Claims

1. A computer-implemented method for providing feedback to a patient using an inhaler of a specific type for inhaling a therapeutic aerosol according to instructions for use provided to the patient for, or along with, the inhaler, the method comprising the steps of:

(a) obtaining a sequence of digital audio signals and a sequence of digital video signals emitted from the patient while using the inhaler;

(b) recognising the type of the inhaler by processing the video signals;

(c) recognising whether the patient has deviated from the instructions by processing the audio and video signals;

(d) if a deviation was recognised in step (c), recognising the type of the deviation; and

(e) presenting to the patient one or more feedback messages indicating

(i) whether a deviation was recognised;

(ii) if a deviation was recognised, the type of deviation; and optionally

(iii) an inhalation manoeuvre without the deviation;

wherein steps b) and c) are performed by analysing the video and audio signals using an artifical neural network trained to identify an inhaler type and to identify deviations, or by a method to detect a regular motion;

wherein the deviation to be recognized in step (c) comprises a deviation from a regular movement using a method to detect a regular motion comprising the steps:

(I) perform the following steps on a series of frames of said video signals of the patient using the inhaler:

(i) optionally converting the color information of said frame to greyscale

(ii) selecting a portion of a frame through which said regular motion passes through;

(iii) computing the mean brightness value within said portion of the frame;

(iv) storing said mean brightness value of said portion of said frame in a buffer;

(II) repeating steps (i) – (iii) for a sequence of frames comprising a plurality of frames, wherein said portion of a frame is identical in each frame creating a buffer of brightness values;

(III) calculating the average of the mean brightness of all values determined and stored in said buffer of brightness values;

(IV) subtracting said determined average of the mean brightness from each value in said buffer to generate a zero centered buffer;

(V) computing the zero crossing rate of said zero centered buffer;

(VI) comparing the determined zero crossing rate with predetermined reference values to obtain an estimate on the speed or strength of said regular motion;

wherein said regular motion is shaking;

wherein steps (a) to (e) are performed by a portable feedback device for handheld use comprising

- a data processing system;
- a data memory;
- a camera;
- a microphone;
- a display; and
- a speaker.

2. The method of claim 1, wherein step c) is performed in real time on said portable feedback device and said feedback messages in step e) are presented immediately.

3. The method of claims 1 or 2, wherein in step e) said feedback messages are presented using augmented reality.

4. The method of any one of the preceding claims, wherein the inhaler is a powder inhaler, a nebuliser, a metered-dose inhaler or a soft mist inhaler.

5. The method of any one of the preceding claims, further comprising a step of recognising the identity of the patient on the basis of the video signals.

6. The method of any one of the preceding claims, further comprising a step of identifying whether a detrimental condition capable of adversely affecting the quality of the audio signals or of the video signals is present, wherein the detrimental condition is optionally an environmental condition such as a luminous contrast or acoustic noise, or a patient activity such as shaking of the portable feedback device.

7. The method of claim 6, further comprising a step of presenting to the patient a feedback message indicating the presence and the nature of the detrimental condition.

8. The method of any one of the preceding claims, further comprising a step of instructing the patient to inhale the therapeutic aerosol using the inhaler according to the

instructions for use while the feedback device is operating and is held such that the camera and the microphone are directed towards the patient's face.

9. A data processing system comprising a processor adapted to carry out the method of any one of claims 1 to 8.

10. A computer programme comprising instructions which, when the programme is executed by a computer, cause the computer to carry out the steps of the method of any one of claims 1 to 8.

11. The computer programme of claim 10, wherein the computer comprises the data processing system of claim 9.

12. A computer-readable storage medium comprising instructions which, when executed by a computer, cause the computer to carry out the steps of the method of any one of claims 1 to 8.

13. The computer-readable storage medium of claim 12, wherein the computer comprises the data processing system of claim 9.

~~14. A computer-implemented method to detect and/or analyse a regular motion comprising:~~

~~(a) obtaining sequence of digital video signals emitted from said regular motion;~~

~~(b) in said video signals perform the following steps on a series of frames of said video signals:~~

~~(i) selecting a portion of a frame through which said regular motion passes through;~~

~~(ii) computing the mean brightness value within said portion of the frame;~~

~~(iii) storing said mean brightness value of said portion of said frame in a buffer;~~

~~(c) repeating steps (i) – (iii) for a sequence of frames comprising a plurality of frames, wherein said portion of a frame is identical in each frame creating a buffer of brightness values;~~

~~(d) calculating the average of the mean brightness of all values determined and stored in said buffer of brightness values;~~

~~(e) subtracting said determined average of the mean brightness from each value in said buffer to generate a zero centered buffer;~~

~~(f) computing the zero crossing rate of said zero centered buffer;~~

~~wherein steps (a) to (f) are performed by a computing device comprising at least~~

- a data processing system;

- a data memory.

15. The computer implemented method according to claim 14, wherein steps (i) to (iii) are repeated for at least 48 frames.

16. The computer-implemented method according to claims 14 or 15, wherein said selection of a portion of a frame is adapted to adjust and correct for movement of the video capture device.

17. The computer-implemented method according to any one of claims 14 to 16, wherein the buffer is a circular buffer.

18. The computer-implemented method according to any one of claims 14 to 17, wherein comprising in step (b) a further step prior to step (i):

(o) converting the color information of said frame to greyscale.

19. The computer-implemented method according to any one of claims 14 top 18, additionally comprising step (g):

(g) comparing the determined zero crossing rate with predetermined reference values to obtain an estimate on the speed or strength of said regular motion.