

Claims

1. A method for performance by a computer, for automatically processing an image including the junction between a cornea and an iris, the method comprising:
 - defining a region of interest (ROI) in the image;
 - deriving an estimated position of said junction within the region of interest;
 - defining a second region of the image based on the estimated position of the junction;
 - extracting features of the second region of the image; and
 - inputting the extracted features to an adaptive model, the adaptive model outputting at least one variable characterizing the junction;
 wherein the estimated position of the junction is found by:
 - binarizing the ROI,
 - selecting a connected region of the binarized region of interest by a criterion which selects a connected region which has said junction as one of its corners, and
 - deriving the estimated position of the junction from the connected region; and
 wherein the connected region is selected by:
 - calculating a plurality of pixel numbers N and a plurality of center coordinates (C_x, C_y) of a plurality of connected regions of the binarized ROI,
 - for each of the connected regions calculating a corresponding weight N_w from the plurality of pixel numbers and the plurality of center coordinates, and
 - selecting the one of the connected regions of the ROI with the highest value of the weight N_w .

2. The method according to claim 1 further comprising generating the adaptive model by a supervised learning process.

3. The method according to claim 1 in which the image is an Optical Coherence Tomography (OCT) image.

4. The method according to claim 1 having a further operation of modifying the connected regions to remove extraneous portions.
5. The method according to claim 1 further comprising determining if the connected region contains multiple angles which are candidates to be the junction, and if the determination is positive selecting one which is furthest in an extension direction of the connected region.
6. The method according to claim 1 in which the adaptive model is a support vector machine trained to classify an anterior chamber angle (ACA) at said junction.
7. The method according to claim 6 in which the SVM is further configured to output a value indicative of whether the ACA is "open" or "closed".
8. A method for performance by a computer, for automatically processing an image including the junction between a cornea and an iris, the method comprising:
 - defining a region of interest (ROI) in the image;
 - deriving an estimated position of said junction within the region of interest;
 - defining a second region of the image based on the estimated position of the junction;
 - extracting features of the second region of the image; and
 - inputting the extracted features to an adaptive model, the adaptive model outputting at least one variable characterizing the junction;wherein extracting features of the second region of the image comprises quantizing the intensity values of pixels of the second region of the image into a plurality of bins, the number of bins being less than the number of possible intensity values taken by pixels of the image.
9. A method for performance by a computer, for automatically processing an image including the junction between a cornea and an iris, the method comprising:
 - defining a region of interest (ROI) in the image;
 - deriving an estimated position of said junction within the region of interest;

defining a second region of the image based on the estimated position of the junction;

extracting features of the second region of the image; and

inputting the extracted features to an adaptive model, the adaptive model outputting at least one variable characterizing the junction;

wherein extracting features of the second region of the image comprises downsampling the image to generate a downsampled image comprising fewer pixels than the number of pixels in the second region of the image.

10. The method according to claim 9 in which the extracted features comprise at least some of the components of the downsized image.

11. The method according to claim 10 in which at least some components of the downsized image are not used as extracted features.

Claims

1. A method for performance by a computer, for automatically processing an image including the junction between a cornea and an iris, the method comprising:

5 defining a region of interest (ROI) in the image;

deriving an estimated position of said junction within the region of interest;

defining a second region of the image based on the estimated position of the junction;

extracting features of the second region of the image; and

10 inputting the extracted features to an adaptive model, the adaptive model outputting at least one variable characterizing the junction.

2. A method according to claim 1 further including generating the adaptive model by a supervised learning process.

3. A method according to claim 1 in which the image is an Optical Coherence
15 Tomography (OCT) image.

4. A method according to claim 1 in which the estimated position of the junction is found by binarizing the ROI, selecting a connected region of the binarized region of interest by a criterion which selects a connected region which has said junction as one of its corners, and deriving the estimated position of the junction from the
20 connected region.

5. A method according to claim 4 in which the connected region is selected by:

calculating a plurality of pixel numbers N and a plurality of centre coordinates (C_x, C_y) of a plurality of connected regions of the binarized ROI;

for each of the connected regions calculating a corresponding weight N_w from
25 the plurality of pixel numbers and the plurality of centre coordinates; and

selecting the one of the connected regions of the ROI with the highest value of the weight N_w .

6. A method according to claim 5 having a further step of modifying the connected regions to remove extraneous portions.

5 7. A method according to claim 5 further including determining if the connected region contains multiple angles which are candidates to be the junction, and if the determination is positive selecting one which is furthest in an extension direction of the connected region.

8. A method according to claim 1 in which the adaptive model is a support vector
10 machine trained to classify an anterior chamber angle (ACA) at said junction.

9. A method according to claim 8 in which the SVM is further configured to output a value indicative of whether the ACA is "open" or "closed".

10. A method according to claim 1 in which the step of extracting features of the second region of the image comprises quantizing the intensity values of pixels of the
15 second region of the image into a plurality of bins, the number of bins being less than the number of possible intensity values taken by pixels of the image.

11. A method according to claim 1 in which the step of extracting features of the second region of the image comprises downsampling the image to generate a
20 downsampled image comprising fewer pixels than the number of pixels in the second region of the image.

12. A method according to claim 11 in which the extracted features comprise at least some of the components of the downsized image.

13. A method according to claim 12 in which at least some components of the downsized image are not used as extracted features.

25 14. A computer system having a processor, and a data storage device containing computer software modules,

the computer software modules being operative when implemented by the processor to process an image including the junction between a cornea and an iris, by:

defining a region of interest (ROI) in the image;

5 deriving an estimated position of said junction within the region of interest;

defining a second region of the image based on the estimated position of the junction;

extracting features of the second region of the image; and

10 inputting the extracted features to an adaptive model, the adaptive model outputting at least one variable characterizing the junction.

15. A computer program product containing a tangible data storage device storing non-transitory computer software modules, the computer software modules being operative when implemented by a computer processor to process an image including the junction between a cornea and an iris, by:

15 defining a region of interest (ROI) in the image;

deriving an estimated position of said junction within the region of interest;

defining a second region of the image based on the estimated position of the junction;

extracting features of the second region; and

20 inputting the extracted features to an adaptive model, the adaptive model outputting at least one variable characterizing the junction.