A computational platform for emotion recognition in the wild

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Category: Data collection software platform for mental health

Note to the PI: *I understand that in order for my abstract to be approved, I accept to participate as a judge, or in case I am not available, send another faculty member on my behalf to participate as a judge during the Biomedical Research Day.* *__X__Yes ____No*

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Descriptive Statement:
Developing a data collection platform that seamlessly collects user's personal data extracted from the user's mobile phone and physiological signals extracted from wearable sensors. The collected data can then be used to run machine learning models and automatically recognize user's emotions any time of the day in real time. The user's emotions can then be used by Psychiatrists to evaluate the user's emotional state in real life settings.

IRB Status:

1. Did the research involve human subjects, including review of existing records / material? ___Yes __X__No
2. If you answered YES to Question 1, was IRB approval granted for the study? ___Yes ____No
   Approving Institution: AUB_____ Other (Pls name) _____

Introduction: background and aims
Previous work on emotion recognition has focused on lab settings or limited analysis in the wild. This project aims at exploring practical use of emotion recognition in the wild with actual psychiatric assessment of system's prediction. Towards this goal, we developed a mobile software platform that aims at enabling automated emotion recognition in the wild. The platform collects three types of data: (1) data about the user's activity on the phone, for instance, time spent on Facebook, text written by the user, and click counts; (2) data from the user's mobile sensors, for instance, GPS

coordinates, audio, and steps count; and (3) data from external physiological sensors, such as EEG, ECG, and GSR sensors. This data can provide coverage of a patient's activity and vital signs.

Methods:

The software platform is developed with Java using Android Studio. It uses "Android Sensors Framework", "Accessibility Service" and special APIs to collect data from mobile sensors, user interactions and external physiological sensors. The data is collected at different sampling rates depending on the data type. For example, mobile sensors data is collected every 20 seconds, audio is collected once per minute for 20 seconds intervals, and brain signals are collected continuously. The platform also aims to collect the ground truth data related to the actual user's emotions. Hence, such ground truth data is needed for building accurate machine learning models. To get the ground truth data, a popup window appears on the mobile phone every two hours asking the user for her emotion (Happy, Sad, Angry, Anxious). The user can also choose to enter her emotion at any time without the need to wait for the two hours interval. All data is collected and stored on the user's phone, but eventually the data should be sent to the server for processing. To give the user secure control over her data, the user can decide what data to upload to the server. Every end of day, a checklist of options (e.g. Audio, Key logs, Mobile sensors, GPS, Time spent on different applications, EEG sensors,..) is displayed to the user. Whatever the user checks, is uploaded to the cloud through Dropbox.

Results:

The application was tested by the application developers over a period of one week, where the data was collected in the background. The developers chose to upload all the collected data to Dropbox including the ground truth annotations. The size of the collected data was about 25 MB per day, which is considered small relative to today's storage capacity. The collected data can then be used to train machine learning models in order to be able to predict the patient's emotions in real-time. Going forward, the platform will be used to run a real user study once the IRB process is complete.

Conclusion:

This paper presented a platform that can provide personal real data collection, which can be used to train machine learning models for predicting and tracking a person's emotions in real time. The data is collected from mobile sensors, accessibility events and external physiological sensors. For future work, more sensors will be integrated to the application like Galvanic Skin Response and Heartbeat. The platform will then be integrated with artificial intelligence models and used for real user studies to evaluate the effectiveness of real-time tracking of users' mental health.