

DESCRIPTION

TITLE OF INVENTION:

DATA CORRECTION DEVICE, DATA CORRECTION METHOD, AND DATA
CORRECTION PROGRAM

BACKGROUND

Technical Field

[0001] The invention relates to a data correction device, a data correction method, and a
data correction program.

Description of Related Art

[0002] Conventionally, a technology has been proposed that performs data correction by
using a correction parameter calculated for each time based on the correspondence
relationship at each time of synchronized data that has undergone temporal synchronization
at the time when a data shift has occurred (e.g., Patent Document 1).

[Prior Art Document(s)]

[Patent Document(s)]

[0003] [Patent Document 1] Japanese Patent No. 7290484

SUMMARY

[0004] [Issues to be solved by the invention]

However, in the conventional technology, there are cases where appropriate data correction
cannot be performed against a data shift. For example, in the conventional technology,
since correction is performed by using a correction parameter calculated for each time, in

the case where the time of the data before and the time of data after data shift are not synchronized, or in the case where deviation occurs in the synchronization even in the case where temporal synchronization has been performed, a correction parameter different from expectation may be calculated and extreme correction may be performed. Therefore, a data correction method based on a global correspondence relationship is desired.

[0005] [Means for solving the issues]

To solve the issues and achieve the objective, a data correction device is configured to perform correction on new data in which a data shift has occurred. The data correction device includes: a calculation unit, calculating a correction parameter based on a correspondence relationship between existing normal data and new normal data in a periodic interval in a same process; and a correction unit, correcting the new data by using the correction parameter that is calculated.

[0006] [Inventive effects]

According to an aspect of the invention, an effect is achieved in that appropriate data correction can be performed against a data shift.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

[FIG. 1] FIG. 1 is a diagram for describing an example of a data shift.

[FIG. 2] FIG. 2 is a diagram for describing an example of an issue present in the conventional technology.

[FIG. 3] FIG. 3 is a diagram for describing an example of an issue present in the conventional technology.

[FIG. 4] FIG. 4 is a diagram for describing a general picture of processing performed by a

data correction device according to an embodiment.

[FIG. 5] FIG. 5 is a block diagram showing an example of a configuration of the data correction device according to the embodiment.

[FIG. 6] FIG. 6 is a diagram for describing an example of a calculation process by a
5 calculation unit according to the embodiment.

[FIG. 7] FIG. 7 is a diagram for describing an example of a calculation process by a calculation unit according to the embodiment.

[FIG. 8] FIG. 8 is a diagram for describing an example of a correction process by a correction unit according to the embodiment.

10 [FIG. 9] FIG. 9 is a flowchart describing an example of the flow of a process executed by the data correction device according to the embodiment.

[FIG. 10] FIG. 10 is a hardware configuration diagram showing an example of a configuration of a computer that realizes the data correction device according to an embodiment.

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DESCRIPTION OF THE EMBODIMENTS

[0008] [Background]

In the field of process automation, early detection of an anomaly is important for enhancing the safety of production facilities and the stability of product quality. As a technology for
20 detecting an anomaly in production facilities from a stage with a sign in a batch processes, there is a technology that generates a model based on normal time-series data measured by various sensors installed in the facilities, and performs anomaly detection independently for each target by comparing the normal model and time-series data measured for a monitoring target.

[0009] In the production facilities such as factories or plants, to maintain the reliability of the facilities, an operation stop period may be established to implement a planned and large-scale inspection or repair process (hereinafter referred to as regular maintenance). However, a data shift may occur in the measurement data of a specific monitoring target before and after the regular maintenance. A data shift refers to a phenomenon in which measurement data, such as current values and voltage values, slide in a value direction due to the influences caused by measurement properties such as sensor calibration (adjustment of a zero point and a span) or changes in operating conditions.

[0010] Here, an example of the data shift will be described with reference to FIG. 1.

FIG. 1 is a diagram for describing an example of the data shift. FIG. 1 shows new data obtained after the data shift has occurred and existing data obtained before the data shift has occurred. The vertical axis indicates data values. The horizontal axis indicates time. The solid line indicates new data. The dotted line indicates existing data. As shown in FIG. 1, after the data shift has occurred, the zero point of values slides in a positive direction relative to the value of the zero point before the data shift has occurred, and a span changes.

[0011] The data shift as shown in FIG. 1 occurs because the "normal state" of measurement data changes before and after regular maintenance, and does not necessarily indicate that an anomaly has occurred. Due to the change of the normal state, there is a concern that if anomaly detection is performed by directly using the normal model that had been used before regular maintenance and new data measured after regular maintenance, there is a risk of frequent false alarms.

[0012] For this reason, conventionally an operation as follows is performed: anomaly detection is temporarily stopped until new data after regular maintenance is accumulated, and the anomaly detection is resumed after the normal model is regenerated after regular

maintenance based on the accumulated new data. However, in such operation, since anomaly detection is stopped for a certain period, there is a risk of overlooking an equipment anomaly including a mistake of calibration or operation during regular maintenance. Also, immediately after resuming the anomaly detection, the accuracy of the model generated cannot be ensured because the new data does not exist as sufficiently as the existing data before regular maintenance, and there is a possibility that anomaly detection accuracy may drop below the accuracy before regular maintenance.

[0013] In order to avoid the issues described above, there exists a technology that augments new data by correcting multiple existing data to data that are assumed to be obtained under the same condition as that of the new data measurement when there is a change in measurement properties or operating conditions, and generates a new normal model from the augmented data.

[0014] However, in the conventional technology, after performing temporal synchronization by using the dynamic time warping method between data obtained by averaging existing data and new data, the difference at each time between the synchronized data is calculated as an offset value respectively, and the existing data are corrected together. The method calculates a separate correction value for each time based on a local correspondence relationship.

[0015] Here, issues existing in the conventional technology will be described with reference to FIG. 2 and FIG. 3. FIG. 2 and FIG. 3 are diagrams for describing examples of issues existing in conventional technology. FIG. 2 shows new data and existing data after temporal synchronization. (1) and (2) in FIG. 2 indicate the locations where deviation occurs in temporal synchronization. FIG. 3 shows new data and existing data after correction. (1) and (2) of FIG. 3 indicate the locations where extreme correction is

performed. The descriptions of the vertical axis, horizontal axis, solid line, and dotted line in FIG. 2 and FIG. 3 are the same as in FIG. 1.

[0016] Since correction is performed by using the correction value calculated for each time in the conventional art, as shown in (1) and (2) of FIG. 2, in the case where the time is not synchronized between the existing data and the new data, or in the case where deviation occurs in temporal synchronization, there is a possibility that an influence is directly received and inappropriate correction is performed. For example, for data that transition between two steady states, correction values greater than expected are calculated around the change points of the steady states where temporal synchronization is lenient as indicated in (1) and (2) of FIG. 2.

[0017] As a result, as indicated in (1) and (2) of FIG. 3, extreme correction is performed. Consequently, data not suitable to be treated as normal new data is used for model generation, and there is a risk that anomaly detection may not function with high accuracy.

[0018] Therefore, a data correction device 100 corrects data based on a global correspondence relationship between existing normal data and new normal data. Here, the general picture of a process performed by the data correction device 100 will be described with reference to FIG. 4. FIG. 4 is a diagram for describing the general picture of a process performed by the data correction device 100 according to the embodiment.

[0019] The data correction device 100 first calculates a correction parameter based on the correspondence relationship between existing normal data and new normal data in a periodic interval within the same process ((1) of FIG. 4). The periodic interval within the same process includes, for example, in addition to the target interval of a batch process, an interval where the same operation is performed in continuous processes operated with the same pattern, such as a periodic operation.

[0020] For example, the data correction device 100 calculates, as the correction parameter, a regression coefficient obtained by using a regression model created based on the existing normal data and the new normal data in the periodic interval within the same process. Then, the data correction device 100 corrects new data detected after a data shift has occurred by using the calculated correction parameters ((2) of FIG. 4). For example, the data correction device 100 corrects new data by using a regression coefficient that is the calculated correction parameter.

[0021] In this way, the data correction device 100 performs correction of new data based on the correction parameter calculated from the global correspondence relationship between the existing normal data and the new normal data, thereby appropriately correcting the data in which a data shift has occurred and accurately reducing the influence of the data shift. Furthermore, according to the data correction device 100, since the data after the data shift has occurred is appropriately corrected, it is possible to continue to use the existing normal model, and it is possible to suppress overlooking of an anomaly accompanying the stoppage of anomaly detection and suppress the decrease in in detection accuracy due to data shortage.

[0022] [Configuration of data correction device]

Next, an example of the functional configuration of the data correction device 100 according to the embodiment will be described with reference to FIG. 5. FIG. 5 is a block diagram showing an example of the functional configuration of the data correction device 100 according to the embodiment. The data correction device 100 shown in FIG. 5 includes a communication unit 110, a storage unit 120, and a control unit 130. The data correction device 100 may include an input unit (for example, a keyboard, a mouse, etc.) that receives various operations from an administrator, etc., of the data correction device 100, and a

display unit (for example, a liquid crystal display, etc.) for displaying various information.

[0023] (Communication unit 110)

The communication unit 110 is realized by, for example, a communication device, a communication circuit, etc. The communication unit 110 is connected to any network
5 such as the Internet by wire or wirelessly, and transmits and receives information to and from an external information processing device. The communication unit 110 may be communicably connected to the external information processing device through a predetermined wireless communication function such as Wi-Fi (registered trademark). For example, the communication unit 110 transmits and receives information to and from
10 the external device. In this way, the communication unit 110 is a connection means by which the data correction device 100 is communicably connected via a predetermined network.

[0024] (Storage unit 120)

The storage unit 120 is realized by, for example, a semiconductor memory element such as
15 a random access memory (RAM) or a flash memory, or a storage device such as a hard disk or an optical disk. For example, the storage unit 120 is a computer-readable recording medium that non-temporarily records data used by an information processing program. As shown in FIG. 5, the storage unit 120 includes an existing normal data storage unit 121, a new normal data storage unit 122, a model storage unit 123, and a correction parameter
20 storage unit 124. Each unit included in the storage unit 120 will be described below.

[0025] (Existing normal data storage unit 121)

The existing normal data storage unit 121 stores existing normal data. The existing normal data storage unit 121 stores normal data measured by various sensors installed in facilities before the data shift occurs. The existing normal data are, for example, existing data

determined to be normal data by an external system or user. The data length of each existing data may be constant or may differ.

[0026] (New normal data storage unit 122)

The new normal data storage unit 122 stores new normal data. For example, the new normal data storage unit 122 stores normal data measured by various sensors installed in facilities after the data shift occurs. The new normal data are, for example, new data determined to be normal by an external system or user. The data length of the new data may be the same as or different from the existing data.

[0027] (Model storage unit 123)

The model storage unit 123 stores models. The model stored in the model storage unit 123 is, for example, a linear model such as a linear simple regression model and a linear multiple regression model, or a nonlinear regression model. The model stored by the model storage unit 123 is a model created by using a conventional regression method, such as the least squares method or the iteratively reweighted least squares (IRLS) method.

[0028] The linear simple regression model stored in the model storage unit 123 is, for example, a model (Formula 3) created by using the mean value, median value, or modal value (Formula 1) of the existing normal data as an explanatory variable, and the mean value, median value, or modal value (Formula 2) of the new normal data as an objective variable. Here, the mean value, the median value, and the modal value refer to the mean value, the median value, and the modal value for each time according to which each data measured from the start point to the end point of the periodic interval is superimposed so that time or process corresponds.

[0029] [Formula 1]

$$x = \{x(1), \dots, x(T)\} \quad \cdots (1)$$

[0030] [Formula 2]

$$y = \{y(1), \dots, y(T)\} \cdots (2)$$

[0031] [Formula 3]

$$y = ax + b \cdots (3)$$

5 [0032] That is, the regression model stored by the model storage unit 123 is a model that indicates the correspondence relationship between the new normal data and the existing normal data.

[0033] While the above describes an example in which the model storage unit 123 stores a linear simple regression model, the model storage unit 123 may store a linear multiple
10 regression model created by using variables such as an operating condition, a temperature , and humidity of the environment where various sensors are present as explanatory variables.

[0034] (Correction parameter storage unit 124)

The correction parameter storage unit 124 stores correction parameters. The correction parameter storage unit 124 stores, for example, regression coefficients obtained from the
15 correspondence relationships between new normal data and existing normal data indicated by the regression models as correction parameters.

[0035] (Control unit 130)

The control unit 130 may be, for example, an information processing device (control device) that controls various configurations or processes. The control unit 130 includes, for
20 example, a central processing unit (CPU) or a graphics processing unit (GPU), and may be realized by executing a program stored inside the control unit 130 by using a RAM, etc., as a working area. Additionally, the control unit 130 may include integrated circuits such as an application specific integrated circuit (ASIC) or a field programmable gate array (FPGA).

[0036] As shown in FIG. 5, the control unit 130 includes an acquisition unit 131, a

synchronization unit 132, a calculation unit 133, and a correction unit 134, and realizes or executes the function or operation of the information processing described below. The internal configuration of the control unit 130 is not limited to the configuration shown in FIG. 5, and may be other configurations as long as such configuration performs the information processing described later.

[0037] (Acquisition unit 131)

The acquisition unit 131 acquires measurement data. For example, the acquisition unit 131 acquires data measured by various sensors installed in facilities. That is, the acquisition unit 131 acquires measurement data that are the target of data correction from various sensors.

[0038] (Synchronization unit 132)

The synchronization unit 132 executes temporal synchronization between the existing normal data and the new normal data. For example, the synchronization unit 132 performs temporal synchronization between the existing normal data and the new normal data by using dynamic time warping (DTW) method.

[0039] For example, first, the synchronization unit 132 obtains a warping path (WP) between the existing normal data and the new normal data by using the time warping method. Then, the synchronization unit 132 stretches or compresses the time series of the existing normal data or the new normal data so that points connected by the obtained warping path have the same time, thereby making the data lengths of the existing normal data and the new normal data equal.

[0040] (Calculation unit 133)

The calculation unit 133 calculates the correction parameter based on the correspondence relationship between the existing normal data and the new normal data in the periodic

interval within the same process. Here, "periodic interval within the same process" may be, for example, a target interval of a batch process that groups multiple processes together, or an interval in which the same operation is performed in continuous processes operated in the same pattern such as a periodic operation.

5 **[0041]** The calculation unit 133 calculates the correction parameter by using a regression model. For example, the calculation unit 133 calculates the correction parameter using a regression model created based on the existing normal data and the new normal data in the periodic interval within the same process.

10 **[0042]** Here, an example of the calculation process of the calculation unit 133 according to the embodiment will be described with reference to FIG. 6 and FIG. 7. FIG. 6 and FIG. 7 are diagrams for describing an example of the calculation process of the calculation unit 133 according to the embodiment. FIG. 6 shows the new normal data and the existing normal data. The vertical axis shows data values. The horizontal axis shows time. The solid line shows the new normal data. The dotted line shows the existing normal data.

15 **[0043]** FIG. 7 is a diagram plotting the relationship between the new normal data and the average value of the existing normal data shown in FIG. 6 in a graph with the vertical axis representing the values of the new normal data and the horizontal axis representing the average of the existing normal data. The vertical axis may be a value calculated based on the values of the new normal data, such as the average value, the median value, or the modal value of the new normal data. Also, the horizontal axis may be a value calculated based on the values of the existing normal data, such as the average value, the median value, or the modal value of the existing normal data. The dotted line shows a point cloud obtained in the case where the value of the new normal data and the average value of the existing normal data match. © indicates an outlier.

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[0044] That is, FIG. 7 shows the correspondence relationship between the values of the new normal data and the average values of the existing normal data. For example, in the case where the straight line obtained from the plotted point cloud is above the dotted line, it is indicated that the values of the new normal data are greater than the average values of the existing normal data. On the other hand, in the case where the straight line obtained from the plotted point cloud is below the dotted line, it is indicated that the values of the new normal data are smaller than the average values of the existing normal data.

[0045] The calculation unit 133 calculates regression coefficients a and b by using, for example, a linear regression model (Formula 3) that indicates the correspondence relationship between the new normal data and the existing normal data as shown in FIG. 7. To show a specific example, the calculation unit 133 calculates a tilt a and a slice b of the linear simple regression model (Formula 3) that indicates the correspondence relationship between the new normal data and the existing normal data as the regression coefficients. In the example of FIG. 7, an example in which the calculation unit 133 calculates the correction parameter by using a linear regression model is described, but the regression model used by the calculation unit 133 may be not only a linear regression model but also a nonlinear regression model.

[0046] As another example, the calculation unit 133 calculates the correction parameter based on the correspondence relationship between synchronized data in the periodic interval within the same process. For example, the calculation unit 133 calculates the regression coefficient using a regression model that indicates the correspondence relationship between the existing normal data and the new normal data that have undergone temporal synchronization in the periodic interval within the same process.

[0047] (Correction unit 134)

The correction unit 134 corrects the new data by using the correction parameter calculated by the calculation unit 133. Here, with reference to FIG. 8, an example of the correction process of the correction unit 134 according to the embodiment will be described. FIG. 8 is a diagram for describing an example of the correction process of the correction unit 134 according to the embodiment. In FIG. 8, the corrected new data and the existing normal data are shown in a graph with the vertical axis representing data values and the horizontal axis representing time. The solid line indicates the corrected new data. The dotted line shows the existing normal data.

[0048] For example, the correction unit 134 corrects the new data by using the regression coefficient calculated by the calculation unit 133. To show a specific example, in the case where the regression coefficients a and b calculated by the calculation unit 133 are calculated, the correction unit 134 performs correction on new data z by using Formula 4 as follows to obtain corrected new data z' (FIG. 8).

[0049] [Formula 4]

$$z' = (z - b)/a \quad \cdots (4)$$

[0050] By performing correction using Formula 4, the correction unit 134 suppresses extreme correction as shown in (1) and (2) of FIG. 3 from being performed even in the case where the locations that do not correspond to the existing normal data and the new normal data in the periodic interval within the same process or in the case where synchronization is offset, and as shown in FIG. 8, can perform correction that brings new data obtained after a data shift closer to data that had been obtained before the data shift that has occurred.

[0051] [Flowchart]

Here, with reference to FIG. 9, the flow of the process executed by the data correction device 100 in the embodiment will be described. FIG. 9 is a flowchart showing an example of

the flow of the process executed by the data correction device 100 according to the embodiment. Each step in the flowchart and the like may be implemented by being interchanged as long as there is no contradiction, and there may also be steps that are not implemented.

5 **[0052]** First, the data correction device 100 acquires the existing normal data (Step S101). For example, the data correction device 100 acquires the existing normal data from the existing normal data storage unit 121. Subsequently, the data correction device 100 acquires the new normal data (Step S102). For example, the data correction device 100 acquires new normal data from the new normal data storage unit 122.

10 **[0053]** Subsequently, the data correction device 100 performs temporal synchronization of the existing normal data and the new normal data (Step S103). For example, the data correction device 100 uses the dynamic time warping method to make the data lengths of the existing normal data and the new normal data equal. Subsequently, the data correction device 100 calculates the correction parameter (Step S104). For example, the data
15 correction device 100 calculates the regression coefficient by using the regression model that indicates the correspondence relationship between the existing normal data and the new normal data in the periodic interval within the same process.

20 **[0054]** Subsequently, the data correction device 100 acquires new data (Step S105). For example, the data correction device 100 acquires, from various sensors, data measured after the data shift occurs by using various sensors installed in the facility. Then, the data correction device 100 corrects the acquired new data (Step S106). For example, the data correction device 100 corrects the new data using the calculated regression coefficients. Thereafter, the data correction device 100 ends the process.

[0055] [Effects]

The data correction device 100 according to the embodiment is a data correction device that performs correction on new data in which a data shift has occurred, and includes the calculation unit 133 that calculates the correction parameter based on the correspondence relationship between the existing normal data and the new normal data in the periodic interval within the same process, and the correction unit 134 that corrects the new data by using the calculated correction parameter.

[0056] Thus, according to the data correction device 100 according to the embodiment, by performing correction on the new data acquired after the data shift based on the correction parameter calculated from the global correspondence relationship between the existing normal data and the new normal data, appropriate data correction is performed on the data in which the data shift has occurred, and the influence of the data shift is accurately reduced. Furthermore, according to the data correction device 100, since data are appropriately corrected after the data shift has occurred, it is possible to continuously use the existing normal model, and it is possible to suppress overlooking of the anomaly accompanying the stoppage of anomaly detection as well as suppressing the reduction of the detection accuracy due to data shortage.

[0057] The data correction device 100 according to the embodiment further includes the synchronization unit 132 that performs temporal synchronization of the existing normal data and the new normal data, and the calculation unit 133 calculates the correction parameter based on the correspondence relationship between the synchronized data in the interval.

[0058] Accordingly, the data correction device 100 according to the embodiment performs temporal synchronization in the case where the data lengths of the existing normal data and the new normal data are different, and calculates the correction parameter based on the correspondence relationship of data after synchronization, so appropriate data

correction can be performed against the data shift. That is, according to the data correction device 100, even in the case where the data lengths are different before and after the data shift has occurred, correction can be performed by synchronizing the data lengths

[0059] The calculation unit 133 of the data correction device 100 according to the embodiment calculates the correction parameter by using a regression model created based on the existing normal data and the new normal data in the periodic interval within the same process. Accordingly, the data correction device 100 of the embodiment enables correction by using the correction parameter calculated based on the global correspondence relationship of the data before and after the data shift.

[0060] The calculation unit 133 of the data correction device 100 according to the embodiment calculates the correction parameter based on the correspondence relationship between the existing normal data and the new normal data in the target interval of the batch process. Accordingly, the data correction device 100 of the embodiment can perform appropriate correction that reduces the influence of the data shift in the target interval of the batch process.

[0061] [Hardware configuration] The data correction device 100 according to the embodiment above is realized by, for example, a computer 1000 having a configuration as shown in FIG. 10. FIG. 10 is a hardware configuration diagram showing an example of a computer that realizes the functions of the data correction device 100 according to the embodiment. The computer 1000 has a form in which a CPU 1100, a RAM 1200, a ROM 1300, an auxiliary storage unit 1400, a communication input output interface 1500, and an input output interface (I/F) 1600 are connected by a bus 1800.

[0062] The CPU 1100 operates based on the program stored in the ROM 1300 or the auxiliary storage unit 1400, and controls each unit. The ROM 1300 stores a boot program

executed by the CPU 1100 at the time of startup of the computer 1000, or a program dependent on the hardware of the computer 1000, and the like.

[0063] The auxiliary storage unit 1400 stores the program executed by the CPU 1100 and data used by the program. The communication input output interface 1500 receives data
5 from other devices via a predetermined communication network NW (including wireless communication in a closed domain in the embodiment) and sends the data to the CPU 1100, and transmits data generated by the CPU 1100 to other devices via the predetermined communication network NW.

[0064] The CPU 1100 controls an output device such as a display and a printer, and an
10 input output device 1700 such as a keyboard and a mouse via the input output interface 1600. The CPU 1100 acquires data from the input output device 1700 via the input output interface 1600. Also, the CPU 1100 outputs generated data to the input output device 1700 via the input output interface 1600.

[0065] For example, in the case where the computer 1000 serves as various devices
15 according to the embodiment, the CPU 1100 of the computer 1000 realizes the function of the control unit 130 by executing the program loaded on the RAM 1200.

[0066] [Others]

Various embodiments have been described in detail in this specification with reference to the drawings, but the embodiments are examples, and are not intended to limit the invention
20 to the embodiments. The features described in this specification can be realized by various methods, including various modifications and improvements based on the knowledge of those skilled in the art.

[0067] Also, the "part (module, -er suffix, -or suffix)" can be replaced with unit, means, circuit, and the like. For example, a communication module, a control module, and a

storage unit storage module can be replaced with a communication unit, a control unit, and a storage unit, respectively.

[Reference Signs List]

[0068]

- 5 100 data correction device
 - 110 communication unit
 - 120 storage unit
 - 121 existing normal data storage unit
 - 122 new normal data storage unit
- 10 123 model storage unit
 - 124 correction parameter storage unit
 - 130 control unit
 - 131 acquisition unit
 - 132 synchronization unit
- 15 133 calculation unit
 - 134 correction unit

CLAIMS

Claim 1:

A data correction device, configured to perform correction on new data in which a data shift has occurred, the data correction device comprising:

5 a calculation unit, calculating a correction parameter based on a correspondence relationship between existing normal data and new normal data in a periodic interval in a same process; and

 a correction unit, correcting the new data by using the correction parameter that is calculated.

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Claim 2:

The data correction device as claimed in claim 1, further comprising a synchronization unit executing temporal synchronization between the existing normal data and the new normal data,

15 wherein the calculation unit calculates a correction parameter based on a correspondence relationship between synchronized data in the interval.

Claim 3:

20 The data correction device as claimed in claim 1, wherein the calculation unit calculates a correction parameter by using a regression model generated based on the existing normal data and the new normal data.

Claim 4:

The data correction device as claimed in claim 1, wherein the calculation unit

calculates a correction parameter based on a correspondence relationship between existing normal data and new normal data in a target interval of a batch process.

Claim 5:

- 5 A data correction method, executed by a computer and performing correction on new data in which a data shift has occurred, the data correction method comprising:
- a calculation process of calculating a correction parameter based on a correspondence relationship between existing normal data and new normal data in a periodic interval in a same process; and
- 10 a correction process of correcting the new data by using the correction parameter that is calculated.

Claim 6:

- A data correction program, performing correction on new data in which a data
- 15 shift has occurred, the data correction program causing a computer to execute:
- a calculation step of calculating a correction parameter based on a correspondence relationship between existing normal data and new normal data in a periodic interval in a same process; and
- a correction step of correcting the new data by using the correction parameter
- 20 that is calculated.