



Neurolinguistic Approach to PTSD Assessment: Integrating NLP and AI-based Diagnosis with Brain Region Activation Analysis

Mathieu Guidere PhD. (INSERM, France), Chirine Chamsine, PhD. (UQAM, Canada), Louis Jehel, MD. PhD (INSERM, France)



INTRODUCTION

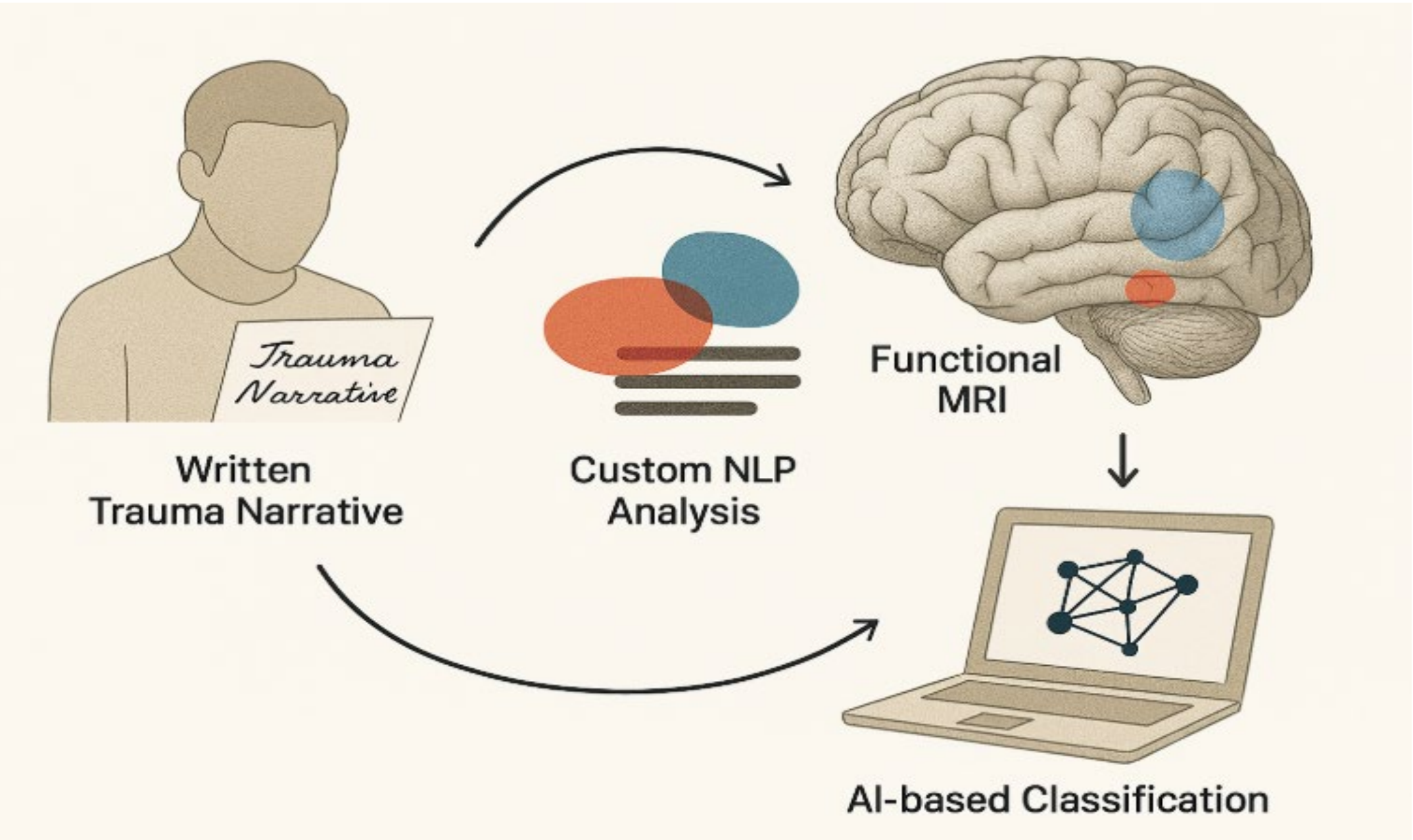
PTSD diagnosis often relies on subjective symptom reporting, which can lead to under recognition or misinterpretation of trauma responses. **Advances in computational linguistics** and neuroimaging provide new opportunities to objectively assess the impact of trauma on both language use and brain function. This study introduces **a neurolinguistic model** that leverages natural language processing (NLP), artificial intelligence (AI), and **functional brain imaging** to deepen understanding of PTSD and **improve diagnostic precision**.

OBJECTIVES

- To design and evaluate **a diagnostic framework** that combines natural language analysis, artificial intelligence, and functional neuroimaging to:
- 1. Detect** linguistic patterns specific to PTSD
 - 2. Map** these patterns to neurobiological responses
 - 3. Improve** the accuracy and objectivity of PTSD diagnosis
 - 4. Lay** groundwork for individualized treatment strategies.

METHOD

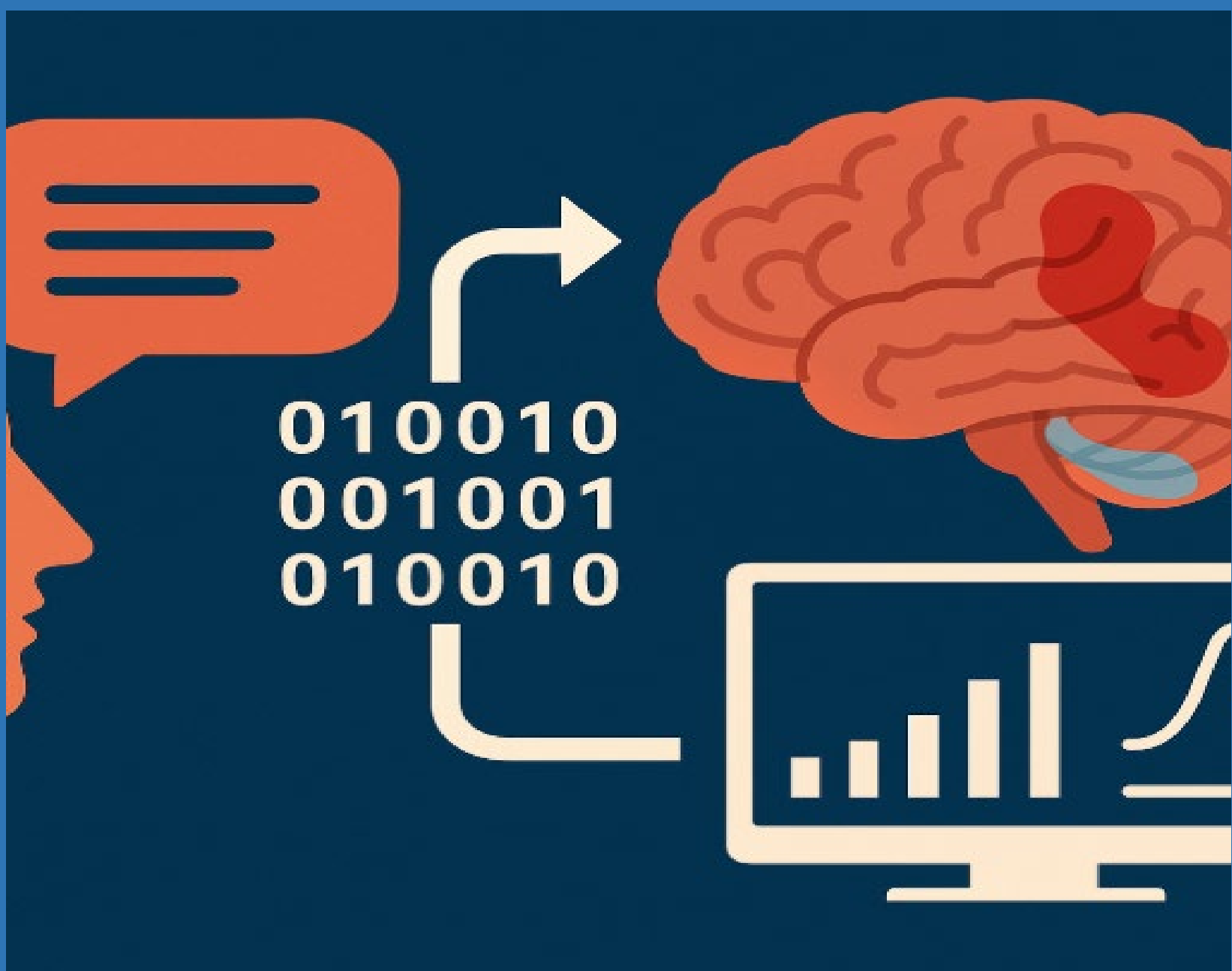
- Thirty adult participants meeting DSM-5 criteria for PTSD were asked to provide sample **trauma narratives**.
- These narratives were **processed using custom NLP algorithms** to identify **linguistic features linked to trauma expression**, such as emotional intensity, disorganization, and time disjunctions.
- Each participant also underwent **functional MRI to measure activation levels** in key brain regions associated with **trauma processing** (amygdala, hippocampus, medial prefrontal cortex).
- An AI-based classifier was **trained on this combined linguistic and neuroimaging dataset**, and its performance was validated against clinician-administered diagnostic interviews.



What does the neurolinguistic approach add to PTSD assessment?

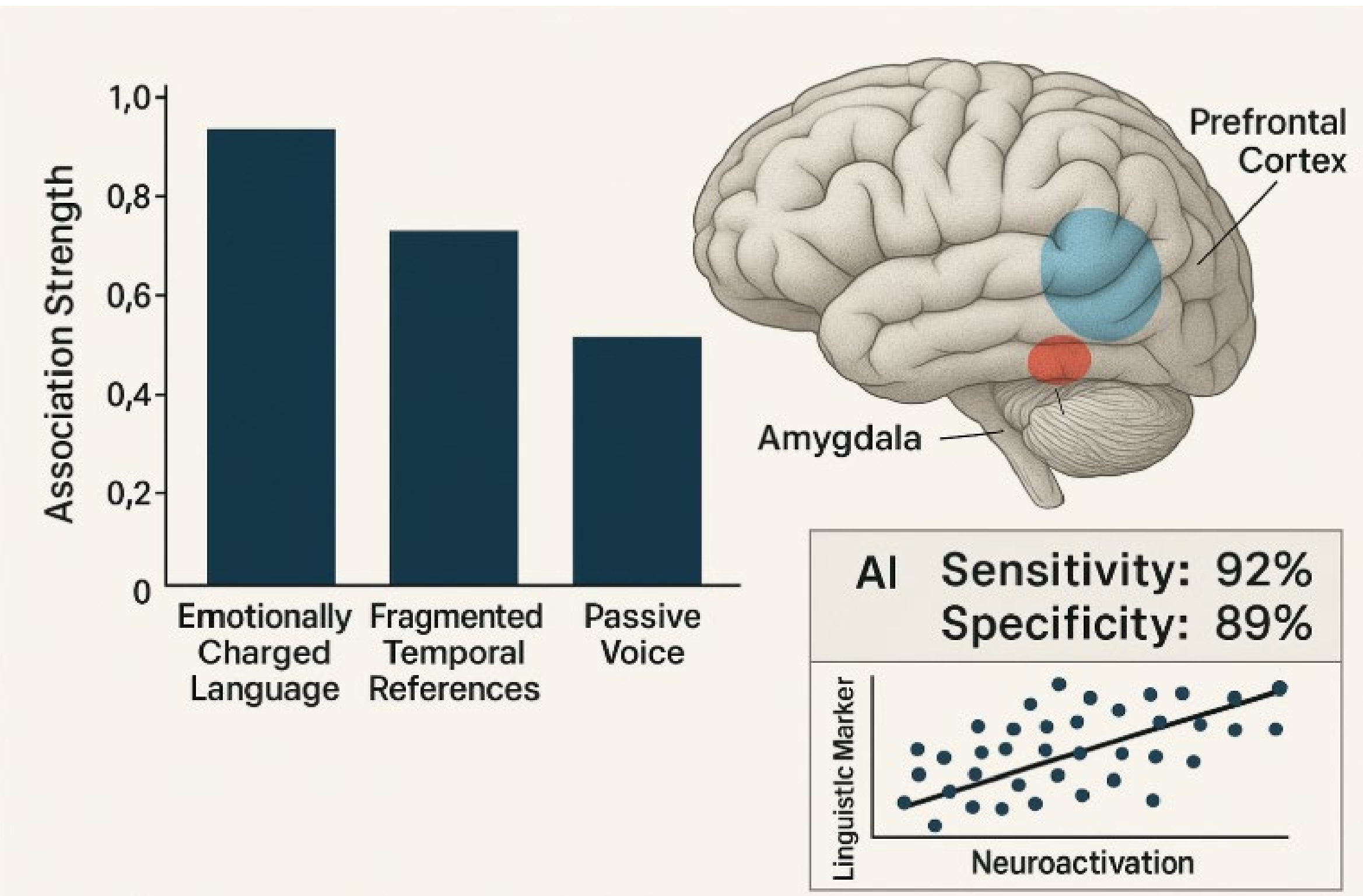
It provides a dual lens on trauma by connecting how patients speak about their experiences with how their brains respond to them.

This method enhances diagnostic accuracy, reduces subjectivity, and opens the door to biologically informed, individualized treatments.



RESULTS

Analysis revealed that increased use of emotionally charged language, fragmented temporal references, and passive voice was strongly associated with **hyperactivation in the amygdala** and **dysregulation in the prefrontal cortex**. The AI diagnostic model achieved **a sensitivity of 92%** and **specificity of 89%**. Additionally, **distinct linguistic markers** correlated with **unique neuroactivation patterns**, suggesting subtype-specific neural profiles.



DISCUSSION

This integrative approach bridges **subjective narrative assessment** with **objective neurobiological data**. It enables **more precise identification** of PTSD symptomatology by linking **verbal expressions** to **neural mechanisms**. The findings support the **utility of neurolinguistic markers** as both **diagnostic tools** and **indicators of neural dysregulation**, potentially guiding **personalized intervention** strategies.

Further studies with larger and more diverse samples are needed to refine and generalize the model.

