

Deploying AI Methods for Mental Health in Singapore: From Mental Wellness to Serious Mental Health Conditions

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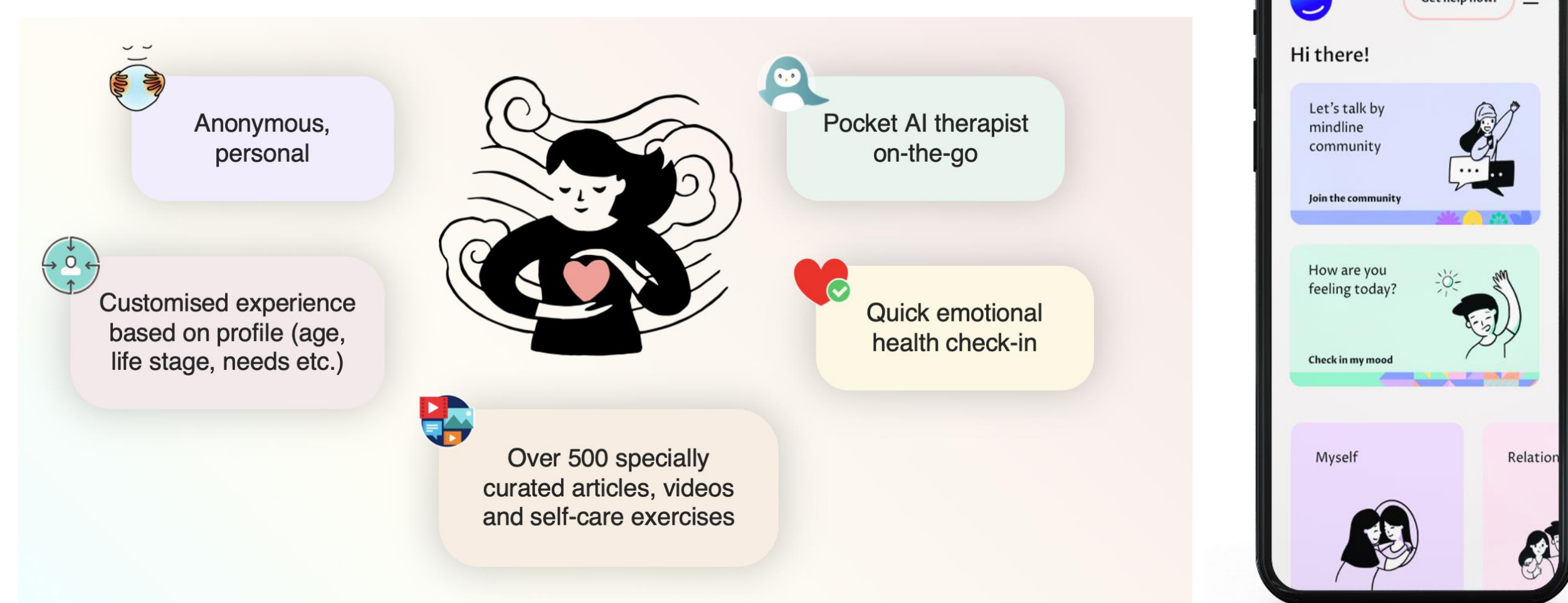
Introduction

We describe our results from the implementation of machine learning and AI methods in three digital health initiatives serving individuals across the mental health spectrum in Singapore

1. **HOPES:** Empowering patients in self-monitoring and predicting relapses in schizophrenia and depression through data collected from smartphones and wearable devices.
2. **mindline.sg:** A digital mental health platform offering curated information, a clinically-validated self-assessment tool, AI chatbot support, and structured learning materials for managing depression and anxiety.
3. **Let's Talk:** An online peer support network co-created with youth advocates featuring moderated forums and an Ask-a-Therapist service to provide a safe, supportive community for discussing mental health issues.

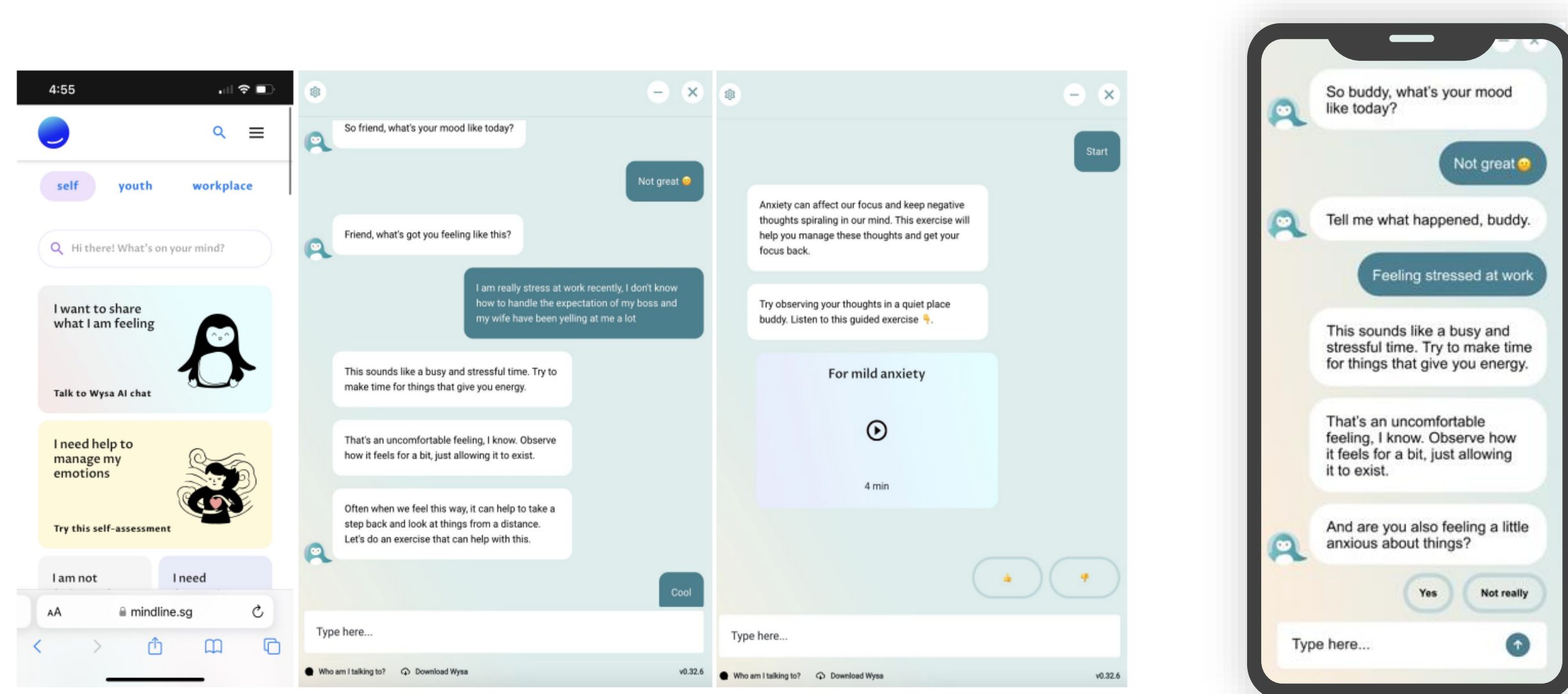
mindline.sg

the mindline.sg experience



(Left) Top features of mindline.sg as a digital mental health resource. (right) youth mindline landing page

mindline.sg is a digital mental health resource offering over 800 resources, validated depression and anxiety self-assessment tools (GAD-7, PHQ-9), an AI chatbot from Wysa and structured learning materials from Intellect.



(Left) The mindline.sg landing page with the AI chatbot and self-assessment triage tools in the top two panels. (Middle and Right) The Wysa AI chatbot directs a user to an exercise inspired by cognitive behavioral therapy.

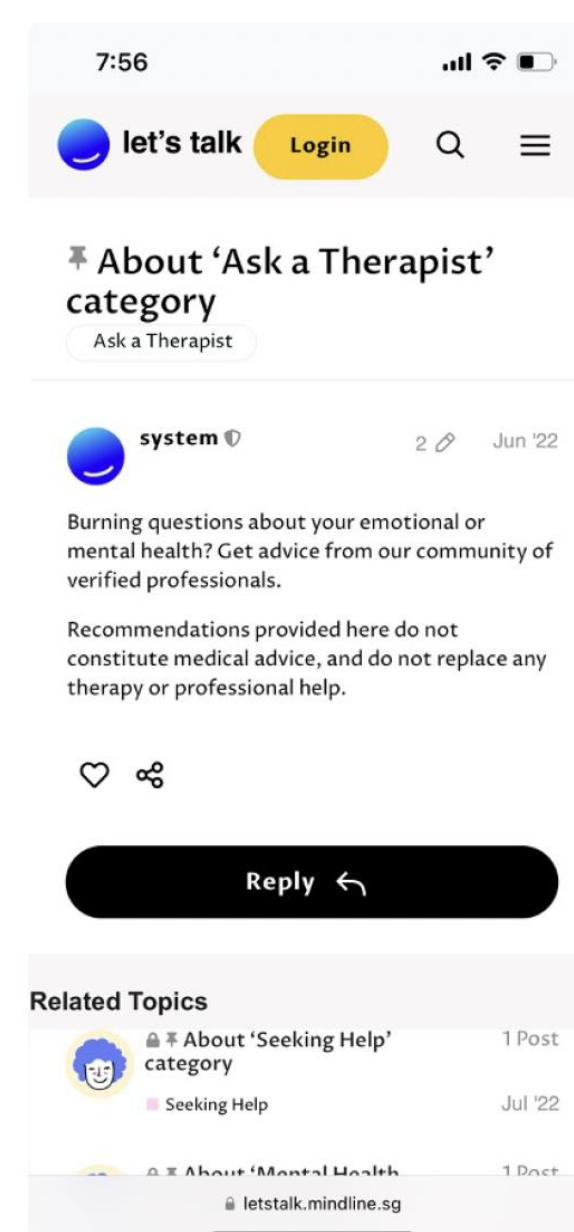
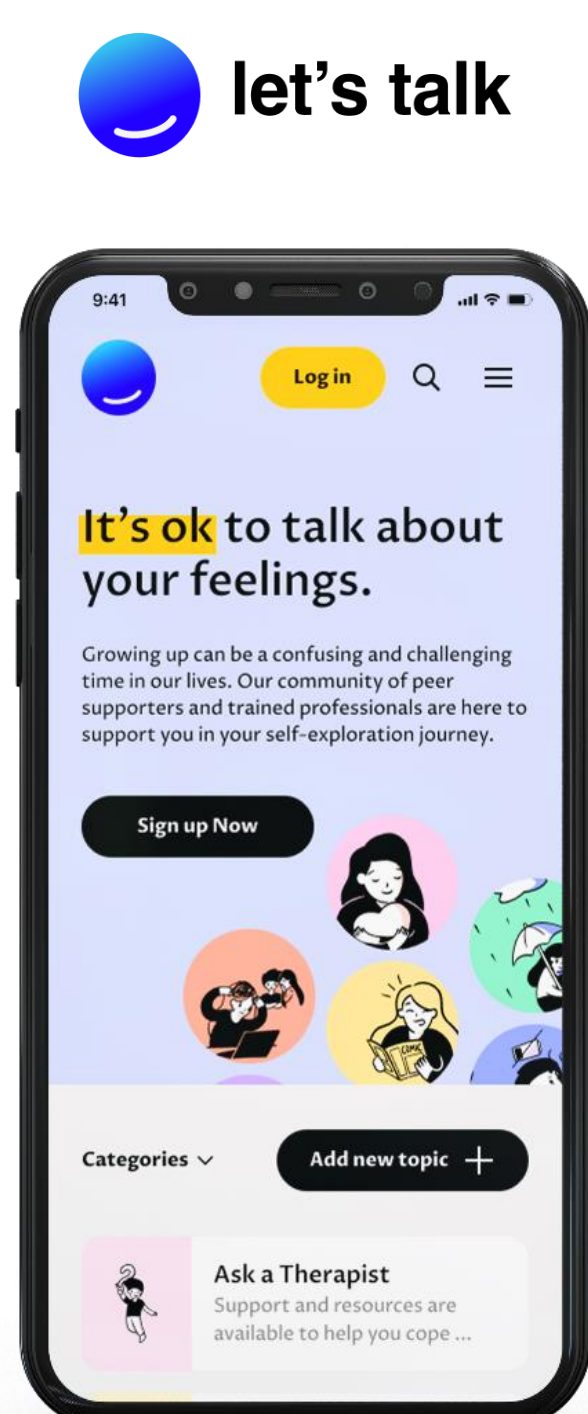
The role of AI and machine learning

AI and machine learning drive an NLP chatbot from Wysa developed for mental health, which engages, triages, and guides users toward appropriate therapeutic exercises, including tools inspired by *cognitive behavioral therapy (CBT)*.

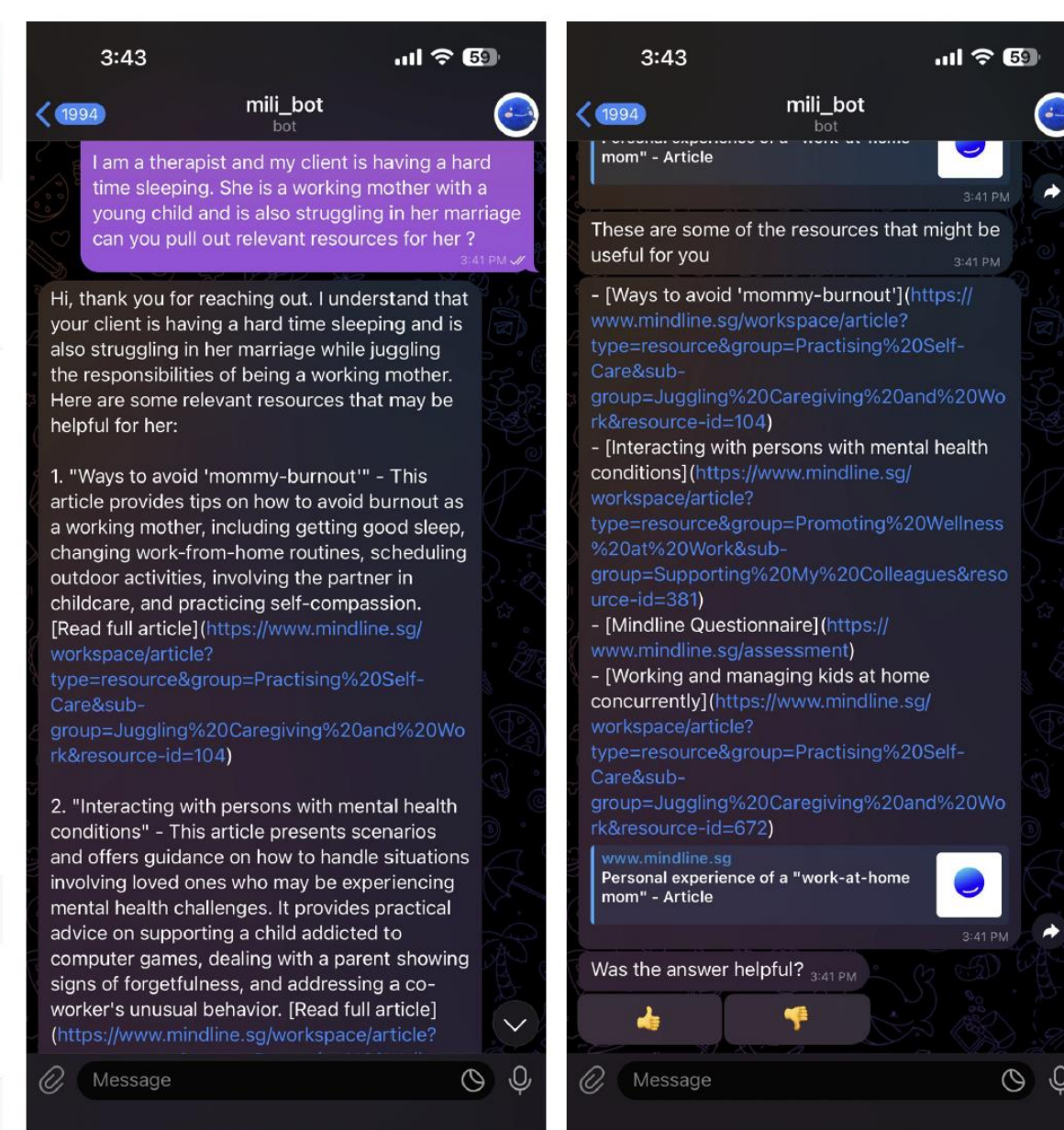
Let's Talk

Let's Talk is an online peer support network co-created with youth advocates in October 2022, which has quickly gained traction with over 80,000 visitors, 6,000 registered members, and 2,800 posts by December 2023. Unlike some other online forums, it ensures a positive and safe environment is provided through careful moderation by trained professionals, who prevent issues like trolling, toxicity, and spam. Features include moderated forums for healthy discussions and an *Ask-a-Therapist* service offering anonymous, timely advice from therapists guided by a Clinical Advisory Panel for emergencies.

Let's talk landing page



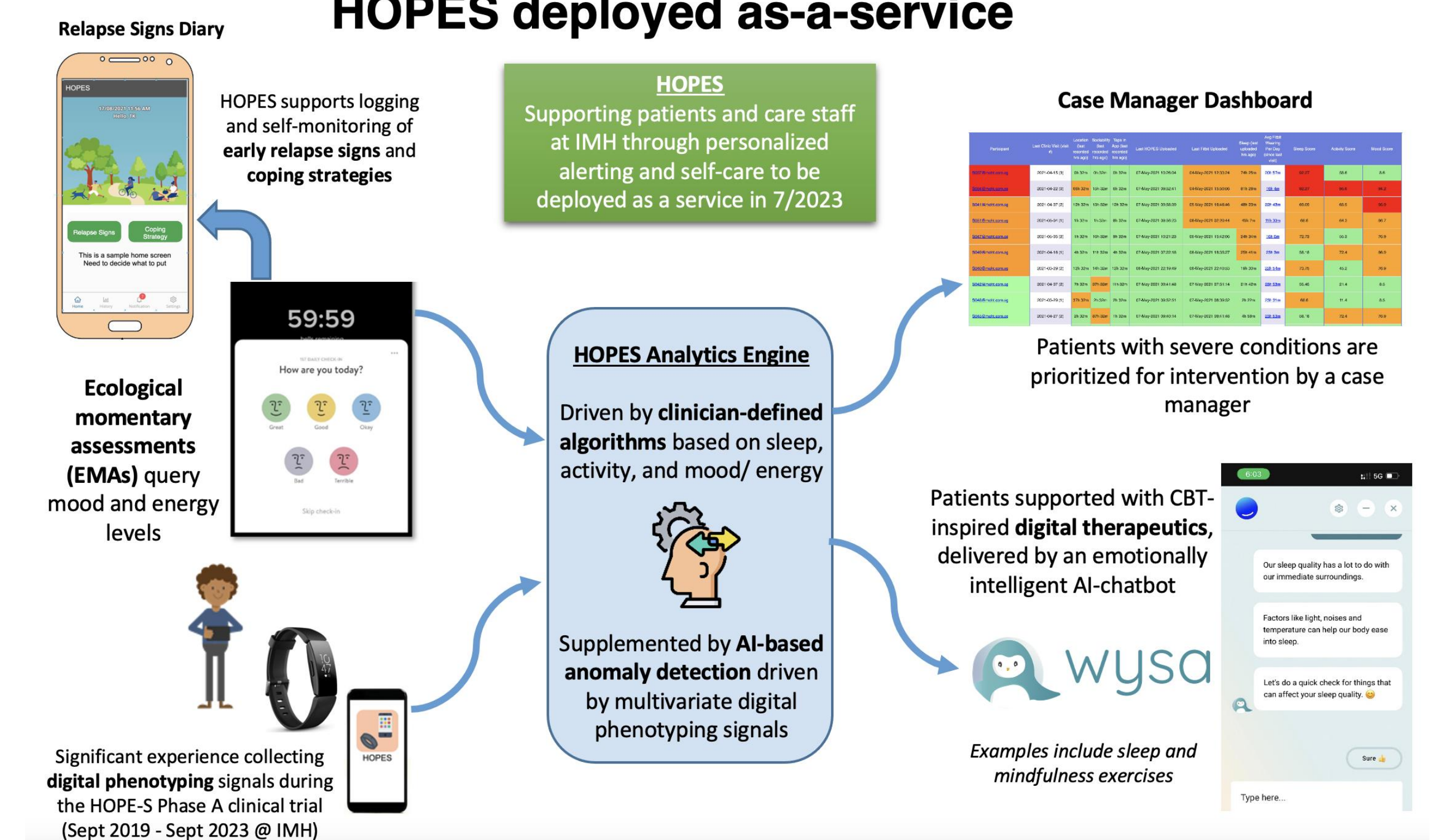
The Ask-A-Therapist service on the Let's Talk digital peer support forum for youth. (Middle) The Telegram interface for the LLM therapist assistant used by Let's Talk staff therapists to retrieve therapeutic content relevant for a post. (Right) Feedback is collected from therapists possibly enabling future AI improvement efforts.



Use of AI: To address increasing demand for therapist consultations, Let's Talk is leveraging LLMs, specifically GPT-3.5, fine-tuned with platform-specific Q&A pairs and Retrieval-augmented Generation (RAG) to reduce hallucinations. This method also helps therapists access mindline.sg's vast resource database efficiently. With this AI support, therapists have produced around 30 tailored responses, achieving an 88% approval rating for usefulness.

HOPES

HOPES deployed as-a-service



Architecture diagram of HOPES deployed as a service

Project HOPES empowers patients with schizophrenia and depression in self-monitoring and management with digital phenotyping, i.e., the passive measuring of behavior through the smartphone and wearables. The HOPES platform collects data on sleep, activity, heart rate and its variability, sociability, locational entropy, tapping speed, light exposure, and screen usage time.

HOPES is used to help patients monitor their own symptoms and to predict relapses, i.e., severe degradation of symptoms resulting in adverse events like re-hospitalization. Through early detection and intervention by clinical care managers, we aim to reduce relapses and hospital length of stay.

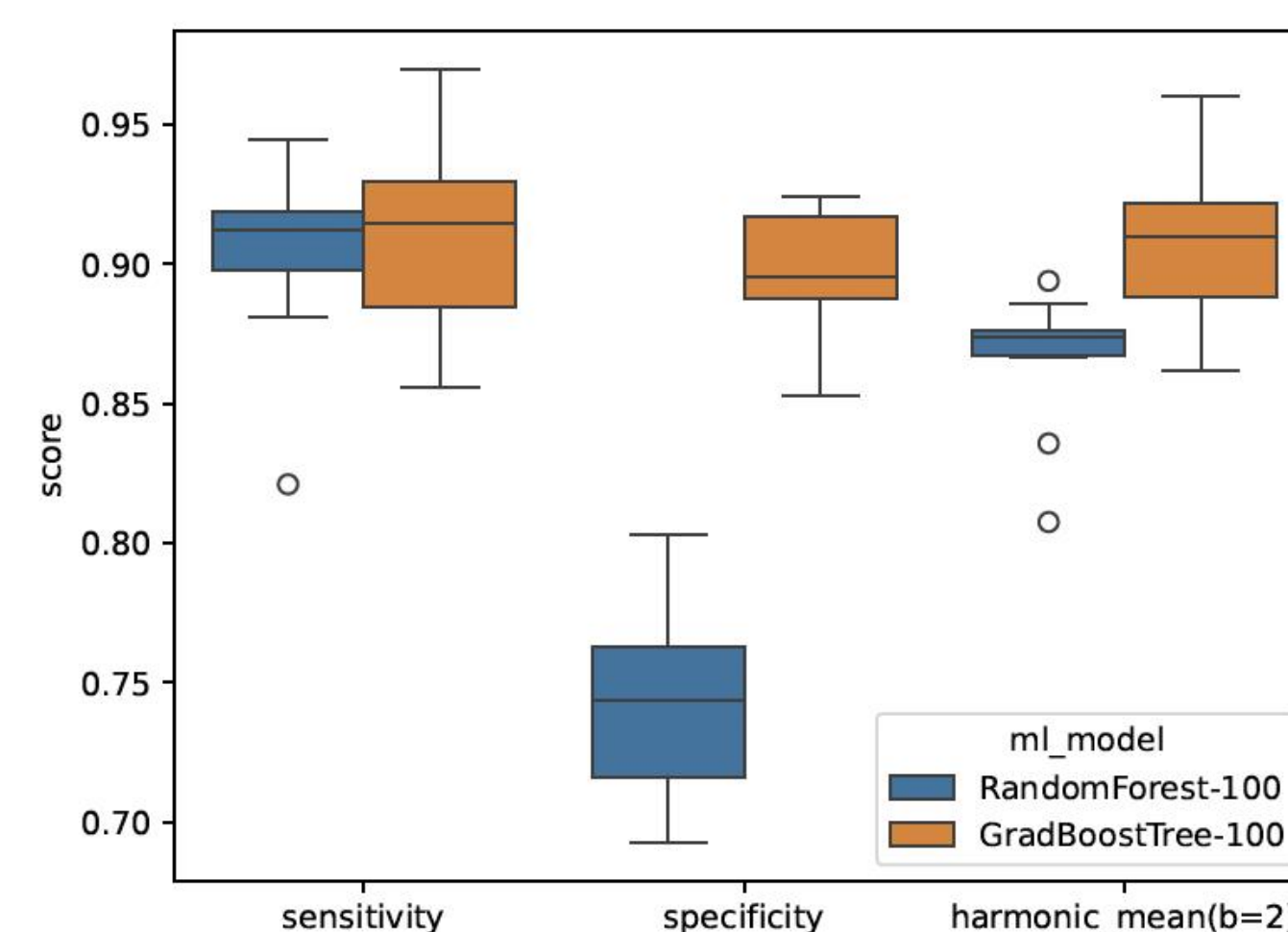


Figure 1: Boxplots of performance metrics for two popular machine learning models on predicting adverse clinical events in schizophrenia, including relapses.

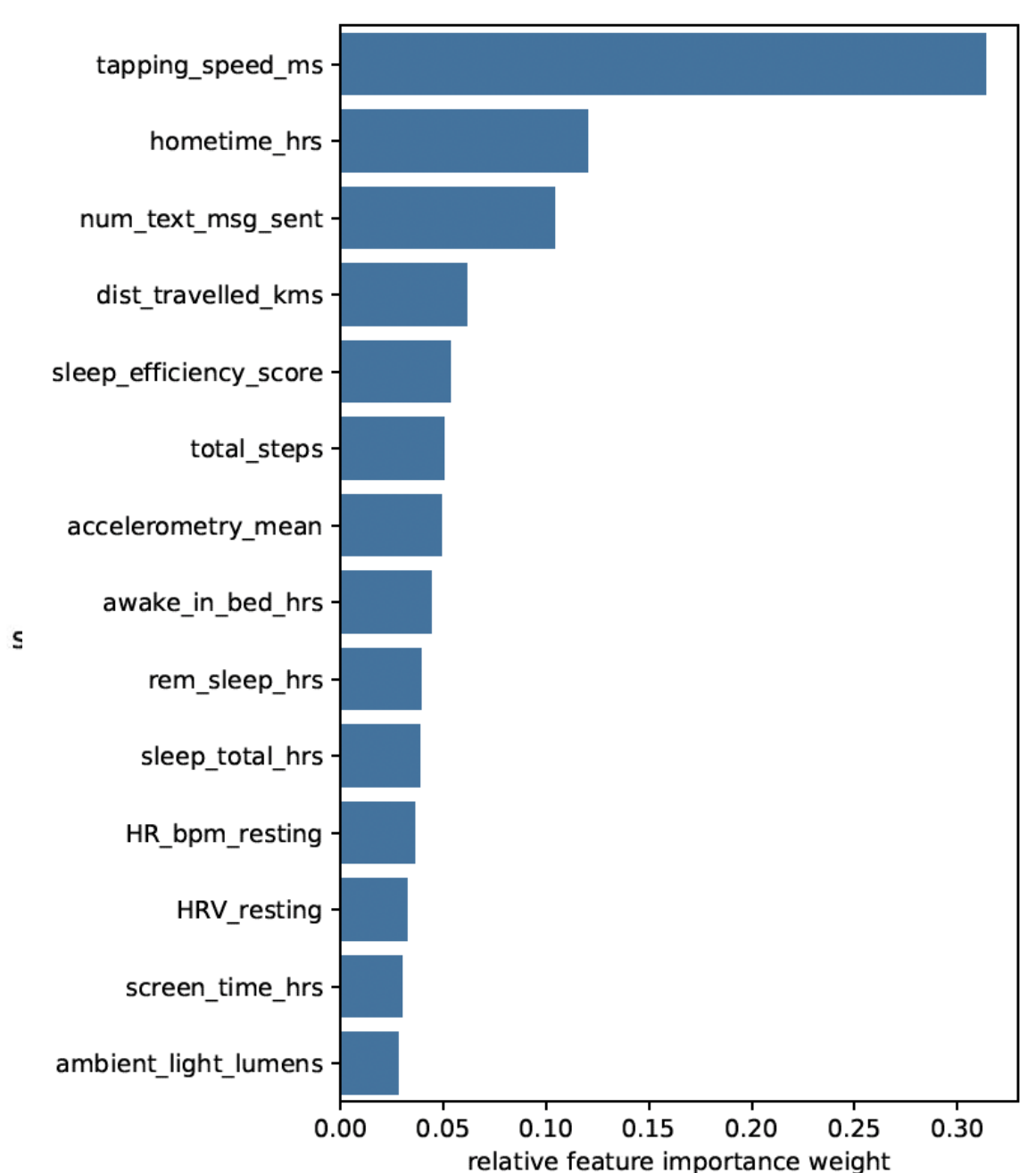


Figure 2: Ranking by feature importance weight in the gradient boosting tree model for the prototypical measures from each sensor.

Machine learning models are used to predict symptoms and functioning and to predict adverse clinical events. A gradient boosting tree achieves a 92% sensitivity and 90% specificity in predicting 29 events in cohort of N=100 patients with schizophrenia in our HOPE-S observational study (2019 – 2023).