Pervasive Monitoring of Mental Health for Preventing Financial Distress*

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***Abstract*— Mental health disorders are ranked among the top twenty main causes of disability worldwide. It was found that there is an intriguing relationship between mental health problems and financial difficulties. Current technology uses mobile apps for self-monitoring of mental health conditions with a potential to avoid debt crisis caused by mental illness. In this paper, we propose the use of a wearable sensor as an objective evaluation tool for monitoring the emotional well-being of the subject. By fusing the sensory data with financial data, an intelligent self-guard system is proposed for preventing excessive spending caused by mental condition.**

Keywords—mental health; financial data; wearables, GSR

I. Introduction

One in four people in debt in the UK are also suffering from a mental health disorder. During periods of poor mental health, more than 90% of them made poor financial decisions [1]. With the aim of empowering consumers, the Open Banking Standard was set up to provide consumers the access to their own transaction data. This initiative encourages the development of mobile apps that combine self-reporting on mood states (such as the Mood 24/7) and financial history data to enable timely support to avoid comfort spending.

Although, financial data can provide valuable information about consumers' spending patterns over a long period of time, it is very difficult to provide timely and accurate information needed to detect impulse buying due to mental disorders which could occur within a few hours. Furthermore, the lack of subjective assessment on a consumer's mental state and the enabling of third-parties to control financial decisions can result to fraud and exploitation.

Biosignals obtained from wearable devices could provide valuable insights in the link between spending and mental health disorders. For example, heart rate, galvanic skin response (GSR) and activity levels have found to be closely related to emotional states and have been exploited for monitoring mental health disorders [2, 3].

In this paper, with the aim of avoiding excessive spending due to mental illness, we propose an integrative approach of fusing wearable sensor signals with financial transaction data to detect poor mental health conditions and abnormal spending patterns.

II. Methods and Results

A. Analysis of Financial Data

To demonstrate the concept, we developed a personal predictive model for detecting abnormal spending patterns. The model was built using real financial transaction data of 2500 households over the period of 2 years along with information per household that includes their income, number of adults/ children and age [4]. We related the household profile information with the amount of spending per month across households to deduce personalized spending models. Abnormal spending can be detected by tracking the trend and deviation from the deduced spending models.

B. Analysis of Biosignals

For biosignal acquisition, a computer mouse prototype is developed (as shown in Fig 1). Conductive tape is placed around the areas where the fingertips typically touch the mouse: the index and middle fingers for GSR measurement whereas the thumb and ring finger for capturing heart rate. Data is sampled at 10Hz and transmitted to an Android device *via* BLE. This prototype demonstrates the feasibility of developing a wearable sensor for capturing distressful events.

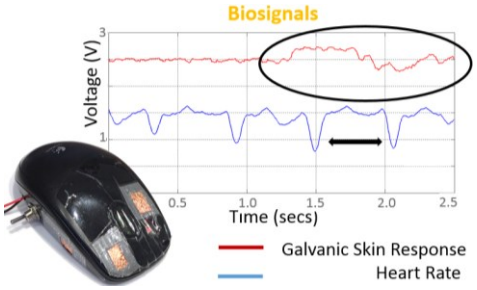


Figure 1. GSR and extracted heart rate signal under normal and simulated stress conditions

III. Discussion and Conclusions

It is difficult to derive an accurate model of mental health and spending based on financial data alone. Using wearable sensors, we can reliably detect changes related to emotional states that take place within seconds. Relating these findings with financial transaction history data would provide valuable insights for developing mechanisms to protect vulnerable people in making poor financial decisions during periods of poor mental health.

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