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Mental Health Monitoring: Design Concept of a Smartphone Application

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Abstract. Mental health (MH) has become a global issue. Digital phenotyping in mental healthcare provides a highly effective, scaled, cost-effective approach to handling global MH problems. We propose an MH monitoring application. The application monitors overall MH based on mood, stress, behavior, and personality. Further, it proposes objective MH assessment from smartphone data and subjective screening of MH via periodic, short, self-report standardized questionnaires.

Keywords. Mental health monitoring, smartphone, explainable assessments

1. Introduction

MH issues are a global challenge; anxiety and depression have become more prominent. This is exacerbated in developing countries where MH services and resources are limited or their affordability and accessibility remain unsatisfactory. Individuals also avoid seeking support due to societal factors such as stigma [1]. Technology utilization is promising in enabling scaled, cost-effective, personalized applications for timely support, and tackling stigmas. MH applications (apps) provide a non-invasive and non-intrusive approach to managing MH [2]. Among 10,000 MH–related apps, low retention, and poor user engagement are common [3,4]. Limited empirical and theoretical evidence and a lack of clinical guidelines have contributed to these issues [3]. We presented a conceptual design of a mobile app for self-monitoring and clinical support.

2. Methods

We reviewed the literature to identify the most important functions for an app designed to support the monitoring of mental health. The modelling resulted in conceptual app design. The app incorporates objective assessments with passive monitoring of smartphone data and subjective assessment using periodic self-report standard short questionnaires.

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3. Results

Mood Profiling: Our solution recommends emotion modelling in valence-arousal spaces. Objective emotion recognition can be periodically measured using speech analysis, and user-perceived emotional assessment using SAM. ***Stress Profiling:*** Stress levels can be presented as a binary multi-label classification of stress levels. Objective stress assessment is recommended from speech while self-report stress screening is recommended with periodic Perceived Stress Scale [5] or Kessler Psychological Distress Scale [6]. ***Behavioral Profiling:*** Behavioral profiling is proposed over social interactions, mobility, and device activity patterns dimensions using communication patterns with call and text logs, and location variables patterns over time. The app identifies user behavioral patterns over time based on behavioral changes that link to MH. This could exploit the relationship between behavioral patterns and affective states of mood and stress. ***Personality Profiling:*** Most studies focus on the Big Five traits [7] in personality assessment. Our app will incorporate personality traits to bring individual impacts on mood, stress, and behavioral profiling.

4. Conclusions

We proposed a conceptual MH app that suggests indications of overall mental wellness based on MH-related concepts and the integration of passive and self-report assessments. While passive monitoring on mobile data provides objective assessments, standard short questionnaires reduce user resistance to manual reporting. The combination of complemented passive monitoring and standard screening provides clinical validation for system assessments and enables integration of the system for standard clinical practice and clinical research. The presentation of interpretable results can ensure user trust and credibility of system assessments with meaningful reports for both individuals and clinicians. Compared to available apps, our app incorporates wider aspects of MH via behavioral analytics and personality, via subjective assessments, while exploiting promising research outcomes on speech analytics for emotion/ stress detection.

References

[1] World Health Organization, World mental health report: transforming mental health for all, in Geneva: World Health Organization, 2022.

[2] Madanian S, Parry D, Adeleye O, Poellabauer C, Mirza F, Mathew S, Schneider S. Automatic Speech Emotion Recognition Using Machine Learning: Digital Transformation of Mental Health. Proceedings of PACIS; 2022; Virtual. Available at: https://aisel.aisnet.org/pacis2022/45

[3] Kaveladze BT, Wasil AR, Bunyi JB, Ramirez V, Schueller SM. User Experience, Engagement, and Popularity in Mental Health Apps: Secondary Analysis of App Analytics and Expert App Reviews. JMIR Hum Factors. 2022 Jan;9(1):e30766, doi: 10.2196/30766.

[4] Balcombe L, De Leo D. Digital Mental Health Challenges and the Horizon Ahead for Solutions. JMIR Ment Health. 2021 Mar;8(3):e26811, doi: 10.2196/26811.

[5] Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Soc Behav. 1983 Dec;24(4):385-96.

[6] Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SL, Walters EE, Zaslavsky AM. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med. 2002 Aug;32(6):959-76, doi: 10.1017/s0033291702006074.

[7] Gosling SD, Rentfrow PJ, Swann Jr WB. A very brief measure of the Big-Five personality domains. Journal of Research in personality. 2003 Dec;37(6):504-28, doi: 10.1016/S0092-6566(03)00046-1.