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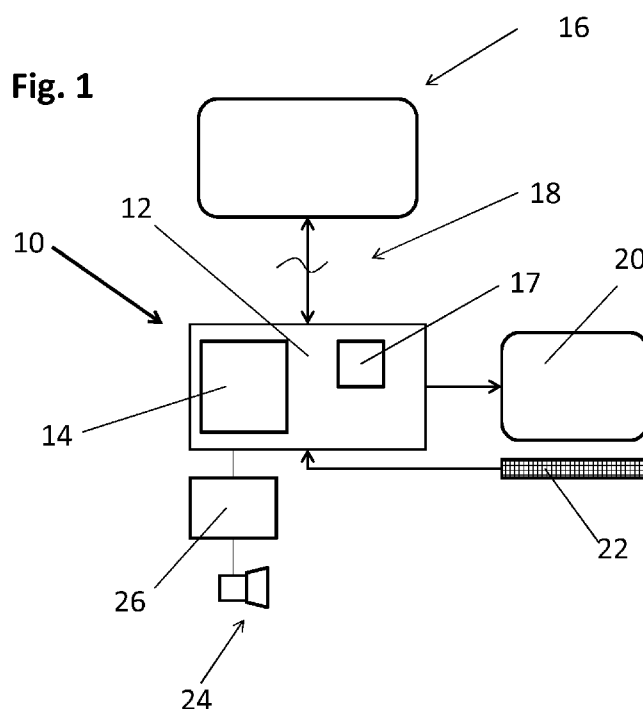
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(54) Title: DIAGNOSIS SYSTEM



(57) Abstract: The invention relates to diagnosis system (10) for a machine-aided diagnosis of skin diseases, comprising an input device (22) for retrieving/inputting skin condition parameters of the skin to be diagnosed, which diagnosis system comprises a processing logic (12) with a model (14) comprising mutual correlations of different skin condition parameters and correlated skin diseases, optionally the value at least of one condition parameter is calculated from the retrieved/inputted skin condition parameters by means of data from the model (14), from the retrieved/inputted skin condition parameters and optionally from the calculated operation parameter an initial set of skin condition parameters is formed, which diagnosis system a) compares the values of the initial set of skin condition parameters with stored skin condition parameters and correlated skin diseases from the model (14), b) the processing logic calculates for each correlated skin disease matching the initial set of skin condition parameters or an expanded set of skin condition parameters a



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probability of coincidence, c) the processing logic (12) checks for the skin disease with the highest probability of coincidence (matching correlated skin disease) whether there are further skin diseases with a similar probability of coincidence and/or whether the probability of coincidence of the matching correlated skin disease is below a pre-defined threshold value, d) in case the check in c) is positive, the processing logic (12) establishes by means of the model (14) at least one further condition parameter being correlated with at least one of the skin diseases of similar probability of coincidence, and e) requests the value of said further condition parameter from the input device (22) and returns to step b) with an expanded set of condition parameters, said expanded set of condition parameters comprising the initial set of condition parameters and said further condition parameter, f) in case the check in step c) is negative or after an abort criterion has been achieved, the processing logic indicates the skin disease with the highest associated probability of coincidence on a display (20) and/or transmits said information to a computer system.

## Diagnosis System

The present invention relates to an diagnosis system for the machine-aided diagnosis of skin diseases which is currently performed by the doctor based on experience.

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The object of the present invention is to improve or verify a diagnosis on skin diseases.

The invention is achieved by means of a diagnosis system according to claim 1 and by means of a diagnosis method according to claim 15. Advantageous further embodiments of the invention are the subject of the attached dependent claims. Preferred embodiments are likewise described in the description and also in the drawing.

According to the invention the diagnosis system for a machine-aided diagnosis of skin diseases comprises an input device for retrieving/inputting skin condition parameters of the skin to be diagnosed. The input device can be a terminal or keyboard but also may be an image forming and/or image recognition device so that it is possible even to make a diagnosis based on a photo of the skin to be diagnosed.

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The diagnosis system further comprises a processing logic with a model comprising mutual correlations of different skin condition parameters and correlated skin diseases. The processing logic may be a conventional microprocessor or a neuronal network or it may comprise a genetic algorithm.

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The model may e.g. an associative memory comprising dependencies between different skin condition parameters and skin diseases.

Optionally the value at least of one condition parameter is calculated from the retrieved/inputted skin condition parameters by means of data from the model. This step is optional and not necessary to carry out the invention.

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From the retrieved/inputted skin condition parameters and optionally from the calculated operation parameter an initial set of skin condition parameters is formed, from which the diagnosis is started.

The diagnosis system

a) compares the values of the initial set of skin condition parameters with stored skin condition parameters and correlated skin diseases from the model, and now the following succession of steps is performed by the diagnosis system.

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- b) the processing logic calculates for each correlated skin disease matching the initial set of skin condition parameters or an expanded set of skin condition parameters a probability of coincidence,
- c) the processing logic checks for the skin disease with the highest probability of coincidence (matching correlated skin disease) whether there are further skin diseases with a similar probability of coincidence and/or whether the probability of coincidence of the matching correlated skin disease is below a pre-defined threshold value,
- d) in case the check in step c) is positive, the processing logic establishes by means of the model at least one further condition parameter being correlated with at least one of the skin diseases of similar probability of coincidence, and
- e) requests the value of said further condition parameter from the input device and returns to step b) with an expanded set of condition parameters, said expanded set of condition parameters comprising the initial set of condition parameters and said further condition parameter,
- f) in case the check in step c) is negative or after an abort criterion has been achieved, the processing logic indicates the skin disease with the highest associated probability of coincidence on a display and/or transmits said information to a computer system.

With this inventive diagnosis system it can be checked whether a diagnosis is made based on the skin condition parameters with a sufficiently high probability of coincidence, so that the diagnosis has a certain level or reliability. On the other hand it is ensured that the matching skin disease which matches the skin condition parameters with the highest probability of coincidence has a probability of coincidence which differs from the next probable one by a value which also ensures that the diagnoses is quite reliable. Thus the system can effectively be used to diagnose skin diseases or to assist a doctor in his diagnosis.

Preferably, the processing logic is designed to repeat steps b) to e) until an abort criterion is achieved that relates either to a period of time or to the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next-probable skin disease, wherein, once the abort criterion has been achieved, in step g) the skin diseases with similar probability of coincidence are indicated on the display. Via this measure it is ensured that if the diagnosed skin diseases with the highest probability of coincidence have a similar level of probability of coincidence (e.g. differ more than 10% of the probability of coincidence of the matching skin disease) all these skin diseases are displayed

together with their probability of coincidence so that the doctor may verify the results with his experience.

- 5 Preferably, in step g) the skin disease with the highest probability of coincidence is displayed together with its probability of coincidence which gives the doctor feedback about the reliability of the diagnosis.

10 Preferably, the processing logic has a decision making network, e.g. a neuronal network, which is self-organizing and self-learning to improve its function with continuing operating time.

15 Preferably, the model is an associative memory comprising dependencies between different skin condition parameters and skin diseases. This associative memory forms an efficient linked database as a model for the processing logic.

20 In this case preferably the associative memory is self-organized as to be able to include new parameters and to establish dependencies based on decision making history. Thus the reliability and accuracy of the diagnoses will improve over the operating time of the diagnosis system.

25 Preferably, the processing logic in connection with the model is configured to retrieve the further condition parameter of a type which excludes as most competitive condition parameters as possible. This means that the processing logic and the model co-act as to retrieve a further skin condition parameter which excludes as many as competitive skin condition parameters as possible so that the diagnosis is terminated in a shorter time period.

30 Preferably, the processing logic defines a probability of coincidence as similar if the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next probable skin disease is within a threshold value, for example at most 30%, more preferably at most 20%, most preferably at most 10% of the probability of coincidence of the matching skin disease.

35 Preferably, the model is embodied as a neural network that automatically creates correlations between skin condition parameters and/or between skin condition parameters and skin diseases on the basis of the diagnosis activity of the diagnosis

system. Also this embodiment includes a self-learning function which increases the accuracy of the diagnosis over the operation time of the system.

5 Preferably, the model comprises a fuzzy logic, which enables the use of various different parameters to be considered in the finding of the correct diagnosis.

10 Preferably the ID or name of the further condition parameter to be inputted is indicated on a display of the input terminal, so that the doctor or the assistant knows which further parameter value is to be inputted. Thus operating mistakes of the system can be minimized..

15 In one embodiment of the invention the input device is an image supplying or image forming device, which is combined with an image recognition device, whereby the output of the image recognition device or a storage with the output data of the image recognition device are fed to the processing logic. Thus the diagnosis can even be made based on an image or photo of a diseased skin portion.

20 The invention also relates to a diagnosis method for machine-aided diagnosis of skin diseases,

comprising an input device for retrieving/inputting skin condition parameters of the skin to be diagnosed, which diagnosis system comprises a processing logic with a model comprising mutual correlations of different skin condition parameters and correlated skin diseases,

25 optionally the value at least of one condition parameter is calculated from the retrieved/inputted skin condition parameters by means of data from the model, from the retrieved/inputted skin condition parameters and optionally from the calculated operation parameter an initial set of skin condition parameters is formed, in which diagnosis system

30 a) the values of the initial set of skin condition parameters are compared with stored skin condition parameters and correlated skin diseases from the model, whereby

b) for each correlated skin disease matching the initial set of skin condition parameters or an expanded set of skin condition parameters a probability of coincidence is calculated,

35 c) for the skin disease with the highest probability of coincidence (matching correlated skin disease) it is checked whether there are further skin diseases with a similar probability of coincidence and/or whether the probability of coincidence of the matching correlated skin disease is below a pre-defined threshold value,

d) in the case the check in step c) is positive, by means of the model least one further condition parameter is established which is correlated with at least one of the skin diseases of similar probability of coincidence, and  
e) the value of said further condition parameter is requested from the input device  
5 and it is returned to step b) with an expanded set of condition parameters comprising the initial set of condition parameters and said further condition parameter,  
f) in case the check in step c) is negative or after an abort criterion has been achieved, the processing logic indicates the skin disease with the highest associated  
10 probability of coincidence on a display and/or transmits said information to a computer system. With respect to the features and advantages of the inventive method it is referred to the above description of the inventive system.

Preferably, steps b) to e) are repeated until an abort criterion is achieved that relates  
15 either to a period of time or to the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next-probable skin disease, wherein, once the abort criterion has been achieved, in step g) the skin diseases with similar probability of coincidence are indicated on the display.

20 Preferably, a probability of coincidence is defined as similar if the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next probable skin disease is within a threshold value, for example at most 30%, more preferably at most 20%, most preferably at most 10% of the probability of the matching skin disease.

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In one preferred embodiment of the inventive method the skin condition parameters are retrieved from an image forming device and/or image recognizing device. Thus the diagnosis can be directly based on an image of the skin or a photo thereof.

30 In one advantageous embodiment of the invention, the model is embodied as a neural network that, on the basis of the analytic activity of the diagnosis system, automatically creates correlations between the skin condition parameters and/or between skin condition parameters and skin diseases. The processing logic is therefore designed so as to feed into the model correlations of values of the skin  
35 condition parameters and skin diseases, said correlations being ascertained during the course of the diagnosis procedure. In other words, the model has a self-learning function and is therefore able to continuously improve the correlations between the stored skin condition parameters and skin diseases. The obtained diagnosis results

are therefore constantly improving as the use of the system increases. Suitable models for this are for example a fuzzy logic or a genetic algorithm so as to improve the logic links of the neural network.

- 5 Preferably, the process logic comprises a decision making network, e.g. a neuronal network, as well as an associative memory for dependencies between different skin condition parameters. This associative memory is advantageously self-organized as to be able to include new skin condition parameters and to establish dependencies based on decision making history. The process logic further comprises an signal
- 10 output device in which the "best decision" of the decision making network is outputted in form of the requested system parameter or parameter set. The signal output device may be connected to a screen to display the diagnosed skin disease(s).

The table below shows a table with different skin condition parameters in the left

15 column and different skin diseases in the first row. The values in the table fields are correlation values between the skin condition parameters and the skin diseases as they could be stored in the model of the inventive system. By increasing the number of skin condition parameters the reliability of the diagnosis result is improved. The system itself asks the assistant or doctor for further skin condition parameters if it is

20 not able to provide sufficiently exact results. If the input device is a phot or image the system may even be able to retrieve skin condition parameters by itself without interposing a doctor or an assistant.

xxx	Frage/Antwort xxxxx	Psoriasis vulgaris	Atopisches Ekzem	Rosacea	Erysipel	Lichen ruber
	<b>1. Have you got red and scaly skin areas ?</b>					
1	never	0,1	0,2	0,7	0,5	0,7
2	sometimes	0,4	0,8	0,5	0,6	0,1
3	often	0,7	0,7	0,1	0,2	0,1
4	always	0,7	0,5	0,1	0,3	0,3
	<b>2. Is the skin itching?</b>					
1	never	0,5	0,0	0,8	0,6	0,0
2	seldom	0,7	0,2	0,6	0,8	0,2
3	sometimes	0,9	0,6	0,5	0,7	0,3
4	often	0,2	0,9	0,1	0,1	0,9
5	almost daily	0,4	0,7	0,2	0,5	0,9
	<b>3. Have you got allergies?</b>					
1	yes	0,3	0,8	0,5	0,5	0,5
2	no	0,6	0,2	0,5	0,5	0,5

Further relevant skin condition parameters may be age and sex of the person, location, color and texture of the skin alteration(s).

This diagnosis might be supported by a smartphone photo by which a pre-diagnosis of the skin can be performed, so that already by the image recognition the number of possible skin diseases can be reduced.

In case of the use of a fuzzy data base as model the skin diseases may be classified into classes. The classes are linked to skin condition parameters which are evaluated in a fuzzy format, as shown in the above table. Via communication of the system with the patient, assistant and/or doctor when retrieving the values of further skin condition parameters the most probable class is found so that a certain solution (matching skin disease can be outputted with a high probability of coincidence.

Following terms are used as synonyms: condition - state - status; value - value range; coincidence - existence; correlation - interdependency; parameter - data

It should be understood that the inventive system comprises soft- and hardware components having the above mentioned combined functionality and that the inventive method describes the functionality which can be performed by the inventive system. Thus, features from the inventive system may be employed for the inventive method and vice versa.

The invention is described herein under by way of example with reference to an exemplary embodiment in conjunction with the schematic drawing, in which:

Fig. 1 illustrates a view of the components of an diagnosis system in accordance with the invention, and

Fig. 2 illustrates a flow chart relating to the inventive diagnosis procedure .

Fig. 1 illustrates an diagnosis system 10 comprising processing logic 12, for example a microprocessor, in which a model 14 of a skin knowledge base 16 is mapped. The processing unit 12. The diagnosis system 10 comprises furthermore a display 20 and an input keyboard 22 for displaying or inputting data. The processing unit 12 is further more connected with an image forming device, e.g. a camera 24 whose output is connected to an image recognition device 26, so that he output of the

image recognition device 26 is able to provide skin condition parameters for the diagnosis system 10.

The method sequence for diagnosing a skin disease is illustrated in Fig. 2. The procedure starts at Point A and in step a) of the procedure wherein the values of at least two different skin condition parameters of the skin to be diagnosed are retrieved via keyboard 22 and/or the image recognition device 26. In the procedural step b) the processing logic 12 of the diagnosis system 10 correlates the values of the retrieved skin condition parameters, the initial set of skin condition parameters by means of the model 14 with at least one skin disease. Once this has occurred, a check is performed in step c) as to whether possibly multiple skin diseases with similar probabilities are correlated with the initial skin condition parameter set and whether the probability of coincidence of the matching skin disease (= skin disease with the highest probability of coincidence) is too low, i.e. is below a predefined threshold value, e.g. 60%. If this is not the case, the procedure continues to step f) in which the matching skin disease with the associated probability of coincidence is indicated on the display 20 as diagnosis result.

If it is found in step c) that multiple skin diseases with a similar probability of coincidence are correlated with the initial skin condition parameter set the processing logic 12 ascertains by means of the model 14 at least one further skin condition parameter that is correlated with at least one of the found skin diseases. Thus an expanded set of skin condition parameters is formed of the initial skin condition parameter set and the further skin condition parameter.

Subsequently, in step d), the further condition parameter is retrieved either directly from the operating system via the image recognition device 26 or by way of requesting the input of a further skin condition parameter via the input device 22 in conjunction with the display 20. As a consequence of which in step e) an expanded set of skin condition parameter values is formed, which is now returned back to step b). It should now be possible by means of the further skin condition parameter to provide an improved diagnosis, i.e. matching skin disease with a better probability of coincidence and/or with a better distance of probability of coincidence to the next probable skin disease found in step b). In the event that this should not yet be the case, in step c) the procedure branches again into the steps d) to e) in which then further condition parameters are retrieved from the image recognition device 26 and/or inputted via the input device 22 until finally the matching skin disease has been ascertained with sufficient accuracy or an abort criterion is achieved that

includes for example a specific period of time, for example 0.1 s, or a sufficiently small change in the probability value of the most probable skin disease to the next probable one.

- 5 The invention is not limited to the described exemplary embodiment but rather can be varied within the protective scope of the attached claims.

### Claims

1. A diagnosis system (10) for a machine-aided diagnosis of skin diseases, comprising an input device (22) for retrieving/inputting skin condition parameters of the skin to be diagnosed, which diagnosis system comprises a processing logic (12) with a model (14) comprising mutual correlations of different skin condition parameters and correlated skin diseases, optionally the value at least of one condition parameter is calculated from the retrieved/inputted skin condition parameters by means of data from the model (14), from the retrieved/inputted skin condition parameters and optionally from the calculated operation parameter an initial set of skin condition parameters is formed,
- 5 which diagnosis system
- 10 a) compares the values of the initial set of skin condition parameters with stored skin condition parameters and correlated skin diseases from the model (14),
- 15 b) the processing logic calculates for each correlated skin disease matching the initial set of skin condition parameters or an expanded set of skin condition parameters a probability of coincidence,
- 20 c) the processing logic (12) checks for the skin disease with the highest probability of coincidence (matching correlated skin disease) whether there are further skin diseases with a similar probability of coincidence and/or whether the probability of coincidence of the matching correlated skin disease is below a pre-defined threshold value,
- 25 d) in case the check in step c) is positive, the processing logic (12) establishes by means of the model (14) at least one further condition parameter being correlated with at least one of the skin diseases of similar probability of coincidence, and
- 30 e) requests the value of said further condition parameter from the input device (22) and returns to step b) with an expanded set of condition parameters, said expanded set of condition parameters comprising the initial set of condition parameters and said further condition parameter,
- 35 f) in case the check in step c) is negative or after an abort criterion has been achieved, the processing logic indicates the skin disease with the highest associated probability of coincidence on a display (20) and/or transmits said information to a computer system.

2. The diagnosis system (10) as claimed in claim 1, wherein the processing logic (12) is designed to repeat steps b) to e) until an abort criterion is achieved that relates either to a period of time or to the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next-probable skin disease, wherein, once the abort criterion has been achieved, in step g) the skin diseases with similar probability of coincidence are indicated on the display (20).  
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3. The diagnosis system (10) as claimed in any one of the preceding claims, wherein in step g) the skin disease with the highest probability of coincidence is displayed together with its probability of coincidence.  
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4. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the processing logic (12) has a decision making network, e.g. a neuronal network.  
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5. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the model (14) is an associative memory comprising dependencies between different skin condition parameters and skin diseases.  
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6. The diagnosis system (10) as claimed in claim 5, wherein the associative memory is self-organized as to be able to include new parameters and to establish dependencies based on decision making history.
7. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the processing logic in connection with the model is configured to retrieve the further condition parameter of a type which excludes as most competitive condition parameters as possible.  
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8. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the processing logic (12) defines a probability of coincidence as similar if the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next probable skin disease is within a threshold value, for example at most 30%, more preferably at most 20%, most preferably at most 10%.  
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9. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the model (14) is embodied as a neural network that automatically

creates correlations between skin condition parameters and/or between skin condition parameters and skin diseases on the basis of the diagnosis activity of the diagnosis system.

- 5 10. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the model (14) comprises a fuzzy logic.
11. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the ID or name of the further condition parameter to be inputted is  
10 indicated on a display (20) of the input terminal.
12. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the input device is an image supplying or image forming device (24), and/or an image recognition device (26), whereby the output of the image  
15 forming/recognition device (24, 26) or a storage with the output data of the image forming/recognition device is connected to the processing logic (12).
13. A diagnosis method for machine-aided diagnosis of skin diseases, comprising an input device (22) for retrieving/inputting skin condition  
20 parameters of the skin to be diagnosed, which diagnosis system comprises a processing logic (12) with a model (14) comprising mutual correlations of different skin condition parameters and correlated skin diseases, optionally the value at least of one condition parameter is calculated from the retrieved/inputted skin condition parameters by means of data from the model  
25 (14), from the retrieved/inputted skin condition parameters and optionally from the calculated operation parameter an initial set of skin condition parameters is formed,  
in which diagnosis system  
a) the values of the initial set of skin condition parameters are compared with  
30 stored skin condition parameters and correlated skin diseases from the model (14),  
b) for each correlated skin disease matching the initial set of skin condition parameters or an expanded set of skin condition parameters a probability of coincidence is calculated,  
35 c) for the skin disease with the highest probability of coincidence (matching correlated skin disease) it is checked whether there are further skin diseases with a similar probability of coincidence and/or whether the probability of

- coincidence of the matching correlated skin disease is below a pre-defined threshold value,
- d) in the case the check in step c) is positive, by means of the model (14) at least one further condition parameter is established which is correlated with at least one of the skin diseases of similar probability of coincidence, and
- 5 e) the value of said further condition parameter is requested from the input device (22) and it is returned to step b) with an expanded set of condition parameters comprising the initial set of condition parameters and said further condition parameter,
- 10 f) in case the check in step c) is negative or after an abort criterion has been achieved, the processing logic indicates the skin disease with the highest associated probability of coincidence on a display (20) and/or transmits said information to a computer system.
- 15 14. The method as claimed in claim 13, wherein steps b) to e) are repeated until an abort criterion is achieved that relates either to a period of time or to the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next-probable skin disease, wherein, once the abort criterion has been achieved, in step g) the skin diseases with
- 20 similar probability of coincidence are indicated on the display (20).
15. The method as claimed in any of claims 13 to 14, a probability of coincidence is defined as similar if the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next probable
- 25 skin disease is within a threshold value, for example at most 30%, more preferably at most 20%, most preferably at most 10%.
16. The method as claimed in any of claims 13 to 15, wherein the skin condition parameters are retrieved from an image forming device (24) and/or image
- 30 recognizing device (26).

**AMENDED CLAIMS****received by the International Bureau on 21 September 2017 (21.09.2017)**

1. A diagnosis system (10) for a machine-aided diagnosis of skin diseases, comprising an input device (22) for retrieving/inputting skin condition parameters of the skin to be diagnosed, which diagnosis system comprises a processing logic (12) with a model (14) comprising mutual correlations of different skin condition parameters and correlated skin diseases, optionally the value at least of one condition parameter is calculated from the retrieved/inputted skin condition parameters by means of data from the model (14), from the retrieved/inputted skin condition parameters and optionally from the calculated operation parameter an initial set of skin condition parameters is formed, which diagnosis system
  - a) compares the values of the initial set of skin condition parameters with stored skin condition parameters and correlated skin diseases from the model (14),
  - b) the processing logic calculates for each correlated skin disease matching the initial set of skin condition parameters or an expanded set of skin condition parameters a probability of coincidence,
  - c) the processing logic (12) checks for the skin disease with the highest probability of coincidence (matching correlated skin disease) whether there are further skin diseases with a similar probability of coincidence and/or whether the probability of coincidence of the matching correlated skin disease is below a pre-defined threshold value,
  - d) in case the check in step c) is positive, the processing logic (12) establishes by means of the model (14) at least one further condition parameter being correlated with at least one of the skin diseases of similar probability of coincidence, and
  - e) requests the value of said further condition parameter from the input device (22) and returns to step b) with an expanded set of condition parameters, said expanded set of condition parameters comprising the initial set of condition parameters and said further condition parameter,
  - f) in case the check in step c) is negative or after an abort criterion has been achieved, the processing logic indicates the skin disease with the highest associated probability of coincidence on a display (20) and/or transmits said information to a computer system, wherein the processing logic in connection with the model is configured to retrieve the further condition parameter of a type which excludes as most competitive condition parameters as possible.
  
2. The diagnosis system (10) as claimed in claim 1, wherein the processing logic (12) is designed to repeat steps b) to e) until an abort criterion is achieved that relates either to a period of time or to the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next-probable skin disease, wherein, once the abort criterion has been achieved, in step g) the skin diseases with similar probability of coincidence are indicated on the display (20).

3. The diagnosis system (10) as claimed in any one of the preceding claims, wherein in step g) the skin disease with the highest probability of coincidence is displayed together with its probability of coincidence.
4. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the processing logic (12) has a decision making network, e.g. a neuronal network.
5. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the model (14) is an associative memory comprising dependencies between different skin condition parameters and skin diseases.
6. The diagnosis system (10) as claimed in claim 5, wherein the associative memory is self-organized as to be able to include new parameters and to establish dependencies based on decision making history.
7. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the processing logic (12) defines a probability of coincidence as similar if the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next probable skin disease is within a threshold value, for example at most 30%, more preferably at most 20%, most preferably at most 10%.
8. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the model (14) is embodied as a neural network that automatically creates correlations between skin condition parameters and/or between skin condition parameters and skin diseases on the basis of the diagnosis activity of the diagnosis system.
9. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the model (14) comprises a fuzzy logic.
10. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the ID or name of the further condition parameter to be inputted is indicated on a display (20) of the input terminal.
11. The diagnosis system (10) as claimed in any one of the preceding claims, wherein the input device is an image supplying or image forming device (24), and/or an image recognition device (26), whereby the output of the image forming/recognition device (24, 26) or a storage with the output data of the image forming/recognition device is connected to the processing logic (12).

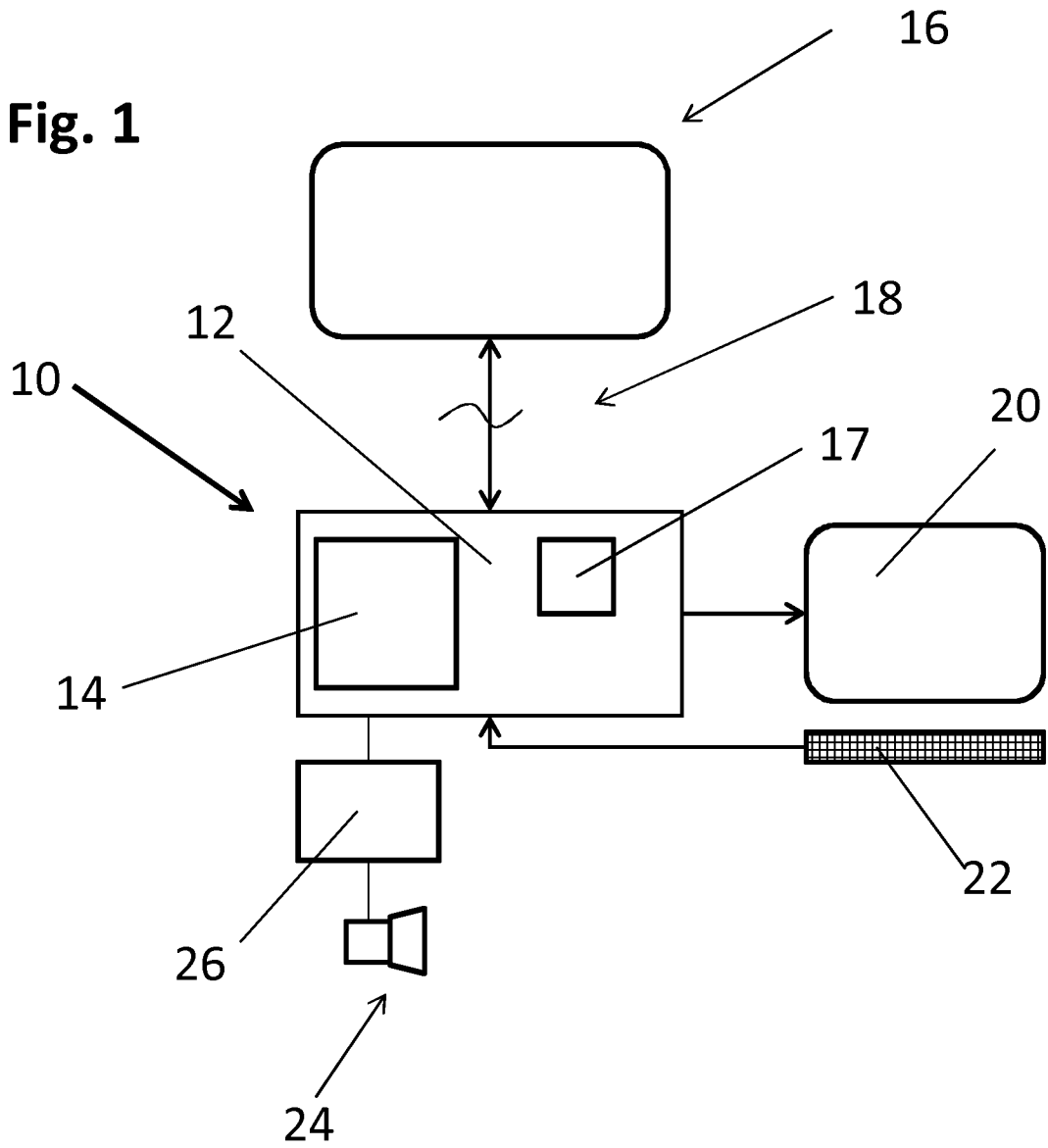
12. A diagnosis method for machine-aided diagnosis of skin diseases, comprising an input device (22) for retrieving/inputting skin condition parameters of the skin to be diagnosed, which diagnosis system comprises a processing logic (12) with a model (14) comprising mutual correlations of different skin condition parameters and correlated skin diseases, optionally the value at least of one condition parameter is calculated from the retrieved/inputted skin condition parameters by means of data from the model (14), from the retrieved/inputted skin condition parameters and optionally from the calculated operation parameter an initial set of skin condition parameters is formed, in which diagnosis system
  - a) the values of the initial set of skin condition parameters are compared with stored skin condition parameters and correlated skin diseases from the model (14),
  - b) for each correlated skin disease matching the initial set of skin condition parameters or an expanded set of skin condition parameters a probability of coincidence is calculated,
  - c) for the skin disease with the highest probability of coincidence (matching correlated skin disease) it is checked whether there are further skin diseases with a similar probability of coincidence and/or whether the probability of coincidence of the matching correlated skin disease is below a pre-defined threshold value,
  - d) in the case the check in step c) is positive, by means of the model (14) at least one further condition parameter is established which is correlated with at least one of the skin diseases of similar probability of coincidence, and
  - e) the value of said further condition parameter is requested from the input device (22) and it is returned to step b) with an expanded set of condition parameters comprising the initial set of condition parameters and said further condition parameter,
  - f) in case the check in step c) is negative or after an abort criterion has been achieved, the processing logic indicates the skin disease with the highest associated probability of coincidence on a display (20) and/or transmits said information to a computer system, wherein a further condition parameter of a type is retrieved which excludes as most competitive condition parameters as possible.
13. The method as claimed in claim 12, wherein steps b) to e) are repeated until an abort criterion is achieved that relates either to a period of time or to the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next-probable skin disease, wherein, once the abort criterion has been achieved, in step g) the skin diseases with similar probability of coincidence are indicated on the display (20).
14. The method as claimed in any of claims 12 to 13, a probability of coincidence is defined as similar if the difference between the probability of coincidence of the matching skin disease and the probability of coincidence of the next probable skin disease is within a

threshold value, for example at most 30%, more preferably at most 20%, most preferably at most 10%.

15. The method as claimed in any of claims 12 to 14, wherein the skin condition parameters are retrieved from an image forming device (24) and/or image recognizing device (26).

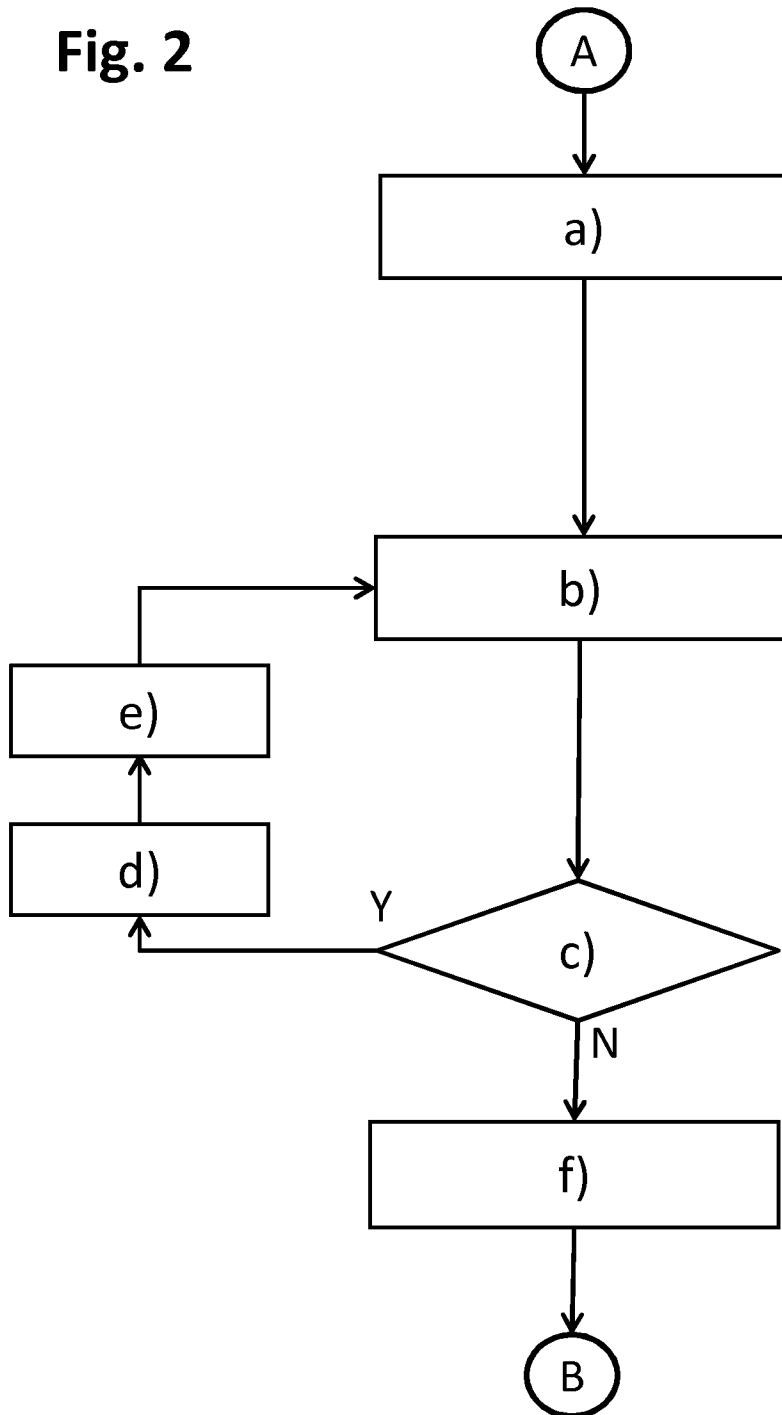
1/2

Fig. 1



2/2

Fig. 2



INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2017/061015

A. CLASSIFICATION OF SUBJECT MATTER  
INV. A61B5/00  
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 G06F  
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, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/268203 A1 (PYLOTH VINCENT THEKKETHALA [IN]) 10 October 2013 (2013-10-10)	1,5-7, 10,11
Y	paragraphs [0010], [0030], [0053], [0079] - [0084], [0095], [0098]; figures 3-6	1-12
Y	----- US 2013/322711 A1 (SCHULTZ PAUL T [US] ET AL) 5 December 2013 (2013-12-05) paragraphs [0025], [0027], [0055], [0057], [0060], [0062], [0066], [0067], [0091] - [0096]; figures 1,7,11 ----- -/--	1-12

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search  21 July 2017	Date of mailing of the international search report  28/07/2017
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Lommel, André

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2017/061015

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>CRUMB JR C B ET AL: "The automatic digital computer as an aid in medical diagnosis", 19591201; 19591201 - 19591203, 1 December 1959 (1959-12-01), pages 174-180, XP058231220, DOI: 10.1145/1460299.1460319 Technique Proposed, bridging pages 174 and 175</p>	1-12
A	<p>----- FILIMON D -M ET AL: "Skin diseases diagnosis using artificial neural networks", 2014 IEEE 9TH IEEE INTERNATIONAL SYMPOSIUM ON APPLIED COMPUTATIONAL INTELLIGENCE AND INFORMATICS (SACI) IEEE PISCATAWAY, NJ, USA, 2014, pages 189-194, XP002772246, ISBN: 978-1-4799-4694-5 the whole document -----</p>	1-12

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/EP2017/061015

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.: **13-16**  
because they relate to subject matter not required to be searched by this Authority, namely:  
**Rule 39.1(iv) PCT - Diagnostic method practised on the human or animal body**
  
2.  Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
  
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/061015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013268203 A1	10-10-2013	US 2013268203 A1	10-10-2013
		WO 2013153428 A1	17-10-2013
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US 2013322711 A1	05-12-2013	NONE	
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