

What is claimed is:

1. A method for obtaining, from a retinal image of an eye, data characterizing the cup region of the optic disc of the eye, the method comprising:

(a) using a database of N reference retinal images, labelled by an index $i=1, \dots, N$, each reference retinal image being associated with corresponding cup data characterizing a corresponding cup region of the reference retinal image, to obtain, for each reference retinal image i , a corresponding weight value w_i , the weight values minimizing a cost function comprising:

a construction error term indicating a difference between a portion of the retinal image and a sum of the reference retinal images weighted by the corresponding weight value w_i , and

a cost term; and

(b) using the set of weight values and the corresponding cup data, to obtain the data characterizing the cup region of the optic disc of the retinal image.

2. The method of claim 1, wherein the method further comprises an operation of obtaining for each of the reference retinal images, a corresponding cost value d_i , indicative of a difference between the portion of the retinal image and the corresponding i -th reference retinal image;

the cost term being generated using a sum over the reference retinal images of the cost values weighted by the corresponding weight values.

3. The method of claim 2, wherein the construction error term is in the form $\|y - Xw\|^2$ where y denotes the portion of the retinal image, Xw denotes the product of a matrix X of the reference retinal images and a vector w composed of the weight values.

4. The method of claim 3, wherein the cost term is $\|d \circ w\|^2$, where

$d = \{d_1, d_2, \dots, d_i, \dots, d_N\}^T \in R^{N \times 1}$, and $\circ$ denotes the Hadamard product.

5. The method of claim 4 wherein $d_i = e^{\frac{\|y-x_i\|^2}{2\delta_f^2}}$, where δ_f is a numerical parameter.

6. The method of claim 1 in which the data characterizing the cup region of the eye comprises a cup-to-disc ratio value.

7. The method of claim 1 further comprising an operation of selecting said
5 portion of the retinal image by segmenting the disc region in the retinal image.

8. A system for obtaining, from a retinal image of an eye, data characterizing the cup region of the optic disc of the eye, the system comprising:

a database of N reference retinal images, labelled by an index $i=1,\dots,N$, each reference retinal image being associated with corresponding cup data characterizing
10 a corresponding cup region of the reference retinal image, and

a processor, arranged:

(a) to obtain, for each reference retinal image i , a corresponding weight value w_i , the weight values minimizing a cost function comprising:

a construction error term indicating a difference between a portion of the
15 retinal image and a sum of the reference retinal images weighted by the corresponding weight value w_i ; and

a cost term; and

(b) to use the set of weight values and the corresponding cup data, to obtain the data characterizing the cup region of the optic disc of the retinal image.

20 9. The system of claim 8, wherein the processor is arranged to obtain for each of the reference retinal images a corresponding cost value d_i , indicative of a difference between the portion of the retinal image and the corresponding i -th reference retinal image,

the cost term being generated using a sum over the reference retinal images
25 of the cost values weighted by the corresponding weight values.

10. The system of claim 9, wherein the construction error term is in the form $\|y - Xw\|^2$ where y denotes the portion of the retinal image, Xw denotes the product of a matrix X of the reference retinal images and a vector w composed of the weight values.

5 11. The system of claim 10, wherein the cost term is $\|d \circ w\|^2$, where $d = \{d_1, d_2, \dots, d_i, \dots, d_N\}^T \in R^{N \times 1}$, and $\circ$ denotes the Hadamard product.

12. The system of claim 11 wherein $d_i = e^{\frac{\|y - x_i\|^2}{2\delta_f^2}}$, where δ_f is a numerical parameter.

10 13. The system of claim 8 in which the data characterizing the cup region of the eye comprises a cup-to-disc ratio value.

14. The system of claim 8 further in which the processor is arranged to select said portion of the retinal image by segmenting the disc region in the retinal image.

15 15. A non-transitory computer-readable medium having stored thereon computer program instructions for performance by a computer system to obtain, from a retinal image of an eye, data characterizing the cup region of the optic disc of the eye, said computer program instructions being operative, when implemented by a processor of the computer system to cause the processor of the computer system to:

20 access a database of N reference retinal images, labelled by an index $i=1, \dots, N$, each reference retinal image being associated with corresponding cup data characterizing a corresponding cup region of the reference retinal image;

obtain, for each reference retinal image i , a corresponding weight value w_i , the weight values minimizing a cost function comprising:

25 a construction error term indicating a difference between a portion of the retinal image and a sum of the reference retinal images weighted by the corresponding weight value w_i ; and

a cost term; and

to use the set of weight values and the corresponding cup data, to obtain the data characterizing the cup region of the optic disc of the retinal image.

16. The method of claim 1 in which the data characterizing the cup region of the optic disc of the retinal image comprising data indicating at least one of (a) a size of the optic cup and (b) a location of the optic cup.
17. The system of claim 8 in which the data characterizing the cup region of the optic disc of the retinal image comprising data indicating at least one of (a) a size of the optic cup and (b) a location of the optic cup.
18. The method of claim 1 in which the corresponding cup data comprises at least one of (a) a cup-to-disc ratio value, (b) a location of the cup, (c) a size of the cup and (d) clinical glaucoma diagnosis results of the eye.
19. The system of claim 8 in which the corresponding cup data comprises at least one of (a) a cup-to-disc ratio value, (b) a location of the cup, (c) a size of the cup and (d) clinical diagnosis results associated with the cup of the eye.
20. The non-transitory computer-readable medium of claim 15 in which the corresponding cup data comprises at least one of (a) a cup-to-disc ratio value, (b) a location of the cup, (c) a size of the cup and (d) clinical diagnosis results of the eye.