

Mental State, Mood, and Emotion

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Mental health is one of the most challenging issues facing our society due to the high prevalence of mental illness and the devastating effects it has on the individual and society. For instance, in 2020, hundreds of millions of people were affected by depression and anxiety. Common risk factors for poor mental health and wellbeing are high levels of stress and anxiety, sleep deprivation, and loneliness. These factors are relevant to the prevention, early intervention, and the support of treatment. Also, chronic mental illnesses such as bipolar disorder, schizophrenia, and substance abuse require long-term self-management and monitoring to avoid deterioration of an individual's mental health and wellbeing. This has led, in recent years, to an increase in the interest and exploration of the use of pervasive technologies such as mobile computing and sensors with machine learning for detecting symptoms, assisting in the diagnosis of mental health problems, and for improving access to, engagement with, and the outcomes of therapeutic treatment. They promise to offer new routes for improving the identification of risk factors, the prediction of disease progression, and the development of personalized health interventions.

Despite great potential, the realization of effective pervasive technologies for mental health remains extremely challenging. How can pervasive computing help diagnosis, treatment, and management for mental health? What are the gaps between technological innovations, and what is needed in clinical settings? How should we develop and evaluate pervasive technologies to help decision-making and ensure safety, accuracy, and fairness? How can we develop privacy-preserving pervasive computing systems for mental health or emotion?

The aim of this special issue is to discuss novel approaches, opportunities, and challenges for developing effective, ethical, and trustworthy pervasive computing technology for mental health and emotion. The accepted articles address a variety of topics, ranging from voice-based depression detection, wrist-worn sensor-based bipolar manic-euthymic state recognition, free-living audio-based conversation network estimation for mental health applications, comparison of wellbeing self-report via conversational agent and web app, meeting success prediction using nuanced emotions, and personalized sleep stage and sleep quality recognition using wearable sensors.

The first four articles focus on the detection of mental health using pervasive technologies.

In "Breaking Age Barriers with Automatic Voice-Based Depression Detection," the authors study automatic speed detection using a variety of acoustic-based voice features derived from smartphone data considering participants of different ages (18–78 years old). In other words, the goal of this work is to build a system that is dealing with age variation in terms of voice characteristics across individuals.

"Long-Short Ensemble Network for Bipolar Manic-Euthymic State Recognition Based on Wrist-Worn Sensors" describes a novel deep learning approach based on physiology and actigraphy to differentiate between mood states in individuals diagnosed with bipolar disorder, combining information derived from both minute- and hour-long intervals. Successful classification of mood states in bipolar disorder may have important consequences for early detection and intervention practices.

"ECoNet: Estimating Everyday Conversation Network from Free-Living Audio for Mental Health Applications" presents an automatic method to estimate conversational networks using modular audio recordings, which is deployed to study the interactions of individuals affected by a variety of mental health disorders.

The last article of the four, "Peer Support Specialists and Service Users' Perspectives on Privacy,

Confidentiality, and Security of Digital Mental Health," explores ethical and social issues surrounding the use of these mental health technologies. The authors present a study including both service users and support specialists of a mental health center, providing a first-hand experience of digital ethics from the perspective of end-users.

The second three articles present technologies for emotion, wellbeing, and sleep sensing.

"Predicting Meeting Success with Nuanced Emotions" shows the analysis of conversations and self-reported meeting success scores collected during real-world virtual meetings and presents ensemble and deep learning frameworks to quantify 32 nuanced emotions (e.g., disappointment, feeling impressed).

"What's the Difference? Investigating the Self-Report of Wellbeing Via Conversational Agent and Web App" presents the comparison of user experience and engagement with a speech-enabled conversational agent and traditional web app to self-report emotion wellbeing.

Our last article "Model Personalization for Sleep Stage and Sleep Quality Recognition Using Wearables" presents personalized algorithms for sleep quality recognition and sleep stage detection using physiological signals.

The collection of articles in this special issue illustrates the wide range of ways in which pervasive computing technology can contribute to mental health and emotion. The articles contribute methodological insights, deliver tools, and provide reflections on the challenges of the development of pervasive computing technology for mental health and emotion. Given the large number of submissions in response to the call for this special issue, we decided to publish a small number of additional articles in a future issue of

the magazine. We hope they will inspire new work, spark novel ideas, and help establish new directions in thinking about how technology can support mental health and emotion.

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