

According to an aspect, a method for generating a software-implemented module for determining an ~~analyte~~glucose value in a bodily fluid is provided. The method comprises, in an arrangement of one or more data processors, providing a first set of input data indicative of first values measured for a plurality of input parameters, the input parameters comprising a first and a second input parameter and providing a second set of input data indicative of second values for the plurality of input parameters. The second values comprise an augmented value for at least one input parameter from the plurality of input parameters, the augmented value being different from the first value measured for the at least one input parameter and determined by augmenting the first value, and the first value for at least one remaining input parameter from the plurality of input parameters. The method further comprises determining first analyte data indicative of a first plurality of analyte values for an analyte being glucose in a bodily fluid by processing the first set of input data by a physiological model; determining second analyte data indicative of a second plurality of analyte values for the analyte by processing the second set of input data by the physiological model; determining a set of training data from both the first analyte data and the second analyte data; determining a set of test data, the set of test data being different from the set of training data; providing a software-implemented machine learning model configured to determine a ~~glucosen-analyte~~ value in a bodily fluid of a patient for the analyte; training the software-implemented machine learning model by the set of training data; and testing the software-implemented machine learning model by the set of test data.

According to another aspect, a system for generating a software-implemented module for determining a ~~glucosen-analyte~~ value in a bodily fluid, comprising an arrangement of one or more data processors, is provided. The one or more processors are configured to provide a first set of input data indicative of first values measured for a plurality of input parameters, the input parameters comprising a first and a second input parameter and provide a second set of input data indicative of second values for the plurality of input parameters. The second values comprise an augmented value for at least one input parameter from the plurality of input parameters, the augmented value being different from the first value measured for the at least one input parameter and determined by augmenting the first value, and the first value for at least one remaining input parameter from the plurality of input parameters. The one or more processors are further configured to determine first analyte data indicative of a first plurality of analyte values being glucose in a bodily fluid for an analyte by processing the first set of input data by a physiological model; determine second analyte data indicative of a second plurality of analyte values for the analyte by processing the second set of input data by the physiological model; determine a set of training data from both the first analyte data and the second analyte data; determine a set of test data, the set of test data being different from the set of training data; provide a software-implemented machine learning

model configured to determine an ~~an~~ glucose analyte value in a bodily fluid of a patient~~for the~~
~~analyte~~; train the software-implemented machine learning model by the set of training data;
and test the software-implemented machine learning model by the set of test data.

5 According to another aspect, a computer program product for generating a software-implemented module for determining an analyte value is provided. The computer program product comprises instructions which, when the program is executed on an arrangement of one or more data processors, cause the arrangement of the one or more data processors to carry out or conduct the method.

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According to still another aspect, a method for determining an analyte value, the method comprising, in an arrangement of one or more data processors: providing the software-implemented module running in the arrangement of one or more data processors; providing present input data indicative of present values measured for a plurality of input parameters for a fluid
15 containing an analyte; and determining an analyte value comprising analyzing the present input data by the software-implemented module.

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According to a further aspect, a system for determining an analyte value is provided, the system having an arrangement of one or more data processors and a software-implemented module running in the arrangement of one or more data processors, wherein the one or more data
20 processors are configured to provide present input data indicative of present values measured for a plurality of input parameters for a fluid containing an analyte; and determine an analyte value, comprising analyzing the present input data by the software-implemented module.

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25 In an embodiment, the measurement data may be indicative of an analyte in a bodily fluid.

The system for determining an analyte value may, for example, be selected from the group consisting of a smart phone, a computer, a tablet, a receiver of a blood glucose meter or of a continuous glucose monitoring device, a remote control of a medication delivery pump and a
30 medication delivery pump.

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The analyte may be glucose in a sample of a bodily fluid, such as interstitial fluid or blood, in particular interstitial fluid. Measured values, for example the first values, may be (time-) continuously measured.

Claims

1. A method for generating a software-implemented module for determining a glucose value in a bodily fluid, comprising, in an arrangement of one or more data processors,
 - 5 - providing a first set of input data indicative of first values measured for a plurality of input parameters, the input parameters comprising a first and a second input parameter;
 - providing a second set of input data indicative of second values for the plurality of input parameters, the second values comprising
 - 10 - an augmented value for at least one input parameter from the plurality of input parameters, the augmented value being different from the first value measured for the at least one input parameter and determined by augmenting the first value; and
 - the first value for at least one remaining input parameter from the plurality of input parameters;
 - 15 - determining first analyte data indicative of a first plurality of analyte values for an analyte being glucose in a bodily fluid by processing the first set of input data by a physiological model;
 - determining second analyte data indicative of a second plurality of analyte values for the analyte by processing the second set of input data by the physiological model;
 - 20 - determining a set of training data from both the first analyte data and the second analyte data;
 - determining a set of test data, the set test data being different from the set training data;
 - providing a software-implemented machine learning model ~~(60)~~ configured to determine a glucose value in a bodily fluid of a patient;
 - 25 - training the software-implemented machine learning model ~~(60)~~ by the set of training data; and
 - testing the software-implemented machine learning model ~~(60)~~ by the set of test data.
- 30 2. Method of claim 1, wherein
 - determining of the first analyte data comprises determining first predictive analyte data indicative of a first time dependent course ~~(43, 53)~~ of the analyte values for the analyte over a prediction time period ~~(22)~~ by processing the first set of input data by the physiological model; and
 - 35 - determining of the second analyte data comprises determining second predictive analyte data indicative of a second time dependent course ~~(46, 56)~~ of the analyte values

for the analyte over the prediction time period ~~(22)~~ by processing the second set of input data by the physiological model.

3. Method of claim 1 or 2, wherein

- 5 - providing of the first set of input data comprises providing a first set of input data indicative of first values measured for the plurality of the input parameters over a measurement time period; and
- providing of the second set of input data comprises providing a second set of input data indicative of second values for the plurality of the input parameters over the
- 10 measurement time period.

4. Method of claims 2 and 3, wherein the prediction time period ~~(22)~~ is provided as a continuation of the measurement time period.

5. Method of at least one of the preceding claims, further comprising, in the arrangement of the one or more data processors,

- receiving limit data indicative of a parameter limit for the at least one input parameter; and
- limiting augmenting of the first value for the at least one input parameter the parameter.
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6. Method of at least one of the preceding claims, wherein determining of the set of test data comprises determining a set of test data from the first analyte data only.

7. Method of at least one of the preceding claims, wherein determining of the set of training data comprises

- determining residual analyte data;
- determining augmented analyte data from the second analyte data and the residual analyte data; and
- 30 - determining the set of training data at least from the augmented analyte data.

8. Method of claim 7, wherein the determining of the residual analyte data comprises determining residual analyte data from the first analyte data and measured analyte data.

9. Method of at least one of the preceding claims, wherein providing of the first set of input data comprises providing a first set of continuous input data indicative of first values continuously measured for a plurality of input parameters.
- 5 10. Method of at least one of the preceding claims, further comprising
- providing a third set of input data indicative of third values for the plurality of input parameters, the third values comprising
 - an augmented value for at least one other input parameter from the plurality of input parameters, the augmented value being different from the first value measured for the at least one other input parameter and determined by augmenting the first value; and
 - the first value for at least one of the remaining input parameters from the plurality of input parameters;
 - determining third analyte data indicative of a third plurality of analyte values for the analyte by processing the third set of input data by the physiological model; and
 - determining a set of training data from the first analyte data, the second analyte data, and the third analyte data.
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11. A system for generating a software-implemented module for determining a glucose value in a bodily fluid, comprising an arrangement of one or more data processors, wherein the one or more processors are configured to
- provide a first set of input data indicative of first values measured for a plurality of input parameters, the input parameters comprising a first and a second input parameter;
 - provide a second set of input data indicative of second values for the plurality of input parameters, the second values comprising
 - an augmented value for at least one input parameter from the plurality of input parameters, the augmented value being different from the first value measured for the at least one input parameter and determined by augmenting the first value; and
 - the first value for at least one remaining input parameter from the plurality of input parameters;
 - determine first analyte data indicative of a first plurality of analyte values for an analyte being glucose in a bodily fluid by processing the first set of input data by a physiological model;
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- determine second analyte data indicative of a second plurality of analyte values for the analyte by processing the second set of input data by the physiological model;
 - determine a set of training data from both the first analyte data and the second analyte data;
 - 5 - determining a set of test data, the set of test data being different from set of the training data;
 - provide a software-implemented machine learning model ~~(60)~~ configured to determine a glucose value in a bodily fluid of a patient;
 - train the software-implemented machine learning model ~~(60)~~ by the set of training data; and
 - 10 - test the software-implemented machine learning model ~~(60)~~ by the set of test data.
12. Computer program product for generating a software-implemented module for determining a glucose value in a bodily fluid, comprising instructions which, when the program is executed on an arrangement of one or more data processors, causes the arrangement of the one or more data processors to carry out the method of at least one of the claims 1 to 10.
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13. A method for determining a glucose value in a bodily fluid, comprising, in an arrangement of one or more data processors:
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- providing a software-implemented module generated by a method of at least one of the claims 1 to 10 and running in the arrangement of one or more data processors;
 - providing present input data indicative of present values measured for a plurality of input parameters for a fluid containing an analyte being glucose in a bodily fluid; and
 - 25 - determining a glucose value in a bodily fluid of a patient comprising analyzing the present input data by the software-implemented module.
14. The method of claim 13, further comprising at least one of:
- outputting the analyte value to the patient through an output device; and
 - 30 - if the glucose value is below a minimum threshold or above a maximum threshold, outputting an alarm to the patient.
15. A system for determining a glucose value in a bodily fluid, the system having an arrangement of one or more data processors and a software-implemented module generated by a method of at least one of the claims 1 to 10 and running in the arrangement
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of one or more data processors, wherein the one or more data processors are configured to

- provide present input data indicative of present values measured for a plurality of input parameters for a bodily fluid containing an analyte being glucose; and
- 5 - determine a glucose value, comprising analyzing the present input data by the software-implemented module.