Project Overview

The Problem……

Currently the detection and classification of retinal disease, through manual registration, is both time consuming and subjective. The results obtained depend highly on the clinician and their level of expertise.

Project Aims….

Due to the limitations of manual registration, the main aim of this project is to develop a registration algorithm that is able to accurately and efficiently register retinal images.

Results Summary….

An algorithm has been created that is able to accurately register images and then isolate any microaneurysms present. The total processing time for this is 52 seconds, which is a considerable improvement on previous results. The image registration and microaneurysm isolation algorithms have been packaged in a GUI for ease of use.

Future Direction….

Further development of this project may enable the creation of a fully automated retinal image processing software tool that can be used in a clinical environment. Further additions to the current algorithm would allow more quantitative results.

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Final Year Project:

Image Processing for Fluorescein Angiography of the Retina

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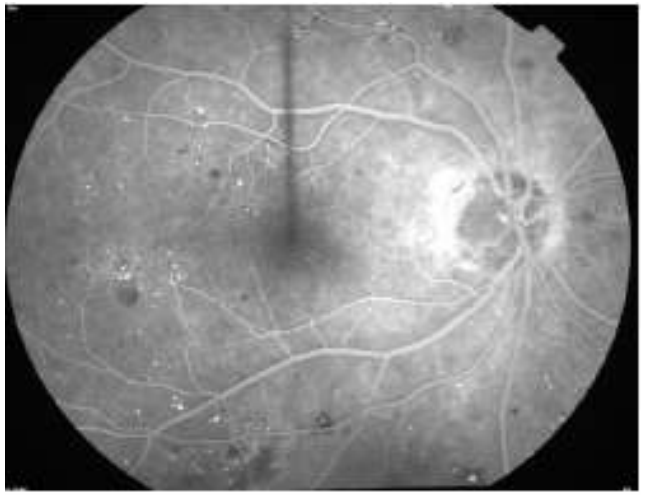


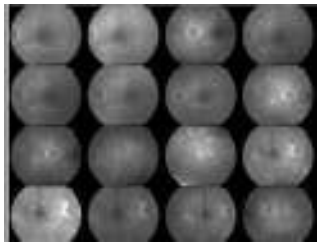
Project Supervisor : Professor Greg Knowles

3 November 2006
Project Expo

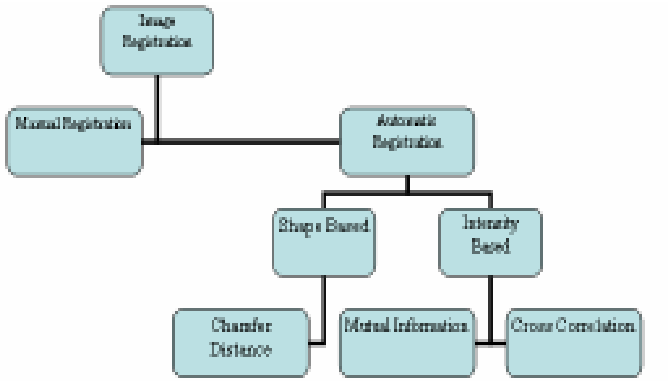
Method

Through the process of Fluorescein Angiography images were obtained using a fundus camera.

Approximately 12 retinal images were taken over a period of 5 minutes as the fluorescent dye passes through the retinal vessels. These images are usually slightly misaligned due to eyeball movement.



To correct the misalignment, the Images are then registered using a registration algorithm so that the corresponding regions from each image lie on top of each other.



Automatic image registration can be performed through intensity based and shape based registration.

The main algorithms considered during the project were ones that incorporated mutual information, cross correlation, chamfer distance and a minimisation algorithm.

Through extensive testing of the various registration algorithms, it was found that an algorithm incorporating mutual information, Cross-Correlation and the Fourier-Mellin transforms on a section of the image, produced the most efficient and accurate registration.

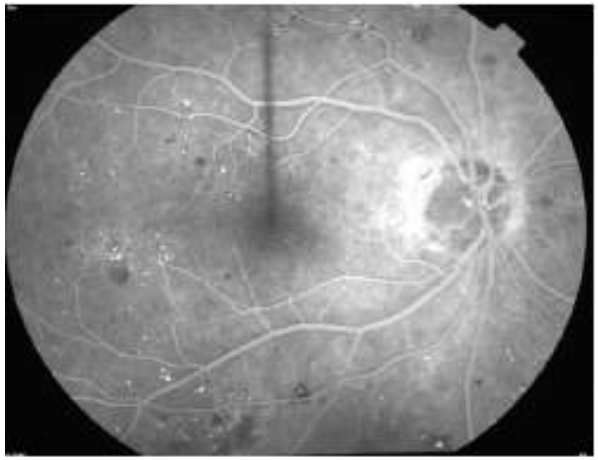
In the final step, the microaneurysms were isolated out of the whole retinal image.

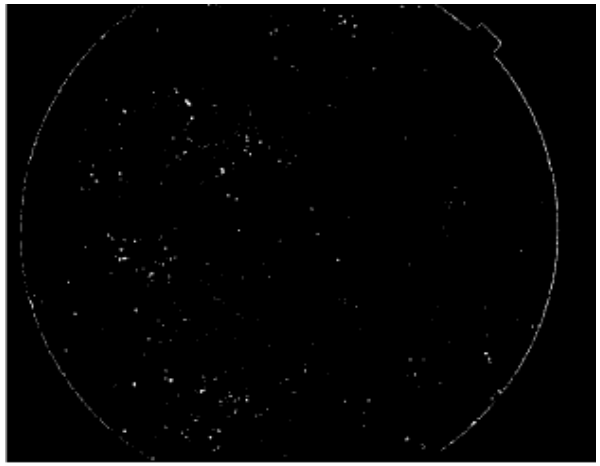
- The presence of the microaneurysms indicate the presence of an eye disease
- The spread of the aneurysms may help diagnose the particular disorder and
- The analysis of such images over time could determine the effectiveness of a treatment in curing the eye disease.

Results

The registration algorithm used was successfully able to register two retinal images in approximately 52 seconds and still maintained a high degree of accuracy. This is a huge improvement over the algorithm we started with which took approximately 2 days of continual processing time to register 2 images.

The figures demonstrate how the second algorithm (developed by Adel Dellagi) was able to successfully isolate the microaneurysms from the whole image, after the images had been successfully registered.





Conclusion

Upon running this algorithm, images were automatically registered with a high degree of accuracy and efficiency and aneurysms were successfully isolated without any input from the user. This process combining automated registration and microaneurysm isolation would greatly assist ophthalmologists in the detection and classification of retinal diseases - as it is faster and less subjective than manual registration.