) and g(α, t2) are described in the description.)

On the other hand, data on inspection results is monitored and, in cases where any non-conforming inspection result is found, the trained neural network is used to estimate a manufacturing condition that caused the non-conformity.

[Effect of Invention]

Since the present invention estimate a manufacturing condition that caused non-conformity using the trained neural network that is trained by means of deep learning, a highly-precise estimation can be made.

State of the art (Prior art, well-known art, etc.)

Cited invention 1 (Invention disclosed in the cited document 1 (D1)):

A quality management program of manufacturing lines causing a computer to realize:

a function of receiving data on inspection results of products that went through predetermined manufacturing processes and were inspected with regard to each of predetermined inspection items from inspection devices via a network and of storing it in a database;

a function of receiving data on manufacturing conditions when the products were manufactured from manufacturing devices via a network and of storing it in the said databased after associating it with the said data on inspection results;

a function of machine learning about a relationship between inspection results of the said data on inspection results stored in the said database and manufacturing conditions that caused non-conformity among the said data on manufacturing conditions;

a function of monitoring test results data stored in the said database; and

a function of estimating manufacturing conditions that caused the non-conformity using the said machine learning result when the non-conforming test result is found as a result of the said monitoring.

(Problems to be solved)

Making a highly-precise estimation of manufacturing conditions that caused nonconformity.

Well-known art:

In the technical field of machine learning, training a neural network by means of deep learning and making an estimation using this trained neural network.

(Problems to be solved)

Making a highly-precise estimation.

[Case 9] – Inventive Step

Title of Invention

Estimation system of hydroelectric generating capacity

What is claimed is:

[Claim 1]

An estimation system of a hydroelectric power generating capacity of a dam comprising:

a neural network that is built by means of an information processor, the neural network having an input layer and an output layer, in which an input data to the input layer containing a precipitation amount of the upper stream of a river, a water flow rate of the upper stream of the river, and a water inflow rate into a dam during a predetermined period between a reference time and a predetermined time before the reference time, and an output data from the output layer containing a hydroelectric power generating capacity in the future after the reference time;

a machine learning unit that trains the neural network using a training data corresponding to actual values of the input data and the output data; and

an estimation unit that inputs the input data to the neural network that has been trained by the machine learning unit with setting a current time as the reference time, and then calculates an estimated value of a future hydroelectric power generating capacity based on the output data of which reference time is the current time.

[Claim 2]

The estimation system of a hydroelectric power generating capacity as in Claim 1, wherein the input data to the input layer further contains a temperature of the upper stream of the river during the predetermined period between the reference time and the predetermined time before the reference time.

Overview of the description

[Background Art]

A hydroelectric power generating capacity in the future is estimated by a dam operator by estimating a water inflow rate into a dam in the future based on a previous precipitation amount of the upper stream of the river, a water flow rate of the upper stream of the river and the like, and then converting the estimated water inflow rate into a hydroelectric power generating capacity.

[Problem to be Solved by the Invention]

Generally, a hydroelectric power generating capacity in the future is estimated based on a precipitation amount of the upper stream of the river, a water flow rate of the upper stream of the river, and an actual water inflow rate into a dam within the past few weeks. In many cases, dam operators make a function to calculate a water inflow rate in the future based on such data, input data that were obtained at certain times within the past few weeks to the function, and then convert the estimated water inflow rate into a hydroelectric power generating capacity.

In this method, however, operators have to make a function for each dam. Then, a water inflow rate in the future should be calculated using this function and converted into a hydroelectric power generating capacity in an approximate way. As a result, a hydroelectric power generating capacity cam1ot be estimated with a high accuracy even if operators precisely modify a function itself.

In view of such a problem, it is an object of the present invention to provide an estimation system of a hydroelectric power generating capacity that can directly estimate a hydroelectric power generating capacity with a high accuracy.

[Means for Solving the Problem]

According to the invention of Claim 1, a neural network is trained through supervised machine learning using a training data. The training data includes an input data containing a precipitation amount of the upper stream of a river, a water flow rate of the upper stream of the river, and a water inflow rate into a dam during a pre-determined period between a reference time and a predetermined time before the reference time; and an output data containing a hydroelectric power generating capacity in the future after the reference time. In response to an input of a precipitation amount of the upper stream of a river, a water flow rate of the upper stream of the river, and a water inflow rate into a dam before the current time to the trained neural network, a hydroelectric power generating capacity in the future is estimated.

According to the invention of Claim 2, the input data further includes a temperature of the upper stream of the river during a predetermined period between a reference time and a predetermined time before the reference time.

[Effects of the Invention]

According to the invention of Claim 1, a hydroelectric power generating capacity in the future can directly be estimated with a high accuracy using a trained neural network.

According to the invention of Claim 2, a temperature of the upper stream of the river is added to the input data. It allows a highly accurate estimation of an actual hydroelectric power generating capacity all year round, including the spring with a low precipitation. It has not been considered that there is a correlation between a hydroelectric power generating capacity and a temperature of the upper stream of the river, so far. However, it is possible to achieve a more accurate estimation taking an increase of inflow rate due to meltwater into consideration, with the use of an input data further containing a temperature.

State of the art (Prior art, well-known art, etc.)

Cited invention 1 (Invention disclosed in the cited document 1 (D1)):

An estimation system of a hydroelectric power generating capacity that carries out a multiple regression analysis by an information processor, comprising:

a regression equation model, in which explanatory variables are a precipitation amount of the upper stream of a river, a water flow rate of the upper stream of the river, and a water inflow rate into a dam during a predetermined period between a reference time and a predetermined time before the reference time, and an objective variable is a hydroelectric power generating capacity in the future after the reference time;

an analysis unit that calculates a partial regression coefficient of the regression equation model based on actual values corresponding to the explanatory variables and the objective variable; and

an estimation unit that, into the regression equation model to which the partial regression coefficient that has been calculated by the analysis unit is set, inputs data of the explanatory variables with setting a current time as the reference time, and then, calculates an estimated value of a future hydroelectric power generating capacity based on an output data from the objective variable setting a current time as the reference time.

Well-known art:

In the technical field of machine learning, it is well-known that an estimation process of an output in the future is carried out based on an input of time series data in the past, by using a trained neural network which has been trained with a training data containing an input of time series data in the past and a certain output in the future.

[Case 10] – Inventive Step

Title of Invention

Screw clamping quality estimation apparatus

What is claimed is:

[Claim 1]

A screw clamping quality estimation apparatus that assesses a screw clamping quality at the time of automatic screw clamping operation by means of a screwdriver comprising:

a condition measurement unit that measures a set of condition variables containing a rotation speed, angular acceleration, position, and inclination of the screwdriver;

a machine learning unit that trains a neural network through machine learning by associating, with each other, the set of condition variables measured by the condition measurement unit and the screw clamping quality at the time of automatic screw clamping operation with the use of the set of condition variables; and

a screw clamping quality estimation unit that estimates a screw clamping quality in response to an input, to the neural network that has been trained by the machine learning unit, of the set of condition variables that have been measured at the time of automatic screw clamping operation by means of a screwdriver.

Overview of the description

[Background Art]

An automatic screw clamping operation is carried out by means of a screwdriver.

[Problem to be Solved by the Invention]

A product that has been assembled through automatic screw clamping operation is inspected by an operator to check whether a screw clamping quality meets a predetermined standard. This inspection burden the operator with a load and is a bottleneck for the whole process.

Inventors of the present invention found that a behavior of a screwdriver used in automatic screw clamping operation affects a screw clamping quality. In view of this, it is an object of the present invention to provide an apparatus that estimates a screw clamping quality based on a behavior of a screwdriver, in order to achieve a time-saving quality inspection.

[Means for Solving the Problem]

A set of state variables is obtained by measuring a combination of rotation speed, angular acceleration, position, and inclination of a screwdriver used in an automatic screw clamping operation. Assessment results by an operator is obtained as a screw clamping quality on a product that has been assembled through the automatic screw clamping operation. Then, a neural network is trained by using a training data containing (i) an input data of the set of state variables and (ii) an output data of a screw clamping quality at the time of the automatic screw clamping using the set of state variables. The screw clamping quality of a product is estimated through an input of rotation speed, angular acceleration, position, and inclination of the screwdriver at the time of automatic screw clamping operation. A product of which

screw clamping quality does not meet a predetermined standard, if any, is sorted to go on to a re-inspection process of a screw clamping quality by an operator or disposal.

[Effects of the Invention]

An apparatus of the present invention assesses a screw clamping quality of a product that has been assembled through an automatic screw clamping operation. Conventionally, an inspection by an operator is needed after an automatic screw clamping process, and it burdened an operator with a load. However, the present invention enables a time-saving inspection by using an estimated screw clamping quality.

State of the art (Prior art, well-known art, etc.)

Cited invention 1 (Invention disclosed in the cited document 1 (D1)):

A screw clamping quality estimation apparatus that assesses a screw clamping quality at the time of automatic screw clamping operation by means of a screwdriver comprising:

a condition measurement unit that measures a set of condition variables containing a rotation speed and angular acceleration of the screwdriver;

a machine learning unit that trains a neural network through machine learning by associating, with each other, the set of condition variables measured by the condition measurement unit and the screw clamping quality at the time of automatic screw clamping operation with the use of the set of condition variables; and

a screw clamping quality estimation unit that estimates a screw clamping quality in response to an input, to the neural network that has been trained by the machine learning unit, of the set of condition variables that have been measured at the time of automatic screw clamping operation by means of a screwdriver.

Cited invention 2 (Invention disclosed in the cited document 2 (D2)):

A screw clamping quality assessment method comprising:

measuring a position and inclination of a screwdriver; and

assessing a screw-clamping quality based on the measured position and inclination of the screwdriver.

Well-known art:

It is a common general technical knowledge in the technical field of machine learning to adopt, as an input to a machine learning device, variables that may have a correlation with an output with high possibility, in order to enhance the reliability and accuracy of an output from the machine learning device.

[Case 11] – Inventive Step

Title of Invention

Dementia stage estimation apparatus

What is claimed is:

[Claim 1]

A dementia stage estimation apparatus comprising:

a speech information obtainment means for obtaining a speech information on a conversation between a questioner and a respondent;

a speech information analysis means for analyzing the speech information, and then specifying a speech section by the questioner and a speech section by the respondent;

a speech recognition means for converting, through speech recognition, the speech information on the speech section by the questioner and the speech section by the respondent into text and then outputting a character string;

a question topic specification means for specifying a question topic by the questioner based on the result of the speech recognition; and

a dementia stage determination means for inputting, to a trained neural network, the question topic by the questioner and the character string of the speech section by the respondent to the question topic in an associated manner with each other, and then determining a dementia stage of the respondent,

wherein the neural network is trained through machine learning using training data so as to output an estimated dementia stage, in response to an input of the character string of the speech section by the respondent in an associated manner with the question topic by the questioner.

Overview of the description

[Background Art]

It is well-known that a doctor asks questions to a subject person and observes the way the person responds to the question, to make a diagnosis of the degree of dementia (dementia stage).

[Problem to be Solved by the Invention]

A dementia stage diagnosis greatly depends on a doctor's experience and needs expertise. There is a pressing need for medical specialists in the field of dementia. It is a possible solution to solve such a problem to provide a diagnosis support for relatively inexperienced doctors taking advantage of a machine learning technique, by training a neural network with know-how of well-experienced doctors and then using the trained network.

However, a conversation for dementia diagnosis between a questioner and a respondent varies every time. Thus, it does not seem that only an input to a neural network using machine learning brings about such results that can readily be used at the site.

It is an object to provide an apparatus that enables a highly accurate estimation of dementia stage by

extracting a significant information from a speech information on a conversation for dementia diagnosis between a questioner and a respondent.

[Means for Solving the Problem]

The inventor of the present invention found that an information on a conversation between a questioner and respondent for dementia stage diagnosis as well as know-how of a well-experienced doctor specializing in dementia and a subject person can effectively be updated in a trained neural network through machine learning with a training data. A question topic by the questioner (food, weather, and family etc.) and a response by the respondent to the question (a character string obtained through conversion into text) are extracted through a speech recognition technique in an associated manner with each other. The training data contains question topics and corresponding responses to each topic as well as diagnosis (on a dementia stage of a subject person) by a well-experienced doctor.

With the above-mentioned trained neural network, a dementia stage estimation apparatus of the present invention is configured to estimate a dementia stage with a high accuracy.

[Effects of the Invention]

A support for a highly accurate dementia stage diagnosis can be realized through a dementia stage estimation with the above-mentioned trained neural network based on an input containing a question topic by a well-experienced doctor and a response by a subject person to the question that have been extracted from a speech information.

State of the art (Prior art, well-known art, etc.)

Cited invention 1 (Invention disclosed in the cited document 1 (D1)):

A dementia stage estimation apparatus comprising:

a speech information obtainment means for obtaining a speech information on a conversation between a questioner and a respondent;

a speech recognition means for converting the speech information into text through speech recognition and outputting a character string; and

a dementia stage determination means for inputting, to a trained neural network, the character string that has been converted into text by the speech recognition means, and then determining a dementia stage of the respondent, wherein the neural network is trained through machine learning using training data so as to output an estimated dementia stage in response to an input of the character string.

(Cited Document 1 discloses that the dementia stage estimation apparatus can estimate a dementia stage of a respondent with a certain accuracy.)

[Case 12] – Eligibility

Title of Invention

Data structure of dialogue scenarios in voice interactive system

What is claimed is:

[Claim 1]

A data structure of dialogue scenarios utilized in a voice interactive system composed of a client's device and a server, comprising:

unit IDs that identify dialogue units constituting dialogue scenarios;

messages including contents of utterances and information presented to users;

a plurality of candidate answers in response to answers from users;

information on communication mode; and

a plurality of branch information mapped to each of the candidate answers and information on communication mode, wherein the branch information indicates the following dialogue unit which contains messages corresponding to the said candidate answers and whose data size is corresponding to the said information on communication mode;

wherein, the said data structure of dialogue scenarios is utilized for the following processing performed by the said client's device:

(1) Outputting a message included in the current dialogue unit;

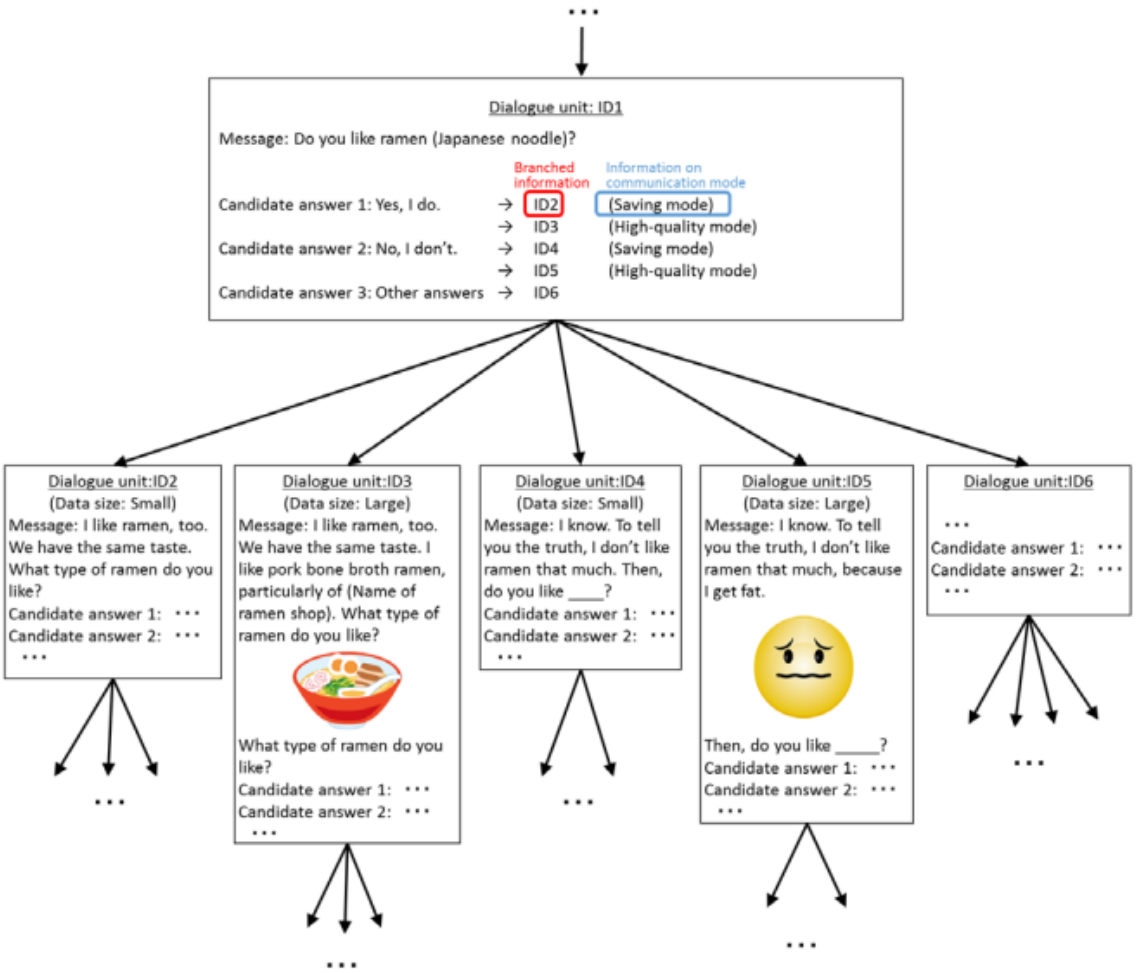
(2) acquiring an answer from the user in response to the said message;

(3) specifying the said candidate answer based on the answer from the said user;

(4) selecting one branch information based on the said candidate answer and information on communication mode; and

(5) receiving from the server a following dialogue unit indicated by the selected branch information.

Drawing
[Fig. 1]



Overview of the description

[Background Art]

In recent years, research and development have progressed aiming at realization of interactive artificial intelligence (AI) that gives users a feeling of actual conversations or communications. The present invention relates to a data structure of dialogue scenarios utilized in voice interactive systems to realize such interactive AI.

As one technique of voice interactive systems, we have a technique of managing contents of dialogues based on dialogue scenarios. A dialogue scenario maps the subsequent scenario to each of candidate answers from a user, and a dialogue is forwarded by selecting one of the scenarios in response to an answer from the user. For example of dialogue scenarios, in the case where a user is asked, "do you like ramen?", a voice dialogue is performed by selecting different scenarios according to positive answers (the user likes ramen) or negative answers (the user does not like ramen) from the user. When a dialogue scenario is created, it is possible to utilize a collection of natural and human dialogue patterns generated by collecting corpus data on actual dialogues from comments posted on websites or social networking services and by analyzing and learning such data with the use of natural language processing technologies such as morphological analysis and syntax analysis.

Voice interactive systems are widely utilized in smartphones, etc. In this case, dialogue scenarios are usually managed by voice dialogue servers.

[Problems to be solved by the invention]

However, conventional voice interactive systems do not give any consideration to the capacity of communications with servers. The monthly capacity of communications is often restricted in the case of communication systems including smartphones. The capacity of communications differs from one price plan to another selected by users. While some users whose monthly capacity of communication is small want to enjoy voice dialogues consuming a small capacity of communications, other users whose monthly capacity of communications is large expect to enjoy high-quality voice dialogues.

The present invention aims to provide a data structure that allows users to select dialogue scenarios adapted to communication capacities they look for.

[Description of the embodiments]

(Overall Structure)

A dialogue scenario describes how a dialogue continues in the tree shape and one unit of dialogue is herein called “dialogue unit”. The overall dialogue scenario is stored in a memory part of a server and sent to a client’s terminal by dialogue unit. The client’s terminal is equipped with a well-known composition such as CPU, memory, touch screen, microphone and speaker. The well-known composition realizes various functions including the function to communicate with the server, the function to store dialogue units received from the server, the function of playing messages included in dialogue units in the form of audio output and image display, and the function of receiving answers from users to messages in the form of voice, character entry, etc.

(Data Structure)

Fig. 1 illustrates one example of data structure of a dialogue scenario. Each of the dialogue units that constitutes the dialogue scenario contains data including, unit IDs, messages indicating contents of utterances to users and information presented, a plurality of candidate answers in response to answers from users, information on communication mode (“saving mode” or “high-quality mode”) and a plurality of branch information mapped to each of the candidate answers and information on communication mode, wherein the branch information indicates the following dialogue unit which contains messages corresponding to the said candidate answers and whose data size is corresponding to the said information on communication mode. The said messages may be mere contents of utterances to be played in audio (Dialogue ID2 or ID4 in Fig. 1) or presented information such as images to be displayed together with audio output reproduction (Dialogue ID3 or ID5 in Fig. l). Thus, the data size of dialogue units differs greatly depending on contents of messages included in dialogue units. In cases where the data size of following dialogue units indicated by the branch information is small, “saving mode” is mapped to the branch information. In cases where the data size of dialogue units indicated by the branch information is large, “high-quality mode” is mapped to the branch information for management. By this way, a plurality of options can be offered as candidates of following dialogue units in response to one candidate answer, in accordance with the capacity of communications.

(Information Processing in Voice Interactive System)

Firstly, after one dialogue unit is distributed to a client's terminal, a message in the dialogue unit is played with the client's terminal. When the client's terminal acquires an answer from the user to the message, the candidate answer is specified based on the answer. The specification is executed, for example, by specifying the most similar candidate answer to the answer from the user through a matching of strings relating to the answer from the user with strings relating to candidate answers. Then, one branch information is selected from a plurality of branch information corresponding to the specified candidate answer. The details of how to select branch information will be described below. When the selected branch information is sent to the server, a following dialogue unit indicated by the branch information is sent to the client's device from the server. A voice interactive system is realized by repeating this processing.

(Selection of Branch Information)

In the present voice interactive system, the communication mode of clients' terminals is set as "saving mode" or "high-quality mode". A communication mode may be set automatically in accordance with price plans of clients' terminals or the status of communications, or manually by users. It is also possible to switch a mode where necessary during voice dialogues.

In cases where "saving mode" is set for clients' terminals, branch information mapped to "saving mode" is selected, while in cases where "high-quality mode" is set, branch information mapped to "high-quality mode" is selected. By this way, in cases where "saving mode" is set, voice dialogues may be realized in a small communication capacity, since dialogue units Whose data size is small are sent sequentially to the clients' devices. On the other hand, in cases Where "high-quality mode" is set, the user may enjoy high-quality voice dialogues, since dialogue units whose data size is large are sent sequentially to the clients' devices.

(Other Embodiments)

In the above embodiment, the case where there are only two communication modes, "saving mode" and "high-quality mode" is explained, but not limited thereto. More detailed setting of communication capacity may be allowed by offering three or more communication modes.

[Case 13] – Eligibility

Title of Invention

Trained model for analyzing reputations of accommodations

What is claimed is:

[Claim 1]

A trained model for causing a computer to function to output quantified values of reputations of accommodations based on text data on reputations of accommodations, wherein;

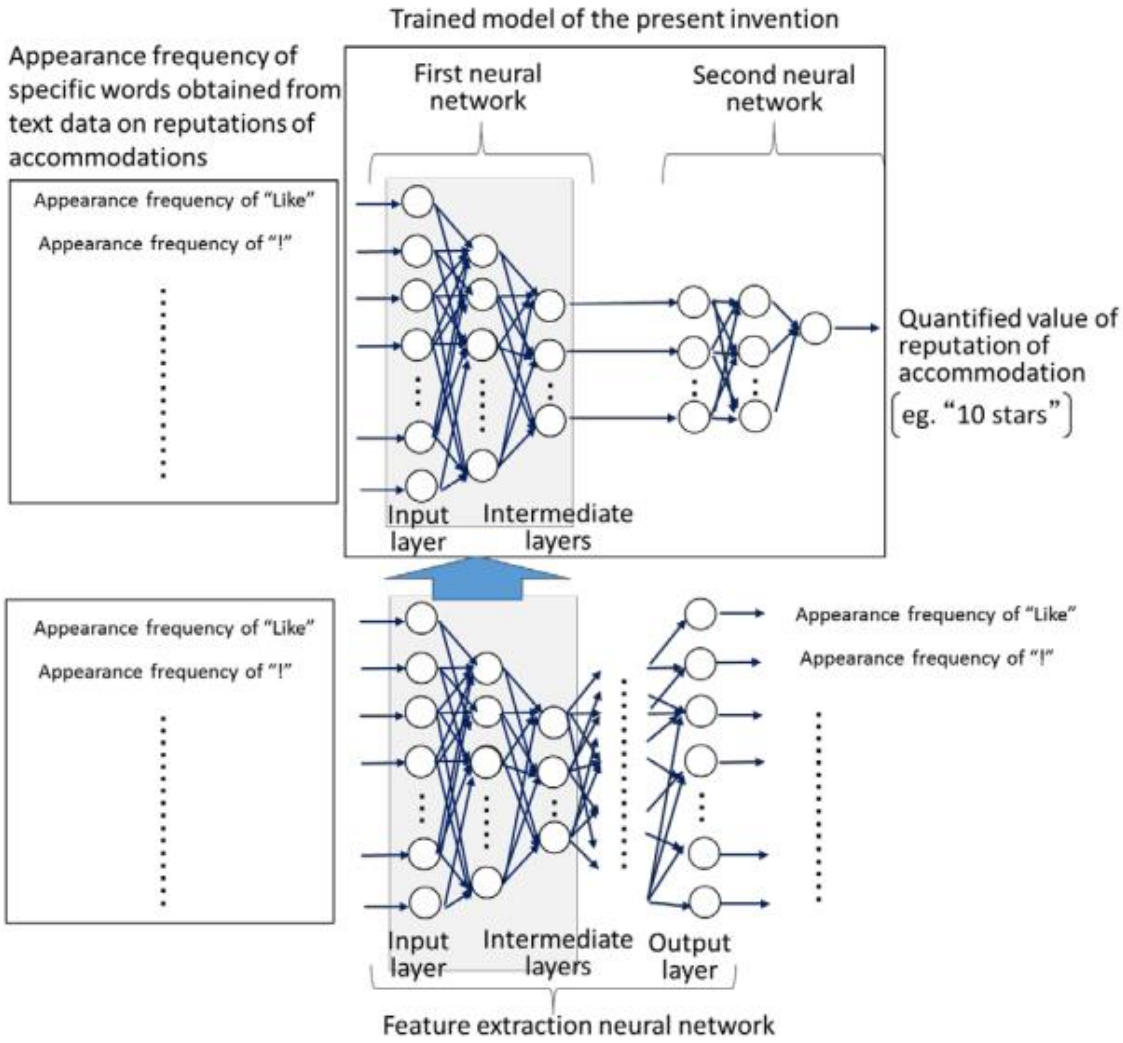
the model is comprised of a first neural network and a second neural network connected in a way that the said second neural network receives output from the said first neural network;

the said first neural network is comprised of an input layer to intermediate layers of a feature extraction neural network in which the number of neurons of at least one intermediate layer is smaller than the number of neurons of the input layer, the number of neurons of the input layer and the number of the output layer are the same, and weights were trained in a way each value input to the input layer and each corresponding value output from output layer become equal;

weights of the said second neural network were trained without changing the weights of the said first neural network; and

the model causes the computer function to perform a calculation based on the said trained weights in the said first and second neural networks in response to appearance frequency of specific words obtained from the text data on reputations of accommodations input to the input laver of the said first neural network and to output the quantified values of reputations of accommodations from the output layer of the said second neural network.

Drawing



Overview of the description

[Background Art]

A neural network, which has a computer function as a computing unit to calculate output in response to certain input, is capable of performing complicated information processing at high speed by being trained from a number of actual examples. Therefore, people intend to use neural networks for various purposes in such fields as image recognition, voice recognition, voice synthesis and automated translation.

Generally, in cases where neural networks are utilized in new areas, in many cases it is not clear what should be input as the input feature values, therefore, it is necessary to carefully review what should be selected as the input feature values accordingly.

In order to analyze text data on reputations of accommodations such as hotels posted on travel review sites with neural networks, it is not straightforward to select the input feature values, because the appearance frequencies of a variety of words ("Like", "!", etc.) included in the text data can be considered as the candidate input feature values.

[Problems to be solved by the invention]

The present invention has been conceived in view of the above problems into consideration and aims to accurately analyze reputations of accommodations even if the input feature values are not properly pre-selected.

[Solution for the Problem to be solved]

The trained model of the present invention aims to cause a computer to function to output quantified values of reputations of accommodations based on text data on reputations of accommodations and is comprised of a first neural network and a second neural network connected in a way that the second neural network receives output from the first neural network. The trained model is supposed to be utilized as a program module which constitutes a part of artificial intelligence software.

The trained model of the present invention is utilized in a computer equipped with a CPU and a memory. Specifically, the CPU of the computer operates, in accordance with instructions from the trained model stored in the memory, in a way that it performs a calculation based on trained weights and response functions in the first and second neural networks in response to data input to input layers of the first neural network (appearance frequency of specific words obtained from text data of reputations of accommodations, e. g. by performing morphological analyses) and outputs results from output layers of the second neural network (quantified values of reputations, e. g. “10 stars”).

The first neural network is comprised of an input layer to intermediate layers of a feature extraction neural network. This feature extraction neural network is generally called auto-encoder. In this network, the number of neurons in the intermediate layers is smaller than the number of neurons in the input layer. The number of neurons in the input layer and the number of neurons in the output layers are set to be equal. Moreover, a response function of each of the neurons in the input and output layers is a linear function, and other response functions of each of the neurons are sigmoid functions (1/(1+exp(-x))).

The feature extraction neural network is trained by means of a well-known art called back propagation method and weights between neurons are updated. In the embodiment of present invention, this neural network is trained to minimize mean square errors for overall input data so that data (each appearance frequency of a plurality of words obtained from text data on reputations of accommodations by performing morphological analyses) is input in the input layers and data the same as this input data is output from the output layers. Since sigmoid functions which are non-linear functions are utilized as neuron’s response functions as explained earlier, the weights between neurons are not symmetrical across the intermediate layer. As the feature extraction neural network is trained, the intermediate layer become possible to obtain the feature values indicating characteristics of each input data. Although the feature values that appear in the intermediate layer do not necessarily have clear physical implication, those feature values are considered as what were compressed to the extent that information input to the input layer can be restored to information output from the output layer and the feature values that appear in the intermediate layer become almost similar regardless of the input feature values to the input layer. Therefore, it is not necessary to properly preselect the input feature values to the input layer any more.

In the present invention, the part from the input layer to the intermediate layers in the feature extraction neural network in which weights were trained is connected to the second neural network as the first neural network. Weights of the second neural network are trained without changing weights of the said first neural network. The training is performed by a well-known art called a back propagation method as explained earlier.

Since the trained model of the present invention is comprised of the above first and second neural networks, it can accurately analyze reputations of accommodations without presetting the feature values.

[Case 14] – Sufficiency of Disclosure

Title of Invention

Sugar content estimation system

What is claimed is:

[Claim 1]

A sugar content estimation system comprising:

a storage means for storing face images of people and sugar contents of vegetables produced by the people;

a model generation means for generating a determination model through machine learning, to which a face image of a person is input and from which a sugar content of a vegetable produced by the person is output, using training data containing the face images of the people stored in the storage means and the sugar contents of the vegetables,

a reception means for receiving an input of an face image; and

a processing means for outputting, using the generated determination model that has been generated by the model generation means, a sugar content of a vegetable produced by a person that is estimated based on the face image of the person inputted to the reception means.

Overview of the Description

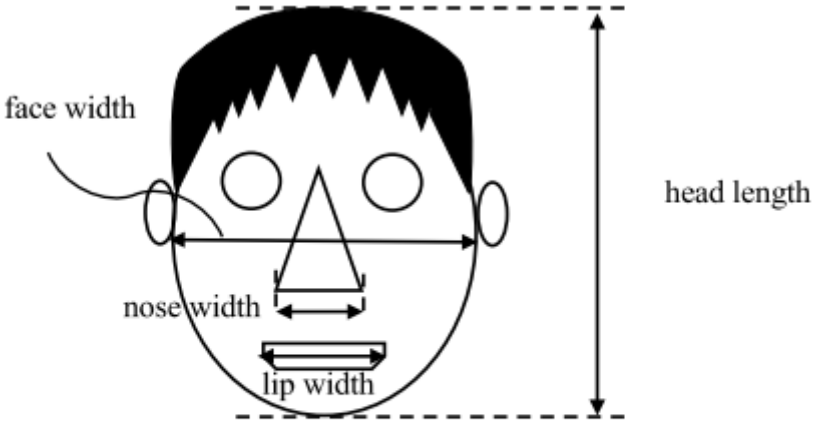
It is an object of the present invention to provide a system that estimates a sugar content of a vegetable produced by a person based on his/her face image, taking advantage of the existence of a certain correlation between a face feature of a person and a sugar content of a vegetable produced by the person. For example, a face figure is characterized by a head length, face width, nose width, and lip width as shown in the figure. Here, a "sugar content" of a vegetable means a sugar content at the time when a certain period predetermined for each type of vegetables has passed after seeding. With this system, it is possible to estimate which person can produce a vegetable with a highest sugar content in a community.

A sugar content estimation system of the present invention firstly receives an input of a face image of a person by a user. A sugar content of a vegetable produced by a person is obtained using a determination model, to which a face image of the person is input and from which a sugar content of the vegetable produced by the person is output. The determination model is generated through a supervised machine learning using a known machine learning algorithm such as a convolutional neural network (CNN) by learning correlation between a face image of a person and a sugar content of a vegetable produced by the person.

Note:

In this case, it is assumed that, even in view of a common general technical knowledge at the time of filing, a person skilled in the art cannot presume a certain relation such as a correlation (hereinafter, referred to as a "correlation or the like" in this Case Example) between a face image of a person and a

sugar content of a vegetable produced by the person.



Figure

[Case 15] – Sufficiency of Disclosure

Title of Invention

Autonomous vehicle

What is claimed is:

[Claim 1]

An autonomous vehicle having a driver monitoring device,

the driver monitoring device including:

an image obtainment unit that obtains an image taken by an imaging device that has been positioned so as to take an image of a driver seated in a vehicle seat; and

a quick reaction capability estimation unit that inputs the taken image to a trained learning model and obtains a quick reaction capability score representing a quick reaction capability of the driver during vehicle operation from the trained learning model, the trained learning model having been trained through machine learning to estimate a quick reaction capability of the driver during vehicle operation,

wherein switching from an autonomous operation mode in which a vehicle is operated automatically to a manual operation mode in which a vehicle is operated manually by a driver is prohibited, in a case where the obtained quick reaction capability score does not satisfy a predetermined condition.

Overview of the Description

An autonomous vehicle having a driver monitoring device of the present invention is configured in a manner that an operation mode can selectively be switched between an autonomous operation mode in which a vehicle is operated automatically and a manual operation mode in which a vehicle is operated manually by a driver. During an operation in an autonomous operation mode, switching from the autonomous operation mode to the manual operation mode is prohibited in a case where a quick reaction capability of the driver to vehicle operation does not satisfy a predetermined condition. The quick reaction capability of the driver is represented by a quick reaction capability score that is obtained by the driver monitoring device. With this configuration, it is possible to provide a vehicle in which switching an operation mode from an autonomous operation mode to a manual operation mode is allowed only when it is appropriate to do so, based on the quick reaction capability of a driver.

The driver monitoring device obtains a quick reaction capability score from a learning model that outputs the quick reaction capability score in response to an input of an image of a driver seated in a vehicle seat. The learning model is generated using a known machine learning algorithm such as a neural network. Training data that is input to the machine learning algorithm can be generated by associating a quick reaction capability score with each of the images of a driver seated in a vehicle seat in various situations. The images of a driver are taken by a camera, for example, that is positioned so as to take an image of a driver seated in a vehicle seat.

The quick reaction capability score in this case is a numeric parameter between 0 to 10. Each of the images of a driver in various types of behavior is manually evaluated, and then a quick reaction capability score is set for each of the images. For example, when a driver is “holding a steering wheel,” “operating a meter,” “operating a navigation system” or the like, it is determined that the driver is ready for vehicle

operation and a high numeric parameter is assigned to the image. Meanwhile, when a driver is “chatting,” “smoking,” “eating,” “talking on the phone,” “using a cell phone,” or the like, it is determined that the driver is not ready for vehicle operation and a low numeric parameter is assigned to the image. The quick reaction capability score may differently be assigned depending on each specific situation, even for a similar behavior. For example, the quick reaction capability score may differently be assigned for “holding a steering wheel” or “chatting” depending on a driver’s face direction, face expression, or the like. Similarly, the quick reaction capability score may differently be assigned for eating depending on a food.

Note:

In this case, it is assumed that, in view of a common general technical knowledge at the time of filing, a person skilled in the art can presume a certain relation such as a correlation (hereinafter, referred to as a “correlation or the like” in this Case Example) between a driver’s behavior that has been taken in an image and a quick reaction capability to vehicle operation.

[Case 16] – Sufficiency of Disclosure

Title of Invention

Body weight estimation system

What is claimed is:

[Claim 1]

A body weight estimation system comprising:

a model generation means for generating an estimation model that estimates a body weight of a person based on a feature value representing a face shape and a body height of the person, through machine learning using training data containing feature values representing face images as well as actual measured values of body heights and body weights of people;

a reception means for receiving an input of a face image and body height of a person;

a feature value obtainment means for obtaining a feature value representing a face shape of the person through analysis of the face image of the person that has been received by the reception means; and

a processing means for outputting an estimated value of a body weight of the person based on the feature value representing the face shape of the person that has been received by the feature value obtainment means and the body height of the person that has been received by the reception means, using the generated estimation model by the model generation means.

[Claim 2]

The body weight estimation system as in Claim 1, wherein the feature value representing a face shape is a face-outline angle.

Overview of the Description

It is an object of the present invention to provide a body weight estimation system that can conveniently be used outside without a body weight scale.

There is a certain degree of correlation between a face feature and physical size of a person. As seen in Fig. 1, the inventor found a statistically significant correlation between a cosine of a face-outline angle and BMI (defined as a body weight divided by the square of a body height) of a person. The face-outline angle here means an angle defined between a tangent line to a jaw and a tangent line to a cheek. As seen in Fig. 2, data plots can be approximated by a linear function in the coordinate system in which the horizontal axis represents BMI and the vertical axis represents a cosine of a face-outline angle.

This suggests a certain degree of correlation between a body height and weight used for BMI calculation and a face-outline angle. Accordingly, an estimation model with a highly accurate output can be generated through machine learning, using a known machine learning algorithm such as a neural network with training data. The training data contains actual measured values of face-outline angles, body heights, and body weights. The face-outline angles are obtained through analysis on face images of people.

A feature value representing a face shape of a person is a face-outline angle in this embodiment, but it

is not limited to this. Any feature value representing a face shape may be obtained from a face image and used.

Note:

In this case, it is assumed that, even in view of a common general technical knowledge at the time of filing, a person skilled in the art can presume a certain relation such as a correlation (referred to as “correlation or the like” in this Case Example) between (i) a body height, weight, and the like of a person and BMI based on these and (ii) a feature representing a face shape such as a face-outline angle is not a common general technical knowledge at the time of filing here.

Figures

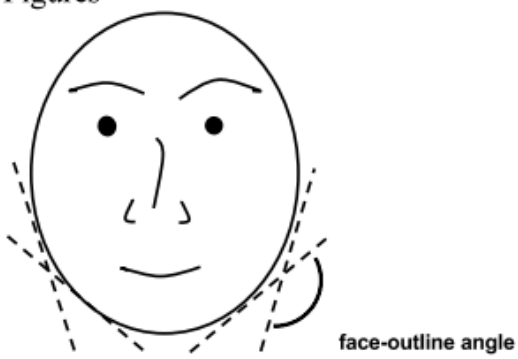


Fig. 1

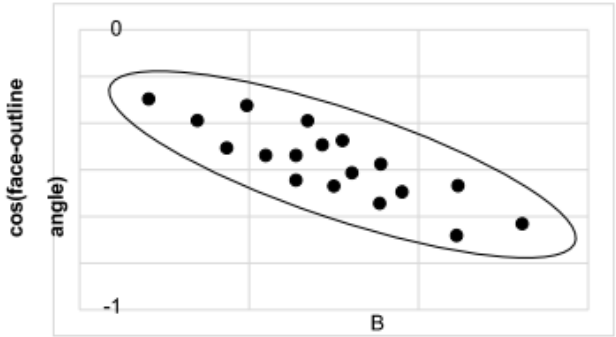


Fig. 2

[Case 17] – Sufficiency of Disclosure

Title of Invention

Method for estimating allergy incidence rate of test substance

What is claimed is:

[Claim 1]

A method for estimating an allergy incidence rate of a test substance in a human being comprising:

inputting a training data to an artificial intelligence model to train the model, the training data including a group of data representing a shape change of a human X cell in culture solution and a scoring data on incidence rates of human allergic reaction caused by each substance, in which each of the substances is separately added to the culture solution and the incidence rates of human allergic reaction caused by each of the substances are already known;

obtaining a group of data representing a shape change of a human X cell that has been measured in culture solution to which a test substance is added;

inputting, to the trained artificial intelligence model, the group of data representing a shape change of a human X cell that has been measured in the culture solution to which the test substance is added; and

causing the trained artificial intelligence model to calculate a scoring data of an incidence rate of human allergic reaction.

[Claim 2]

The method for estimating an allergy incidence rate as in Claim 1, wherein the group of data representing a shape change of a human X cell is a combination of a shape change in an ellipticity, rugosity, and oblateness of the human X cell; and the allergic reaction is contact dermatitis.

Overview of the Description

The present invention relates to a method for estimating an allergy incidence rate of a test substance in a human being, using a trained artificial intelligence model. It is an object of the invention to prevent loss in selecting a candidate substance, through an estimation of an incidence rate of human allergic reaction of a test substance at an early stage in selecting a candidate substance.

An embodiment discloses an experimental result verified by (i) adding each of candidate substances, of which contact dermatitis incidence rate is known, is separately added to culture solution for a human X cell, (ii) obtaining a group of data representing a shape change of a human X cell in the culture solution in an ellipticity, rugosity, and oblateness between before and after the addition; inputting, to a universal artificial intelligence model, a training data to train the model including the above-mentioned 3 types of data in the shape change and a scoring data on incidence rates of contact dermatitis caused by each of the substances so as to train the model; each of substances that has not been used for the training of the artificial intelligence model, of which contact dermatitis incidence rate is known, is separately added to culture solution for a human X cell; obtaining a group of data representing a shape change of a human X cell in the culture solution in an ellipticity, rugosity, and oblateness between before and after the addition; inputting the obtained group of data to the trained artificial intelligence model; and calculating

a scoring data on contact dermatitis incidence rates that is estimated by the artificial intelligence. The experimental result shows that, for a% or more of the candidate substances, the difference between the estimated score and the actual score was equal to or less than b%.

Note:

In this case, it is assumed that, even in view of a common general technical knowledge at the time of filing, a person skilled in the art can presume a certain relation such as a correlation (hereinafter, referred to as a “correlation or the like”) between an allergy incidence rate and a shape change of a cell.

[Case 18] – Sufficiency of Disclosure

Title of Invention

Anaerobic adhesive composition

What is claimed is:

[Claim 1]

An anaerobic adhesive composition comprising:

a 0.08 - 3.2 mass % compound A,

a 0.001 - 1 mass % compound B, and

a residue containing an anaerobically curable (meth)acrylate monomer,

wherein the anaerobic adhesive composition shows the curing strength equal to or exceeding 30 % of the curing strength after 24 hours have passed, within 5 minutes from the start of curing.

Overview of the Description

Conventionally, various combinations of a free radical initiator and a free radical reducing agent have been used for a curing system to enhance the cure rate of an anaerobic adhesive composition. Nevertheless, any optimal combination has not been found among numerous combinations, which realizes the curing strength equal to or exceeding 30 % of the curing strength after 24 hours have passed, within 5 minutes from the start of curing.

It is an object of the present invention to provide an anaerobic adhesive composition with an optimal component that shows the curing strength equal to or exceeding 30 % of the curing strength after 24 hours have passed, within 5 minutes from the start of curing.

In an embodiment, in order to derive an anaerobic adhesive composition attaining such an object, a conventionally known component data of an anaerobic adhesive composition, a curing strength data within 5 minutes from the start of curing, and a curing strength data after 24 hours have passed were input to a neural network; and then a trained model was prepared in a manner that a component of the anaerobic adhesive composition and a ratio between the curing strength within 5 minutes from the start of curing and the curing strength after 24 hours have passed were associated with each other. Further, an estimation result is disclosed showing the possibility where an anaerobic adhesive composition containing an anaerobically curable (meth)acrylate monomer can be obtained using the trained model, which realizes the curing strength equal to or exceeding 30% of the curing strength after 24 hours have passed within 5 minutes from the start of curing, by adding a 0.08 - 3.2 mass % compound A and a 0.001 – 1 mass % compound B in combination.

Notes

The description does not disclose any embodiment in which an anaerobic adhesive composition is actually produced within the above combination ratio and then the curing strength is measured. Further, there is no verification shown on the estimation accuracy of the trained model. Furthermore, it is not known that the curing strength is enhanced within 5 minutes after the start of curing, by adding any one of a compound A, a compound B, and the combination thereof. Meanwhile, a measurement method and

condition are specifically disclosed to measure the curing strength within 5 minutes after the start of curing and the curing strength after 24 hours have passed.

It is assumed that it is a common general technical knowledge at the time of filing that it is difficult to control an anaerobic adhesive composition so as to rapidly raise the curing temperature within 5 minutes or so after the start of curing, and that various conditions for production such as a type, combination, or combination ratio of polymer material, free radical initiator, or free radical reducing agent closely interact with each other. Meanwhile, it is not assumed that it is a common general technical knowledge at the time of filing that an estimation result by a trained model can be a substitution for an actual experimental result.

[Case 19] – Eligibility

-- Identifying the technical features.

Title of Invention

Method for solving multidimensional optimization problems

What is claimed is:

[Claim 1]

Method for solving multidimensional optimization problems on a set of feasible solutions $\{S_1,...,S_n\}$ of a discrete combinatorial problem comprising steps of:

- calculating optimization values for the set of feasible solutions $\{S_1,...,S_n\}$ by using a set of optimization functions $\{f_1,...,f_k\}$

- calculating mean values $\mu(f_i)$ to the set of optimization functions $\{f_1,... ,f_k\}$ according to

$$\mu(f_i) = \frac{1}{n}\sum_{j=1}^{n} f_i(S_j)$$

- calculating standard deviation values s(f) to the set of optimization functions $\{f_1,...,f_k\}$ according to

$$s(f_i) = \sqrt{\frac{1}{n-1}\sum_{j=1}^{n} (f_i(S_j) - \mu(f_i))^2}$$

- normalize the optimization values for the set of feasible solutions $\{S_1,...,S_n\}$ according to

$$norm(f_i(Sol)) = \frac{f_i(Sol) - \mu(f_i)}{s(f_i)}$$

- accumulate the normalized optimization values norm *norm*(f_i(Sol)) according to

$$f_i(Sol) = \sum_{i=1}^{k} norm(f_i(Sol))$$

- find a minimum for the accumulated normalized optimization values

$$min_{i=1}^{n} f(S_i)$$

8. ANNEX II - Analysis of case studies on AI-Related Inventions

8.1 Definition of Case Studies

This stage of the project sought to identify patent applications for inventions related to AI for evaluation by IP BRICS members, aiming to point out how the offices are dealing with the following topics: eligibility, inventive step and sufficiency of disclosure. In addition, the case studies sought to identify some limitations in the documental framework (guidelines, normative instruction, manual, among others) available for the technical examination performed by the examiners.

At first, INPI identified thirty-five patent applications relevant to the case studies, but some applications had similar themes. In this scenario, it was decided to make a selection of documents that could add more value to the analysis to be carried out. It is worth mentioning that the selected documents were obtained from the following consultation sources: JPO (Japanese Office), EPO (European Office), DKPTO (Denmark Office) and articles published by patent offices and academic researchers.

After a detailed reading of the documents found in the first selection, INPI restricted the scope of the study to nineteen (19) patent applications, as shown in Table 1 – List of case studies. It is worth mentioning that the full content of the case studies is provided in Annex I.

List of Cases		
Case No.	Title of Invention	Assessed Criteria
[Case 1]	Artificial neural network-based system for the autonomous generation of useful information	Eligibility
[Case 2]	Classification method and apparatus	Eligibility
[Case 3]	A method for (re-)training a machine learning component	Eligibility
[Case 4]	Method and system for checking consistency and completeness of selection conditions in a product	Eligibility
[Case 5]	Food container	Inventorship
[Case 6]	Sugar content data of apples and a method for predicting sugar content data of apples	Eligibility
[Case 7]	Learning system comprising on-vehicle devices and a server	Inventive Step
[Case 8]	Quality management program of manufacturing lines	Inventive Step
[Case 9]	Estimation system of hydroelectric generating capacity	Inventive Step
[Case 10]	Screw clamping quality estimation apparatus	Inventive Step
[Case 11]	Dementia stage estimation apparatus	Inventive Step
[Case 12]	Data structure of dialogue scenarios in voice interactive system	Eligibility
[Case 13]	Trained model for analyzing reputations of accommodations	Eligibility
[Case 14]	Sugar content estimation system	Sufficiency of Disclosure
[Case 15]	Autonomous vehicle	Sufficiency of Disclosure
[Case 16]	Body weight estimation system	Sufficiency of Disclosure
[Case 17]	Method for estimating allergy incidence rate of test substance	Sufficiency of Disclosure
[Case 18]	Anaerobic adhesive composition	Sufficiency of Disclosure
[Case 19]	Method for solving multidimensional optimization problems	Eligibility

Table 1 – List of case studies

The case studies analysis stage had an exploratory character aiming, mainly, to understand the concepts related to eligibility, inventive step and sufficiency of disclosure in the context of artificial intelligence by IP BRICS members. The evaluation of the case studies made it possible to contemplate the following characteristics:

- Deepening the discussion for the selected topics within the context of the technical analysis carried out by the examiners;
- Formulate an analysis for each of the proposed cases, seeking to identify the limitations of the

documentation; and

- Assist in compiling the main positions presented by IP BRICS members on the topics selected for the study.

The information presented in the rest of this topic only takes into account the analyzes of the case studies that were made available under this project, given that not all offices had the availability to carry out the analysis in the scheduled period.

8.2 Eligibility Cases

The case studies related to eligibility are presented in Table 2, indicating the case study number, title and topic under discussion.

Case	Title of Invention	Remarks
1	Artificial neural network-based system for the autonomous generation of useful information	Technical effect, technical field and mathematical method
2	Classification method and apparatus	Technical effect, technical field and mathematical method
3	A method for (re-)training a machine learning component	Mathematical method
4	Method and system for checking consistency and completeness of selection conditions in a product configuration system	Mathematical method
6	Sugar content data of apples and a method for predicting sugar content data of apples	Presentation of information and clarity of description
12	Data structure of dialogue scenarios in voice interactive system	Database
13	Trained model for analyzing reputations of accommodations	Neural networks
19	Method for solving multidimensional optimization problems	Mathematical method

Table 2 – Eligibility case studies

8.2.1 Case 1: Artificial neural network-based system for the autonomous generation of useful information

The present case study refers to a system based on an artificial neural network, seeking to emulate the creativity of the human mind. In this scenario, the system allows the fully autonomous generation of new concepts, designs, music, processes, discoveries and problem solving using artificial neural networks (ANN). In addition, the system provides the equivalence of freewill and a continuous flow of consciousness through which the system can formulate new concepts or plans of action or other useful information.

For INPI, according to the analysis carried out in the scope of claim 1, it appears that the neural network generates automatic information, given there is a disturbance in the operating parameters, but it is not clear either what would be the technical field where the neural network would be applied or the technical problem to be solved. According to the analysis of INPI, the simple generation of fully autonomous information provided by the neural network was not considered a solution to a technical problem inserted in a technical field, being identified only as an application of mathematical operations. In this scenario, it was evaluated that the subject matter of protection contemplated in claim 1 does not define the technical field of the invention. Therefore, claim 1 is not considered eligible because it is regarded as a mathematical method as provided in Article 10 (I) of the IPL (Industrial Property Law).

According to the CGPDTM, the subject matter of claim 1 which relate to a system for "ARTIFICIAL NEURAL NETWORK-BASED SYSTEM FOR THE AUTONOMOUS GENERATION OF USEFUL INFORMATION " prima facie does not fall within scope of clause (k) of section (3) of the Patents Act, 1970 (as amended). From the wording of the claim, the CGPDTM understood that **technical effect or technical advancement** lies in the feature "whereby said system is operable to establish over a period of time a plurality of input/perturbation/output mapping relation-ships, to synthesize novel concepts at the out-put of said first artificial neural network when said first artificial neural network is appropriately perturbed, and **to identify, by way of said monitor, useful outputs produced by said first artificial neural network**". In view of above, the subject matter appears to be patentable.

8.2.2 Case 2: Classification method and apparatus

The scope of the invention contemplates a highly efficient and flexible method and apparatus for building a classification scheme that can be used to classify documents. In accordance with the present invention, a classification scheme or model in which documents are represented as vectors for classification purposes is provided, forming a document associated with a sequence of terms.

For INPI, according to the analysis carried out in the subject matter of claim 1, it became evident that the technical problem stems from the difficulty of quick and efficient access to relevant documents because of the increasing number of documentation available in the contemporary world. Due to the technical problem presented, it was possible to identify that the technical effect of the claim resides in the fact of classifying documents, using as a basis terms that comprise representations of a finite set of symbols. Thus, the subject matter contemplated in claim 1 adequately defines both the problem to be solved and the technical effect.

On the other hand, CGPDTM pointed out that Claim 1 is a computer implemented method for building a classification model for classifying unclassified documents and said method comprising the steps for representing each of said plurality of documents by a vector of n dimensions, representing the classification of said already classified documents into classes by separating said vector space into a

plurality of subspaces by one or more hyperplanes, such that each subspace comprises one or more documents as represented by their corresponding vectors in said vector space, so that said each subspace corresponds to a class. Here, all the above steps are algorithmic or procedural in nature and are being performed by a computer program in the form of an algorithm in a predefined and sequential manner. Thus, falls under the head of 'algorithm' within the scope of clause (k) of section (3) of The Patents Act, 1970 (as amended), not being characterized as a patentable matter.

8.2.3 Case 3: A method for (re-)training a machine learning component

The present application pertains to the detection and correction of critical flaws in machine learning components through an active parametric content generation approach. The method, comprising evolving a set of augmented training data and training a machine learning component with the following steps: (i) synthesizing augmentation data based on inputting a set of parameter values; (ii) generating a set of augmented training data by augmenting training data based on the augmentation data; (iii) evolving the set of augmented training data over generations using a said synthesizing of augmentation data and based on evolving the set of parameter values in accordance with optimization of a fitness function; (iv) determining a set of adversarial augmented training data which are augmented training data in the set of augmented training data that caused a performance deficiency associated with an output produced by the machine learning component in response to receiving augmented training data as its input; (v) training the machine learning component based on the set of adversarial training data.

For INPI, when carrying out the analysis, it was identified that the subject matter of claim 1 of the present case study refers to the training of a neural network, which is already an inherent part of the process of this type of network. The protection scope is associated with the mathematical part of the training process of a neural network. Therefore, it is a pure and simple machine learning technique. Taking into account the elements presented in the case study, it was not identified what is the technical problem to be solved, making it impossible to identify the deficiencies of the state of the art that the patent application intends to solve. In addition, the subject matter in claim 1 does not define the technical field of the invention. In this context, the claimed subject matter falls under Article 10 (I) of the IPL and does not comply with paragraphs [11] and [13] of item 2.1 of the CII guidelines (INPI/PR No. 411/2020. Therefore, claim 1 is not considered eligible because it is regarded as a mathematical method.

In the same sense, CGPDTM mentioned that claim 1 recites method steps: synthesizing augmentation data based on a set of parameter values; generating a set of augmented training data; evolving the set of augmented training data over generations in accordance with fitness function; determining a set of adversarial augmented training data which are augmented training data in the set of augmented training data; and training the machine teaming component based on the set of adversarial training data. The method steps appear to be a set of predefined sequence of steps used to train the machine learning component. Further, no hardware features have been defined in the claims. Hence, all the above steps are nothing but an algorithm to be implemented with the help of computer programs. Prima facie from the wording of claims it appears that the activity of optimization of a fitness function can be performed by mathematical operations and computer programs. Hence, claim 1 is not patentable.

8.2.4 Case 4: Method and system for checking consistency and completeness of selection conditions

in a product configuration system

Embodiments of the present invention relate to a method and system for evaluating selection conditions associated with variants of components of a multi-component configurable product for consistency and completeness. The embodiments may include forming a bit matrix corresponding to combinations of values of characteristics of the product, and applying the selection conditions to the bit matrix to form bit strings or vectors representing the selection conditions. Logical operations may then be performed on the bit strings to determine whether the corresponding selection conditions are consistent and complete. Bit strings representing "forbidden" combinations of characteristics and combinations not covered by the selection conditions may also be formed. Results of the logical operations may be output to a user in the form of, among other things, a list of inconsistent selection conditions, allowing them to make the appropriate corrections.

For the INPI, according to the analysis, the subject matter of claim 1 defines that the technical problem to be solved is to assure that the configurations chosen by a user for a particular product are feasible. The product is the result of the selection of variants of a certain product that can be configured in several ways. In this context, it is understood that the non-technical features are applied to obtain a technical effect which solves a problem of the state of the art in a given technical field, making the claim eligible. The set of features in claim 1 (i.e., the evaluation of the selection of possible variants) has a technical effect, despite the fact that the subject claimed is broad and presents issues of clarity. In this case, taking into account only the assessment of eligibility, the claimed subject matter does not fall under Article 10 of the IPL, having been considered eligible as an invention.

Differently, ROSPATENT pointed out that the claimed method relates to methods of intellectual activity and is not an invention in accordance with paragraph 5 of article 1350 of the Civil Code of the Russian Federation. According to paragraph 49 of the Rules for Inventions, the claimed invention is recognized as related to objects that are not inventions as such when the generic term which reflects the purpose of the invention given in the claim, or all the characteristics that characterize the claimed invention in the claim are characteristics of these objects, or all the characteristics that characterize the claimed invention in the claim provide a non-technical result. All characteristics of the claimed method are characteristics of intellectual activity. Methods of intellectual activity are not inventions in accordance with paragraph 5 of article 1350 of the Civil Code of the Russian Federation.

In the same direction as ROSPATENT, CGPDTM mentioned that the instant filed application relates to non-patentable subject matter as it relates to mathematical methods as per Section 3(k) of the Patents Act,1970 (as amended). CGPDTM also mentioned that this leads to the fact that the alleged claim intends to protect a subject matter that relates to an input-output model working upon mere mathematical operations related to matrices. Such non-technical features can be easily reached upon by the person skilled in the art using the common general knowledge by using the conventional hardware. Furthermore, it must be noted that the terminologies like “selection conditions” and “configurable product” give an insight that the alleged invention relates to computer programs per se and hence not patentable as per Section 3(k) of the Patents Act,1970 (as amended).

8.2.5 Case 6: Sugar content data of apples and a method for predicting sugar content data of apples

The objective of the present case study was to analyze how IP BRICS member offices judge whether a creation is considered a mere presentation of information and, consequently, is not considered an invention.

In the present case study, sugar content data from pre-harvest apples on trees is measured with a portable apple sugar content sensor. To do this, the sugar content sensor for apples measures the sugar content of these apples by beaming infrared lights onto the apples and performing spectroscopic analysis of the reflected light. Additionally, a said sugar content sensor for apples is equipped with a communication function and can transmit measured sugar content data to the server directly or by a terminal.

In claims 1 and 2, the sugar content data of pre-harvested apples in trees, measured by a portable sugar content sensor, received by a receiving unit of a server and stored in a memory unit of a said server are claimed. In claim 3 the method for predicting sugar content data of apples is claimed.

For INPI, taking into account the analysis carried out for claim 1, the sugar content data are considered as content of information only. In this sense, the data on the sugar content of the apples in claim 1 do not have technical characteristics, being only related to the presentation of the information, since the subject matter lies solely and exclusively in the content of the information. In relation to Claim 2, although it mentions that the sugar content data of apples will be stored in a memory unit, it is considered that the essential characteristic continues exclusively in the information content. Although the data are sent and stored in memory, claim 2 also has no technical characteristic in the storage of information. Therefore, the characteristics contemplated in claims 1 and 2 refer to issues related to the presentation of information. On the other hand, claim 3 is a method for predicting sugar content data of apples, which performs information-processing based on technical properties such as chemical or biological properties of apples. Therefore, the essential features of claim 3 are not considered to be presentation of information.

For ROSPATENT, the object of the claim 1 is not an invention under the Article 1350 of the Civil Code of the Russian Federation (hereinafter – Civil Code). Generic term of claim 1 ("Sugar content data of preharvest apples") directly refers to the claimed object to solutions consisting only of providing information. The method of obtaining this data (by a portable sensor of the sugar content in apples, which performs a reflective spectroscopic analysis in the near infrared range) does not change this conclusion. This conclusion is supported by the fact that no technical result is achieved as a result of using this data. The conclusion with regard to claim 1 applies to claim 2.

On the other hand, ROSPATENT points out that the object of claim 3 falls under the definition of a method as a process of affecting a material object using material means (see paragraph 1 of article 1350 of the Civil Code). Since in the method claimed in claim 3, the following is carried out:

- Measurement of the sugar content in apples by a portable sensor, which performs reflective spectroscopic analysis in the near infrared range;
- Reception of measured data by the receiving unit of the server;
- The server analyzing unit of the server analyzes the relationship between sugar content in apples before harvesting for specified periods before they are harvested and data on meteorological conditions, as well as sugar in apples at the time of their shipping, based on past performance.

Lastly, for CGPDTM, claim 1 does not pinpoint any method or system for presenting sugar content data of apples. The sugar content data of apples is considered to be characterized only in the content of information by using a portable sugar content sensor which performs reflective near-infrared spectroscopic analyses. Although claim 2 identifies the sugar content data of apples of claim 1 as "received by a receiving unit of a server and stored in a memory unit of the server". The measured sugar content data is transmitted to the server directly or via a terminal. It does not specify any step, module or method for communication of sugar content data of apples. In the same direction, the sugar content data of apples of claim 2 is again a mere presentation of information under the clause (n) of section (3) of the Patents Act, 1970 (as amended). Therefore, the apples sugar content data of claims 1 and 2 are mere presentations of information.

On the other hand, for CGPDTM, claim 3 is computer implemented method comprising the first step for analyzing the relationship between sugar content data of preharvest and post harvest apples for specified periods by modeling meteorological data; a second step in which the receiving unit of the server receives the sugar content data of apples for specified periods; and a third step in which a prediction unit of the server predicts and outputs sugar content data of apples at the time of future shipping using the sugar content data of apples for specified periods and data on past and future meteorological conditions as inputs, based on the said analyzed relationships. Here, all the above steps appear to be technical in nature and performed by the technical means. Therefore, a method for predicting sugar content data of apples prima does not fall within the scope of clause (k) of section (3) of The Patents Act, 1970 (as amended).

8.2.6 Case 12: Data structure of dialogue scenarios in voice interactive system

In the present case study, claim 1 reveals a data structure that stores distinct dialogue scenarios, used in an interactive voice system in a client/server model, containing dialogue unit identifiers, messages and possible answers to continue the dialogue with a user, within a tree shape that maps possible scenarios of a dialogue to possible answers.

INPI considered that the claim refers to a method that uses a data structure and not the data structure itself. In this sense, it would be necessary to make changes to the preamble of the claim in order to make it clear that it refers to the method category claim. Nevertheless, the subject matter in claim 1 adequately defines the technical effect (processing of specific information according to the voice dialogues), as well as the solution to the technical problem of the state of the art (limitation of the ability to communicate with the user), not being considered a data structure per se. That is, claim 1 presents a data structure of dialogue scenarios in a voice interaction system, mapping predefined responses to compose a dialogue with the user.

On the other hand, ROSPATENT considered that The object of the claim 1 is not an invention under the article 1350 of the Civil Code. In this sense, the generic term of claim 1 ("data structure") directly refers to the claimed object to solutions consisting only of providing information. According to paragraph 49 of the Rules for Inventions, the claimed invention is recognized as belonging to objects other than inventions, when the generic term reflecting the purpose of the invention given in the claim, or all of the characteristics with which the claimed invention is characterized in the claim are the characteristics of these objects.

Lastly, CGPDTM pointed out that the claim deals with data structure of dialogue scenarios, without defining the structural or functional relationship with the elements of a computer. Unlike INPI, CGPDTM considered that the feature of claim fails to cause technical effect which is capable of causing a functional change in the computer or real world. Thus the scope subject matter of claim attracts the section 3(k) [algorithm] of the Patents Act, 1970. Furthermore, the capacity of communication depends upon the price plan selected by the user, that is related to a business method or virtual interaction model.

8.2.7 Case 13: Trained model for analyzing reputation of accommodations

In the case study under analysis, claim 1 includes a model trained to quantify reputation values of accommodations, based on textual data containing reputation of said accommodations, with the model consisting of two neural networks, in which the first network is responsible for extracting of characteristics and the second receives the output of the first as input and returns in its output quantified values of the accommodation reputation.

For INPI, the claimed model provides quantified values of accommodation reputation based on text data referring to accommodations. Such a model uses a function that performs a calculation based on neural networks, using as input the frequency of specific words in the user's comments to evaluate the accommodations. In this context, the subject matter in claim 1 adequately defines the technical problem (precisely analyzing the accommodation reputation) to be solved by the application, claiming the model to rate the reputation of accommodations using neural networks. Therefore, the claimed subject matter does not fall under Article 10 (Incise III) of the IPL, since the subject matter in claim 1 is an artificial intelligence technique applied to rate the reputation of accommodations. Claim 1 is considered eligible as an invention, because when evaluating the claimed matter as a whole, it is observed that it solves a problem of a technical nature and not merely as an existing financial method.

On the other hand, for CGPDTM, the alleged invention discloses a trained model for causing a computer to function to output quantified values of reputations of accommodations. As per specification disclosure and claim, it is clear that in substance the invention lies in a trained model which is nothing but a computer program and hence claimed subject matter falls within scope of section 3(k) [computer program per se] of the Act.

8.2.8 Case 19: Method for solving multidimensional optimization problems

In this case study, the scope of claim 1 is a method for solving multidimensional optimization problems by calculating optimization values for a group of possible solutions $\{S_1,...,S_n\}$ of a discrete combinatorial problem, using a group of optimization functions $\{f_1,...,f_k\}$, generating average values $\mu(f_i)$ and standard deviation values s(f), as well as normalizing the optimization values for said possible solutions and finding the minimum value among the accumulated normalized optimization values $min_{i=1}^{n} f(S_i)$.

For INPI, claim 1 presents only mathematical operations in order to solve multidimensional optimization problems. As an example, we can mention the operations of calculation of mean, bias and normalization. The subject matter in claim 1 does not define a technical field, and it was not possible to identify a technical problem to be solved, since multidimensional optimization is considered a purely mathematical problem. In this context, the claimed matter falls under Article 10 (I) of the IPL and does not comply with

paragraph [10] of item 2.1 of the CII guidelines (INPI/PR No. 411/2020), thus, claim 1 is not considered eligible because it is a mathematical method.

In the same direction, ROSPATENT pointed out that the object of claim 1 is not an invention under the article 1350 of the Civil Code, paragraph 5. Generic term of claim 1 ("data structure") directly refers to the claimed object to solutions consisting only of providing information. According to paragraph 49 of the Rules for Inventions, the claimed invention is recognized as belonging to objects other than inventions, when the generic term reflecting the purpose of the invention given in the claim, or all of the characteristics with which the claimed invention is characterized in the claim are the characteristics of these objects.

Similarly, CGPDTM pointed out that the claimed subject matter relates to solving Multidimensional Optimization Problems by performing various mathematical steps. Therefore, subject matter to be protected by the applicant is nothing but a mathematical method and hence falls within scope of section 3(k) of the Patents Act, 1970.

8.3 Inventive Step Cases

The case studies related to the inventive step are presented in Table 3, indicating the case study number, the title and the topic under discussion.

Case	Title of Invention	Remarks
7	Learning system comprising on-vehicle devices and a server	Different types of training data / training method
8	Quality management program of manufacturing lines	Mere AI application
9	Estimation system of hydroelectric generating capacity	Mere AI application
		Modification of training data
10	Screw clamping quality estimation apparatus	Modification of training data
11	Dementia stage estimation apparatus	Data pre-processing

Table 3 – Inventive step case studies

8.3.1 Case 7: Learning system comprising on-vehicle devices and a server

The present case study aimed to verify if the use of different training data, obtained differently, would be able to confer inventive step to a claimed subject.

In claim 1, a machine learning system is described that includes on-vehicles mounted devices and a server used to communicate with each of the on-vehicles installed devices through a communication network. The devices installed in the vehicles, in addition to performing image recognition, send these acquired images to a server that, based on them, trains the neural network by obtaining new parameters. These parameters are sent back to the devices to update the neural network, improving its functioning.

For the INPI, document D1 already teaches the retraining of the recognition system based on the images captured during the usage of the equipment. In this context, a system is claimed where the input

parameters utilized (i.e., using image data around the vehicle captured by a camera in the vehicle) of claim 1 and the prior art D1 are similar. The difference between claim 1 and D1 is the fact that the training is performed on a server based on the images of all the devices in the system, and then the update is performed on each of them. However, as noted, such a feature is taken as common knowledge by a skilled person. Thus, the difference between the present case study and the state of the art lies in the training dataset used. By changing the training dataset, using information obtained by all vehicles in the system, it is possible to have neural networks trained so that a particular vehicle can react to a situation that it has not yet experienced. In this case, the INPI considered that the specificity of the training dataset is related to the efficiency of the implementation, which cannot confer an inventive step as it is the competence of the skilled person.

Similarly, ROSPATENT pointed out that the claimed training system differs from the device known from D1 by the presence of a server, which consists of:

- an acquisition unit that acquires the said data for learning provided from the said plurality of on-vehicle devices;
- a learning unit that carries out machine learning based on the said data for learning and generates data for generating the said parameters;
- a provision unit that provides the said plurality of on-vehicle devices with the said data for updating.

According to ROSPATENT, these units are intended for machine learning and updating of the parameters based on which image recognition is performed on the vehicle. Further improvement in the quality of image recognition could be achieved by taking into account the working conditions of different vehicles by the server that generates data for updating the image recognition parameters. However, these features are not present in the claim.

As pointed out by ROSPATENT, the use of the three units mentioned above intended for machine learning and updating parameters based on which image recognition is performed on the vehicle is known from D1. Generating mobile device update data on the server based on data received from mobile devices and transmitting update data to mobile devices is known from D2.

Thus, for ROSPATENT, said invention does not have an inventive step since it is based on the creation of an appliance consisting of known parts, which are selected and connected according to known rules and recommendations. Furthermore, the technical result achieved in this case is due only to the known properties of the parts of this appliance and the connections between them.

Lastly, the CGPDTM pointed out that, in claim 1, the problem to be solved is improving functions of computer programs of various terminals including mobile type terminals after they are shipped. To this end, a server generates data for updating the computer programs or the setting values of the computer programs collectively, and provides a plurality of terminals therewith by making an analysis based on data that were used for processing of the programs and were provided from the plurality of terminal devices to the server via a network.

Given the claimed matter and the state of the art, the CGPDTM highlighted the following characteristics:

1. The instant application uses a multifunction camera to capture the various angles and uses that data to update the server (as claimed in the instant application, a provision unit that provides the

said server with the image data used for the said image recognition as data for learning; an acquisition unit that acquires data to update the said parameters provided from the said server; and an updating unit that updates the said parameters based on the said acquired data)

2. In the instant application, a learning unit carries out machine learning based on acquired data to update the data.

According to the CGPDTM, a server that generates data to update computer programs or configuration values of computer programs is considered common knowledge to a skilled person. In addition, D1 also performs an analysis based on the data collected to update the data and improve the functions of the computer program. Therefore, features (i) and (ii) are not inventive on D1.

Thus, according to the CGPDTM, given the characteristics described in the state of the art, it would be obvious for a skilled person to reach the object of the present case study. Thus, claim 1 lacks an inventive step.

8.3.2 Case 8: Quality management program of manufacturing lines

The present case study was chosen to verify if, in the opinion of the IP BRICS offices, the mere replacement of an AI technique by another one can confer an inventive step to the claimed matter.

Claim 1 of the present case study refers to a method of quality inspection of production lines, where a neural network is trained to indicate non-compliance of items. The inspection results and the manufacturing conditions of the corresponding items are used to train a neural network through Deep Learning. The trained neural network generates an estimate of the manufacturing conditions that caused the nonconformity.

For the INPI, the system in D1 already teaches the use of machine learning techniques to estimate the manufacturing conditions of the items that have caused the noncompliance. The difference between the case study and document D1 would be in the fact that Deep Learning is used as an estimator of manufacturing conditions. Replacing a known machine learning with another one with a corresponding purpose, without observing any unexpected technical effects, is considered an obvious solution for a person skilled in the art and, consequently, without an inventive step. Thus, the object of claim 1 evidently or obviously derives from the teachings of the state of the art, not having an inventive step.

ROSPATENT considered that the claimed object is a computer program and pointed out that such matter is not considered an invention according to paragraph 5 of article 1350 of its Civil Code.

In the same vein as the INPI, the CGPDTM pointed out that D1 differs from the alleged invention in the use of machine learning instead of a neural network. However, it would have been obvious for a skilled person to apply a neural network to the method disclosed in D1 to arrive at the matter claimed in the present case study. Thus, because of the teachings of D1, the object of claim 1 is not inventive.

8.3.3 Case 9: Estimation system of hydroelectric generating capacity

In claim 1, a system for estimating hydroelectric power generation capacity is described. A system comprising a neural network having an input layer and output layer in which input data to input layer is:

1. A precipitation amount of the upper stream of the river;
2. A water flow rate of the upper stream of the river and,
3. A water inflow rate into the dam.

The system calculates the estimated value of the future hydroelectric power generating capacity of the dam, using the trained neural network.

For the INPI, the system described in D1 estimates this same magnitude through a regression model, optimizing the parameters of this model based on the same input data. The difference between the matter claimed in claim 1 and D1 is the use of a neural network, instead of the regression model, as an estimator of the generation capacity. However, the mere replacement of an AI algorithm by another AI technique of corresponding purpose without observing any unexpected technical effects is considered an obvious solution for a skilled person and, consequently, without an inventive step.

According to ROSPATENT, The claimed invention provides an increase in the accuracy of the power plant capacity forecast only by using an artificial neural network to predict the same value as in D1, using the same input data as in D1. The use of artificial neural networks to make a forecast based on historical data is well known. The potential ability of neural networks to make a more accurate forecast than a forecast based on mathematical equations is also known.

Thus, according to ROSPATENT, the invention claimed in claim 1 clearly follows from the prior art and is obvious for a specialist trained in the art, since it is based on replacing a part of assessment system of the generating capacity of hydroelectric power plants known from D1 (the regression equation model and the analysis unit that calculates the partial regression coefficient of the regression equation model) with another known part (an artificial neural network and a machine learning unit) to obtain the result known for such a replacement.

Lastly, the CGPDTM pointed out that the difference between claim 1 and the cited document is the use of a neural network in claim 1. However, this feature of claim 1 is obvious to a person skilled in the art. In the technical field of machine learning, it is well-known that an estimation process of output in the future is carried out based on an input of time series data in the past, by using a trained neural network that has been trained with a training data containing an input of time series data in the past and a certain output in the future. Since it is a well-known technique to use a neural network instead of a regression model, hence claim 1 is not inventive.

Concerning claim 2, it is added that the temperature of the river water upstream of the dam is used as an additional input parameter.

For the INPI and ROSPATENT, as this characteristic is not revealed by D1, it is understood that claim 2 has an inventive step. ROSPATENT additionally points out that the temperature of the upper river flow is used to increase the accuracy of the forecast of the power plant capacity by taking into account the inflow of meltwater. On the other hand, the CGPDTM pointed out that, although the hydroelectric power generation capacity estimation system uses the temperature in the region upstream of the dam as input data, such a characteristic is obvious to a skilled person. Whereas, it is common general technical knowledge that there is a correlation between a temperature and a hydroelectric power generation capacity. Hence, claim 2 does not involve an inventive step.

8.3.4 Case 10: Screw clamping quality estimation apparatus

Claim 1 of the present application refers to a device for estimating the screw-clamping quality, automatically screwed by a screwdriver, using a neural network, whose inputs refer to rotation speed, angular acceleration, position, and inclination of the screwdriver.

For INPI, the device described in D1 makes this same estimation with neural networks using only two of these input variables: rotational speed and angular acceleration of the screwdriver. D2 reveals the use of screwdriver position and inclination variables to estimate this clamping quality, although it does not mention the use of neural networks. It is common general knowledge in the machine learning field to adopt, as input parameters, variables that may have a higher possibility of correlation with the output to increase the reliability and assertiveness of the output of the machine learning device. So, it is understood as an obvious solution for a skilled person to add these two variables to the device of D1 to obtain the claimed object.

Similarly, ROSPATENT pointed out that the claimed invention differs from the device known from D1 only in that it uses two additional parameters to assess a screw clamping quality – the position and inclination of the screwdriver. Since the technical result achieved by the distinctive features is not specified, it is not necessary to establish the known influence of such distinctive features on the technical result (according to paragraph 80 of the Rules for Inventions). According to ROSPATENT, D2 describes that the position and inclination of the screwdriver are used to assess the quality of screw clamping. In addition, it is widely known to use a machine learning device when the input and output data are correlated.

For ROSPATENT, since the correlation of the rotation speed, angular acceleration (D1), position, and inclination of the screwdriver (D2) with the quality of screw clamping is known from the prior art, the claimed invention was created by joining the information contained in the prior art with the general knowledge of a specialist trained in this art. Thus, claim 1 does not meet the inventive step requirement.

Similarly, the CGPDTM pointed out that D1 does not disclose a condition measurement unit that measures a set of condition variables containing the position, and inclination of the screwdriver. However, the given feature is disclosed by D2. Therefore, at the time of filing of this application, it would have been obvious to a person skilled in the art to combine the teachings of D1 with D2 to arrive at the subject matter of claim 1.

8.3.5 Case 11: Dementia stage estimation apparatus

Claim 1 of the present application relates to a device for estimating a patient's stage of dementia. In this device, the speech signal of the doctor and the patient in a conversation is captured and split per speaker. They are then converted to a text string using speech signal recognition. The text referring to the doctor's speech is replaced by the topic the text refers to. Lastly, the topic and text referring to the patient's speech are used as input to a neural network trained to estimate the degree of dementia at the output.

INPI pointed out that, despite performing the same estimation of dementia degree, the device of D1 does not have the following pre-processing steps revealed in the claim:

1. to separate the speeches per speaker;
2. to replace the doctor's speech by the topic the text refers to and,

3. to use, as input to the neural network, the topic, and text referring to the patient's speech to estimate the degree of dementia.

According to INPI, the subject matter in claim 1, especially the inclusion of data pre-processing for input parameters, does not follow evidently or obviously from the teachings of the state of the art, and the pre-processing of training data for machine learning leads to an unexpected technical effect. In this way, claim 1 is considered to present an inventive step (Article 13 of the IPL) given the assessed state of the art.

Similarly, ROSPATENT pointed out that the claimed invention differs from the solution known from D1 in that it:

- contains a speech information analysis means for analyzing the speech information, and then specifying a speech section by the questioner and a speech section by the respondent;
- the speech recognition means separately converts a fragment of the questioner’s speech and a fragment of the respondent's speech into text;
- a question topic specification means for specifying a question topic by the questioner based on the result of the speech recognition;
- and in that the training of an artificial neural network and the subsequent determination of the stage of dementia take into account the topic of the question and the respondent's answer to this question.

For ROSPATENT, these differences allow determining more accurately the degree of dementia based on crucial information in the interview between the questioner and the respondent. Thus, the claimed invention meets the inventive step requirement, since no solutions with the same characteristics have been identified in the prior art.

Lastly, with a similar conclusion, the CGPDTM pointed out the claimed matter differs from D1 when specifying the question topic as per speech recognition. The cited invention feeds raw data to an AI machine, however, the alleged invention feeds a kind of pre-processed or, shall we say, well-structured data, the topic of the question specified or categorized. The alleged invention shall lead to more accuracy in dementia stage determination for categorizing the question into topics. Thus, the feature relating to “the question topic ”, the alleged invention is said to be inventive as per Section 2(1)(j) of the Patents Act,1970(as amended) as the above said feature leads to technical enhancement in terms of accuracy and said technical enhancement is not obvious to person skilled in the art in view of document D1.

8.4 Cases of sufficiency of disclosure

As already mentioned, patents are temporary titles granted by the State to inventors as a measure of return on investment in research and development of new technologies. During the term of the patent, the holder has the exclusive right to exploit the invention, and may prevent third parties from using, reproducing, selling, or importing the patented object without his consent. On the other hand, the patent holder must make public the technical information relating to the invention protected by the patent, to allow its reproduction by a person skilled in the art. The disclosure of the invention plays an important role in promoting innovation by stimulating research into new products and industrial processes, which places the patent system as one of the most important means of stimulating the development of new technologies.

In this context, the sufficiency of disclosure condition is a fundamental part of the system, as it is responsible for the "quid pro quo" that can only be established if the sufficiency of description condition is met. Thus, it is only possible to have a patent granted if a skilled person can carry out the invention, otherwise, the holder will have two protections (patent and trade secret), causing a dysfunction of the patent system. It is noteworthy that the condition of the sufficiency of disclosure has been required since the beginning of the patent system, whose correct evaluation results in the achievement of the main objective of supporting the technological and economic development of a country.

In the case of AI-related inventions considered, much has been discussed about the need to establish specific criteria to guarantee the reproduction of the invention by a skilled person. In this scenario, the assessment of the sufficiency of disclosure through case studies is of great relevance. The case studies related to the condition of sufficiency of disclosure are presented in Table 4, indicating the case study number, the title, and the topic under discussion.

Case	Title of Invention	Remarks
14	Sugar content estimation system	Correlation and model determination
15	Autonomous vehicle	Correlation and prior art
16	Body weight estimation system	Correlation and prior art
17	Method for estimating allergy incidence rate of test substance	Black box (detailing of parameters) and correlation
18	Anaerobic adhesive composition	Clarity of description in order to carry out the invention

Table 4 – Sufficiency of disclosure case studies

As already mentioned, the compilation of results will only present information on the member countries that submitted the analyzes of the proposed case studies.

8.4.1 Case 14 - Sugar content estimation system

In the present case, the applicant describes an alleged correlation between the sugar content of vegetables and face parameters (head length, face width, nose width, and lip width) of the person who harvested the vegetables. Based on this correlation, a system for estimating sugar content in vegetables is proposed, which comprises generating a determination model through machine learning (more specifically convolutional neural network (CNN)), whose training data contains images of people's faces and sugar content of vegetables. Furthermore, the system provides means for storing the images of faces and means for storing the sugar content of vegetables.

For INPI, the correlation of input and output data is not well established. In this case, they believe that the invention could only be considered as having descriptive sufficiency if there was a sufficient description of the AI model used. In addition, INPI pointed out that details of the model used to make

the estimates are not presented, having been presented as a “black box”.

Based on the analysis carried out by INPI, it was noticed that the construction and operation of the requested model is contrary to the provisions of Article 24 of IPL, since the person skilled in the art would not be able to presume how to arrive at the expected answers from the defined inputs.

The analysis presented by the CGPDTM was in the same vein as the INPI, mentioning that the correlation between a face feature of a person and sugar content of the vegetable produced by that person is not sufficiently disclosed in the description. Furthermore, the CGPDTM has flagged that it is not clear how the determination model is generated using a known machine learning algorithm such as a convolutional neural network (CNN) because the description is silent on the data relating to the correlation between a face image of the person and sugar content of the vegetable produced by the person. Also, a skilled person would not be able to assume any relation given the common general knowledge in the art.

Hence, CGPDTM considers that the invention and its operation or use and the method by which it is to be performed is not fully and particularly described in the complete specification and thereby the instant application does not meet the requirements of section 10(4) of the Patents Act, 1970 (as amended). The description also failed to disclose the best method of performing the Invention, which is known to the applicant and for which he is entitled to claim protection.

8.4.2 Case 15 - Autonomous vehicle

The case in question presents a vehicle in which it can be driven in autonomous or manual mode of operation, and the condition for switching from autonomous to manual operation is that a predetermined condition of the driver's rapid reaction capability to drive the vehicle is met. Such rapid reaction capability is determined by a score obtained by a driver monitoring device. The driver's reaction score is determined through the use of machine learning that has as input, images of the driver on the vehicle seat in various situations (holding the steering wheel, using a cell phone, smoking, eating and so on). The training model is generated through machine learning with a known algorithm, such as a neural network. In this case, the input data are defined as a set of images of the driver and the output, a numerical parameter from 0 to 10.

In the analysis carried out by INPI, considering the matter presented in the specification, it is understood that such description in association with the state of the art makes it possible to clearly and sufficiently identify the possibility of the person skilled in the art to reproduce the invention. In this scenario, it is possible to identify the correlation (input X output), making it possible to say that this correlation would be presumed by a person skilled in the art, allowing such person to arrive at the expected solution from the defined inputs, and therefore the invention could be carried out. The current case study is in accordance with the Article 24 of the IPL (sufficiency of disclosure).

According to CGPDTM, the description and claim 1 of the instant application sufficiently disclose the claimed invention. The description discloses, using multiple images of a driver seated in a vehicle seat that has been taken by a camera positioned to take images of the driver in various behaviors and using a quick reaction capability score based on numeric parameters that have manually been assigned to the taken images. Further, the description discloses examples of a driver’s behavior in an image and a corresponding numeric parameter. It can be presumed that, in view of a common general technical

knowledge at the time of filing, there is a correlation between a driver's behavior seen in an image and the quick reaction capability of the driver.

Moreover, the CGPDTM pointed out that It is also a common general technical knowledge for a person skilled in the art at the time of filing that a learning model can be generated that estimates output in response to input through machine learning with a training data containing an input data and output data having a correlation or the like with each other, using a generally used machine learning algorithm.

8.4.3 Case 16 - Body weight estimation system

The case in question presents a system for estimating body weight through the use of a model that is based on a statistically significant correlation between a cosine of an angle of the face, facial contour and BMI (body mass index) of a person. In this case, the measured values of facial contour angles obtained from the image analysis, in addition to body heights and body weights, are defined as training data.

According to INPI, despite establishing a correlation between the cosine of the face angle, facial contour, and a person's BMI in the specification, what is being claimed is a method that uses any feature of a person's face to determine weight. In this sense, a parameter of the face can be an element such as distance between eyes and so forth, for which a person skilled in the art would not be able to establish a statistically significant correlation with BMI.

Therefore, INPI pointed out that the details of the model used to make the estimation are not revealed, the model is presented as a "black box". Although some parameters of the model are pointed out, the lack of details to make the estimation is not following the condition of sufficiency of disclosure (Article 24 of the IPL). The description does not provide enough elements for a person skilled in the art to presume that an estimation of body weight can be obtained based on body height and any features represented by face shape.

On the other hand, in claim 2, the protection scope has as its essential characteristic "the face-outline angle", for which it is possible to establish a correlation with the BMI, as described in the specification. To the best of our knowledge, once said correlation between input and output is well established, the claimed subject matter in claim 2 complies with what is described in item 2.15 of Block I of the Examination Guidelines, in accordance with Article 24 of the IPL.

For the CGPDTM, the feature correlation between cosine face outline angle and BMI of claim is the essential feature of the said application. Except figure 2, the disclosure fails to disclose the methodology to calculate the correlation between face outline angle and BMI. Further, figure 2 also fails to indicate exact BMI values corresponding to cos(face outline angle). The CGPDTM has mentioned that the application fails to disclose the processing means for outputting an estimated value of a body weight of the person.

Furthermore, for the CGPDTM, the description states that invention is not limited to face outline angle, but rather any feature value representing a face shape may be considered for BMI estimation. However, the disclosure failed to disclose other feature values of the face and its correlation with BMI.

8.4.4 Case 17 - Method for estimating allergy incidence rate of test substance

The case in question presents a method for estimating the incidence rate of allergy caused by a test substance in a human being. In this case, training data is defined as data representing the change in shape of a human X cell between before and after the addition of a test substance in a culture solution. The trained artificial intelligence model should calculate the score data of an incidence rate of human allergic reaction. It is assumed that, even in view of a common general technical knowledge at the time of filing, a person skilled in the art can presume a certain relation such as a correlation between an allergy incidence rate and a shape change of a cell.

For INPI, despite the aforementioned understanding that a person skilled in the art is able to assume a relationship between “an allergy incidence rate” and “a shape of a cell”, as also claimed in independent claim 1, the specification only details the correlation of a type of allergic reaction and specific changes in cell format, not allowing the person skilled in the art to generalize such correlation to different types of allergies and changes in cell format, contrary to the provisions of Article 24 of IPL.

According to INPI, considering the information provided in the specification, related to the essential features of claim 1, the lack of detail on the parameters used in the estimation of the incidence rate of allergic reaction, as well as the absence of correlation between any allergic reaction and cell shape, lead to evaluation of the model as a “black box”. However, details of the model used to make the estimation are not revealed and the lack of details to make the estimation is not in accordance with the condition of sufficiency of disclosure (Article 24 of the IPL).

On the other hand, for INPI, in claim 2, the scope of protection complies with what is described in the specification “wherein the group of data representing a shape change of a human X cell is a combination of a shape change in an ellipticity, rugosity, and oblateness of the human X cell; and the allergic reaction is contact dermatitis”. To the best of our knowledge, once said correlation between input and output is well established and the other steps of the claimed method are sufficiently described, the claimed subject matter in claim 2 complies with what is described in item 2.15 of Block I of the Examination Guidelines, in accordance with Article 24 of the IPL, even if the AI is described in the form of a “black box”.

For the CGPDTM, the disclosure only related to “dermatitis incidence” but the independent claim is related to “allergy incidence”. Further, there is no verification shown on the estimation accuracy of the trained model and the experimental result data. The furnished claim and disclosure are not allowable as the claim appears to be indefinite.

Lastly, the CGPDTM pointed out that the claims shall define the boundaries of legal protection sought by the patentee and form a protective fence around the invention which is defined by the words and phrases in the claims. The claims must not be too broad to embrace more than what the applicant has in fact invented. In the view of the above objections, the claim shall not be allowed under sufficiency of disclosure.

8.4.5 Case 18 - Anaerobic adhesive composition

The case in question presents an anaerobic adhesive composition with an ideal component that presents a curing strength equal to or greater than 30% of the curing strength after 24 hours within a time interval of 5 minutes from the start of curing.

In this case, curing strength data within 5 minutes of onset and curing strength data after 24 hours of a known component of an anaerobic adhesive composition are defined as training data. Such data is entered into a neural network. The result presents an estimate showing the possibility of a composition as defined in the anaerobic adhesive claim forming an anaerobic curable product.

INPI, during the analysis of this case study, using their current documental framework, identified that the analysis would not be related to the sufficiency of disclosure. As the topic to be analyzed is not within the scope of the case studies, INPI chose not to carry out this assessment.

The CGPDTM pointed out that the claimed “compound A” and “compound B” has not been disclosed fully and particularly in claim also clear disclosure and support not found in the description. According to the CGPDTM, the claimed “residue” shall be defined with adequate range, and the expression “exceeding 30% of the curing strength” shall be restricted to a range within which the claimed invention works best to ascertain the chemical compounds which may be used for the alleged invention. Further, the description fails to disclose excremental data or examples proving the fact of exceeding 30% of the curing strength.

Lastly, the CGPDTM pointed out that if the application depends on the training model, the data provided to the training model to achieve the desired result must be disclosed in the description. Furthermore, the technique or methodology used by the training model must also be disclosed with the help of examples.