

## **Depressive Disorder Remote Detection through Touchscreen Typing Behaviour**

Ruba Fadul<sup>1</sup>

Hessa Alfalahi, Aamna Al Shehhi and Leontios Hadjileontiadis

<sup>1</sup> Khalifa University of Science and Technology

Depressive Disorder (DD) is a leading cause of disability worldwide. Passive tools for screening the symptoms of DD are essential in monitoring and limiting the spread of the disease. From an alternative perspective, individuals' kinetic expression and activities, including smartphone interaction, reflect their mental status. Such widely available data in everyday life form a promising source of information on keystroke dynamics and their characteristics. This work explores how keystroke dynamics derived from touchscreen typing patterns have revealed the diagnosis of mental disorders, particularly depressive disorders. Different deep-learning approaches were established to detect patients' depressive tendencies denoted by the self-reported Patient Health Questionnaire-9 (PHQ-9) score based on keystroke digital biomarkers. In particular, Convolutional Neural Networks (CNN), Long-Short-Term-Memory (LSTM), and CNN-LSTM models were examined and compared. The keystroke sequences are captured unobtrusively during routine interaction with touchscreen smartphones in a non-clinical setting. This study used 23,264 typing sessions provided by 10 DD patients and 14 healthy controls (HC). The proposed approach was investigated under two keystroke feature combinations and validated utilizing a leave-one-subject-out (LOSO) cross-validation scheme. The best-performing LSTM-withhold-time (LSTM-HT) model achieved an Area Under Curve (AUC) of 0.86 with the correlated probabilities for subjects' status [95% confidence interval (CI):0.66-1.00, sensitivity/specificity (SE/SP) of 0.8/0.93].