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Exploring the use of online and mobile data to passively track and analyse psychological state

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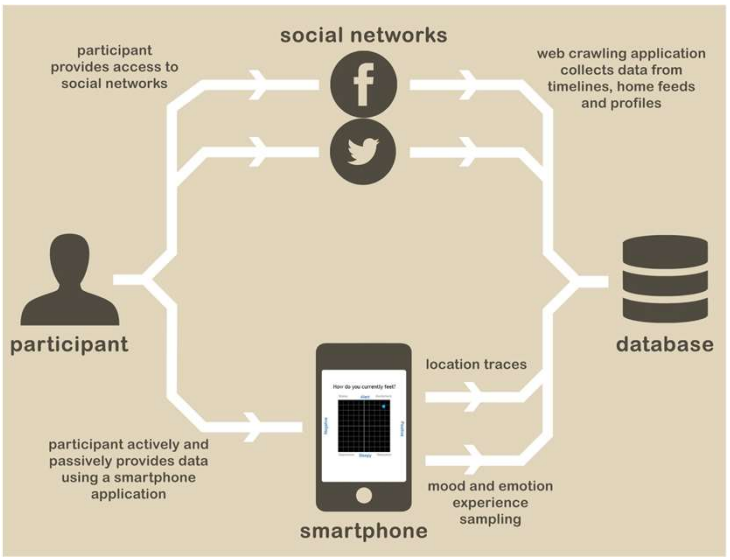
Introduction

This project aims to explore the use of data from personal digital technologies including online social networks, smartphones and wearable sensors in order to passively track a person's psychological state such as their emotions and mood. Current methods for capturing psychological state rely on intrusive experience sampling assessments, observations or questionnaires which are often limited in duration and quantity of participants due to cost or time constraints.

The core aspect of the research will be to explore the feasibility of automatically detecting the psychological state of people without their active involvement. This requires an exploration of the possible signals that can be extracted such as online activity and real-life location which can be used to estimate the psychological state of the person involved. The ability to passively track a person's psychological state without intrusive methods can find applications within the marketing and healthcare industries as well as improving the self-awareness of mental well-being.

Data collection

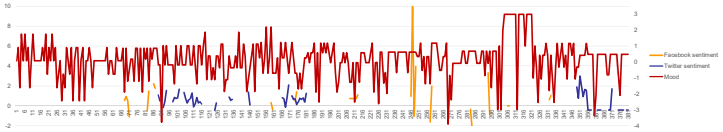
An initial study was conducted to collect data about online behaviour and mood. This involved participants providing both active and passive data sets for ground truth and prediction features respectively. 18 participants were recruited during the summer of 2015. They were asked to use a smartphone application to record their mood and emotion once per day for an average duration of 28.5 days. The application additionally collected location traces in the background. Participants were also asked to provide access to their Facebook and Twitter accounts which allowed a web crawling application to capture their online activity including their posts, home feeds and profiles. Two further, identical studies are being conducted to collect a larger dataset.



Data collection process

Analysis

Sentiment analysis, also known as opinion mining, is the process of extracting subjective information such as subjects, opinions and mood from text sources. Sentiment analysis was performed on the statuses and tweets to convert the text into a numerical representation of mood. However, no strong correlations were discovered between the results from the sentiment analysis and the self-reported mood, contradicting existing research which observes mood via sentiment on social networks. However, this could have been affected by the insufficient number of daily posts by the participants.

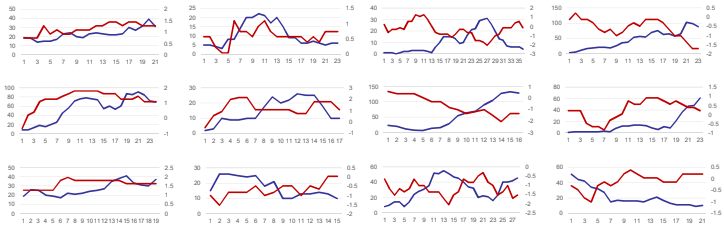


Graph showing the mood of all participants per day, the weak correlations with sentiment and the fragmented sentiment data

Features including the interaction with the social networks (number of statuses, tweets, likes and comments), interaction with others, time of day of posts and days since the last interaction were explored. The total social network interaction displays a strong correlations with mood.

Correlations have been found to be more successful when analysing individuals separately, rather than attempting to produce a model for the population as a whole. This was expected as everyone thinks, speaks and portrays themselves online differently.

There is also a significant display of time delayed correlation, where a participant reports to feel positive on one day, but does not portray this positivity online until a following day. Sliding windows of 3, 5 and 7 days were used to incorporate the delays into the analysis.



Mood (red) vs. total social network interaction (blue) for a selection of participants across a 7-day sliding window

Concluding remarks

- Initial analysis has shown that sentiment analysis produces weak correlation with mood.
- Online interaction shows much stronger correlations.
- Sliding windows must be used to overcome time delays.
- Conclusions must be made per individual, not for the population as a whole.
- Future work will look into utilising the location traces as an additional feature.
- The aim of this work is to develop a system that estimates psychological state changes through passively tracking a person's activity.

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