ZEISS Innovation Hub @ KIT

Leo Fiedler, Moritz Andres
ZEISS Innovation Hub @KIT

16 May 2025

EEG Challenge – let your mind take control

Process **live EEG signals** for the game CANABALT
and **control it with your mind**

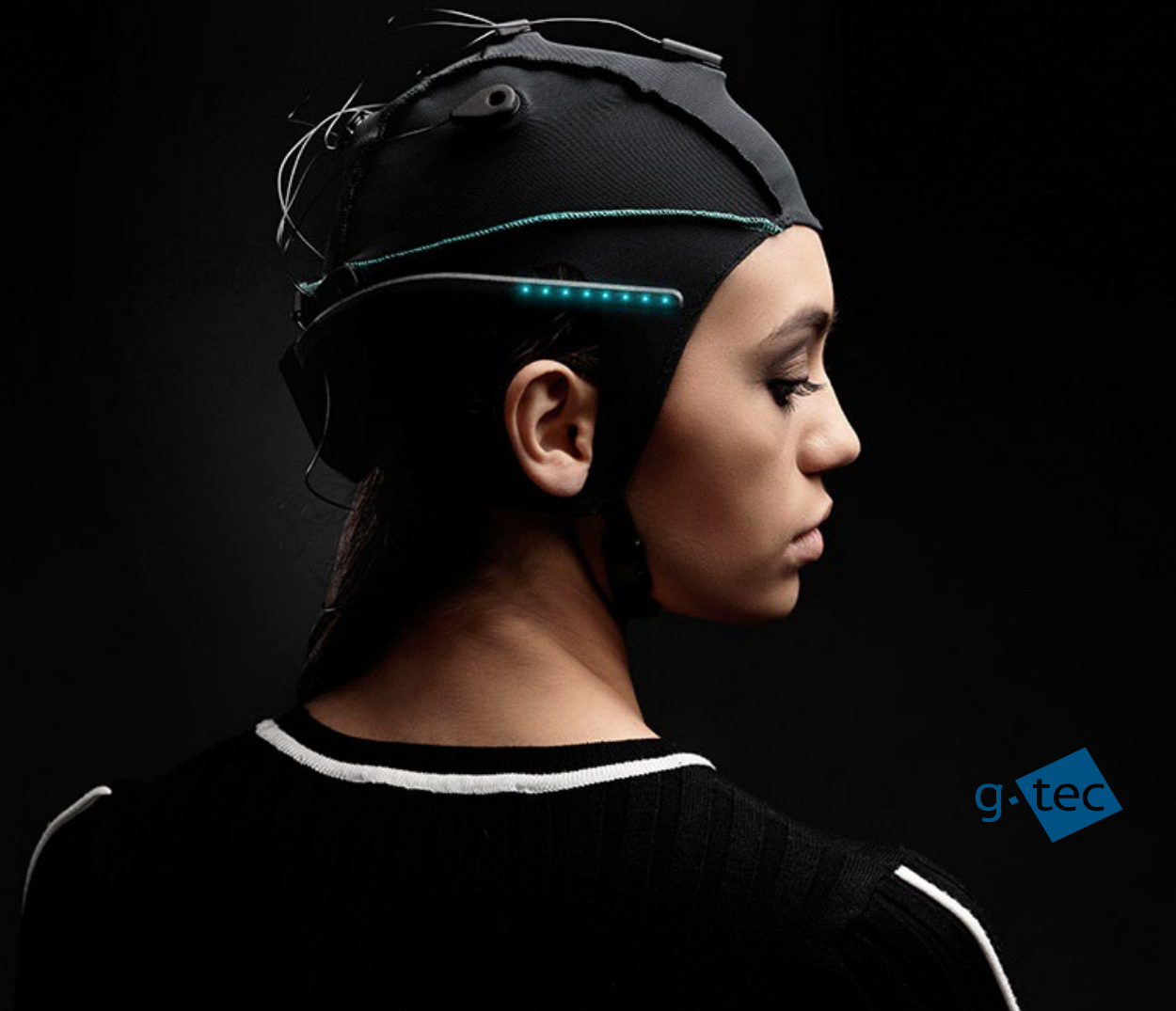
EEG Challenge
Introduction

g.tec Unicorn Hybrid Black
8 channels, 24-bit, 250Hz

What is EEG?

Electroencephalography measures electric potentials caused by synchronous firing of aligned groups of neurons.

This carries information about the information processed by the brain.



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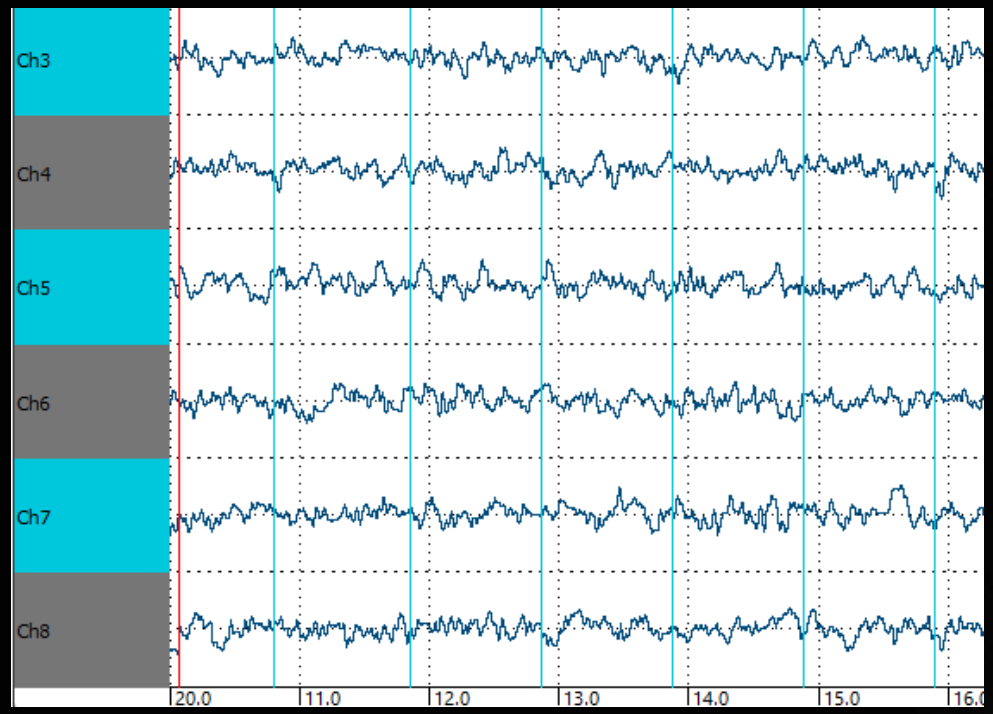
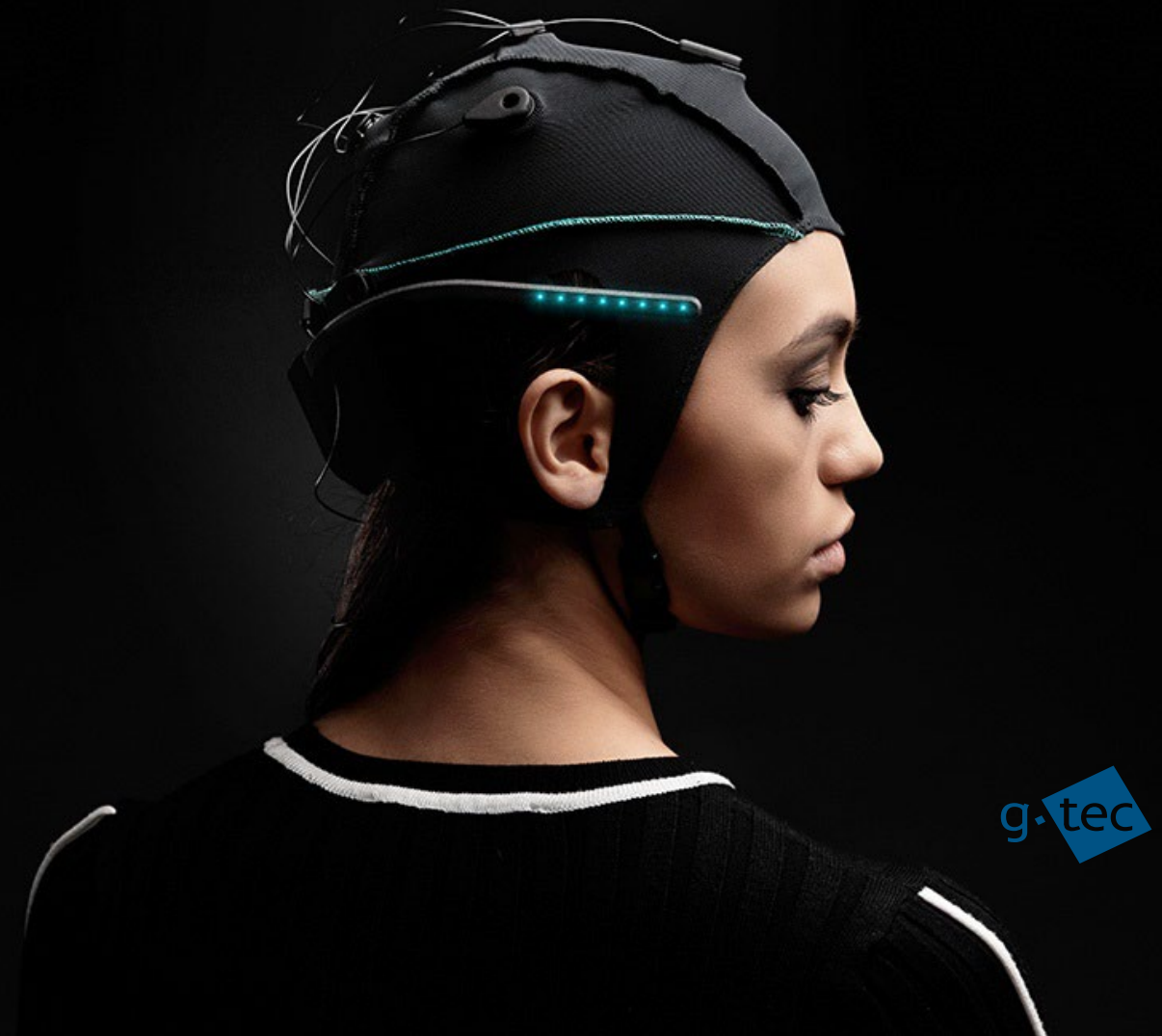
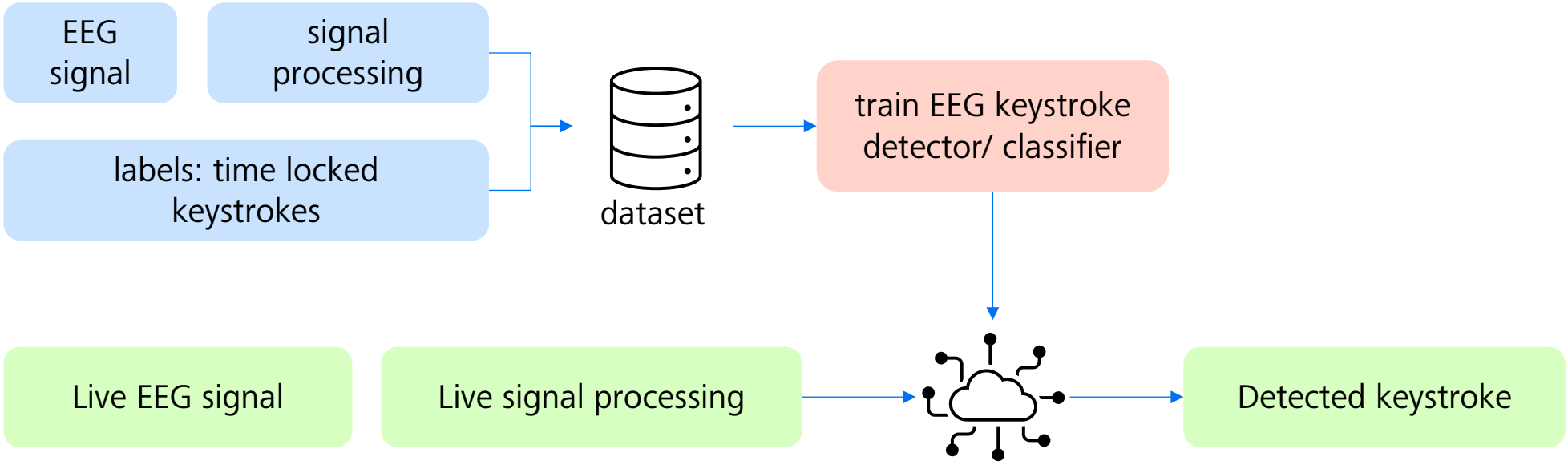




EEG Challenge
Your Task

Convert this into a full data driven problem:

(1) Acquire data, (2) process the data, (3) train EEG models and (4) evaluate and compare your models



Goal

Make the game control work! Don't focus too much on keystroke prediction and think outside the box.
Best and most creative approach wins!

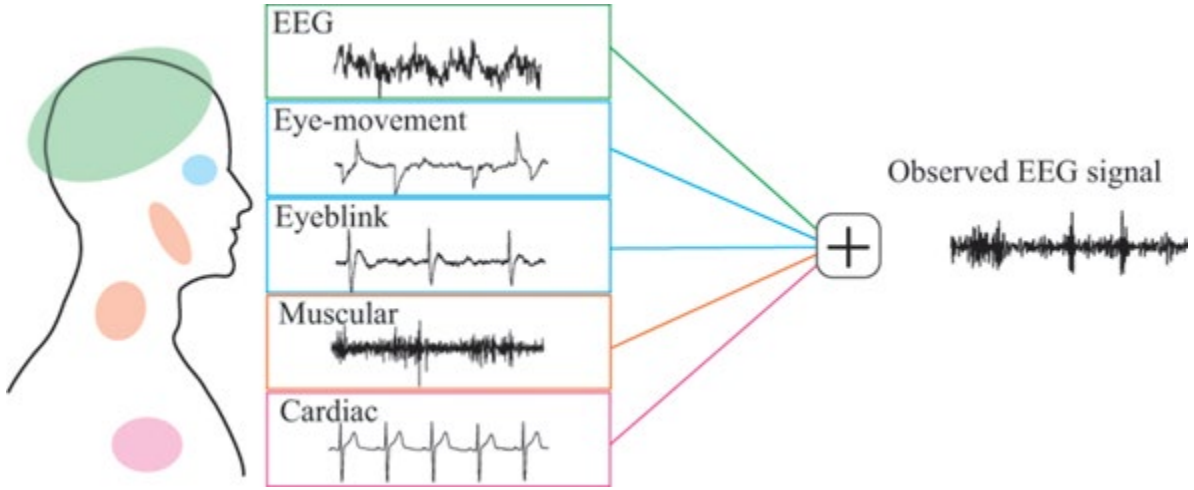
EEG Challenge – Data Acquisition
EEG Fundamentals

Basics:

- Signal quality is key! If you can improve the signal to noise ratio (SNR) do it!
- Inter subject variability is extremely high – only consider models trained on one subject
- Labeling tool is provided in the repository

Noise Sources:

- Environmental noise (e.g., powerline frequency 50Hz)
- Muscle artifacts (e.g., blinking, heartbeat, movement)



https://www.intechopen.com/chapters/54606

EEG Challenge – Data Acquisition
Setup the EEG cap

- EEG cap positioning
  - Sensor (aka. Channel) location should be measured based on the nasion, inion and mastoids
  - Use a measuring tape to be reproducible! Mutiple recording sessions should have the same sensor locations!

- EEG cap sensors
  - All sensors must touch the skin for low impedance! Otherwise measuring electric potentials is impossible
  - Move the sensors around to push away the hair (this might hurt the subject a bit)
  - Make sure the all sensors have good pressure to stay on the skin during the recording

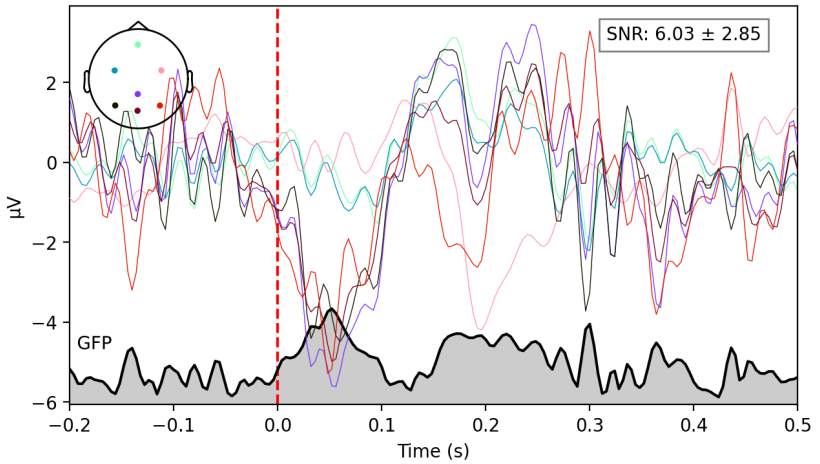
- Subject
  - The subject should be calm and concentrated during the recording to reduce other signals
  - Even small movements will cause artifacts

EEG Challenge – train EEG classifier

- What you have: dataset of event locked data based on the keystroke events
- Focus on:
  - Feature extraction
  - Modelling the objective

- Raw signal is very noisy and have too many dimensions (overfitting!)
  - Extract relevant features
  - Features should be in time and frequency domain
  - Multiple functions are already provided

- Window approach to model the classifier:
  - Define a fix time window of EEG activity
  - Predict if keystroke appeared during this time
  - Binary classification (for one keystroke)



Seeing beyond