

# 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

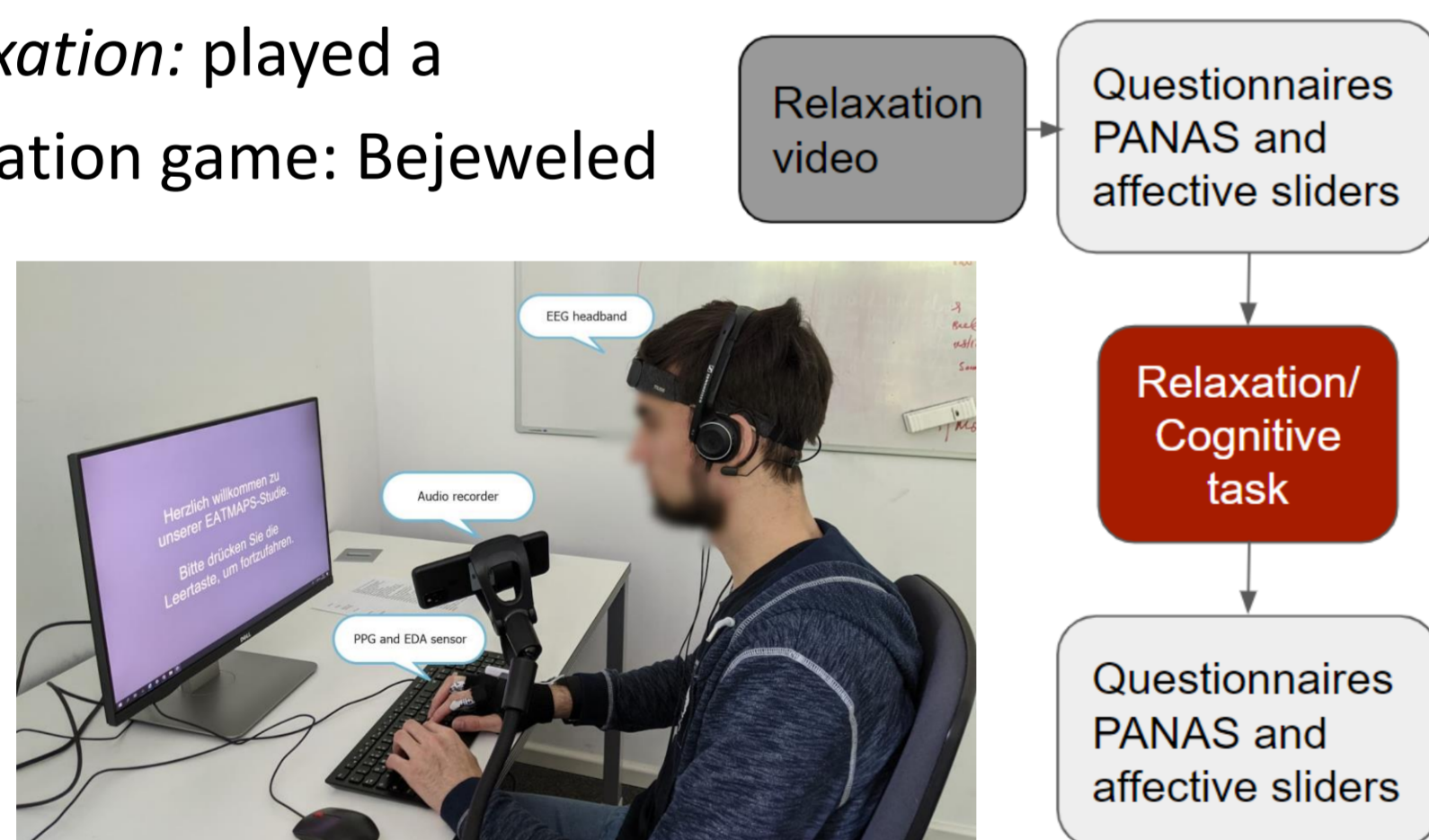


Figure (left): Data acquisition in the lab sessions

Figure (right): Study design

- 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

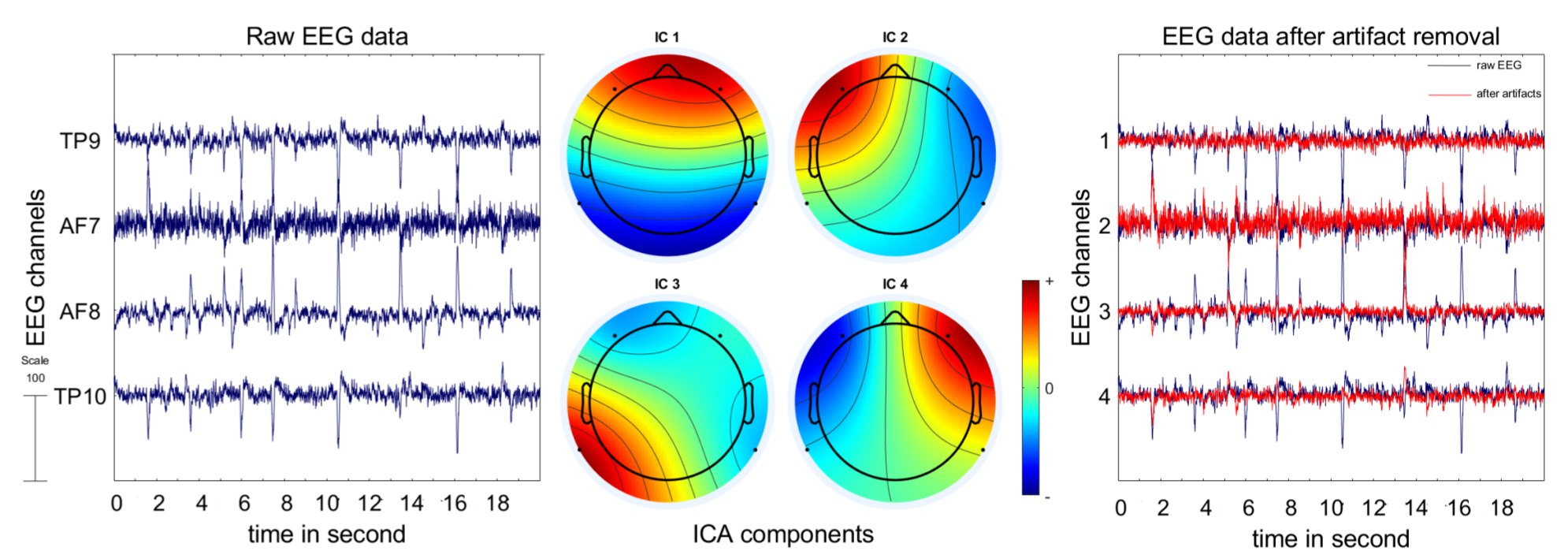


Figure: Pre-processing of raw EEG data by Independent Component Analysis (ICA)

## 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 ( $\delta$ ,  $\theta$ ,  $\alpha$ ,  $\beta$ ,  $\pi$ )
- *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

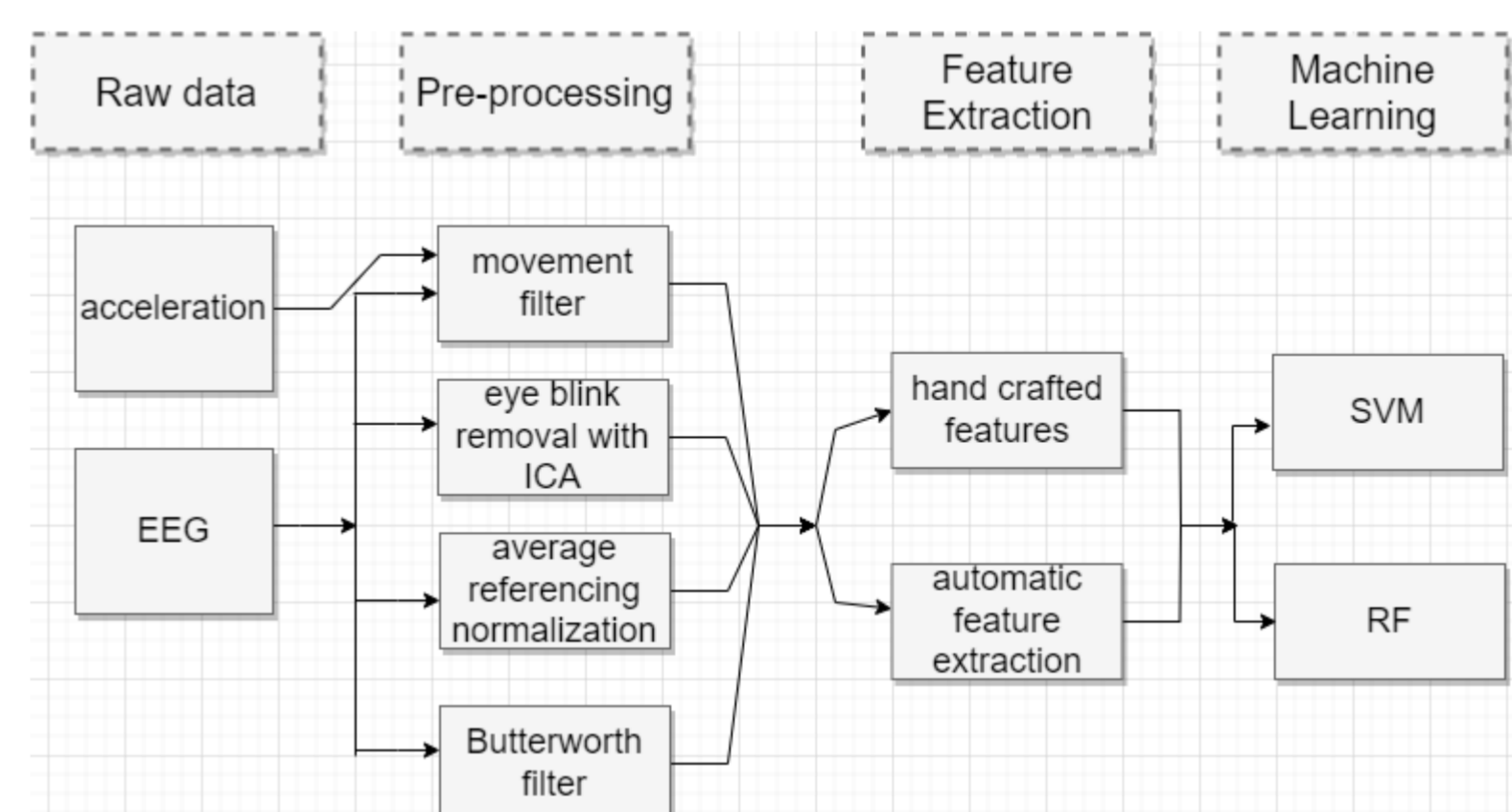


Figure: Data analysis pipeline

## 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