Initial Plan

Can we detect expert and novice anaesthetists by how they watch video?

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CM3203 – One Semester Individual Project, 40 credits

DESCRIPTION

Previous research suggests that a distinction could be found between novices and experts in a field, based on how they view a set of images, or video. For example, the length of time fixated on any object of interest within the scene, or the frequency of movement between two focussed areas in the scene. In this project I will attempt to apply this theory to the field of Anaesthetics.

Using previously collected eye tracking data for expert and novice anaesthetists, and laymen, I intend to design a set of features that can be used to distinguished between experts and novices. These features in the eye movement of the subject to identify them as an expert, non-expert, novice, or non-novice, depending on which group is found to be most easily identifiable.

The eye tracking data follows the subject's eyes as they view a series of clips (static image and video), each depicting various scenes that one might come across whilst practising anaesthetics, all featuring some flaw(s) that an expert anaesthetist would be expected to notice. The scenes are salted, so as to provoke a difference in behaviour between the three groups that will allow the model to distinguish between them.

For my environment I will use MATLAB, as previous work done on this project was carried out using it, which will make continuing much easier. Also, the built-in support for mathematical and scientific functions will be useful for data visualisation, and feature building.

This project could provide more insight into what defines an expert anaesthetist, and possibly in other fields, medical or otherwise. What's more, a model that can classify a subject with a good degree of certainty could then be implemented as an application to be used on trainee anaesthetists in order to test their progress, in the stead of more practical and involved tests, that require equipment or more time.

I will not consider any ethical issues with the use of the data, as proper procedure was taken by the student and member of staff who recorded the data, during the research project they were part of that acted as a precursor to this one.

AIMS AND OBJECTIVES

I have set out below a list of main objectives for myself in this project, such that on achieving the majority of these, I would consider the project successful. These are only the main objectives, that I feel are integral to the project, and as such will likely remain necessary throughout the project. However, there may be objectives other than these, that present themselves later in the project as a result of complications, changes in direction with the project and new discoveries.

- Compile data for all three groups.
    - As mentioned in the project description, this project continues the work of a previous summer project carried out by another student, in that project the student was able to test many subjects each falling comfortably into a level of expertise in the field.
    - I intend to use MATLAB to unformat the data, which is taken straight from the tracker camera used, and visualise it.
    - From here I can look for some notable characteristics and patterns in the data between subjects from each group. This will enable me in the next aim.
- Find various features of a subject in how they watch the test clips.
    - This is the main aim of the project. I need to find a sufficient amount of features from the data to build a large enough set of features that can be used in classification.
    - Obtaining spatial and temporal features will be necessary as either dimension might prove significant. For example in the case of spatial clustering of the eye data, I can observe cluster size, sparsity, and total number of clusters. Time spent focusing on an object, or conversely, the degree to which a subject flicks between multiple areas of the screen, and various other temporal features should also prove useful, especially in the context of video clips.
- Compare and contrast the results of all subjects in order to determine the defining characteristics of one, two or possibly all three groups.
    - The variance of at least some of these features should prove large enough between groups to then be used for classification.
    - These features can be run through a standard classifier (SVM or Bayesian for example), to test their effectiveness.

WORK PLAN

The following is a week by week work plan. This will allow me to measure my progress against this initial plan for the project.

WEEK	COMMENCING	TASKS	NOTES
1	29/01/2018	• Initial Research into methods for formatting, analysing, and classifying the data. Research the relevance of Saliency and such studies to my project. • Investigate the effect the small sample space will have on the robustness of my model. • Write my interim report, discussing the initial plan for the project. • Meet with David, my supervisor, and discuss the game plan for the first week.	
2	05/02/2018	• Meet with David, and the advisor on anaesthetics for the project, Michael Lim. Discuss the findings of my initial research and explore the possibility of gaining additional data.	**Deliverables:** Interim Report – Initial Plan for the project due 23:00 05/02/2018. **Milestone:** The method in which my system will achieve the goals of the project are certain. **Review:** I intend to meet with David on average, twice a week.

		Discuss my final draft for the interim report. • Decide on, and investigate further, the methods I want to test in my system. This decision will come as a result of the initial research.	Once with Michael, and once without.
3	12/02/2018	• Develop a random class that acts as a baseline in order to improve robustness for noise in the classifier. • Investigate and implement methods for sampling new subjects from pre-existing actual data.	
4	19/02/2018	• Experiment with different methods of formatting the spatial information of the data, i.e. automated clustering vs. sectioning the image into grids.	
5	26/02/2018	• Begin implementing a basic working model for my project. • Meet with David and discuss the	**Milestone:** This marks the beginning of my work on an implementation.

		progress of the project so far and early implementation.	
6	05/03/2018	• Continue implementation of the basic working model. • Meet with David. Review implementation so far and discuss the solution to any issues that might arise.	
7	12/03/2018	• Complete work on the basic model. • Evaluate it's fit to the project so far and what alterations could be made to the design to improve performance.	**Milestone:** I have a working model, capable of taking eye tracking data as input, formatting and visualising this data, and computing a number of features from it. **Review:** The initial system with David.
8	19/03/2018	• Run tests on various features, in the hopes that they prove distinct between each class.	**Milestone:** I am running the first tests on features.
9	26/03/2018	• Continue tests on features, establishing a set of features that best distinguishes each class.	
10	02/04/2018	• Finalise the set of features I want to use for classification.	**Milestone:** The main experimental stage of the project is complete and I can now test the feasibility of the theory.

11	09/04/2018	• Investigate the advantage of each type of classifier for my project. While minimal given a good enough choice of features, the advantage of one type of classifier over another might improve the performance of the classification process	
12	16/04/2018	• Run my features through a classifier to evaluate their effectiveness.	**Milestone:** I can confidently say at this point how well the theory of classification through eye tracking works within this scenario.
13	23/04/2018	• Discuss with David and Michael the results of the project and draw a conclusion. • Begin work on the final report for this project.	
14	30/04/2018	• Continue work on the final report. • Write up notes for presenting the project in the viva.	
15	07/05/2018	• Complete the final project and take part in the project viva with David and my	**Milestone:** The project is complete, and I have a conclusion for the theory.

		moderator Richard Booth.	**Deliverables:** Final Report for the project, due 23:00 11/05/2018.