

A LAYERED MEDICAL DATA COMPUTER ARCHITECTURE

FIELD OF THE INVENTION

The invention relates to the field of medical data handling system, related methods and uses thereof.

BACKGROUND OF THE INVENTION

The field of medical data handling is today characterized in that there exist an enormous set of such medical data but organized in silos per discipline, say per sensor (used in the broad sense of the word here as information) available about a human (or animal).

While in principle combining all said sets of different sensor data into one computer system by using of Artificial Intelligence (AI) techniques can be put forward as the way to go, such mere combination is probably in practice hard to achieve while the per discipline build up expertise in medical data analysis and data processing might be difficult re-used in such global approach.

In the field of Artificial Intelligence, Deep Learning is a known technique, however typically used on 2- or more dimensional data such as images.

AIM OF THE INVENTION

Embodiments of the present invention aim at overcoming the above discussed problem and provides a carefully selected workable technical solution (being real-time deployable) with a layered approach, leveraging use of a plurality of diverse medical data bases in combination with a mix of discipline specific data processing algorithms with generic Artificial Intelligence methods, more in particular Machine Learning.

SUMMARY OF THE INVENTION

Embodiments of the present invention relate to the field of (at least partially real-time available) medical data handling (such as data analysis or data processing) systems and/or computer or compute architectures, related use and tuning (learning) methods, uses thereof and related arrangements and tools (such as suited data bases).

For sake of clarity in the further description a medical data computer system is described in the sense of a computer system which has been trained, adapted, tuned based on a plurality of heterogeneous sensorial information of different persons (“learning phase”), and ones being trained, adapted or tuned, will generate monitoring of one or more parameters of a human, representative for his or hers physical condition or state (“use phase”), preferably the obtained information is accurate and/or precise enough to even further generate at least one action (providing monitoring information to a third party and/or generating alarms and/or performing preventive measures) for the environment of said human.

According to a first aspect of the present invention, there is provided a medical data processing computer system including a first computer subsystem; and a second computer subsystem, wherein said first computer subsystem, including: a plurality of further third computer subsystems; each further third computer subsystem being adapted for a single sensor data processing; and said second computer subsystem being adapted for joint data processing a plurality of the outputs, generated by said further third computer subsystems, whereby at least part of said second computer subsystem being further adapted for artificial intelligence based data processing, whereby at least one of said further third computer subsystems being further adapted for artificial intelligence based data processing, whereby said artificial intelligence based data processing being machine learning based data processing, wherein said machine learning based data processing being deep learning based data processing, in particular artificial (multi-layer) neural networks.

According to a second aspect of the present invention, there is provided a sensor handling system, including the above computer system, and a plurality of sensors, each of said sensors separately being connected to one of said further third computer sub systems, whereby one or more of said sensors also have artificial intelligence based data processing.

According to a third aspect of the present invention, there is provided a computer system including one or more general purpose processing elements, (related) memory components, input means adapted for inputting sensorial signals and output means for outputting computed signals; computer system being adapted for (i) executing a plurality of single sensor data processing methods, (ii) a further (joint) data processing method on a plurality of the outputs, generated by each of said single sensor data processing methods, and (iii) methods for

computing output signals based on the outcome of said joint data processing method, whereby at least part of said further joint data processing method and one or more or essentially all of said single sensor data processing methods being artificial intelligence based data processing.

According to a fourth aspect of the present invention, there is provided a real-time health measuring use of the computer system of the above aspects, to process data, obtained from a plurality of sensors, of which at least part of said sensors being adapted for real-time monitoring a parameter of a human or animal.

According to a fifth aspect of the present invention, there is provided a use of the computer system of the above aspects, to generate at least (in real-time) one action providing monitoring information and/or generating alarms and/or performing preventive measures for the environment of said human or animal, based on the output of said computer system.

According to a sixth aspect of the present invention, there is provided a use of the computer system of the above aspects for determining (when occurring) at least one physical problem of said human and/or animal from (a combination of) a plurality of sensor data, preferably determining (when occurring) a plurality of distinct physical problems.

According to a seventh aspect of the present invention, there is provided a method for processing data, from a plurality of sensors, said method comprises the step of executing plurality of single sensor data processing methods and a further (joint) data processing (data fusion) method on a plurality of the outputs, generated by each of said single sensor data processing methods, at least one of said data processing method plurality of single sensor data processing methods and at least one of said (joint) data processing (data fusion) method being artificial intelligence (machine learning) based data processing based on deep learning.

According to an eighth aspect of the present invention, there is provided a computer program product, operable on a processing engine, for executing any of the steps of the method of the seventh aspect.

According to a ninth aspect of the present invention, there is provided a non-transitory machine-readable storage medium storing the computer program product of the eighth aspect.

According to a tenth aspect of the present invention, there is provided a medical data database, compiled to be operable on a computer environment and adapted for being controlled accessible by any of the systems of the above aspects for use in the (off-line) learning of any of the artificial intelligence based data processing, including, for a plurality of users, a plurality of records, of

which part are suited for storage of medical data of such user, each of said records being associated with a different type of sensor.

According to an eleventh aspect of the present invention, there is provided a medical data computer arrangement including a medical data computer system of the above aspects, operably connected to the medical data database of the tenth aspect.

In essence an at least 2 layered medical data computer system (10) or architecture is proposed including a first computer subsystem (layer 1) (20); and a (data fusion) second computer subsystem (layer 2) (30), wherein said first computer subsystem, including: a plurality of further third computer subsystems (40); each further third computer subsystem being adapted for a single sensor data processing; and said second computer subsystem being adapted for data processing a plurality of the outputs, generated by each of said further third computer subsystems.

The following embodiments can be clarified already at this level.

The layer 1 allows for having single sensor data processing which is specific for the type of sensor (or information) at hand and hence enables embedding of (some kind of) related discipline expertise therein. Such sensor data processing can be based on machine learning, but preferably one taking into account also per discipline expertise.

CLAIMS

1. A medical data processing computer system (10) comprising a first computer subsystem (20); and a second computer subsystem (30), wherein said first computer subsystem, comprising: a plurality of further third computer subsystems (40); each further third computer subsystem being adapted for a single sensor data processing; and said second computer subsystem being adapted for joint data processing a plurality of the outputs, generated by said further third computer subsystems, whereby at least part of said second computer subsystem being further adapted for artificial intelligence based data processing,
whereby at least one of said further third computer subsystems being further adapted for artificial intelligence based data processing,
whereby said artificial intelligence based data processing being machine learning based data processing,
wherein said machine learning based data processing being deep learning based data processing, in particular artificial (multi-layer) neural networks.
2. The computer system of claim 1 being adapted in that one or more of said subsystems provide feedback control signals to other subsystems lower in the layers.
3. A sensor handling system, comprising the computer system of any of the previous claims, and a plurality of sensors, each of said sensors separately being connected to one of said further third computer sub systems, whereby one or more of said sensors also have artificial intelligence based data processing.
4. The system of claim 3, wherein at least part of said sensors being adapted for monitoring a parameter of a human or animal, at least part of said sensors are on or implanted in the body of said human or animal.
5. The system of claim 3 or 4, further comprising a fourth sub computer system (50), being capable of computing in real-time at least one action being providing monitoring information and/or generating alarms and/or performing preventive measures for the

environment of said human or animal, based on the output(s) of said second computer subsystem, said fourth sub computer system (40) is adapted for inputting dashboard information.

6. The system of claim 5, whereby (part of) said fourth sub computer system (50) being further adapted for artificial intelligence based data processing being deep learning based data processing.

7. The system of any of the previous claims, wherein further comprising comprises one or more additional sub computer systems, inputting personal info like genome data and/or biometric info; and/or alternatively electronically available literature sources, to perform further data enhancement operations.

8. The computer system of claim 7, whereby at least one of said one or more additional computer subsystems being further adapted for artificial intelligence based data processing.

9. A computer system comprising one or more general purpose processing elements, (related) memory components, input means adapted for inputting sensorial signals and output means for outputting computed signals; computer system being adapted for (i) executing a plurality of single sensor data processing methods, (ii) a further (joint) data processing method on a plurality of the outputs, generated by each of said single sensor data processing methods, and (iii) methods for computing output signals based on the outcome of said joint data processing method, whereby at least part of said further joint data processing method and one or more or essentially all of said single sensor data processing methods being artificial intelligence based data processing.

10. The computer system of claim 8, wherein said artificial intelligence based data processing being deep learning based data processing.

11. Real-time health measuring use of a computer system of claim 1 or 10, to process data, obtained from a plurality of sensors, of which at least part of said sensors being adapted for real-time monitoring a parameter of a human or animal.

12. Use of a computer system of claim 1 or 10, to generate at least (in real-time) one action providing monitoring information and/or generating alarms and/or performing preventive measures for the environment of said human or animal, based on the output of said computer system.
13. Use of a computer system of claim 1 or 10 for determining (when occurring) at least one physical problem of said human and/or animal from (a combination of) a plurality of sensor data, determining (when occurring) a plurality of distinct physical problems.
14. A method for processing data, from a plurality of sensors, said method comprises the step of executing plurality of single sensor data processing methods and a further (joint) data processing (data fusion) method on a plurality of the outputs, generated by each of said single sensor data processing methods, at least one of said data processing method plurality of single sensor data processing methods and at least one of said (joint) data processing (data fusion) method being artificial intelligence (machine learning) based data processing based on deep learning.
15. A computer program product, operable on a processing engine, for executing any of the steps of the method 14.
16. A non-transitory machine-readable storage medium storing the computer program product of claim 15.
17. A medical data database, compiled to be operable on a computer environment and adapted for being controlled accessible by any of the systems of claims 1 to 10 for use in the (off-line) learning of any of the artificial intelligence based data processing, comprising, for a plurality of users, a plurality of records, of which part are suited for storage of medical data of such user, each of said records being associated with a different type of sensor.
18. A medical data computer arrangement comprising a medical data computer system (10) of any of the claims 1 to 9, operably connected to the medical data database of claim 17.