Credit: Data Science Research Center

CITY

Opening the Black Box of Therapy

Harnessing the Power of Artificial Intelligence to Improve the Treatment of Depression

Treatment quality and effectiveness are strongly influenced by the therapeutic alliance established between a therapist and patient, particularly in patients with severe depression. Facial expression analysis during treatment sessions can provide a good indication of interaction quality.

*The AI-based feedback system designed by UofH researchers was one of several projects featured in the **Data Science for Humanity Art Exhibition**, promoting multidisciplinary data science research for the benefit of society and the environment. The Exhibition was curated by the University's Data Science Research Center and the Kibbutz Galuyet 91 Gallery in Haifa.*

While global headlines over the past two years were dominated by the medical and financial impact of the COVID-19 virus, under the surface a secondary public health crisis has been brewing that has the potential to be even more devastating. According to numerous studies, already high global rates of depressive and anxiety disorders were further exacerbated during the pandemic due to social isolation, loss of freedom and fear of illness and death.

In response to the surging demand for mental health services worldwide, researchers at UofH's School of Psychological Sciences and Departments of Computer Science and Information Systems are developing an AI-based feedback system that enables personalized treatment for clinical depression. "We are shining a light into the 'black box' of therapy," explains Prof. Sigal Zilcha-Mano, Director of the Psychotherapy Research Lab. "We wanted to understand what makes some treatments more successful and identify the factors that contribute to the success of each patient's treatment."

The research team collected data from hundreds of therapy sessions with clinically depressed patients, and then utilized machine learning to automatically code a range of individual patient traits and characteristics. The data included patients' non-verbal measures, such as micro-facial expressions, voice patterns, and numerous biological markers, including fMRI and hormonal tests. Led by data scientists Prof. Hagit Hel-Or and Prof. Ilan Shimshoni, the researchers were then able to survey the large dataset and identify hidden patterns that are improving clinical efficacy and patient satisfaction.

The unique multidisciplinary team is also developing a smart algorithm based on computer vision and AI that will enable clinicians to individualize patient care. The App will provide immediate feedback that is especially useful in helping to identify productive interventions, as well as predict potential complications, such as a breakdown in the bond between the therapist and client, known as 'alliance ruptures'. Early detection and repair of 'alliance ruptures' is a powerful predictor of successful therapy outcomes, and one of the keys to successful treatment. The digital tool will help predict ruptures early on to prevent dropouts and improve treatment efficacy among patients.

The treatment program is part of an ongoing study being conducted at the Laboratory and is funded by grants from the Israel Science Foundation (ISF), the National Institute for Psychology and an MIT-Israel Zuckerman STEM Fund. The 16-week program integrates a combination of modalities, including psychodynamic, affect-focused, and interpersonal therapy approaches. Study participants represent a range of socioeconomic backgrounds, ethnicities and religions.

"The results have been nothing short of amazing," says Prof. Zilcha-Mano, noting that the treatment relieved depression in 93% of participants. "Patients reported a much better quality of life and an enhanced sense of wellbeing. We are very encouraged by our positive outcomes and look forward to expanding our study and continuing to promote mental health."

Credit: Eli Gross

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