**Major project logs**

Week one (28/01/2019)

Group Meeting

Initial talk about each of our projects and our intentions in terms of what sort of things we want to achieve through our projects.

Useful Materials

<https://www.vicon.com/motion-capture/life-sciences>

Website contains various case studies using the vicon system, good place to start and understand how they have managed to use it for various purposes and better understand how your work will fit into the picture.

Also has different versions of the software which can be used on the system as well as how to calibrate and other useful information to do with the system itself. Will probably come in very handy as a beginning overview.

<https://www.youtube.com/results?search_query=vicon+software+tutorial+calibration>

Various videos in this search which should be tutorials for various software versions and how to calibrate them. Need to get in touch with Marco and find out exactly which cameras and version of the software we are using in the Sports Science building. Once you have a vague idea of what you need to know and how you are going to perform the research then get in touch with Otar and say you’re ready to see Marco and get a proper tutorial. (Find out the software before watching).

<https://www.sciencedirect.com/science/article/pii/S1746809418301162#tbl0005>

Scientific paper written about using machine learning to assess 3-D plots. May or may not contain relevant information about some of the systems I might be able to make use of when I get the vicon data to play with. (Still need to read properly).

Has a few sub-papers which may be required or simply useful information later on:

<https://www.sciencedirect.com/topics/engineering/boltzmann>

<https://www.sciencedirect.com/topics/engineering/centroid>

<https://www.sciencedirect.com/topics/engineering/neurons>

<https://www.sciencedirect.com/topics/engineering/classification-performance>

<https://www.sciencedirect.com/topics/engineering/data-visualization>

<https://www.sciencedirect.com/topics/engineering/supervised-training>

Tasks

Watch and phone

1. Work on the watch and phone system, testing first to make sure everything still runs fine.
2. Try to implement some kind of data storage so that upload can be stalled an re-tried.

Vicon

1. Watch some tutorials and read up on how the vicon system works.
2. Find out what software and which cameras are being used in the vicon system.
3. Start looking for some examples of effective machine learning tools for 3-D plot graphs, which should be the output of the vicon data.

Week two (04/02/2019)

Group Meeting

Early stages of the project, most people prototyping their work and finishing the outline of the project. Talked through where we have got so far. Need to look into the vicon output and how this is going to relate to the machine learning algorithm I choose to use.

Useful Materials

<https://blackboard.aber.ac.uk/webapps/blackboard/content/listContent.jsp?course_id=_21547_1&content_id=_1208158_1>

Contains the documentation suggested by Neil to read and assist with some of the aspects of the project. For example, things like managing the time and developing a methodology etc.

<https://ieeexplore.ieee.org/abstract/document/6471801>

Paper suggested by Neil, could be quite relevant in terms of motion analysis techniques. Used for determining whether someone has fallen in a care home, used cameras to detect features of “falling”.

<https://docs.scipy.org/doc/>

Documentation for numpy and scipy libraries on python. Numpy is used for taking matrices or large datasets and performing SIMD operations on them (makes use of the multiple cores in a computer to faster give results. Scipy I believe contains (much more than this) but a group of mathematical functions such as random which is potentially useful for generating things like random weights in neural networks.

<https://scikit-learn.org/stable/documentation.html>

Scikit-learn documentation which was suggested by Neil as a good library to use for feature extraction and training and testing data.

<https://scikit-learn.org/stable/tutorial/index.html>

Some tutorials for scikit-learn which I will go through soon and use to learn feature extraction techniques.

<https://docs.python.org/2/library/pickle.html>

Pickle is a library which can be used to save and load files in python and will be useful for generating modified datasets within PyCharm.

<https://pandas.pydata.org/pandas-docs/stable/>

Pandas (panel data) is a library for displaying data in various tabular and graphical formats and can also be used to load csv files into matrices which will be especially useful for me when I get a csv file containing the motion data.

<https://en.wikipedia.org/wiki/Multiclass_classification>

Essentially this is the type of problem I am looking at where I want to take some data and apply it in a way that one of multiple classes is given at the output. There are many ways to do this as the article will show, but what I am looking into first is the abillity to extract features.

<https://en.wikipedia.org/wiki/Feature_(machine_learning)>

General information on what counts as a feature, will be useful when it comes to writing as I will need to be able to succinctly explain what a feature is and why exactly I am looking for these within my datasets.

Tasks

Module

1. Write project outline document (deadline friday this week).
2. Read the documentation outlined by Neil to make sure you are also keeping track of the module requirements as well as completing the work.

Python Machine Learning Practice

1. Watch tutorials and practice writing programs in PyCharm to get to grips with writing machine learning applications.
2. Take Neil’s advice and look into feature extraction techniques, to be able to define what a step is etc.
3. Read Marco’s Biomechanics module, specifically sections of motion analysis techniques.

Week three (11/02/2019)

Group Meeting

Met Jake for the first time and heard about his project which is very similar to mine with a focus on reading the heart rate of a person and responding to emergency situations based upon this. Everyone else updated about their projects and I talked about the progress on mine which is currently at the stage where I am learning more about motion analysis from Marco’s biomechanics module and also practicing some python coding with datasets provided as part of the sci-kit learn tutorials.

Useful Materials

<https://www.youtube.com/results?search_query=cortex+motion+analysis+tutorial>

These are tutorials using the same software as is used in the sports science building, basically showing some of the different data cleaning techniques and various other uses for the system. Quite interesting if not actually that useful practically.

Tasks

1. Practice using and manipulating data sets on the “sci-kit learn” tutorials.
2. Organise meeting and observation with Marco and his students to learn the motion analysis system.
3. Figure out the locations of markers which would be most useful for my research, ready for next thursday when we start my instruction.

Week four (18/02/2019)

Group meeting

Claudio and Josh gave presentations on some of the work they have been doing towards their project and we updated Otar on our progress. For me, I have a meeting with Marco on thursday at 9am to learn more in terms of using the motion analysis system. Also need to decide upon where the markers need to be placed (they are accurate to 1mm). Finally, the task below sums up that I need to find some relevant research papers which closely resemble sections of the work I have to do.

Useful Materials

<https://www.hindawi.com/journals/cin/2011/406391/>

The paper here used EEG (Electroencephalogram) signals, basically electrical signals from the brain to diagnose neurological conditions. This paper was about the creation of an open source python library PyEEG, which essentially used feature extraction techniques in python. Reading this will be very helpful in terms of some of the methods used to extract features and could potentially be applied to my work. Features were too specific to this example, need to look for something more general to time series data. May be useful to look at their code however.

<https://www.researchgate.net/profile/Yannis_Manolopoulos/publication/234800113_Feature-based_Classification_of_Time-series_Data/links/56b3237008ae795dd5c84b8e/Feature-based-Classification-of-Time-series-Data.pdf>

This paper is proving to be a more useful general comparison of different feature extraction techniques and is probably more relevant to my work as I have to understand some of the different types of feature extraction I could experiment with when it comes to time series data. This also contains references to many other papers which lay the groundwork for feature extraction in time series data and the use of NNs to solve these classification problems.

Tasks

1. Find and delve into a scientific paper which has done something similar to my research.
2. Design a series of tests which will be used to gather data on the cortex system.
3. Set up a git repository to be used to keep track of versions of your work.

Week five (25/02/2019)

Group Meeting

General updates on how the projects are going. I showed the file format I am getting from my tests and it was suggested that I create a sort of animated wire skeleton for the demonstration.

Useful Materials

<https://matplotlib.org/contents.html>

matplotlib documentation, which can be used to create plots of the data. Will come in handy for visualisation of the results and the data. Also need to investigate how this can be paired with pandas and also pickle perhaps for saving results.

Tasks

1. Now I have an example CSV file from my tutorials with Marco, I can begin to look at reading the file and manipulating the values for feature extraction.
2. Continue reading papers on feature extraction.
3. Create an animated graph of the data for demonstration.

Week six (04/03/2019)

This will be a particularly big week as hopefully I will be receiving the first full set of data recorded from myself.

Group Meeting

Useful Materials

Tasks

1. Organised two slots on the motion system. Will take recordings of myself in the full marker set and try to figure out how to get some really clean recordings and experiment with camera position.
2. Once I have the data I can plot it using the same method I figured out last week.
3. Start to manipulate the data in terms of sectioning the time series and find various features (max, min, average, stdev so on)
4. Clearly label the data with the ground truth of what was happening at what time.