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# The Integration of AI in Mental Health Assessment: Leveraging Digital Biomarkers and Behavioral Data

by Maren M. Michaelsen[1] and Tobias Esch[1]

[1]Institute for Integrative Health Care and Health Promotion, School of Medicine, Witten/Herdecke University, 58455 Witten, Germany

Current psychiatric assessment methods are resource-intensive, requiring time-consuming evaluations by trained clinicians. AI offers the potential for scalable and cost-effective assessment of psychiatric diagnosis and symptom change (Barnett et al., 2018; Ćosić et al., 2021; Jacobson et al., 2019b; Pedrelli et al., 2020). AI algorithms can analyze large datasets collected from various sources, such as wearable devices, smartphones, and online platforms, to identify patterns and extract relevant features. This enables the identification of digital biomarkers associated with mental health conditions. AI techniques, such as machine learning and deep learning, can build predictive models based on these identified digital biomarkers, process complex data and detect subtle changes in behavior or physiological signals that may indicate symptom severity or predict relapse. Based on this, AI-powered technologies enable remote monitoring of individuals' mental health. This can reduce the burden on patients and clinicians, as well as enhance accessibility to mental health care, e.g., by providing real-time insights and alerts to healthcare providers about changes in symptom severity or potential relapse. In addition, AI can support the development of personalized interventions by analyzing individual data and providing tailored recommendations or interventions based on an individual's specific needs. For example, AI algorithms can identify behavioral anomalies or changes in real-time smartphone data and, as a consequence, trigger timely interventions, such as providing reminders, coping strategies, or connecting individuals with mental health support services. Finally, AI can assist clinicians in making more informed decisions by providing them with additional information and insights.

The field of research exploring digital movement patterns as potential biomarkers for mental diseases, such as depression and schizophrenia, as well as examining online shopping behaviors and environmental radius/GPS data, is rapidly growing (e.g., Jacobson et al., 2020; Jacobson et al., 2019a; Saeb et al., 2015). Research has explored the use of smartphone sensor data, such as GPS and usage sensors, as well as social contact data, in monitoring behavioral patterns indicative of depressive symptoms (Jacobson et al., 2019b; Pedrelli et al., 2020; Saeb et al., 2015). One study investigated the use of passive movement and light data collected from wearable devices to assess depression severity in patients with major depressive disorder (Jacobson et al., 2019b). By analyzing over a week of movement data, the researchers were able to significantly evaluate depression severity with high precision, both for self-reported and clinician-rated symptom severity. Another study re-analyzed public-use actigraphy data from patients with major depressive or bipolar disorder and healthy controls, aiming to identify robust digital biomarkers for diagnostic status and changes in symptom severity (Jacobson et al., 2019a). The results indicated that participants' diagnostic group status could be predicted accurately using features extracted from actigraphy data alone. Additionally, actigraphy data were found to predict symptom

change over a two-week period (Jacobson et al., 2019a). Similarly, passive sensor data acquired from smartphones have shown promise in predicting social anxiety symptom severity. By collecting data on movement and social contact, Jacobson et al. (2020) were able to develop digital biomarkers that accurately predicted social anxiety symptom severity and distinguished it from depressive symptoms and affective states. In the case of schizophrenia, relapse rates are high even with appropriate treatment. Passive smartphone behavioral data presents an underutilized opportunity to monitor patients and identify warning signs of relapse. A study involving patients with schizophrenia utilized smartphone data collected through the Beiwe app to detect changes in mobility patterns and social behavior prior to relapse (Barnett et al., 2018). The researchers observed statistically significant anomalies in patient behavior during the days preceding relapse, suggesting the potential for real-time detection and intervention before symptom escalation occurs. In the context of COVID-19 recovery, the pandemic's impact on mental health can have enduring consequences if left untreated. To address potential psychological and behavioral changes, the use of AI tools and prediction strategies in post-COVID clinics is proposed by Ćosić et al. (2021). They argue that the integration of AI into mental health recovery programs may enhance the global mental health of ex-COVID-19 patients by providing early identification of vulnerable individuals and enabling timely preventive interventions. The implementation of AI-based tools can augment existing resources and capabilities in diagnosing, preventing, and treating psychiatric disorders in the acute phase of the disease (Ćosić et al., 2021).

This body of research offers promising prospects for scalable, time-sensitive, and cost-effective strategies to improve the detection and treatment of mental diseases. However, further replication and validation studies are necessary to establish the reliability and generalizability of these findings. It is important to note that while AI shows promise in the field of mental health, it is not intended to replace human clinicians or care providers. Rather, AI technologies complement traditional clinical approaches by providing additional data-driven insights, enhancing efficiency, and enabling personalized and timely interventions.

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