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IPN Harnesses Artificial Intelligence to Improve Diagnosis of Anxiety and Depression Episodes

- **Using deep learning algorithms and a sensor-equipped smart shirt, researchers are detecting anxiety and depression episodes to support more accurate diagnoses and personalized treatment.**
- **Following the rise in anxiety and depression cases after the COVID-19 pandemic—particularly among young people—an IPN research project is exploring how Artificial Intelligence can transform mental healthcare.**

In response to the growing prevalence of anxiety and depressive disorders, the Instituto Politécnico Nacional (IPN) is advancing an innovative research project that applies Artificial Intelligence (AI) and deep learning technologies to improve the diagnosis and treatment of mental health conditions.

The project analyzes physiological data collected through a specially designed smart shirt equipped with multiple sensors capable of detecting anxiety and depression episodes. By combining wearable technology with Artificial Intelligence, the system aims to provide clinicians with more accurate diagnostic information and support more personalized treatment strategies.

The research is being led by María Caridad Mireles Pérez, a Ph.D. candidate in Computer Science at the Research Center for Computing (CIC), through a project entitled Development of a Deep Learning Algorithm for the Detection of Anxiety and Depression Episodes Based on Human Physiological Signals. She is supervised by Amadeo José Argüelles Cruz, Ph.D., a researcher at CIC's Intelligent Computing Laboratory, and Alejandra Hernández, Ph.D., from the Universidad de las Américas Puebla.

The initiative aligns with the science and technology priorities promoted by the administration of President Claudia Sheinbaum Pardo and the educational policies established by Secretary of Public Education Mario Delgado Carrillo.

Mireles Pérez explained that no comparable scientific project currently exists worldwide. Its primary objective is to improve care for individuals experiencing anxiety and depression episodes, which may involve symptoms such as crying, rumination (repetitive

negative thoughts), aggressive behavior, and self-harm.

"According to the World Health Organization, anxiety and depression disorders increased by 25 percent worldwide following the COVID-19 pandemic, with young people being particularly affected," she noted.

A recipient of the Lázaro Cárdenas Medal 2023 and a graduate of IPN's Biomedical Engineering and Master's in Computing Technology programs, Mireles Pérez explained that the smart shirt incorporates sensors capable of measuring electrodermal activity, electrocardiogram signals, body temperature, respiratory activity, and muscle tension. These sensors are connected to a wireless module that continuously transmits physiological data to a computer for analysis.

Using Artificial Intelligence and deep learning algorithms, the system processes this information and classifies it into four stages: Baseline (calm state), Transition (early signs of nervousness), Induction (anxiety-depression episode), and Recovery (gradual reduction of tension and emotional release).

"We recruited volunteers who participated in a controlled protocol during which they were exposed to stress and sadness-inducing stimuli under psychological supervision. The physiological data collected during these sessions formed the training dataset for the algorithm, enabling it to identify the emotional states experienced over a given period," she explained.

The IPN researcher also reported that the patent application process for the project's first technological innovation is already underway. She emphasized the significant opportunities that multidisciplinary research offers for expanding the use of Artificial Intelligence in healthcare.

"It is deeply rewarding to develop technology that can improve healthcare. I hope this research will serve as a foundation for future innovations created by the next generation of graduate students," she said.

For more information, visit www.ipn.mx

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