Initial Plan:
Automatic emotion capture when viewing web-based media on a smartphone

Matthew Jones
Supervisor: Professor Dave Marshall
Co-Supervisor: Professor Roger Whitaker
Moderator: Dr Yukun Lai

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Contents

1 Project Description **3**

2 Aims and Objectives **4**

3 Ethical Considerations **5**

4 Work Plan **6**

4.1 Prior work 6
4.2 Week 1 6
4.3 Week 2-3 6
4.4 Week 4-5 6
4.5 Week 6-8 7
4.6 Week 9 7
4.7 Weeks 10-11 7

1 Project Description

Every day, we view different types of web-based media such as tweets, online videos, and articles. Each of these types of media can produce a different emotional response such as happiness, anger, or surprise. Automatic classification of these responses has received a lot of attention in the image and video analysis communities, as well as in social computing. For example, AI researchers at Carnegie Mellon University's Human Sensing Laboratory recently released work on new emotion detection techniques [1]. Microsoft's Project Oxford has also recently released new vision APIs for emotion detection in images. [2].

Following on from a successful CUROP project [3], this project aims to develop a proof-of-concept system capable of showing users a set of web-based medias, and automatically classifying their emotional response, using their smartphone. Existing work has focused on methods of detecting emotion, whereas this study is more about applying this technology to a real-time application. The output of this project aims to provide more insight into how humans respond to different types of media, and has the potential to impact studies in areas such as marketing, healthcare, and augmented reality.

2 Aims and Objectives

The main aim of this project is to develop a proof of concept system that allows emotion classification experiments to be conducted using a smartphone. The system will be designed to be a general tool for conducting emotion experiments. For the purpose of this project, the system will be tested using an emotion experiment designed with guidance from my co-supervisor, Professor Roger Whitaker.

To build the system, the following objectives need to be achieved:

- *To develop an API for accessing/modifying experiment data.* This will be used to access/modify all experiment information and this API data will drive the web application and iOS application components of the project.
- *To develop an API-centric web application capable of creating experiments and viewing experiment results.* The web application will need the following areas of functionality:
  - To allow the creation of experiments through specifying links to different types of web-based media such as social media posts, videos, and articles
  - To be able to view experiment data sent from the iOS application in an appropriate format such as charts
- *To develop an iOS application capable of performing these emotion classification experiments.* The application will therefore need to have the following functionality:
  - To be able to detect and track facial landmarks, that will be the basis of the features used for emotion classification
  - To be able to obtain confidence measures of emotions from tracked facial landmarks
  - To be able to retrieve a pre-defined experiment using the API, show the web-based media, and to send back the tracking/classification data back using the API
- *To further develop the emotion classifiers using data generated from experiments.* This may include:
  - Retraining of the emotion classifiers using data from experiments and/or third-party datasets
  - Investigation into the features selected for classification

3 Ethical Considerations

The project aims to deliver a proof-of-concept system to allow emotion classification experiments to be set up and then completed by users. An experiment will involve a user obtaining the iOS application, and viewing a small set of web-based medias such as YouTube videos/Tweets/articles. Whilst they are viewing the media, the application will use the iOS device's camera to track their facial landmarks, and to classify their emotion.

The data generated from experiment participants will be recorded and sent back via the API to be reviewed by the person(s) who set up the experiment. The experiment results will be made up of anonymised tracking data and classification data.

The data will also be used to evaluate the performance of the system in general, particularly the emotion classifier. The data may be used to retrain the classifier or used in another project.

As experiments involving users will not take place until the latter stages of the project, ethical approval does not need to be considered initially. As the project progresses, my supervisors and I will discuss any appropriate actions that need to be taken for ethical approval.

4 Work Plan

I have outlined an exploratory work plan for the project below, taking into account the main objectives for the project, and the dependencies between them. Some of the tasks outlined, particularly development, may take more time than planned. However, the Easter Recess has not been factored into this work plan and it is intended to be used as a buffer to minimise impact on deliverables caused by any delays.

I intend on having weekly meetings with my supervisor to assess project progress, and to facilitate some of the testing that will be required of the system.

4.1 Prior work

As mentioned within the project description, this project is based on a CUROP project that I undertook in Summer 2015 entitled *'Facial expression analysis on a smartphone'*, also supervised by Dave Marshall [3]. That project provided me with the fundamental knowledge/skills that will be required during this project including machine learning, and iOS development.

The main output from the CUROP project that will be used to support this project is the emotion classifier. This classifier has already been trained using external datasets, and will save time during this project compared to having to build a classifier from scratch. However, this classifier is limited in its performance and part of this project will involve improving the classifier. I also intend on reusing parts of the code for the proof-of-concept iOS application I built to ensure that the iOS application in this project can be built as early as possible to conduct experiments with users and to analyse the results.

4.2 Week 1

- Complete the 'Initial Plan' deliverable
- Investigate appropriate languages, web frameworks, and databases to develop the web application and API components of the project
- Investigate the availability of third-party datasets to retrain emotion classifiers

4.3 Week 2-3

- Design the project's database structure to store the experiment information including web links and classification data
- Create the project database and develop an initial version of an API based on this
- Meet with Professor Roger Whitaker and his PhD students to design an appropriate emotion experiment to test the system with

4.4 Week 4-5

- Create the initial version of the web application, capable of interacting with the developed API to allow the creation/modification of an experiment

4.5 Week 6-8

- Integrate the developed API and existing iOS work on face tracking and classification into a new iOS application that is capable of executing experiments

4.6 Week 9

- Set-up the designed experiment in the web application, and complete the experiment with a small sample of users
- Develop the ability to view experiment data through the web application
- Investigate performance and possible improvements to the system using raw experiment data
- Start the write-up for the 'Final Report' deliverable

4.7 Weeks 10-11

- Make improvements to emotion classifiers using findings from investigations and update the iOS application accordingly
- Complete the 'Final Report' deliverable

References

[1] W.-S. Chu, F. De la Torre and J. F. Cohn. *Selective Transfer Machine for Personalized Facial Action Unit Detection*. Available: `http://www.humansensing.cs.cmu.edu/intraface/index.php` [Accessed 25/01/16]

[2] Microsoft *Emotion APIs*. Available: `https://www.projectoxford.ai/emotion` [Accessed 25/01/16]

[3] Matthew Jones. *Face tracking and emotion classification iOS app*. Available: `https://github.com/mrhysjones/curop` [Accessed 25/01/16]