
Initial Plan

Sports Video Analysis and Annotation

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CM3203 – 40 Credits
Large One Term Individual Project

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Project Description

Currently, every game of Rugby Union, including both International Matches and Regional Matches are hand annotated by expert sport coders employed by the Welsh Rugby Union (WRU). Using specialist software, they tag key events within a match such as scrums, line-outs and rucks to create a XML File which is synchronized to accompany the video data.

This project will hopefully assist in the very long and tedious process of annotating video by hand - saving time, money and human resources by developing software capable of recognizing key events in a rugby match and tagging them.

As an ongoing project, code has already been created to carry out a number of features such as crowd removal and Scrum/Line-out Detection using various techniques giving a satisfactory level of accuracy. My project will involve evaluating and testing the accuracy of the existing code, then proceeding to improve it in order to obtain better results and improve efficiency before finally developing my own code to recognize other events in play such as tackles. Due to the strong connection between the school and the WRU, several full 80-minute Wales matches are already available on the system for use as training and testing footage.

As a mathematically based language MATLAB is perfect for use within computer vision and, as all existing code has been written in MATLAB I shall continue to use it. Throughout the course of my project, I hope to learn and use a variety of different coding techniques and computer vision algorithms such as K-Means, HMM (Hidden Markov Models) and SIFT (Scale-Invariant Feature-Transform). I shall also be using the open-source library of computer vision algorithms, VLFeat¹ which makes use of the aforementioned algorithms.

Project Aims and Objectives

My aims and objectives during this project in the order I hope to achieve them are as follows:

- Gain an understanding of SIFT, HMM and K-Means
 - By both theoretical and practical learning I hope that I will gain a solid understanding of all three of the above algorithms and how they are used within computer vision.
- Being able to understand and use existing code for the project.
 - Understanding someone else's code and practices can be difficult, but in order to move on with my project this will be vital to ensure I don't code existing functionalities.
- Test and Evaluate existing code.
 - In order to progress with my project, I need to know exactly how well the existing code works in terms of accuracy and efficiency.
- Improve accuracy and efficiency of existing code.
 - Having evaluated the code, I may find areas in need of improving, in particular how the temporal dynamic of plays are recognized, and how dimension reduction is currently achieved.
- Attempt to improve the clustering methods currently used.
 - By possibly implementing other clustering methods such as Agglomerative Clustering and testing against results obtained with K-Means.
- Improve the Temporal Coding that already exists.
 - Which will hopefully lead to better accuracy of results, but once again will have to be compared with previous results.
- Implement and train the machine to recognize other events such as tackles.
 - Ideally, the finished system will be able to recognise all events in a game, therefore implementing more events will hopefully lead to a more rounded system.

Work Plan

As touched upon in the previous section, I have attempted to split my project up into smaller parts that should hopefully take no more than two weeks at most to complete. I have scheduled each task to a time slot as demonstrated in the Gantt Chart attached in Appendix 1.

To help with the organisation of my project, I plan on keeping a daily diary of my achievements, any problems I have faced and anything I find that I need to bring up with my Supervisor during our scheduled weekly meetings on a Friday afternoon. I hope that the diary will also contribute to the completion of my Final Report.

With regard to the two review meetings, I have split the project into roughly three parts, the first review meeting will hopefully be in week 5, a third of the way through, and the second in week 9, two-thirds of the way through. This should allow time for adequate progress to be made prior to the review meetings and time for any feedback to be acted upon following the meetings.

Whilst I have allocated three weeks to the creation of the final report, I hope to add to it as much as possible during the course of the project as and when aims and objectives are fulfilled. With that in mind, I also hope that I can use some of the three weeks allocated to the final report to catch up on any aims or objectives I may have fallen behind with during the course of the project.

Final Report Contents

My Final Report should consist mainly of the following:

- Results and conclusions following the testing and evaluation of the existing code.
- Description of how I contributed and improved the existing code.
- Results and conclusions obtained by experimenting with different clustering methods.
- Description of how the Temporal Coding has been improved.
- Descriptions of how I have contributed to the recognition of individual events.
- New results and conclusions following testing of the new and the improved code.
- How the project could be continued in the future.
- Overall conclusions and reflections on the project.

Some, if not all of the above sections of the final report should prove my understanding of SIFT, HMM and K-Means.

References

¹ Vedaldi, A. & Fulkerson, B., 2013. *Download - Using from MATLAB*. [Online] Available at: <http://www.vlfeat.org/install-matlab.html> [Accessed 3 February 2014].