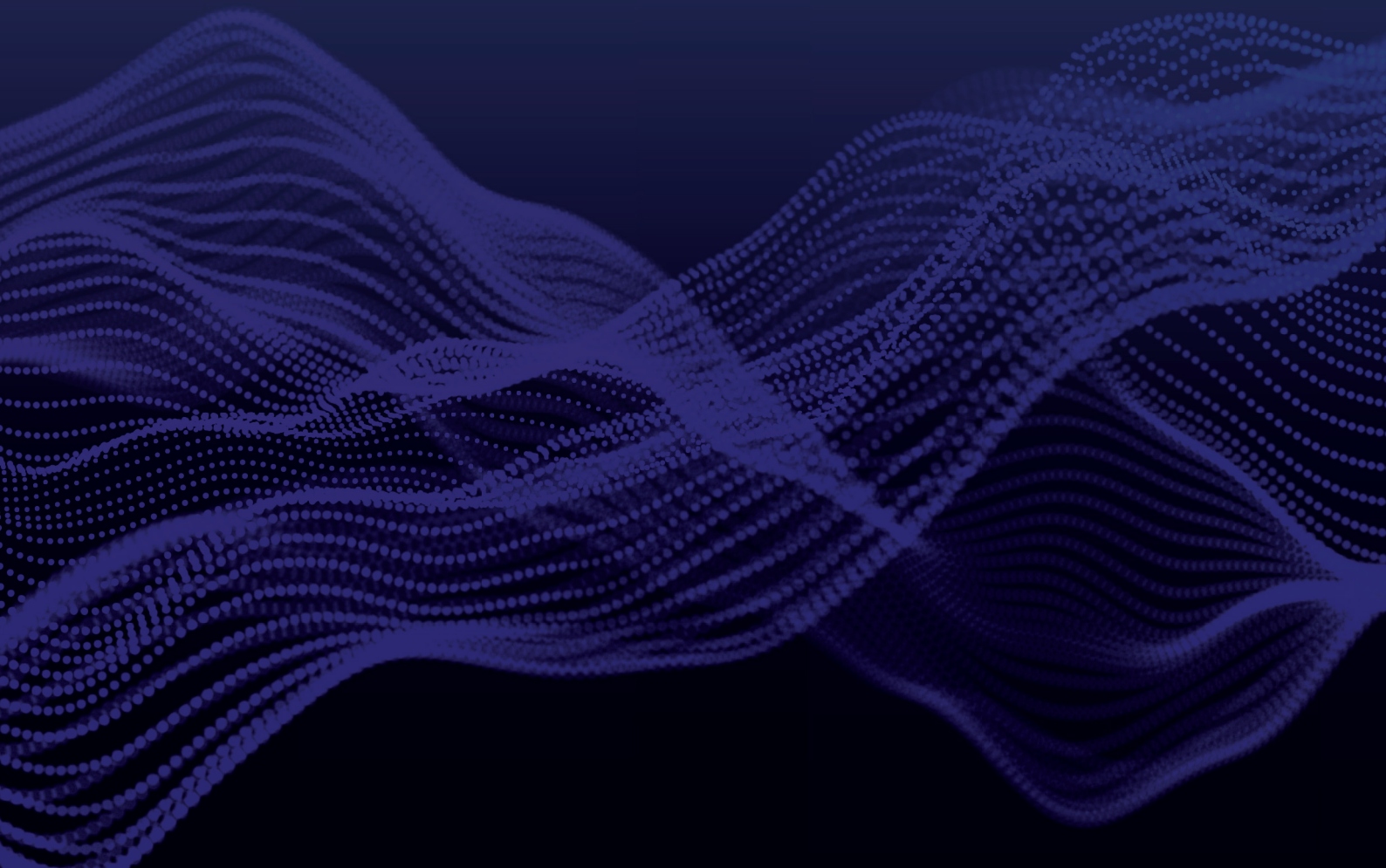
WHITE PAPER

voicesense

General Health & Wellness

May 2020



Overview

Voicesense addresses the need for remote mental health screening and monitoring by measuring and assessing mental health vocal biomarkers. Using advanced acoustic speech analysis technology, the system automatically analyzes personal speech patterns, links them to personal behavioral tendencies, and provides mental health indications. The system is language and culture independent, supported by clinical studies and robust validation. Main use cases include Remote Patient Monitoring and General Risk Screening, as a decision support system for healthcare specialists.

Voicesense Ltd.
www.voicesense.com

The problem and need

The recognized prevalence of mental illness continues to expand globally and has become one of the major healthcare burdens both medically and economically.

With over 300 million people suffering from depression globally, it is now the leading cause of disability worldwide. Over 20 million people are diagnosed as depressed in the US. One in 10 women experience postpartum depression symptoms. 8 million adults are diagnosed with post-traumatic stress disorder (PTSD) annually. Despite those already high statistics, mental health conditions are vastly underdiagnosed and undertreated. Studies estimate that over 35% of the population in developed countries suffer from serious mental health conditions without receiving care, and higher percentages exist in under-developed nations. Depression and anxiety disorders cost the global economy over $1 trillion annually.

Leading experts in healthcare, human rights and political realms have talked for years about the need for a new paradigm for mental health care, one that addresses the chronic nature of these illnesses and the need for improved screening, monitoring and treatment. Today, with the growing presence of stress, anxiety, social isolation and depression impacting modern life and large parts of the population, the need is even greater. Some of the recurrent and recognized Ideas for the new mental health paradigm stresses include moving to mental health prevention instead of the post crisis intervention; taking mental health out of the hospitals and into the community; and applying ongoing, everyday care methods in the places we live – workplace, schools, homes, rather than just clinics.

However, these ideas are challenging to implement, as screening and monitoring of mental health states are still done manually by mental health experts. Reaching the wide-ranging mental health coverage of large portions of the population would require huge resources that aren't available. Actually, mental health systems all over the world struggle with lack of resources and do not have the budgets to extend coverage to the wide population. Moreover, these systems are constructed and operated in the traditional model of crisis intervention through clinics and hospitalization. While new mobile mental health applications have been introduced, the majority of these digital mobile mental health applications lack the underlying evidence based studies and scientific credibility. Additionally, the majority of these apps typically base their assessments on self-filled subjective patient questionnaires.

Changing this situation requires new assessment means that allow remote, automatic, ongoing and objective screening and monitoring of mental health within our everyday life systems.

The Solution

The recognized prevalence of mental illness continues to expand globally and has become one of the major healthcare burdens both medically and economically.

Technology and validation

The system applies acoustic speech analysis of the user's voice using a mobile or web application. The proprietary acoustic analysis uses over 200 different voice parameters to measure different aspects of speech intonation, or 'speech prosody'. Prosody has been recognized for many years in psychiatric research as being linked to emotional states and pathological mental states.

Using advanced signal processing and machine learning methods, and backed-up by robust research, Voicesense enhanced the prosodic analysis to link personal speech patterns with behavioral tendencies and mental health states. Our clinical studies have demonstrated significant, strong relations, between speech patterns and depression, schizophrenia, ADHD, stress, and general wellbeing.

The analysis is based on statistical probabilities, reflecting the resemblance of the individual speech patterns to patterns that are associated with different mental health states. Typical accuracies exceed 70% and improve with continued use by the patient. The output is a risk indication reflecting the risk associated with the analyzed person for depression or other mental health states. The system is designed as a healthcare decision support system, rather than a stand-alone diagnostic tool.

Features and operation

One of the main advantages of using such intonation analysis is that it is language and culture independent, hence offering both an objective and broadly applicable tool to screen and monitor mental states globally and among wide and varying populations. Given the acoustic nature of the analysis it does not 'listen' to the content of the speech and doesn't understand what has been said. Therefore, privacy of users is highly maintained and bias is eliminated.

The audio collection is fully operated by the user (the patient or anyone that wants to track his mental health state) without the need for active involvement by the healthcare specialist. This offers huge economic benefit: Enabling mental health tracking of wide population segments with minimal costs to healthcare systems. Users receive login credentials, record their voices through the website or on their mobile device, and receive instant feedback about their current wellbeing. They are encouraged to record their voices on a regular basis (daily/weekly) and see trends over time. The scores are managed in the Voicesense cloud server. Two audio collection methods are optional:

Self-recording (answering general questions) or recording regular phone conversation made through the mobile app (only the user's side is recorded). The healthcare specialists (doctors, caregivers, therapists) login with their credentials, and can view users analysis results of wellness and mental health states (reports, trends, alerts) through their web account. High priority alerts (significant changes of user's indications) are sent as alerts to the care providers.

Use cases and expected value

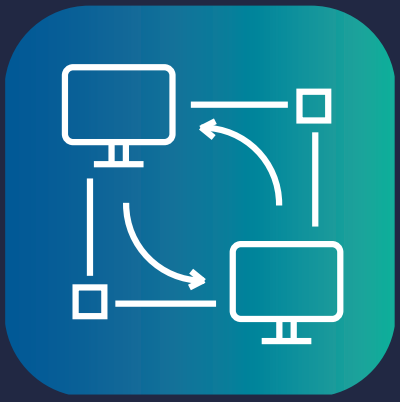
The system supports three main use cases – Remote patient monitoring, General screening, and Employee wellness tracking.

Remote patient monitoring

This use case is designed to provide healthcare specialists with ongoing, remote monitoring of patients by tracking changes in their speech pattern indications. A reference baseline of the patient's regular speech patterns is calculated, and then the system tracks and alerts of changes from this baseline that may indicate that the patient's mental state is altering.

Expected values:

- Relapse prevention: Reduced hospitalization costs by early relapse detection.
- Improved treatment effectiveness: Reduced treatment costs by better and faster medication and dosage fine tuning, and patient adherence adjustments.
- Effective follow-up: Reduced in-person follow-up costs by tuning according to remote tracking.
- Better treatment outcome: Reduced overall medical costs by improved treatment outcome.



General Screening

This use case is designed to provide healthcare specialists with a screening tool to assess the general wellness and the mental health vulnerability of individuals. The tool can be offered to different population segments, such as women after labor, to screen for possible post-partum depression; emergency teams or soldiers to screen for possible post traumatic symptoms (PTSD); teenagers for early detection of depression and so on.

Expected values:

- Risk prioritization: Reduced hospitalization and reduced treatment costs by early identification of mental health illness risk, and better client prioritization according vulnerability.
- Improved underwriting decision: Better insurance underwriting decisions (initial and renewal) for health insurers, by better candidate risk classification.

Employee wellness tracking

This use case is designed to provide healthcare as well as human resource specialists a tool to screen and track the wellness of their employees. The tool can be offered to enterprises and government institutions to assess the vulnerability of workers, and to track changes in their well-being over time.

Expected values:

- Lower burnout & attrition: Reduced work-days loss and improved employee retention by better tracking of burnout and attrition prediction.
- Improved performance and satisfaction: Better responsiveness of the organization to employees in accordance with their wellness state, leading to better performance and satisfaction.

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