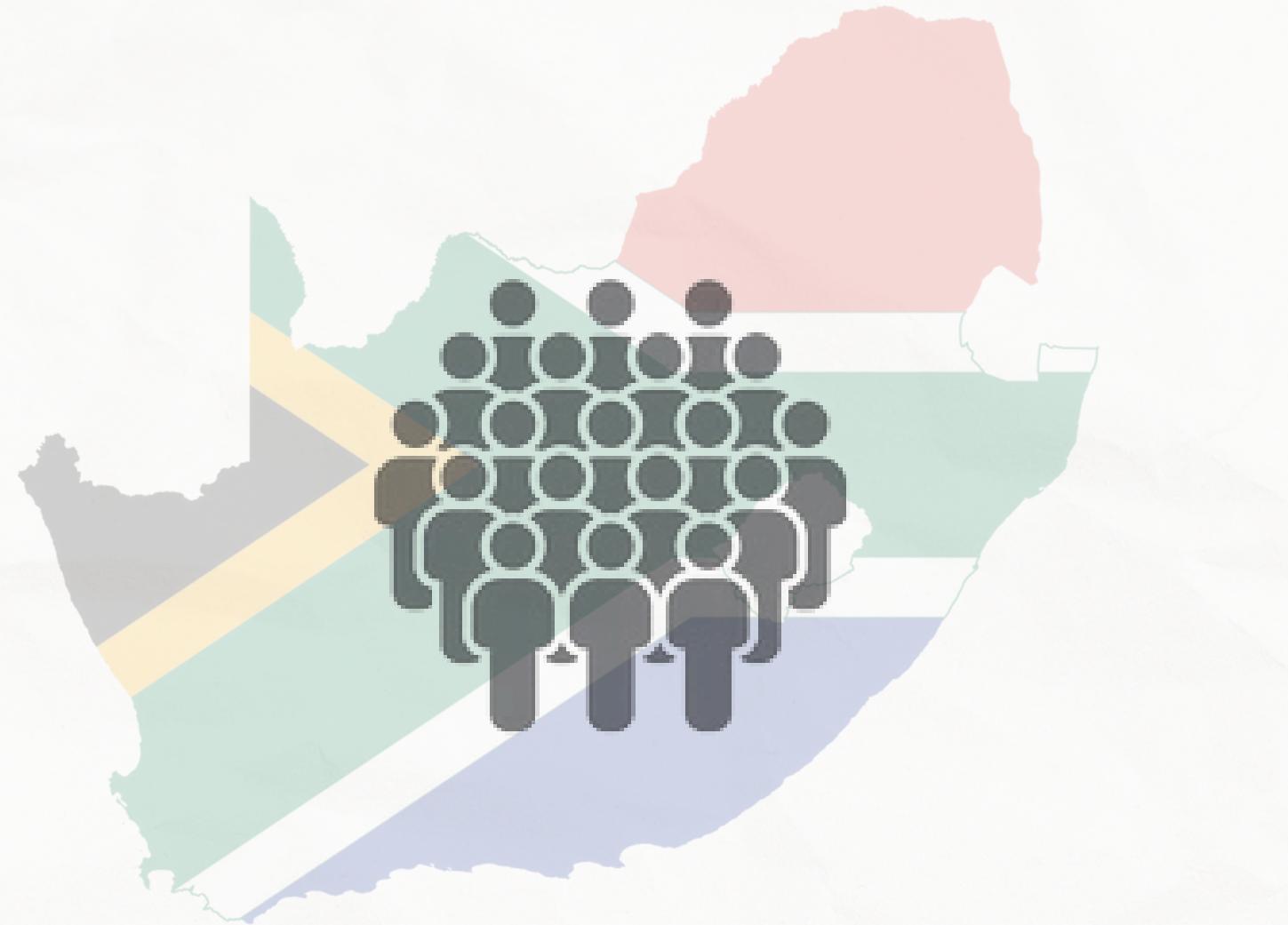


WHAT IS THE CHALLENGE ?



Numbers of patients equivalent to South Africa's population

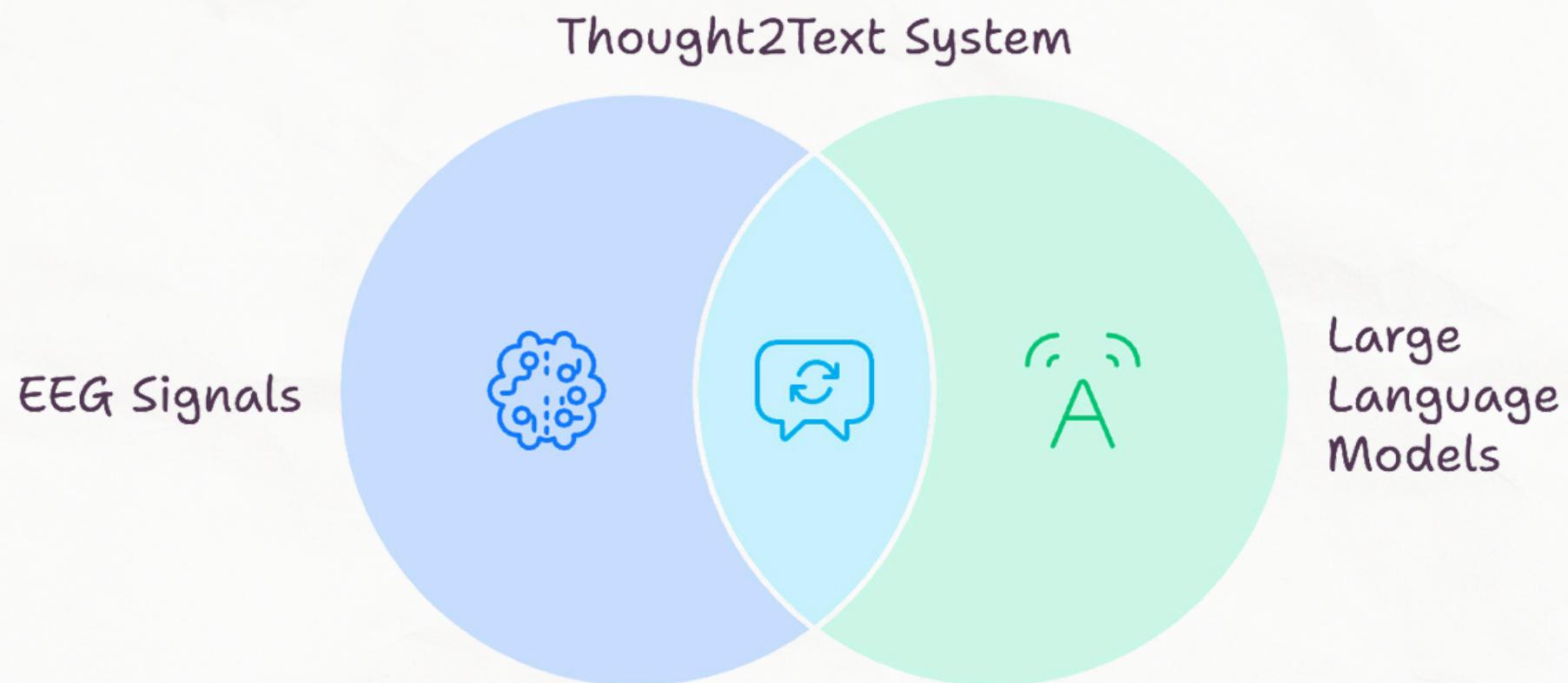
Traditional communication methods like speech and typing pose barriers for individuals with speech or motor disabilities. Decoding brain signals into text is highly complex due to the variability of EEG patterns across individuals and the lack of direct links between brain activity and language.

Why is it serious

- Over **62 million** people worldwide (equivalent to the population of South Africa) live with speech or motor impairments, facing daily challenges in expressing themselves

Goal: Enable seamless, silent communication by translating thoughts directly into meaningful text.

WHAT IS THE SOLUTION?



Imagine a World Where Thoughts Turn into Words!

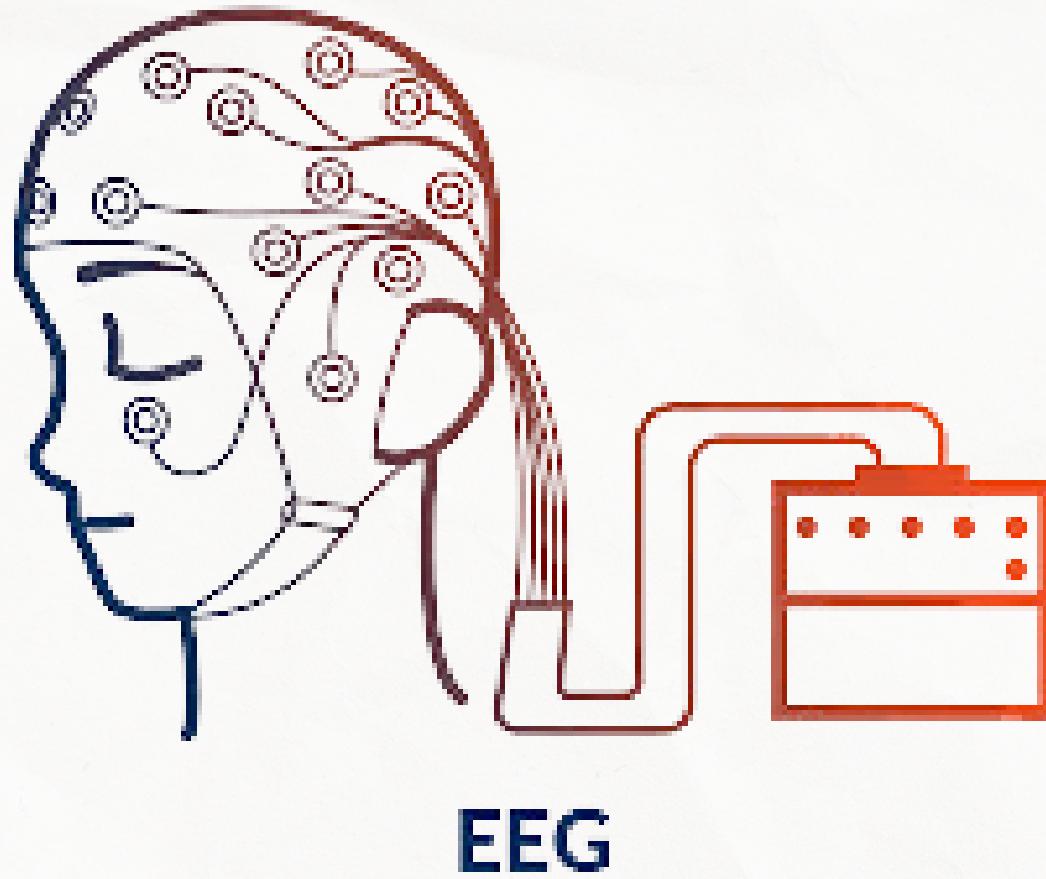
In the Thought2Text system, Large Language Models (LLMs) play a crucial role in turning brain signals into coherent text. Here's how:

1. Decoding Thoughts: Once the EEG signals are processed, LLMs analyze the patterns and help interpret the intended message.
2. Generating Text: Trained on vast text datasets, LLMs create meaningful, grammatically correct sentences from the decoded signals.
3. Adding Context: LLMs ensure the output aligns with the context, making the generated text natural and human-like.

With LLMs, Thought2Text bridges the gap between raw brain activity and clear, structured language.

WHY THIS SOLUTION ?

EEG signals are tiny electrical messages from your brain, detected by sensors on your scalp. This non-invasive method safely tracks voltage changes as neurons communicate, revealing brain activity without surgery.



How it works:

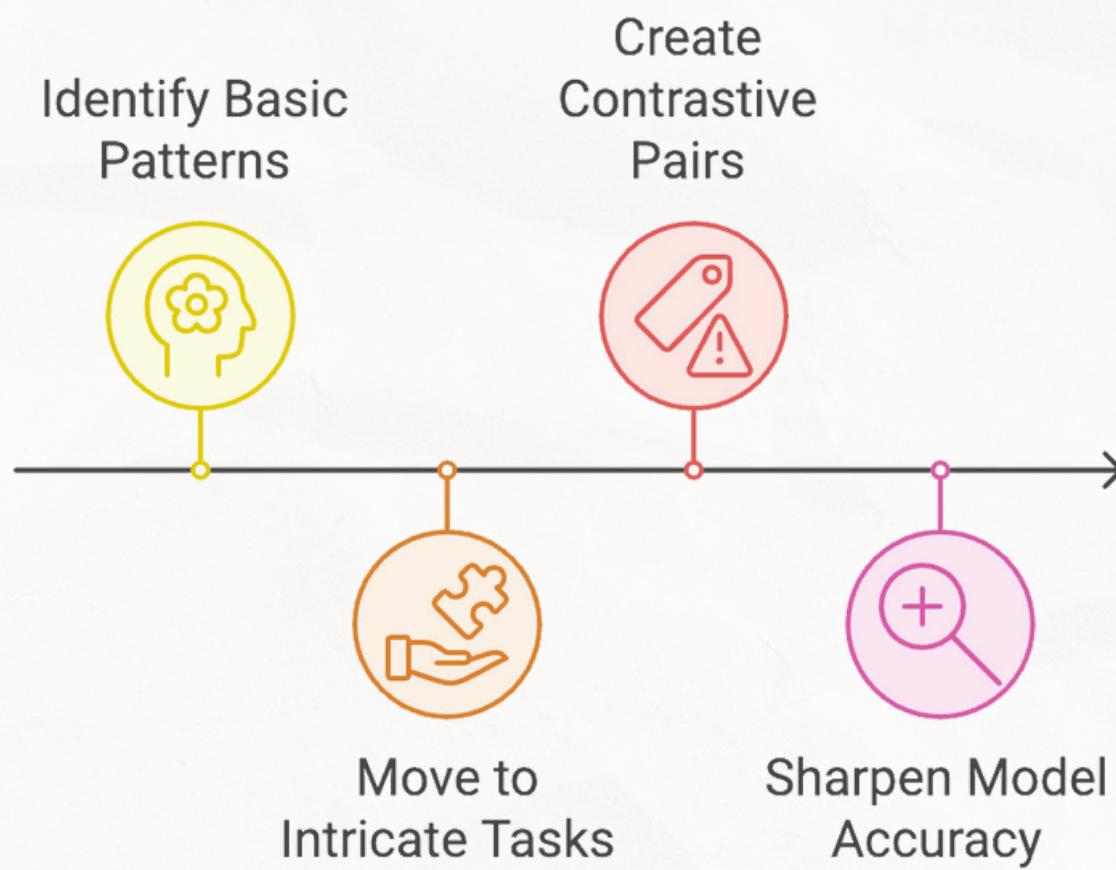
- Your brain's nerve cells (neurons) send tiny electrical signals when they communicate. Special sensors, called electrodes, pick up these signals from your scalp.
- These impulses are collected as raw data in the form of waves, categorized into different frequency bands like alpha, beta, theta, and delta.

Why EEG for Thought2Text?

- EEG is a popular, safe, and pain-free way to study how the brain works.
- It captures neural patterns that reflect cognitive processes, making it ideal for decoding thoughts.

HOW DOES IT WORK ?

Curriculum Learning: This approach teaches the model step by step, starting with simple tasks and moving to more complex ones.



How It Works:

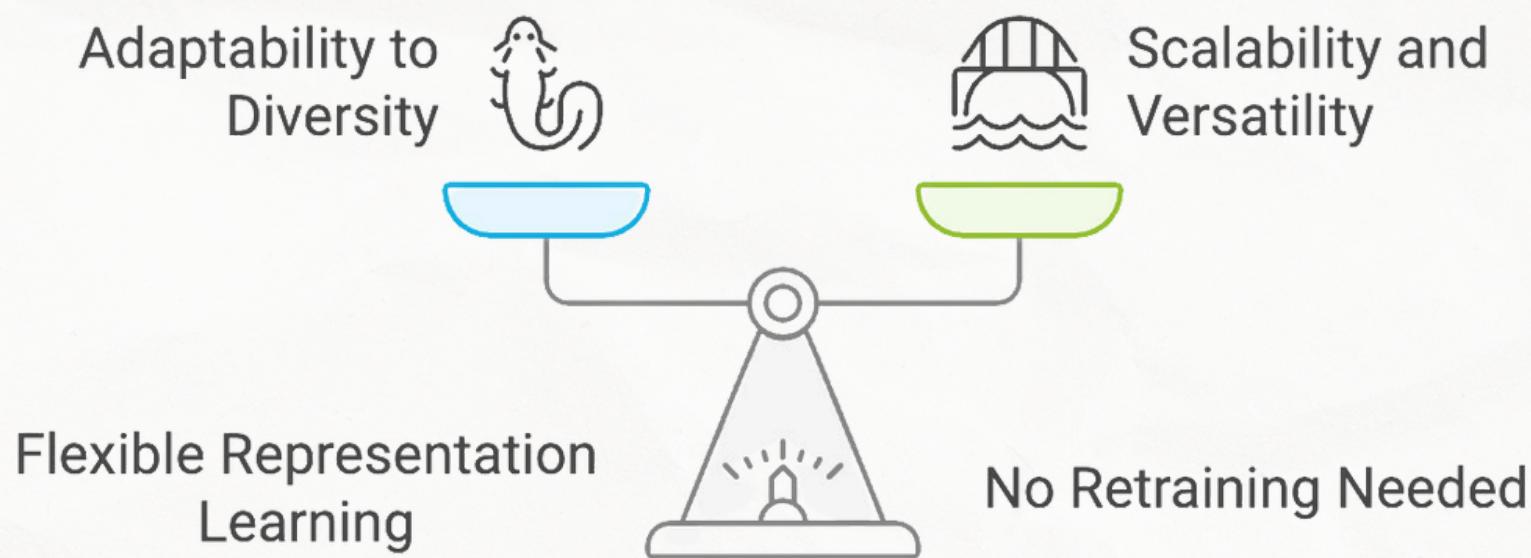
- 1. Simple-to-Complex Progression:** The model begins by mastering simple tasks, such as identifying basic mental states (e.g., relaxed vs. focused), before advancing to decode specific words or phrases.
- 2. Creating Meaningful Contrastive Pairs:** Gradual training helps the model form strong associations between similar and dissimilar EEG signals, improving its ability to differentiate complex patterns.

Result: The model becomes highly skilled at understanding complex thought patterns, accurately translating EEG signals into text..

HOW WELL IT GENERALISES?

Zero-Shot Learning Capabilities:

The Thought2Text system excels in zero-shot learning, which means it can generate text from EEG signals it hasn't been specifically trained on



How It Achieves Generalizability:

- **Flexible Representation Learning:** The model is trained on diverse EEG data, allowing it to generalize across unseen signals.
- **No Retraining Needed:** Unlike traditional methods, the system does not require user-specific retraining, making it scalable and versatile.

This feature ensures the system can work across a wide range of users and contexts, overcoming individual differences in EEG patterns.

HOW RELIABLE ?

Exceptional Results on the ZuCo Benchmark:

Thought2Text has achieved new state-of-the-art performance metrics, setting a high bar for EEG-to-text systems

EEG Translation System

Reliability

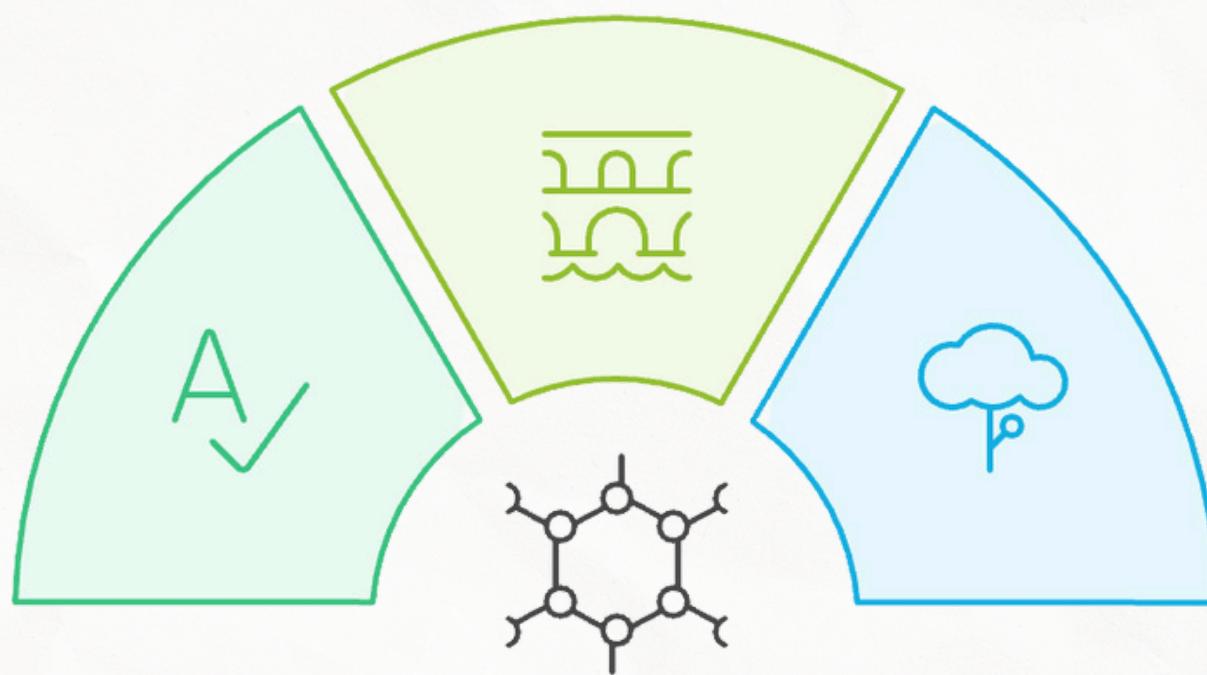
Maintains robust performance across different datasets and subjects.

Accuracy

Ensures precise and consistent translation of EEG signals into text.

Scalability

Capable of handling various EEG inputs without performance loss.



Outcome:

Thought2Text redefines possibilities in the field of Brain-Computer Interfaces, making EEG-to-text systems more accurate, reliable, and scalable than ever before



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