# Appeal decision

Appeal No. 2019-10332

Appellant Fujitsu Limited

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The case of appeal against the examiner's decision of refusal of Japanese Patent Application No. 2018-236435, entitled "DATA STRUCTURE" [published on June 25, 2020, Japanese Unexamined Patent Application Publication No. 2020-98476, the number of claims is (5)] has resulted in the following appeal decision.

Conclusion

The examiner's decision is revoked.

The Invention of the present application shall be granted a patent.

Reason

No. 1 History of the procedures

The present application was filed on December 18, 2018, a notice of reasons for refusal was issued on January 28, 2019, a written amendment was submitted on April 8, 2019, and an examiner's decision of refusal (Examiner's decision) was issued on June 28, 2019. Against this, an appeal against the examiner's decision of refusal and a written amendment were submitted on August 5, 2019. A notice of reasons for refusal was issued by the body on September 17, 2020. A written amendment was submitted on November 12, 2020.

No. 2 Outline of the reasons for refusal

1. Outline of the examiner's decision

The matters recited in Claims 1 to 5 of this application do not satisfy the requirements stipulated in the Main Paragraph of Article 29(1) of the Patent Act. Therefore, the Appellant should not be granted a patent.

2. Outline of the reasons for refusal by the body

The descriptions in the scope of claims of this application do not satisfy the requirements stipulated in Article 36(6)(ii) of the Patent Act.

No. 3 Introduction

The "invention" in the Patent Act "means the highly advanced creation of technical ideas utilizing the laws of nature" (Article 2(1)). Thus, matters that do not utilize the laws of nature, e.g., simple mental activities of humans, pure and simple academic laws, or artificial arrangements, do not fall under the "invention".

According to the fact that the "invention" is completed through the steps of setting a certain technical problem, employing technical means for solving the problem, and confirming the effect that a desired object can be obtained by the technical means, whether the "invention for which a patent is sought" recited in the scope of claims (Claims) falls under the above "invention" should be determined depending on whether the invention falls under the creation of technical ideas "utilizing the laws of nature" as a whole in light of a technical problem presupposed by the "invention for which a patent is sought", disclosed in the description in the scope of claims or the description of the specification and drawings attached to the application, a configuration of the technical means for solving the problem, and technical significance, such as effects, to be derived from the configuration.

Therefore, even if technical means of some kind is presented in the "invention for which a patent is sought", as a result of overall consideration, it cannot be said that the invention falls under the "invention" when the essence of the invention is directed to simple mental activities of a human, pure and simple academic laws, or artificial arrangements.

Hereinafter, we will examine whether the inventions according to Claims 1 to 6 fall under the technical ideas "utilizing the laws of nature", as a whole.

No. 4 Regarding Claim 1

Claim 1 amended by the written amendment submitted on November 12, 2020 is as follows.

[Claim 1]

A data structure comprising:

attendance book data of employees composed of a plurality of records having elements of date, month, and attendance status indicating attendance/absence of the employees, and

correct answer information, set for each piece of learning data, which is an objective variable to modify a parameter of a neural network so as to minimize a classification error with a result output by a learner of supervised learning, wherein each predetermined period of the attendance book data is defined as one piece of learning data being an explanatory variable of the supervised learning, the employee with a treatment period set in the attendance status within a specified period from the predetermined period indicates an unwell person having medical treatment, and the employee without the treatment period set in the attendance status within the specified period from the predetermined period indicates a well person, and to modify a target core tensor so that a feature pattern of the target core tensor may be similar to a feature pattern of the unwell person on the basis of the classification error, and weight information set for each piece of learning data and indicating weight for changing a shape of tensor data to be generated from the attendance book data, wherein

a learning device having a storage unit storing a target core tensor and a weighting rule for a treatment-experienced person that indicates an employee who has a past experience of receiving medical treatment and has been reinstated and a generation unit for generating tensor data on the basis of each piece of learning data generated from the attendance book data, is used for processing of: modifying, when the employee falls under the treatment-experienced person, the weight of one element of the learning data after the past medical treatment with respect to the learning data after the past medical treatment out of the learning data generated from the attendance book of the employee, in accordance with the weight information and the weighting rule, to modify the tensor data to tensor data with a shape modified from the initial tensor data generated from the learning data before modifying the weight; generating a core tensor from the tensor data with the modified shape so as to be similar to the target core tensor; inputting the core tensor to the learner; and repeating supervised learning to modify a parameter of a neural network so as to minimize a classification error between a result output by the learner and correct answer information being the objective variable set for the learning data after the past medical treatment and to modify the target core tensor so that a feature pattern of the target core tensor may be similar to a feature pattern of the unwell person on the basis of the classification error, until no learning data not yet processed are present.

No. 5 Contents of the detailed description of the invention

The detailed description of the invention includes the following matters.

1 Regarding the problem to be solved by the invention
"[Summary of Invention]
[Problem to be solved by the invention]
[0004]

The DT can process a partially common pattern by the core tensor. However, in some cases, data that are partially similar to the common pattern on the basis of the partial tensor but, in fact, have a different feature as a whole are processed as the common pattern. As a result, prediction accuracy is reduced.

[0005]

For example, when attendance book data are learned by the DT, the attendance book data about an unwell person and the attendance book data about a well person are input to the DT to learn a prediction model. The attendance book data about a person subjected to determination are input to the learned prediction model to predict the possibility of the person receiving medical treatment (taking administrative leave).

[0006]

In such learning, the attendance book data about a treatment-experienced person, who has a past experience of receiving medical treatment due to developing of mental illness, for example, have fluctuation such as frequent leave or frequent tardiness in some cases even when the person works as normal after been reinstated. In such a case, the attendance book data may be similar to the attendance book data that have fluctuation in attendance, which is a sign before newly receiving medical treatment, on a partial tensor in some cases. The medical treatment, however, does not always occur after the fluctuation in attendance. The attendance book data about the treatment-experienced person serve as noise, thereby reducing prediction accuracy of a person who will newly receive medical treatment.

[0007]

In one aspect, the invention is intended to provide a data structure which can prevent deterioration in prediction accuracy."

2 Regarding the means for solving the problem
"[Means for solving the problem]
[0008]

In a first plan, the data structure comprises attendance book data of employees composed of a plurality of elements, and correct answer information for specifying the employee as an unwell person who has a past experience of receiving medical treatment or a well person who has no experience of receiving medical treatment. The learning device includes a storage unit storing a target core tensor and a weighting rule for a treatment-experienced person that indicates an employee who has a past experience of receiving medical treatment and has been reinstated, and a generation unit for generating tensor data from the attendance book data. The data structure is used by the learning device which modifies, when the employee falls under the treatment-experienced person, the weight of one element of the attendance book data in accordance with the weighting rule, to modify the tensor data, generates a core tensor from the tensor data modified so as to be similar to the target core tensor, and inputs the core tensor to the learner using a deep tensor to execute supervised learning."

3 Regarding the advantageous effect
"[Advantage of the invention]
[0009]
In one embodiment, the invention can prevent degradation in prediction accuracy."

4 Regarding the embodiment of the invention
"[0012]
[Overview example]
Physical condition management of employees has recently been ranked as an important matter that companies address. Companies predict mental disorders of their employees in the coming few months from attendance book data about the employees and take early actions such as counseling. In general, full-time staff members read the attendance book data about a huge number of employees and search employees matching a working condition having distinctive patterns such as frequent business trip, long time overtime work, continuous absence, unauthorized absence, and combinations thereof in a visual manner. Such distinctive patterns are difficult to clearly define, because the full-time staff members have different standards.
[0013]
In this embodiment, a prediction model that predicts metal disorders of employees is learned as an example of deep learning using a deep tensor. In the learning, the attendance book data about employees are the object to be learned and the attendance book data about an unwell person and the attendance book data about a well

person are input to the deep tensor to create the prediction model.

[0014] (omitted)

[0015]

For example, the learning device 100 stores therein learning data including the attendance book data that are about an employee and include a plurality of elements and employee information (label) that identifies whether the employee is an unwell person who has an experience of receiving medical treatment or a well person who receives no medical treatment. The learning device 100 stores therein a target core tensor and a weighting rule for the attendance book data about a treatment-experienced person that indicates an employee who has a past experience of receiving medical treatment and has been reinstated.

[0016]

In this state, the learning device 100 produces a tensor from the attendance book data to be represented by a tensor without changing a weight (e.g., the weight is left unchanged as 1) for the attendance book data as for the learning data that do not fall under the treatment-experienced person. The learning device 100 performs tensor decomposition on tensor data represented by a tensor to produce a core tensor so as to be similar to the target core tensor. Thereafter, the learning device 100 inputs the core tensor to a learner using the deep tensor to perform supervised learning.

[0017]

As for the learning data that fall under the treatment-experienced person, the learning device 100 changes the weight for any element included in the attendance book data to be represented by a tensor in accordance with the preliminarily stored weighting rule to change the tensor data. The learning device 100 performs the tensor decomposition on the data after the weight change to produce the core tensor so as to be similar to the target core tensor. Thereafter, the learning device 100 inputs the core tensor to the learner using the deep tensor to perform supervised learning.

[0018]

The following describes the learning data input to the deep tensor. FIG. 2 is a diagram explaining an example of the learning data. The learning data include the attendance book data for six months and a label that indicates whether the employee received medical treatment within three months after the six months. FIG. 2(a) is the attendance book data about an unwell person, and a label (medically treated) is attached to the attendance book data. FIG. 2(b) is the attendance book data about a well person, and a label (no medical treatment) indicating that no medical treatment was received is attached to the attendance book data. As illustrated in FIG. 2, the learning device 100 according to the first embodiment learns a prediction model using "the attendance book data for six months attached with the label (medically treated)" and "the attendance book data for six months attached with the label (no medical treatment)" as the learning data. The learning device 100 predicts, after the learning, whether a certain person will receive medical treatment within three months from the attendance book data about the person for six months. In FIG. 2, the shaded section indicates leave."

"[0024]

The following describes learning in the deep tensor. FIG. 5 is a diagram explaining an example of learning in the deep tensor. As illustrated in FIG. 5, the learning device 100 produces an input tensor from the attendance book data attached with a teacher label (label A) indicating that the employee had received medical treatment, for example. The learning device 100 performs the tensor decomposition on the input tensor to produce a core tensor so as to be similar to the target core tensor randomly produced initially. The learning device 100 inputs the core tensor to a neural network (NN) to obtain a classification result (label A: 70%, label B: 30%). Thereafter, the learning device 100 calculates a classification error between the classification result (label A: 70%, label B: 30%) and the teacher label (label A: 100%, label B: 0%).

[0025]

The learning device 100 learns a prediction model and a method of tensor decomposition using extended backpropagation, which is an extended method of backpropagation. The learning device 100 corrects various parameters in the NN so as to reduce the classification error by propagating the classification error in an input layer, an intermediate layer, and an output layer included in the NN such that the error is propagated toward lower layers. The learning device 100 propagates the classification error to the target core tensor to correct the target core tensor so as to be close to the partial graph structure contributing to prediction; i.e., a feature pattern indicating a feature of the unwell person or a feature pattern indicating a feature of the well person.

[0026] (omitted)

[0027]

When performing the learning using the tensors produced from the attendance book data about the well person and the attendance book data about the unwell person, the learning device 100 refers to the whole period of the attendance book data regardless of whether medical treatment is included in a period (e.g., six months + three months for label use) extracted as one piece of the learning data, and identifies the person who has a past experience of receiving medical treatment (treatment-experienced person).

The learning device 100 reduces the weight for the tensor of data in a period after medical treatment (after reinstatement) of the treatment-experienced person, the data having a risk of partially being similar to the fluctuated pattern in the attendance book, the pattern being a sign before receiving medical treatment, when producing the core tensor (extracting the partial pattern).

[0028]

This allows the learning device 100 to extract the treatment-experienced person and the unwell person (person who will newly receive medical treatment) as different core tensors when the attendance book data about the treatment-experienced person are partially similar to the attendance book data about the unwell person before newly receiving medical treatment, such as frequent absent and tardiness in the attendance book data. The learning device 100, thus, can correctly learn the feature of the unwell person, thereby making it possible to prevent deterioration in prediction accuracy of the person who will newly receive medical treatment.

[0029]

[Functional structure]

FIG. 6 is a functional block diagram illustrating a functional structure of the learning device 100 according to the first embodiment. As illustrated in FIG. 6, the learning device 100 includes a communication unit 101, a storage unit 102, and a control unit 110.

[0030] (omitted)

[0031]

The storage unit 102 is an example of the storage device that stores therein programs and data. The storage unit 102 is a memory or a hard disk drive, for example. The storage unit 102 stores therein a weight information DB 103, an attendance book data DB 104, a learning data DB 105, a tensor DB 106, a learning result DB 107, and a prediction object DB 108.

[0032]

The weight information DB 103 is a database that stores therein a weighting rule indicating weight setting contents set to the tensor data. FIG. 7 is a diagram illustrating an example of weight information stored in the weight information DB 103. As illustrated in FIG. 7, the weight information DB 103 stores therein "types and setting values (weights)" in association with each other. The "type" stored therein indicates a data type, while the "setting value (weight)" stored therein indicates the value to be set.

[0033]

In the example in FIG. 7, the weight for the tensor data of the treatment-experienced person after medical treatment period is set to "0.5", while the weighting for the tensor data other than that data is set to "1.0". The weight "1.0" can be interpreted that the tensor data is not changed, thereby making it possible to use a default value, for example. The weight "0.5" can be interpreted that a part of the weight for the tensor data is changed so as to reduce importance, thereby making it possible to use a value smaller than the default value. The weight can also be set for each of elements, such as the month and the attendance status.

[0034] [0035] (omitted)

[0036]

The learning data DB 105 is a database that stores therein learning data serving as the object to be represented by a tensor. Specifically, the learning data DB 105 stores therein pieces of learning data, each of which is a set of data extracted from the attendance book data in a period of six months, and the label.

[0037]

For example, the attendance book data for six months are extracted as one piece of learning data. The label "medically treated" is set when a medical treatment period in which the employee received medical treatment is present in three months after the six months, while the label "no medical treatment" is set when no medical treatment period is present in three months after the six months. When the medical treatment period is included in the attendance book data for six months, the attendance book data are not used as the learning data. This is because, at the predicting time, it is clear that the person who is already recorded as "medical treatment" in the attendance book data for six months, which serves as prediction origin data (input), received treatment quite recently. The person is thus excluded from the object of medical treatment prediction for the coming three months.

[0038]

FIG. 9 is a diagram illustrating an example of the information stored in the learning data DB 105. As illustrated in FIG. 9, the learning data DB 105 stores therein "the employee, the data (explanatory variable), and the label (objective variable)" in association with one another. The "employee" stored therein is the employee corresponding to the attendance book data serving as the production origin of the learning data. The learning data including the data (explanatory variable) and the label (objective variable) are stored.

[0039]

In the example in FIG. 9, the label "no medical treatment" is set to the attendance book data about employee A from January to June and to the attendance book data about employee A from February to July. The label "medically treated" is set to the attendance book data about employee A from March to August.

[0040] to [0043] (omitted)

[0044]

The learning data generation unit 111 is a processing unit that produces the learning data composed of sets of pieces of data for certain periods with different starting times and labels corresponding to the staring times from the respective pieces of attendance book data stored in the attendance book data DB 104. Specifically, the learning data generation unit 111 samples pieces of data for a designated period from the attendance book data about a person allowing duplication. The learning data generation unit 111 extracts a plurality of pieces of data having different beginnings of periods (starting times) from the respective pieces of attendance book data. The learning data generation unit 111 sets the label "medically treated" when the medical treatment period is present in three months from the end time of the data. The learning data generation unit 111 sets the label "no medical treatment" when no medical treatment period is present in three months from the end time of the data, for each piece of data. Thereafter, the learning data generation unit 111 stores the learning data in which the extracted pieces of data and the set labels are in association with each other in the learning data DB 105.

[0045]

For example, the learning data generation unit 111 extracts the attendance book data from January to June from the attendance book data from January to December. The learning data generation unit 111 attaches the label "no medical treatment" to the extracted attendance book data when no medical treatment period is present in the three months from July to September to produce the learning data. Then, the learning data generation unit 111 extracts the attendance book data from February to July from the attendance book data from January to December. The learning data generation unit 111 attaches the label "medically treated" to the extracted attendance book data when the medical treatment period is present in the three months from August to October, to produce the learning data.

[0046]

The treatment-experienced person determination unit 112 is a processing unit that determines whether the employee to be determined is the treatment-experienced person on the basis of the attendance book data serving as the origin of the respective pieces of learning data. For example, the treatment-experienced person determination unit 112 refers to the attendance book data for the whole data period, which differs from "six months" used for prediction, of the employee, determines the employee to be the treatment-experienced person when the "medical treatment period" was present in the past, and determines that the employee is a well person when no "medical treatment period" was present in the past. The treatment-experienced person determination unit 112 notifies the weight setting unit 113 of the determination results of the respective pieces of learning data.

[0047]

The treatment-experienced person is the employee who has a medical treatment period in the whole attendance book data in the past; i.e., the period is not limited to only a period used for one piece of learning data. For example, when the treatment period was present two years previous to the learning time, a case occurs where the person is not the "unwell person" but falls under the "treatment-experienced person" on the basis of only the data for recent six months in some cases.

[0048]

The weight setting unit 113 is a processing unit that determines whether each piece of learning data falls under a period after the medical treatment of the treatment-experienced person, and changes a part of the weights for the tensor data in accordance with the determination result. Specifically, the weight setting unit 113 sets the weights for each piece of learning data stored in the learning data DB 105 in accordance with the weighting rule stored in the weight information DB 103. The weight setting unit 113 outputs the setting result of the weights to the tensor generation unit 114.

[0049]

For example, the weight setting unit 113 sets the weight to "0.5" for the learning data produced from the attendance book data that are about the employee determined to be the treatment-experienced person by the treatment-experienced person determination unit 112 and falls under the period after the medical treatment period. The weight setting unit 113 sets the weight to "1.0" for each piece of learning data other than the learning data corresponding to "the treatment-experienced person in a period after medical treatment". The weight setting unit 113 sets the weight for the learning data about the treatment-experienced person, which is an example of a certain condition, so as to reduce importance of the data falling under a period after the medical treatment period of the employee who has been reinstated.

[0050]

The following describes the medical treatment period and the setting of the weight with reference to FIG. 10. FIG. 10 is a diagram explaining the determination of the medical treatment period and the weight setting. As illustrated in FIG. 10, the weight setting unit 113 determines whether each piece of learning data corresponds to any of before and after the "medical treatment period" prior to each piece of data is represented by a tensor. In the example in FIG. 10, the weight setting unit 113 detects the "medical treatment period" from "Aug. 24, 2015" to "Oct. 4, 2015", then sets the weight to "1.0" for the learning data falling under before "Aug. 24, 2015", at which the medical treatment started, and sets the weight to "0.5" for the learning data falling under after "Oct. 4, 2015", at which the medical treatment ended.

[0051]

It is determined that the period before the medical treatment period, which is described as a period before medical treatment, is important to extract as the core tensor (a partial pattern influencing the prediction), which is a partial pattern serving as a factor of receiving medical treatment factor. The weight is, thus, set to "1". In contrast, it is determined that the period after the medical treatment period, which is described as a period after medical treatment, is not important to extract as the core tensor, which is a partial pattern serving as a factor of receiving medical treatment. The weight is, thus, set to "0.5". As described above, a part of the weights for the tensor data is changed for the learning data falling under the after medical treatment period of the treatment-experienced person.

[0052]

The tensor generation unit 114 is a processing unit that represents each piece of learning data as a tensor. Specifically, the tensor generation unit 114 produces tensors composed of elements included in the respective pieces of learning data which are stored in the learning data DB 105 and to which the weight setting unit 113 completes the weight setting, and stores them in the tensor DB 106. For example, the tensor generation unit 114 produces the fourth rank tensor composed of four elements included in each piece of learning data and stores it in the tensor DB 106. The tensor generation unit 114 stores the tensor and the label "medically treated" or "no medical treatment" attached to the learning data in association with each other.

[0053]

Specifically, the tensor generation unit 114 produces the tensor from the learning data using each attribute assumed to characterize a tendency of receiving medical treatment as each dimension. For example, the tensor generation unit 114 produces the fourth rank tensor having the fourth dimension using four elements of the month, the date, the attendance status, and business trip status. When the data is for six months, the number of elements of the month is "6", the number of elements of the date is "31" because the maximum value of the number of days in each month is 31, the number of elements of the attendance status is "3" when the types of attendance status are attendance, leave, and holiday, and the number of elements of the business trip status is "2" because the status is either the business trip was made or was not made. The tensor produced from the learning data is, thus, "6×31×3×2" tensor. The value of element corresponding to the attendance status and the business trip status for each date in each month is 1 while the value of element other than those is 0.

[0054] [0055] (omitted)

[0056]

The learning unit 115 is a processing unit that learns a prediction model by the deep tensor using each tensor produced from each piece of learning data and the label, and a method of the tensor decomposition. Specifically, the learning unit 115 performs learning utilizing a characteristic of the deep tensor. The deep tensor has the characteristic of "being capable of recognizing a partial structure of the graph (tensor)". For example, the learning unit 115 extracts the core tensor from the tensor serving as the input object (input tensor), inputs the core tensor to the NN, and calculates an error (classification error) between the classification result from the NN and the label attached to the input tensor, in the same manner as the method described with reference to FIG. 5. The learning unit 115 learns parameters of the NN and optimizes the target core tensor using the classification error. Thereafter, the learning unit 115 stores the various parameters in the learning result DB 107 as the learning results when the learning ends.

[0057]

In the tensor decomposition described in the first embodiment, the core tensor is calculated so as to be similar to the target core tensor to dispose the important structure for classification at the similar position in the core tensor. The learning is performed on the NN using the core tensor, thereby achieving highly accurate classification."

"[0061]

[Influence of the weight change]

The following describes influence on learning of the NN due to changing the weight to 0.5 for the attendance book data about the treatment-experienced person after the medical treatment period with reference to FIGS. 12 to 16. FIG. 12 is a diagram illustrating an example of comparison of the pieces of tensor data. FIG. 13 is a diagram explaining weight change on the tensor data about the treatment-experienced person. FIG. 14 is a diagram explaining the learning data excluded from weight change. FIG. 15 is diagram explaining the learning data on which weight change is performed. FIG. 16 is a diagram explaining influence of the weight change.

[0062]

In the following description, the attendance book data, which are attached with the label "medically treated", about employee A who is an unwell person, and the attendance book data, which are attached with the label "no medical treatment", about employee B who is the treatment-experienced person are exemplified. The attendance book data about employee B are those after the medical treatment period.

[0063]

In the example in FIG. 6, for example, the weight is set to "0.5" for all of the elements in the attendance book data about the treatment-experienced person in the period after medical treatment. In the following example, the weight is changed for only one element. Among the date, the month, and the attendance status in the attendance book data, the weight for the attendance status is changed to 0.5 while the weights for the others are left unchanged as 1.0. The weight for which an element is changed is set by the weighting rule.

[0064]

As illustrated in FIG. 12, the tensor data produced from the attendance book data, which are attached with the label "medically treated", about employee A (unwell person), and the tensor data produced from the attendance book data, which are attached with the label "no medical treatment", about employee B (treated person) are different data when comparing them in a long time period such as one or two years. When paying attention to a short period P such as six months, they are the data similar to each other or the same data. Their features are, thus, not distinguished from each other. The data originally to be handled separately are handled as the data similar to each other by virtue of having the same feature amount when the data are extracted for six months as the learning data. In the learning of the prediction model, such data are processed as the same case and the data about the treatment-experienced person become noise, causing deterioration in optimization of the target core tensor and accuracy deterioration in learning the NN. As a result, accuracy of a prediction model deteriorates.

[0065]

As a countermeasure for the accuracy deterioration, as illustrated in FIG. 13, a part of weights for a tensor indicating the data about the treatment-experienced person (employee B) after being medically treated, which may include partially similar data, is changed by the weight setting by the weight setting unit 113 when the core tensor is formed (a partial pattern is extracted). For example, for the data about the treatment-experienced person having the medical treatment period, the values of the records falling under leave such as "annual leave" and "quasi absence" in the "attendance status" are set to "0.5" as a part of the weights for data period after medical treatment. The lengths of the edges and the values set to the nodes are changed.

[0066]

The change of weights for data about the treatment-experienced person after the medical treatment period causes the edges in the graph structure to be changed, resulting in the tensor data being changed. As a result, the core tensor extracted from the attendance book data can be differentiated from the other one. The feature of the attendance book data about the treatment-experienced person in the period after medical treatment can be distinguished from the feature of the other attendance book data.

[0067]

Specifically, as illustrated in FIG. 14, the learning device 100 sets the weight to "1.0" for all of the records in the attendance book data, which are attached with the label "medically treated", about employee A who is the unwell person although the attendance status includes leave such as annual leave. The attendance book data, thus, has a graph structure with data values left unchanged, and are represented as a tensor.

[0068]

On the other hand, as illustrated in FIG. 15, the learning device 100 basically sets the weight to "1.0" for all of the records in the attendance book data, which are attached with the label "no medical treatment", about employee B. The weight is changed to "0.5" for the records (data) including annual leave and quasi absent in the attendance status. Since the shape of the graph structure representing the attendance book data differs from the shape of that when the weight is "1.0", the tensor data after being represented in a tensor also differ from that when the weight is "1.0".

[0069]

The weight change, thus, allows different pieces of tensor data to be produced even when the pieces of attendance book data are similar to one another. Even when the pieces of attendance book data serving as the extraction sources of the core tensors are similar to one another, different pieces of tensor data can be produced from the respective pieces of data, thereby making it possible to learn the NN as the different features.

[0070]

Specifically, as illustrated in FIG. 16, the shapes of the respective graph structures serving as the pieces of input data are changed before and after the weight change. The shapes of the respective input tensors (pieces of tensor data) that are produced from the pieces of input data and serve as the production sources of the core tensors are also changed. At this time, since main component directions of the respective input tensors are not fixed, the main component directions, thus, also have a possibility of coinciding with each other before and after the weight change.

[0071]

The tensor decomposition that extracts the core tensor from the input tensor is, then, performed, and different core tensors are produced because the input tensors serving as the decomposition sources differ before and after the weight change. At this time, the main component direction of the core tensor representing the feature amount of the input tensor is fixed. The different core tensors having different main component directions are, thus, extracted before and after the weight change. Even when the pieces of attendance book data are similar to one another, the different core tensors can be extracted by the weight change. As a result, the reduction of the accuracy of the prediction model can be prevented even when the attendance book data about the treatment-experienced person in the period after medical treatment are used as the learning data.

[0072]

[Learning processing flow]

FIG. 17 is a flowchart illustrating a learning processing flow. As illustrated in FIG. 17, the learning data generation unit 111 reads the attendance book data from the attendance book data DB 104 (S101) and selects one employee serving as the learning object (S102).

[0073]

The learning data generation unit 111 extracts pieces of data for six months from the attendance book data and attaches labels to respective pieces of extracted data on the basis of the presence or the absence of the medical treatment period in the attendance book data in the following three months, thereby producing the learning data (S103). When the medical treatment is included in the date for six months, the data are not employed as the learning data.

[0074]

Then, the learning data generation unit 111 selects one piece of the learning data (S104), refers to all of the pieces of attendance book data in the past about the employee corresponding to the learning data, and determines whether the medical treatment period is included in the pieces of attendance book data (S105). If the medical treatment period is included (Yes in S105), the learning data generation unit 111 sets the label "medically treated" to the learning data (S106). If no medical treatment period is included (No in S105), the learning data generation unit 111 sets the label "no medical treatment" to the learning data (S107).

[0075]

If learning data not yet processed are present (Yes in S108), the processing from S104 onwards is repeated. If no learning data not yet processed are present (No in S108), the processing from S109 onwards is performed.

[0076]

Specifically, the treatment-experienced person determination unit 112 selects one piece of learning data (S109) and determines whether the learning data fall under "a condition that the employee is the treatment-experienced person in a period after medical treatment" (S110). If the learning data fall under the condition (Yes in S110), the weight setting unit 113 changes the weight to "0.5" according to the weighting rule (S111). If the learning data do not fall under the condition (No in S110), the weight setting unit 113 sets the weight to "1.0" without being changed (S112).

[0077]

The tensor generation unit 114 represents the weighted learning data by a tensor to produce tensor data (S113). If learning data not yet processed are present (Yes in S114), the processing after S109 onwards is repeated. If no learning data not yet processed are present (No in S114), the processing after S115 onwards is repeated.

[0078]

Specifically, if the employee serving as the learning object is not yet processed is present (Yes in S115), the processing after S102 onwards is repeated. If the processing is completed for all of the employees (No in S115), the learning unit 115 performs the learning processing using the learning data (S116)."

"[0083]

[Advantageous effect]

As described above, in learning of the feature of an unwell person, accuracy of the prediction model is reduced, because the attendance book data about the unwell person and the attendance book data about the treatment-experienced person in a period after medical treatment are similar to each other and the learning, thus, includes noise. The learning device 100 according to the first embodiment can change the graph structure of the attendance book data by changing the weight for the attendance book data about the treatment-experienced person in a period after medical treatment, thereby making it possible to differentiate the core tensors input to the NN from each other.

[0084]

Specifically, the learning device 100 sets the weight to "1.0" for the learning data (the label: no medical treatment) falling under a well person, the learning data falling under the unwell person (medically treated), and the learning data (label: medically treated) falling under the treatment-experienced person in the period before medical treatment in accordance with the weighting rule. The learning device 100 changes the weight to "0.5" for the learning data falling under the treatment-experienced person in the period after medical treatment (label: medically treated).

[0085]

The learning device 100 can clearly differentiate the feature amounts (core tensors) of the respective pieces of learning data from one another as described above. The learning device 100, thus, can effectively utilize the characteristic of "the deep tensor is capable of extracting a partial structure (partial pattern of the tensor) contributing to the prediction as the core tensor", thereby making it possible to accurately perform prediction using a small amount of learning data."

No. 6 Judgment by the body

1 Regarding the Main Paragraph of Article 29(1) of the Patent Act (eligibility for a patent)

(1) Regarding Claim 1

A Regarding the technical significance described in the detailed description of the invention

As indicated in "No. 5" "1", in order to solve the problem that the attendance book data about the treatment-experienced person serve as noise, thereby reducing prediction accuracy of a person who will newly receive medical treatment", as indicated in "No. 5" "2", the learning device has a storage unit storing a target core tensor and a weighting rule for a treatment-experienced person that indicates an employee who has a past experience of receiving medical treatment and has been reinstated, and the learning device modifies, when the employee falls under the treatment-experienced person, the weight of one element of the attendance book data in accordance with the weighting rule, to modify the tensor data, generates a core tensor from the tensor data modified so as to be similar to the target core tensor, and inputs the core tensor to the learner using a deep tensor to execute supervised learning, using a data structure, for the above processing, comprising attendance book data of employees composed of a plurality of elements, and correct answer information for specifying the employee as an unwell person who has a past experience of receiving medical treatment or a well person who has no experience of receiving medical treatment. The advantageous effect thereof is, as indicated in "No. 5" "3", to prevent deterioration in prediction accuracy.

Specifically, as indicated in "No. 5" "4", regarding the data structure, the learning data include the attendance book data for six months and a label that indicates whether the employee received medical treatment within three months after the six months ([0018] [0037]). The weights (weight information) are set for each piece of learning data in accordance with the weighting rule stored in the weight information DB 103 ([0048]).

Regarding the medical treatment period and the setting of the weight, it is determined that the period before the medical treatment period is important to extract as the core tensor (a partial pattern influencing the prediction), which is a partial pattern serving as a factor of receiving medical treatment factor. The weight is, thus, set to "1". In contrast, it is determined that the period after the medical treatment period is not important to extract as the core tensor, which is a partial pattern serving as a factor of receiving medical treatment. The weight is, thus, set to "0.5". As described above, a part of the weights for the tensor data is changed for the learning data falling under the after medical treatment period of the treatment-experienced person ([0050] [0051]).

The tensor data produced from the attendance book data, which are attached with the label "medically treated", and the tensor data produced from the attendance book data, which are attached with the label "no medical treatment", are different data when comparing them in a long time period such as one or two years. When paying attention to a short period P such as six months, they are the data similar to each other or the same data. Their features are, thus, not distinguished from each other ([0064]).

The learning device 100 sets, for the attendance book data about the treatment-experienced person in the period after medical treatment, to change, among the date, the month, and the attendance status in the attendance book data, the weight for the attendance status to 0.5 while changing the weights for the others to 1.0 in the weighting rule. Accordingly, the change of weights causes the edges in the graph structure to be changed, resulting in the tensor data being changed ([0063] [0065]-[0068]). The weight change, thus, allows different pieces of tensor data to be produced even when the pieces of attendance book data are similar to one another ([0069]).

The different core tensors having different main component directions are, thus, extracted before and after the weight change. Even when the pieces of attendance book data are similar to one another, the different core tensors can be extracted by the weight change. As a result, the reduction of the accuracy of the prediction model can be prevented ([0071]).

B　Regarding the configuration of the invention according to Claim 1

(A) The data structure in Claim 1 is composed of "attendance book data of employees", "correction answer information" set for each piece of learning data, wherein each "predetermined period" of the attendance book data is defined as one piece of learning data being an explanatory variable of the supervised learning, and "weight information" set for each piece of learning data.

(B) The learning device modifies one element of the learning data in accordance with the "weight information" and the weighting rule, to modify the tensor data to tensor data with a shape modified from the initial tensor data, generates a core tensor from the tensor data with the modified shape, inputs the generated core tensor to the learner, and performs learning processing using the learning data.

(C) Accordingly, even when the pieces of learning data are similar to each other or the same, the effect of preventing reduction in accuracy of the prediction model can be made.

(D) In light of the above, the data structure in Claim 1 is configured to include "weight information" for one element of learning data for each "predetermined period". The "weight information" can prevent reduction in accuracy of the prediction model even when the pieces of learning data are similar to each other or the same.

The "weight information" of the data structure in Claim 1, which is a weight of one element of learning data set for each piece of learning data for each predetermined period and, specifies the change of shape of the tensor data in the tensor data generation processing based on the learning data executed by the learning device, and is equivalent to a program.

Accordingly, the data structure in Claim 1, which does not only specify the contents of a data element provided to the learning device, is not considered artificial arrangements, and falls under the "invention" utilizing the laws of nature.

C　Summary

As described above, regarding Claim 1, as a result of overall consideration in light of a technical problem presupposed by the "invention for which a patent is sought", disclosed in the description in the scope of claims or the description of the specification and drawings attached to the application, a configuration of the technical means for solving the problem, and technical significance, such as effects, to be derived from the configuration, it cannot be said that the essence of the invention of the data structure is directed to artificial arrangements per se, or the like. Thus, Claim 1 falls under the above "invention".

(2) Regarding Claims 2 to 5

Claims 2 to 5 depending on Claim 1 also include the "data structure" in Claim 1, thereby producing the effect of preventing reduction in accuracy of the prediction model.

Therefore, regarding Claims 2 to 5, as a result of overall consideration in light of a technical problem presupposed by the "invention for which a patent is sought", disclosed in the description in the scope of claims or the description of the specification and drawings attached to the application, a configuration of the technical means for solving the problem, and technical significance, such as effects, to be derived from the configuration, it cannot be said that the essence of the invention of the data structure is directed to artificial arrangements per se, or the like. Thus, Claims 2 to 5 fall under the above "invention".

2 Regarding Article 36(6)(ii) of the Patent Act (clarity)

Since the description before the amendment, "(omission) the learning data", is amended to the description, "for the learning data", by the amendment made by the written amendment submitted on November 12, 2020, the reason for refusal was resolved.

No. 7 Closing

In light of the above, the inventions according to Claims 1 to 5 fall under the "invention" and are clear.

Thus, the present application cannot be rejected due to the reasons of the examiner's decision and the reasons by the body.

No other reason for rejecting the present application can be found.

Therefore, the appeal decision shall be made as described in the conclusion.

January 6, 2021

Chief administrative judge: WATANABE, Satoshi
Administrative judge: MATSUDA, Naoya

Administrative judge: AIZAKI, Hirotsune