Self-Prediction of Epileptic Seizures by Affective Computing using EEG Sensors

Motivation

- **Epilepsy facts:**
  - 6.9% to 39% patients report prodromes: fatigue, mood changes, behavioural disorder
  - 90% patients report precipitant factors (most commonly, stress)
- Correlation of human affects with seizure occurrence
- An objective analysis of human affects, e.g., stress, mental workload is crucial
- Electroencephalography (EEG) sensors: objective measurement of affectivity by understanding brain dynamics

Study Setup

- Study conducted in two lab sessions: **Cognitive** and **Relaxation**
- **Cognitive:** performed three cognitive tasks: Stroop test, reading span, and n-back
- **Relaxation:** played a relaxation game: Bejeweled

- In both lab sessions:
  - **equipment:** headband with EEG sensors
  - **relaxation video:** to reduce prior stress
  - answering questionnaires about their mood
  - **duration:** ~2 hours each
  - **number of participants:** 11

Methods

- **Data Collection:** with a low-cost wearable EEG device after extensive literature analysis and testing.
- **Hand crafted features:** power, and power ratio features from five frequency bands (δ, θ, α, β, π)
- **Automatic feature extraction:** Echo-State Network
- **Cross-validation (CV):** leave-one-subject out
- **Hyperparameter tuning:** nested CV with leave-one-subject out
- **Feature reduction:** recursive feature elimination

Results and Future Work

- **Result:** more than 80% accuracy with subject-dependent-models
- **Future work:** addition of multimodal features e.g., heart rate variability, electrodermal activity