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(54) Title: SEIZURE DETECTION AI

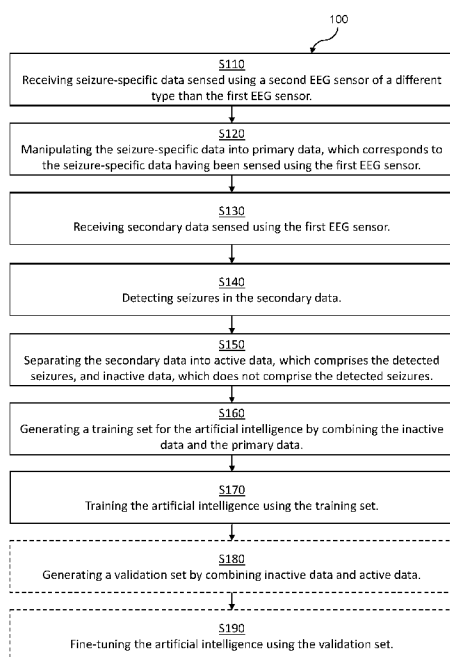


Fig. 3

(57) Abstract: A method (100) for training an artificial intelligence to detect seizures using a first EEG sensor is provided. The method comprises steps of: receiving (S110) seizure-specific data (20) sensed using a second EEG sensor of a different type than the first EEG sensor; manipulating (S120) the seizure-specific data (20) into primary data (21), which corresponds to the seizure-specific data (20) having been sensed using the first EEG sensor; receiving (S130) secondary data (10) sensed using the first EEG sensor; detecting (S140) seizures in the secondary data (10); separating (S150) the secondary data (10) into active data (11), which comprises the detected seizures, and inactive data (12), which does not comprise the detected seizures; generating (S160) a training set (30) for the artificial intelligence by combining the inactive data (12) and the primary data (21); and training (S170) the artificial intelligence using the training set (30). A method (200) for detecting seizures using a first EEG sensor is further provided.

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SEIZURE DETECTION AI

Technical Field

5 The present inventive concept relates to methods for training an artificial intelligence (AI) to detect seizures. In particular, the present inventive concept relates to methods for training an AI to detect seizures using a non-standardized electroencephalogram (EEG) sensor.

Background

10 In order to train an AI, a lot of data is needed. There exists a lot of measured data for seizures, but this data is of a very specific type and is not useable for a non-standardized EEG sensor.

Summary

15 It is thereby an object of the present inventive concept to make use of the available measured data for seizures. Another object of the present inventive concept is to make use of long-term EEG data, which is not typically available in the same data sets as the measured data for seizures. These and other objects are achieved by the features set out in the appended independent claims, with embodiments set out in
20 the dependent claims.

Accordingly, a first aspect of the inventive concept is provided by a method for training an artificial intelligence (AI) to detect seizures using a first EEG sensor. The method comprises steps of: receiving seizure-specific data sensed using a second EEG sensor of a different type than the first EEG sensor; manipulating the seizure-specific data into primary data, which corresponds to the seizure-specific data having
25 been sensed using the first EEG sensor; receiving secondary data sensed using the first EEG sensor; detecting seizures in the secondary data; separating the secondary data into active data, which comprises the detected seizures, and inactive data, which does not comprise the detected seizures; generating a training set for the artificial intelligence by combining the inactive data and the primary data; and
30 training the artificial intelligence using the training data.

The first EEG sensor may be any EEG sensor, including non-standardized EEG sensors.

The second EEG sensor is typically a standardized EEG sensor used to collect large data sets of seizure-specific data.

5 Manipulating the seizure-specific data into data corresponding to having been sensed using the first EEG sensor may comprise removing some amount of data that would not be measurable by the first EEG sensor, and/or transforming some of the data to better match the measurements made by the first EEG sensor.

10 The secondary data may comprise all data sensed by the first EEG sensor, i.e. not only seizure data but also inactive data. By training the AI also on inactive data, the training is improved by having a more realistic non-seizure data.

The method may be implemented in any processing circuit and the trained artificial intelligence may be stored in a memory circuit either locally or on a (remote) server.

15 The seizure-specific data may comprise at least two different types of seizures.

There are many types of seizures, such as temporal lobe seizures, frontal lobe seizures and generalized seizures, so training the AI on at least two different types makes the detection of the AI more reliable.

20 The secondary data may comprise data collected during at least one continuous week.

By training the AI with data collected during at least a full week, the data contains normal everyday activity not normally collected at hospitals during seizure data collection. Further, by having access to more long-term data, long-term effects leading to seizures may be trained to be detected by the AI.

25 The inactive data may be at least 10000 times larger than the active data.

Seizures are generally rare, so training the AI on realistic amounts of data will provide more accurate detection. Further, training the algorithm to better recognize a non-seizure lowers the rate of incorrect detections (i.e. false positives or false negatives). Additionally, it may be easier to acquire inactive data.

30 The seizure-specific data may comprise multi-rater labels.

Labelled data, and especially multi-rater labelled data, may be used as absolute truth when training the AI to improve the accuracy of the training.

The method may comprise steps of: generating a validation set by combining inactive data and active data; and fine tuning the artificial intelligence using the validation set.

5 By using a validation set, the detection of the AI is improved by the fine-tuning made available by the validation set. Using the inactive and active data when generating the validation set has shown to be effective.

Generating a training set for the artificial intelligence may comprise combining an amount of the inactive data and an equivalent amount of a combination of the active data and the primary data.

10 Using active data when generating the training set has shown to improve the detection of the trained AI. Further, equivalent amounts of non-seizure data and seizure data has shown to improve the detection of the trained AI.

The first EEG sensor may be portable and/or the second EEG sensor may be non-portable.

15 Portability may comprise a lack of cumbersome wires, a robustness against fast and sudden motion, a size that allows mobility and using headwear such as hats and headphones, and/or other factors that enable the EEG sensor to be worn uninterrupted (at least while awake) for over a day and preferably several days to weeks during normal day-to-day activities.

20 The first EEG sensor may comprise subcutaneous EEG electrodes.

Available standardized seizure-specific data uses scalp-mounted EEG electrodes. Hence an EEG sensor that uses subcutaneous EEG electrodes is further improved by the method of the invention. Subcutaneous EEG electrodes also enable better portability of the EEG sensor, which in turn enables more non-controlled data
25 to be collected.

The first EEG sensor may be limited to sensing an area above and around a temporal lobe of a user.

Available standardized seizure-specific data comprises data from the whole brain. Hence an EEG sensor that has a limited sensing area is further improved by
30 the method of the invention.

Training the artificial intelligence may comprise transforming the training set into images and using image processing techniques to detect seizures.

Image processing techniques are well-researched and there exists very advanced and effective algorithms and implementations that may be used to improve the training of the AI.

5 Training the artificial intelligence further may comprise transforming segments of the training set between 90 and 150 seconds long into image frames and using image processing techniques on the image frames to detect seizures.

90 to 150 seconds long image frames have shown to improve the detection of the trained AI. This time window is long enough to contain a characteristic evolution of epileptic activity of most seizures with margin, which means that there may be
10 several frames with seizures and a good number of frames with partial seizures in the data set.

Each sequential segment may overlap by at least 60 seconds to the preceding segment.

Such an overlap further improves the detection of the trained AI. This means
15 that the number of frames with partial seizures is optimized for the AI to be able to quickly and efficiently detect a seizure even with limited information.

This limited information, especially frames comprising only the beginning of the seizure and some time beforehand, may be also used to predict seizures before they occur.

20 Manipulating the seizure-specific data into primary data may comprise simulating how the seizure-specific data would appear if sensed using the first EEG sensor by removing data beyond the sensing range of the first EEG sensor and adding noise and/or artefacts specific to the first EEG sensor.

This is an efficient and reliable method for creating primary data from the
25 seizure-specific data.

A second aspect of the inventive concept is provided by a method for detecting seizures using a first EEG sensor. The method comprising steps of: training an artificial intelligence to detect seizures according to the first aspect; transmitting user data sensed by the first EEG sensor to the trained artificial
30 intelligence; and using the trained artificial intelligence to detect seizures within the transmitted user data.

The method may further comprise a step of alerting a user or caretaker that a seizure has been detected. The user may fall or suffocate during a seizure, alerting

may prevent these risk-factors. Sudden death from suffocating in bed is relatively common and may be prevented with an alarm if a seizure is detected.

All the embodiments and advantages of the first aspect also apply to the second aspect *mutatis mutandis*.

5

Description of drawings

The invention will be described in further detail with reference to preferred aspects and the accompanying drawing, in which:

Fig. 1a shows a schematic view of different data sets according to an embodiment;

10

Fig. 1b shows a schematic view of an area above a temporal lobe of a user according to an embodiment;

Fig. 1c shows a prior art standardized EEG sensor;

Fig. 2a shows a schematic view of different data sets according to an embodiment;

15

Fig. 2b shows a schematic view of different data segments according to an embodiment;

Fig. 2c shows a schematic view of transforming different data sets according to an embodiment;

Fig. 3 shows a flowchart of a method for training an artificial intelligence to detect seizures using a first EEG sensor according to an embodiment,

20

Fig. 4a shows a schematic view of a method for detecting seizures using a first EEG sensor according to an embodiment; and

Fig. 4b shows a flowchart of a method for detecting seizures using a first EEG sensor according to an embodiment.

25

Description of embodiments

In the following, terms such as *a/an/the* and *comprising* are intended to be interpreted as non-limiting. Any processor or computing unit may be implemented as an electronic circuit and electronic connections may be wired or wireless unless otherwise explicitly stated. Unless explicitly specified, a wireless connection may be implemented in any number of standards known to a person skilled in the art, such as Wi-Fi, Bluetooth®, Zigbee, 4G/LTE, 5G and so on.

30

Electroencephalograms (EEGs) are mainly used today to investigate brain activity. They are recorded using standardized EEG sensors and usually comprise three-dimensional data of electric activity in a brain of a user.

Such EEGs are mainly used today to learn about the brain as activity is sensed in a controlled testing environment, but ideally EEGs may also be used to detect and/or predict further brain activity in a non-controlled environment. One such brain activity that is of special importance is detecting seizures, as seizures may be of great risk to a person experiencing the seizure if they are not prepared for it and/or if they are alone.

Further, by using a more objective seizure count (e.g. taken by an AI), medication may be prescribed with more accuracy.

The inventors of the present inventive concept have realized that it is possible to detect seizures using an AI trained on large data sets of EEGs comprising seizures, however it proved challenging to generate such a data set.

The AI may be implemented by a deep neural network.

Fig. 1a shows a schematic view of different data sets of the inventive concept. The inventive concept relies on manipulating different available data sets into a training set 30.

The inventive concept starts out with an assumption that there are two available data sets from the start: secondary data 10 and seizure-specific data 20.

The secondary data 10 is sensed using a first EEG sensor, which may be a non-standardized EEG sensor. The first EEG sensor may comprise subcutaneous EEG electrodes rather than the more standardized scalp electrodes.

The first EEG sensor may be limited in its sensing area, i.e. not be able to measure electric activity in the whole brain. The first EEG sensor may have a limited number of sensing electrodes, such as 2-3 or around 10, and/or may be limited in its position and placement on the head of the user.

One such example is shown in Fig. 1b, where an area around a temporal lobe of the user is highlighted in white. The first EEG sensor may be limited to sensing this area, on one or both sides of the head.

The first EEG sensor may be portable. The first EEG sensor may thereby be used to enable taking measurements during a longer time than a more standardized EEG, and in non-controlled environments.

A first EEG sensor may be worn without great discomfort or limited mobility for the user, such that the user may wear the first EEG sensor during their normal day-to-day life.

Accordingly, a first EEG sensor may collect data from a user suffering from
5 seizures that comprises non-seizure activity and seizure activity that occurs naturally, which is different from induced seizures that are recorded during a session at a hospital using a standardized EEG sensor.

The secondary data 10 comprises both seizure activity and non-seizure activity. The secondary data may thereby be separated into active data 11, which
10 comprises the seizures, and inactive data 12, which does not comprise the seizures.

This separation is performed by first detecting the seizures in the secondary data 10. The detection may be performed in any number of ways, such as a user manually labelling the data by registering a seizure as it occurs or by algorithms detecting activity that corresponds to seizures. This detection process will be
15 described in more detail in relation to Figs. 2b-c.

The secondary data 10 may have been collected over several days, such as during at least one continuous week.

Seizures are relatively rare when non-induced by artificial means, such as chemical, biological, or psychological means, even with users that suffer from a lot of
20 seizures. The inactive data 12 may be much larger than the active data 11, such as 1,000 or 10,000 times larger.

The secondary data 10 is not large enough to train an AI to detect seizures, as it may not comprise enough seizures. Therefore, the secondary data 10 is complemented by seizure-specific data 20.

25 The seizure-specific data 20 is sensed using a second EEG sensor of a different type than the first EEG sensor. The second EEG sensor may be a standardized EEG sensor, such as the one in Fig. 1c.

The second EEG sensor may use scalp-attached electrodes to sense brain activity. The electrodes may be in a web or cloth to position them on the head of the
30 user and may be attached to the scalp using gel.

The second EEG sensor may use dozens of electrodes attached to a computer via wires or wirelessly.

The second EEG sensor may be configured to be used while sitting and staying relatively immobile. The second EEG sensor may be non-portable.

The sensing area of the second EEG sensor may be most or all of the brain of the user.

Scalp-mounted electrodes as in the embodiment of the second EEG sensor shown in Fig. 1c may provide less sensitive and more noisy readings than subcutaneous electrodes, as in one embodiment of the first EEG sensor. However, this may be compensated for using more electrodes, at a cost of portability and wearability.

The second EEG sensor has been used to sense seizure-specific data 20. This normally comprises the patient visiting a hospital and inducing seizures, e.g. using flashing lights or drugs, which are measured in a controlled environment with the second EEG sensor.

The exact method for collecting the seizure-specific data 20 is beyond the scope of this application. The important thing is that there now exists large databases of seizure-specific data 20 that may be used to train an AI.

The seizure-specific data 20 may comprise information collected from most or all of the brain.

The seizure-specific data 20 may comprise at least two different types of seizures and may be formatted and have been collected in different ways.

The seizure-specific data 20 mainly comprises seizure data, i.e. not background activity such as normal day-to-day life when seizures are not occurring.

The seizure-specific data 20 has been sensed using a different type of EEG sensor than the secondary data 10. The seizure-specific data 20 may be further differentiated from the secondary data 10. For example, the seizure-specific data 20 may have a larger sensing area, have more data on seizure activity and less data on non-seizure activity than the secondary data.

The seizure-specific data 20 may further be collected in a different, more controlled environment than the secondary data 10.

The seizure-specific data 20 may also comprise multi-rater labels. As this data is created for research purposes, large parts of it have been rated several times by doctors and researchers. This is especially useful when training an AI, as these labels may be used as absolute truth.

The seizure-specific data 20 may be relatively inconsistent, especially if taken from different sources. By relying on multi-rater labels, such as using a

predetermined amount of data with multi-rater labels, fewer falsely labelled seizures used to train the AI.

While the seizure-specific data 20 is large and possibly even rated, it's still not ideal for training an AI as it's lacking normal day-to-day brain activity to contrast the seizure activity. Further, the seizures available in the seizure-specific data 20, while numerous and possibly of different types, have been occurred in a controlled environment and were possibly induced. Hence, training will be improved by also using secondary data 10.

However, these seizure-specific data 20 and secondary data 10 are incompatible, as they've been collected using different types of EEG sensors.

The present inventive concept thereby comprises manipulating the seizure-specific data 20 into primary data 21, which corresponds to the seizure-specific data 20 having been sensed using the first EEG sensor.

The secondary data 10 and the primary data 21 are thereby compatible. It may be impossible to instead manipulate the secondary data 10 to be compatible with the seizure-specific data 20, either because the secondary data 10 has a more limited sensing area than the seizure-specific data 20; or because the seizure-specific data 20 is inconsistently formatted so there is no single compatible format into which the secondary data 10 may be transformed.

The manipulation of the seizure-specific data 20 into primary data 21 may comprise simulating how the seizure-specific data 20 would appear if sensed using the first EEG sensor by removing data beyond the sensing range of the first EEG sensor and adding noise and/or artefacts specific to the first EEG sensor.

A training set 30 may then be generated by combining the secondary data 10 and the primary data 21. In particular, at least the inactive data 12 of the secondary data 10 is combined with the primary data 21 to generate the training set 30, so that the training set 30 comprises both seizure data and non-seizure data.

The AI may then be trained using the training set 30.

The training set 30 may comprise an amount of the inactive data 12 and an equivalent amount of a combination of the active data 11 and the primary data 21. This may further improve the training set 30 as now seizures detected in a non-controlled manner is used.

Additionally, by having an equivalent amount of seizure data and non-seizure data, the training set 30 may be made more similar to validation and testing data sets 40, 60.

5 The secondary data 10 may also be used to create a validation set 40 and a test set 60. This may be done by combining an equivalent amount of active data 11 and inactive data 12.

The validation set 40 may be used to fine-tune the AI after training is performed. This mitigates over-fitting the AI to the training set 30.

The test set 60 may be used to test the AI to ensure consistency and quality.

10 The use of validation sets 40 and test sets 60 once they are generated is known in the art.

Fig. 2a shows a more detailed zoomed-in view of the training set 30, validation set 40 and test set 60.

15 Fig. 2b shows a schematic view of segmenting the secondary data 10 in order to detect seizures within the data. Each rectangle shows a segment 16 of the secondary data 10. The secondary data 10 may be separated into any number of segments, much more than the two shown in Fig. 2b.

The segments 16 may be between 30-300 seconds, such as 60-180 seconds or 90-150 seconds or around 120 seconds long.

20 Each sequential segment 16 may overlap by at least 30, 45, 60 or 90 seconds with each other.

Fig. 2c shows a schematic view of transforming the secondary data 10, or segments 16 of the secondary data 10, from time series signals into images 15. By transforming the data 10, 16 into images 15, image processing techniques may be
25 used to detect seizures in the images 15.

Other similar transformations are also possible.

Fig. 3 shows a flowchart of a method 100 for training an artificial intelligence to detect seizures using a first EEG sensor. Method steps shown with a dashed line are optional. The method steps are listed in a specific order, however a different
30 order may also be possible, as well as some steps being performed simultaneously.

The method 100 may be implemented using a processing circuit and a memory, e.g. using a computer.

The details of the different method steps have already been discussed in relation to Figs. 1-2.

The first step is receiving S110 seizure-specific data sensed using a second EEG sensor of a different type than the first EEG sensor.

A next step is manipulating S120 the seizure-specific data into primary data, which corresponds to the seizure-specific data having been sensed using the first

5 EEG sensor.

A next step is receiving S130 secondary data sensed using the first EEG sensor.

A next step is detecting S140 seizures in the secondary data.

A next step is separating S150 the secondary data into active data, which
10 comprises the detected seizures, and inactive data, which does not comprise the detected seizures.

A next step is generating S160 a training set for the artificial intelligence by combining the inactive data and the primary data.

A next step is training S170 the artificial intelligence using the training set.

15 A next optional step is generating S180 a validation set by combining inactive data and active data.

A next optional step is fine-tuning S190 the artificial intelligence using the validation set.

20 Fig. 4a shows a schematic view of a method for detecting seizures using a first EEG sensor.

The method comprises training an artificial intelligence (AI) to detect seizures. This may be done e.g. as discussed in relation to Fig. 3. The method further comprises transmitting user data 50 sensed by the first EEG sensor to a trained AI. The trained AI is used to detect seizures within the user data 50, shown as a
25 lightbulb in Fig. 4a.

The first EEG sensor and the AI may be the same as discussed in relation to Figs. 1-3.

By detecting seizures in such a manner, an objective seizure count may be received to be relied upon when prescribing medication.

30 Once the trained AI has detected seizures, the method may further comprise alerting the user or a caretaker that a seizure has been detected.

This may comprise sounding an audio alarm or sending an automatic text or emergency signal to a caretaker or hospital.

This may reduce risks associated with having a seizure.

The trained AI may be used to detect seizures as they are about to happen, i.e. be able to alert the user before the user has any effect of the seizure. This may further reduce risks associated with having a seizure.

5 Fig. 4b shows a flowchart of a method 200 for detecting seizures using a first EEG sensor according to an embodiment. Method steps shown with a dashed line are optional. The method steps are listed in a specific order, however a different order may also be possible, as well as some steps being performed simultaneously.

The method 200 may be implemented using a processing circuit and a memory, e.g. using a computer.

10 The details of the different method steps have already been discussed in relation to the preceding Figures.

The first step is training 100 an artificial intelligence to detect seizures. This corresponds to the method of Fig. 3.

15 The next step is transmitting S210 user data sensed by a first EEG sensor to the trained artificial intelligence.

The next step is using S220 the trained artificial intelligence to detect seizures within the transmitted user data.

The next optional step is alerting S230 a user or caretaker that a seizure has been detected.

20 The preceding description has been a non-exhaustive disclosure of different exemplifying embodiments of the present inventive concept. This is not to be misconstrued as limiting the scope of the protection sought for the inventive concept, which is defined by the appended claims.

CLAIMS

1. A method (100) for training an artificial intelligence to detect seizures using a first EEG sensor, the method comprising steps of:

5 receiving (S110) seizure-specific data (20) sensed using a second EEG sensor of a different type than the first EEG sensor;

manipulating (S120) the seizure-specific data (20) into primary data (21), which corresponds to the seizure-specific data (20) having been sensed using the first EEG sensor;

10 receiving (S130) secondary data (10) sensed using the first EEG sensor; detecting (S140) seizures in the secondary data (10);

separating (S150) the secondary data (10) into active data (11), which comprises the detected seizures, and inactive data (12), which does not comprise the detected seizures;

15 generating (S160) a training set (30) for the artificial intelligence by combining the inactive data (12) and the primary data (21); and

training (S170) the artificial intelligence using the training set (30).

2. The method according to claim 1, wherein the seizure-specific data (20) comprises at least two different types of seizures.

3. The method according to claim 1 or 2, wherein the secondary data (10) comprises data collected during at least one continuous week.

25 4. The method according to any one of the preceding claims, wherein the inactive data (12) is at least 10000 times larger than the active data (11).

5. The method according to any one of the preceding claims, wherein the seizure-specific data (20) comprises multi-rater labels.

30 6. The method according to any one of the preceding claims, further comprising steps of:

generating (S180) a validation set (40) by combining inactive data (12) and active data (11); and

35 fine-tuning (S190) the artificial intelligence using the validation set (40).

7. The method according to any one of the preceding claims, wherein generating (S160) a training set (30) for the artificial intelligence comprises combining an amount of the inactive data (12) and an equivalent amount of a combination of the active data (11) and the primary data (21).

40 8. The method according to any one of the preceding claims, wherein the first EEG sensor comprises subcutaneous EEG electrodes.

9. The method according to any one of the preceding claims, wherein the first EEG sensor is limited to sensing an area above and around a temporal lobe of a user.

5 10. The method according to any one of the preceding claims, wherein detecting (S140) seizures in the secondary data (10) comprises transforming the secondary data (10) into images (15) and using image processing techniques to detect seizures in the images (15).

10 11. The method according to claim 10, wherein detecting (S140) seizures in the secondary data (10) further comprises transforming segments (16) of the secondary data (10) between 90 and 150 seconds long into images (15) and using image processing techniques on the images (15) to detect seizures in the images (15).

15 12. The method according to claim 11, wherein each sequential segment (16) overlaps by at least 60 seconds to the preceding segment (16).

20 13. The method according to any one of the preceding claims, wherein manipulating (S120) the seizure-specific data (20) into primary data (21) comprises simulating how the seizure-specific data (20) would appear if sensed using the first EEG sensor by removing data beyond the sensing range of the first EEG sensor and adding noise and/or artefacts specific to the first EEG sensor.

25 14. A method (200) for detecting seizures using a first EEG sensor, the method (200) comprising steps of:
training (100) an artificial intelligence to detect seizures according to any one of the preceding claims;
transmitting (S210) user data (50) sensed by the first EEG sensor to the
30 trained artificial intelligence; and
using (S220) the trained artificial intelligence to detect seizures within the transmitted user data (50).

35 15. The method according to claim 14, further comprising a step of alerting (S230) a user or caretaker that a seizure has been detected.

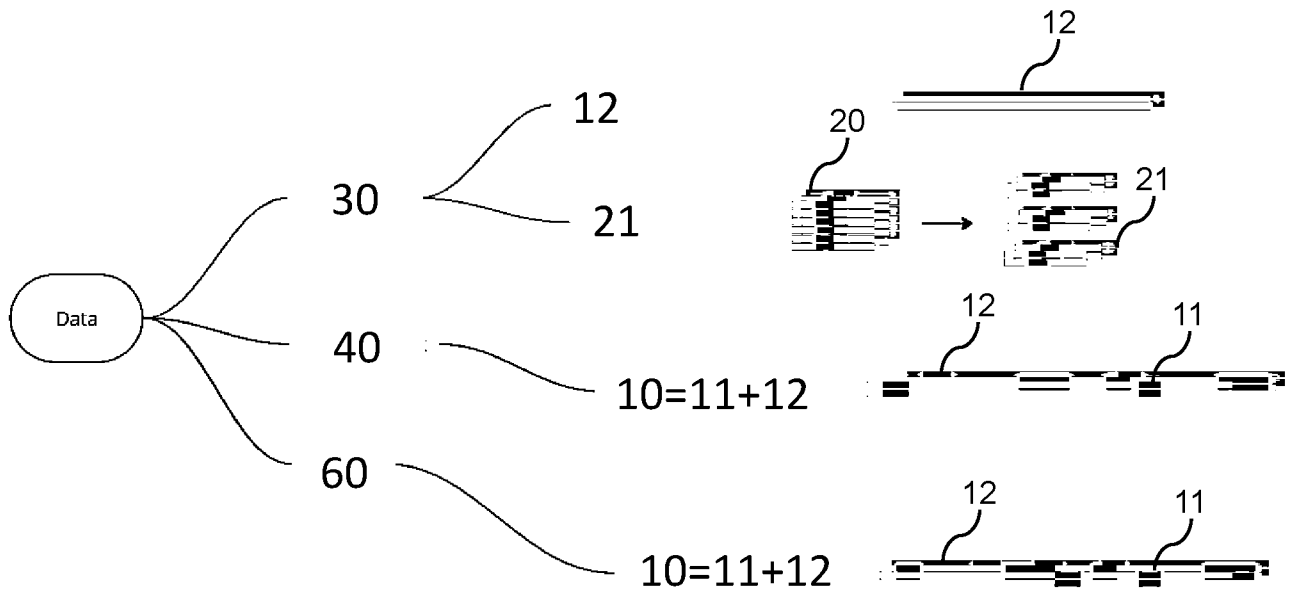


Fig. 1a



Fig. 1b



Fig. 1c

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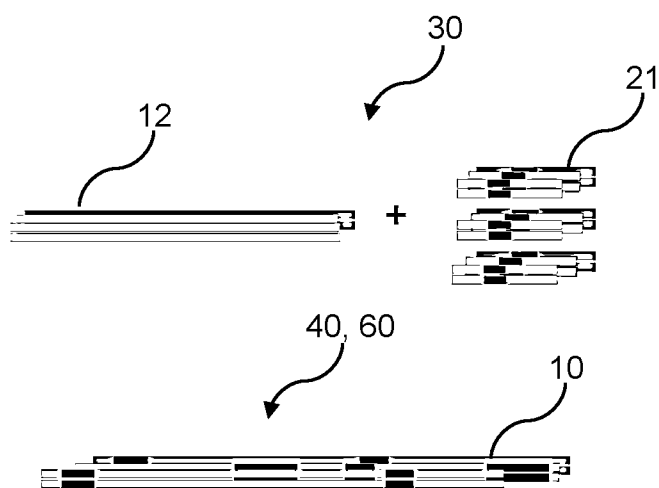


Fig. 2a

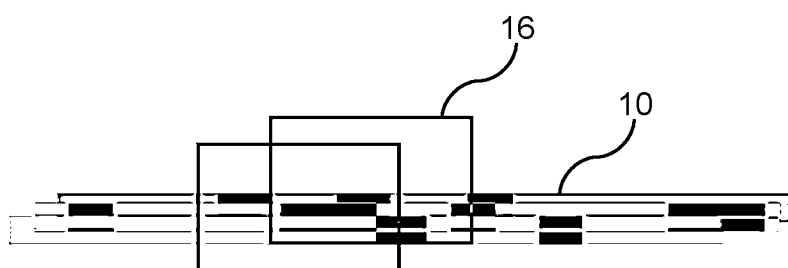


Fig. 2b

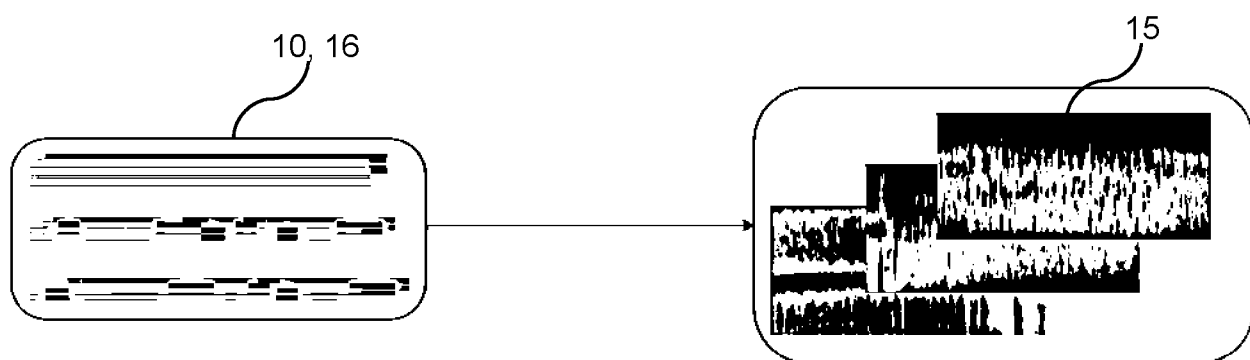


Fig. 2c

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100

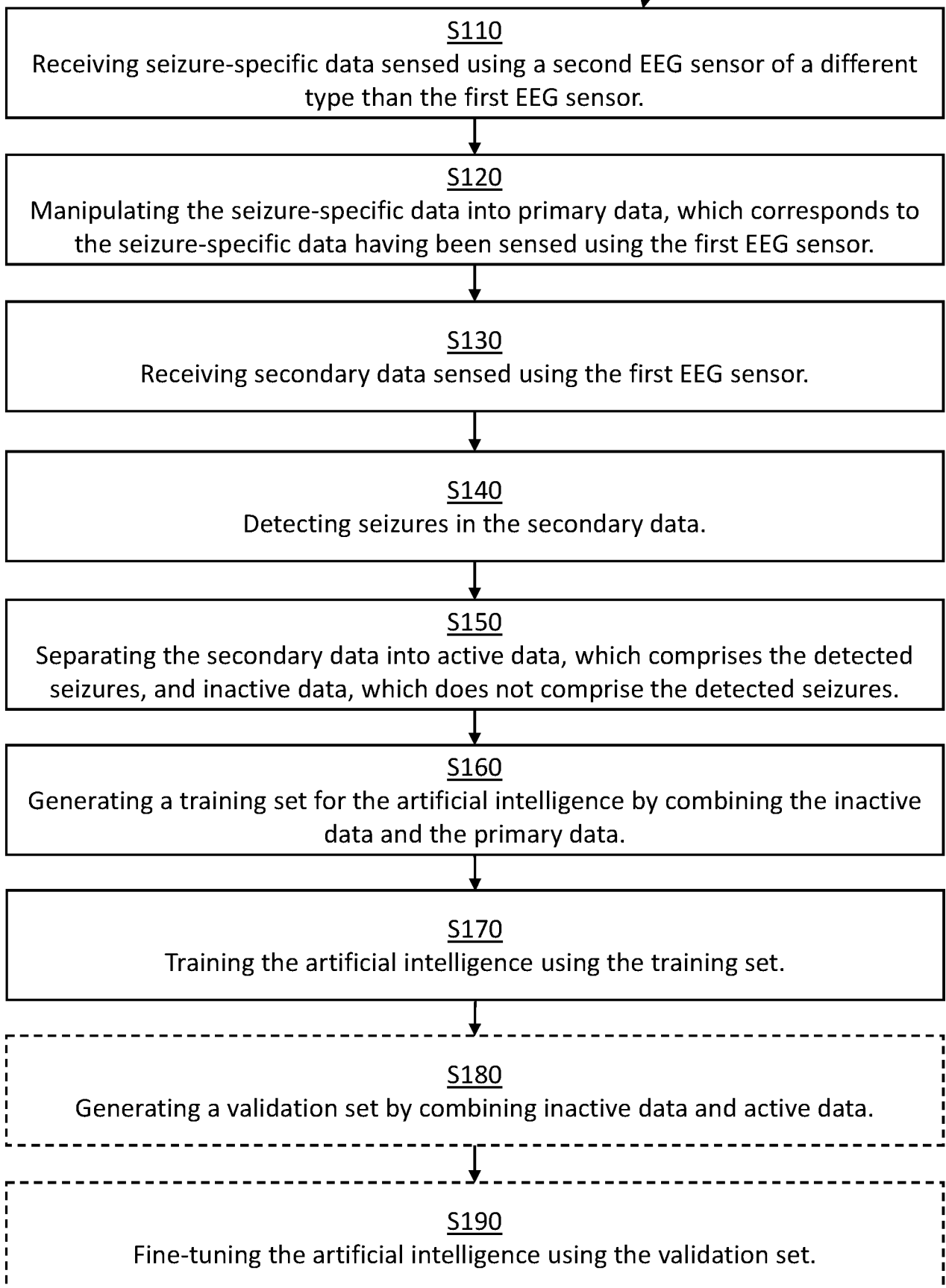


Fig. 3

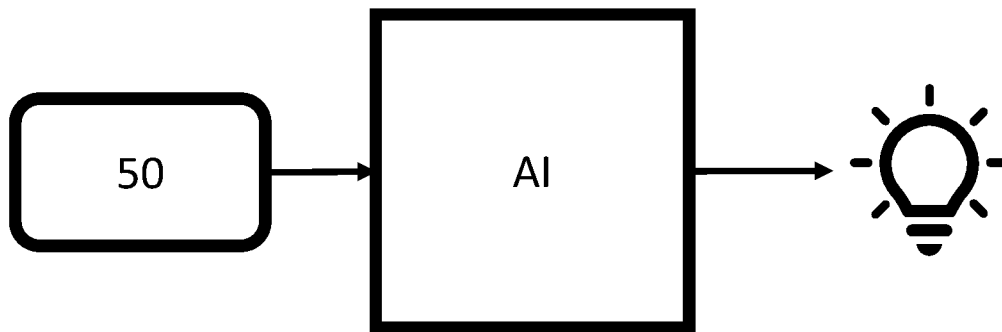


Fig. 4a

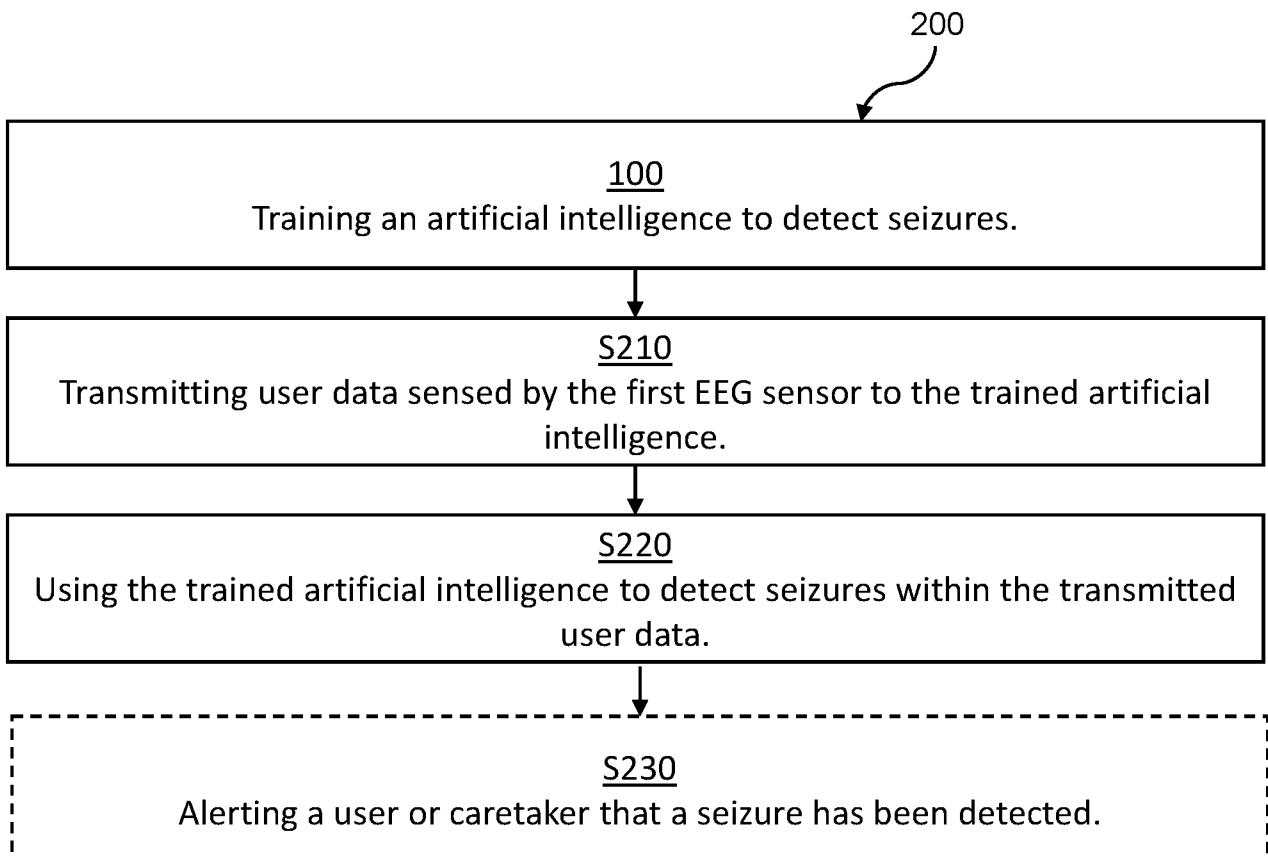


Fig. 4b

INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER

INV. A61B5/369 A61B5/00 G06N3/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61B G06N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2021/259621 A1 (ALVES DAVID [US] ET AL) 26 August 2021 (2021-08-26)	1-6,8, 14,15
A	paragraphs [0007], [0034], [0072], [0153], [0165], [0176] -----	7,9-13
A	US 10 596 377 B2 (IBM [US]) 24 March 2020 (2020-03-24) figure 1 -----	1-15
A	US 2022/071550 A1 (HECOX KURT E [US]) 10 March 2022 (2022-03-10) claim 1 -----	1-15
A	WO 2022/104412 A1 (EPI MINDER PTY LTD [AU]; COCHLEAR LTD [AU]) 27 May 2022 (2022-05-27) claims 1-4 -----	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

7 November 2024

Date of mailing of the international search report

28/11/2024

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2024/067193

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