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# PERSONALised Health Monitoring System

## Reporting

### Project Information

#### PERSONA

Grant agreement ID: 327702

Project closed

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5 May 2014

#### End date

24 July 2017

#### Funded under

Specific programme "People" implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013)

#### Total cost

€ 294 693,00

#### EU contribution

€ 294 693,00

#### Coordinated by

THE CHANCELLOR MASTERS  
AND SCHOLARS OF THE  
UNIVERSITY OF CAMBRIDGE  
 United Kingdom

## Final Report Summary - PERSONA (PERSONALised Health Monitoring System)

The main focus of the PERSONA project is to develop a personalised monitoring system to assess depression, including its increase or decrease, in an automatic, more objective, pre-symptomatic, and cost-effective way. The system measures individuals' behaviour (such as diurnal sleep patterns,

socialization, activity context, high-level movement patterns), physiological parameters (like heart rate variability, respiration rate and volume, skin temperature and conductance etc.) and vocal characteristics (such as syncopation, pacing and fluctuations in speaker's tone) using comfortable wearable wireless sensors and mobile phone. The collected data is analysed using machine learning and data mining techniques with the aim of extracting interesting knowledge for mental health doctors and scientists to enable early diagnosis of depression, prevention of depression, assessment of depression for people who cannot communicate, better assignment of a treatment, early detection of treatment remission and response, and anticipation of post-treatment relapse or recovery.

During the outgoing phase at the MIT Media Lab, the fellow developed 4 clinical trials together with medical experts from the Boston hospitals (Massachusetts General Hospital, and Brigham and Women's Hospital), the Harvard Medical School and the Harvard Department of Psychology. In these longitudinal studies more than 65 depressed people were monitored for 3-8 weeks during daily life activities as they were undergoing a depression therapy. The enrolled participants were diagnosed with different types of depression; from the mild depression treated with a cognitive behavioral therapy, through more severe cases undergoing drug therapy or brain stimulation therapy -Transcranial Magnetic Stimulation (TMS) or Electroconvulsive therapy (ECT), to the people with suicidal depression admitted to a hospital.

Initial analysis of the in-hospital results shows that asymmetry of the EDA signal from palms measured during TMS sessions may indicate depression. These data have the potential to provide objective biomarkers to advance the understanding and treatment of depression. The results, if confirmed on a larger population, may potentially contribute to early diagnosis and monitoring of depression.

Moreover, the team developed a method for predicting Depression level from the ambulatory measurements of physiological, behavioral and phone-based parameters. The model trained on 25 clinically Depressed people monitored for 8 weeks, enables an estimation of the Hamilton Depression Rating Scale with an 8.5% Normalized Root Mean Square Error.

Depression is one of the most prevailing health problems in the world. Many recent publications have provided statistics about the scale of the problem:

- Globally, more than 350 million people of all ages suffer from depression. Depression is the leading cause of disability worldwide, and is a major contributor to the global burden of disease. At its most severe, depression can lead to suicide. Almost 1 million people take their own life each year.
- Depression lifetime prevalence rates range from approximately 3 percent in Japan to 16.9 percent in the United States, with most countries falling somewhere between 8 to 12 percent (11 percent of the EU population) .
- Depression is already the most prevalent health problem in many EU-Member States which accounted for 5,6% of all DALYs in Europe
- Depression costs the EU an estimated 3%-4% of GDP, mainly through lost productivity, and it is expected to grow if no preventive actions are taken
- The World Health Organization estimates that depression will be the 2nd highest medical cause of disability by the year 2030, 2nd only to HIV/AIDS

Despite depression's prevalence and disquieting predictions, the methods used to diagnose and then ultimately select appropriate treatment are based on the most widely used approach to assess depression severity developed in 1960s. Diagnosing and tracking depressive symptoms has been accomplished by assessing subjective diagnostic criteria, either from the Diagnostic and Statistical Manual of Mental Disorders (DSM), or from standardized rating scales. Though useful for semantic and billing purposes, this approach has limited utility for 1) determining subtypes of depression; 2) capturing variations over

relatively short time periods (i.e. over the course of a day), and 3) predicting the course of the illness. Despite recent research efforts, no clinically useful, non-invasive, inexpensive biomarkers for the diagnosis and prognosis of depression have been identified. Therefore, there is a critical need to identify and discover objective biomarkers for the diagnosis, prognosis, and treatment of depression. As a result patients will spend less time in an acute state of illness, which will ultimately lead to reduced society and financial burden of illness.

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