Anticipatory Monitoring of Psychological States through the Analysis of Mobility Data

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Mobile phones today have become the most ubiquitous personal computing devices on the planet. They have transformed over a period of time from merely communication tools to smart and highly personal devices that are able to assist us in a variety of day-to-day situations. Besides being an indispensable part of our daily life and pervasive in nature, mobile phones come equipped with a plethora of sophisticated sensors with the capability to capture our physical contextual information such as location, movement, audio environment, proximity with other objects, collocation with other devices and many others [7]. Many recent studies have shown the potential of exploiting mobile sensing data to learn and, potentially, predict the user's behavioural patterns such as mobile phone interaction [4]. Causal links between behavioural information extracted from mobile data and psychological states have also been investigated [8]. Moreover, mobility traces extracted by means of mobile phones have also been effectively used for a range of digital health applications, in particular for effectively monitoring and predicting mental health and well-being of users [9, 3, 5, 2].

Indeed, in the course of a day, people visit many places for a variety of reasons, for work or for leisure. Some of these visits are regular, whereas others are not. Our daily movements directly reflect our decisions and behavioural patterns, which are also linked to our mental states [1]. As a result, there is a tremendous potential in understanding routines and mobility behaviour of people through the analysis of location data obtained passively from mobile phones. However, feature extraction for characterising human mobility remains a heuristic process that relies on the domain knowledge of the condition under consideration. Moreover, we do not have guarantees that these "hand-crafted" metrics are able to effectively capture mobility behaviour of users. Indeed, informative emerging patterns in the data might not be characterised by them. This is also a complex and often time-consuming task, since it usually consists of a lengthy trial-and-error process.

We are investigating the potential of using autoencoders for automatically extracting features from the raw input data [6]. Through a series of experiments we have shown the effectiveness of autoencoder-based features for predicting depressive states of individuals compared to "hand-crafted" ones. Our results demonstrate that automatically extracted features lead to an improvement of the performance of the prediction models, while, at the same time, reducing the complexity of the feature design task.

References

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