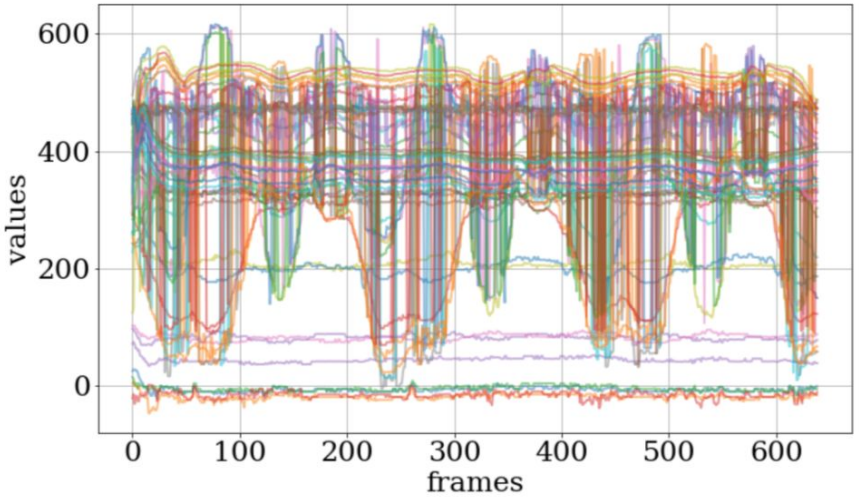
Measurements to construct a machine learning model

1. EEG 128–256 channels, 1 kHz
2. IMU accelerometer, gyroscope 512 Hz fixed frequency
3. Video-camera for skeleton and
   eye-tracking recognition
4. Breath and blood pulse wave sensor
5. User-friendly one-press buttons

A compact, low-energy, and non-expensive device requires additional measurements and a model tuning for deployment

Reconstruction of body trajectory and acceleration using video



To make a machine learning model

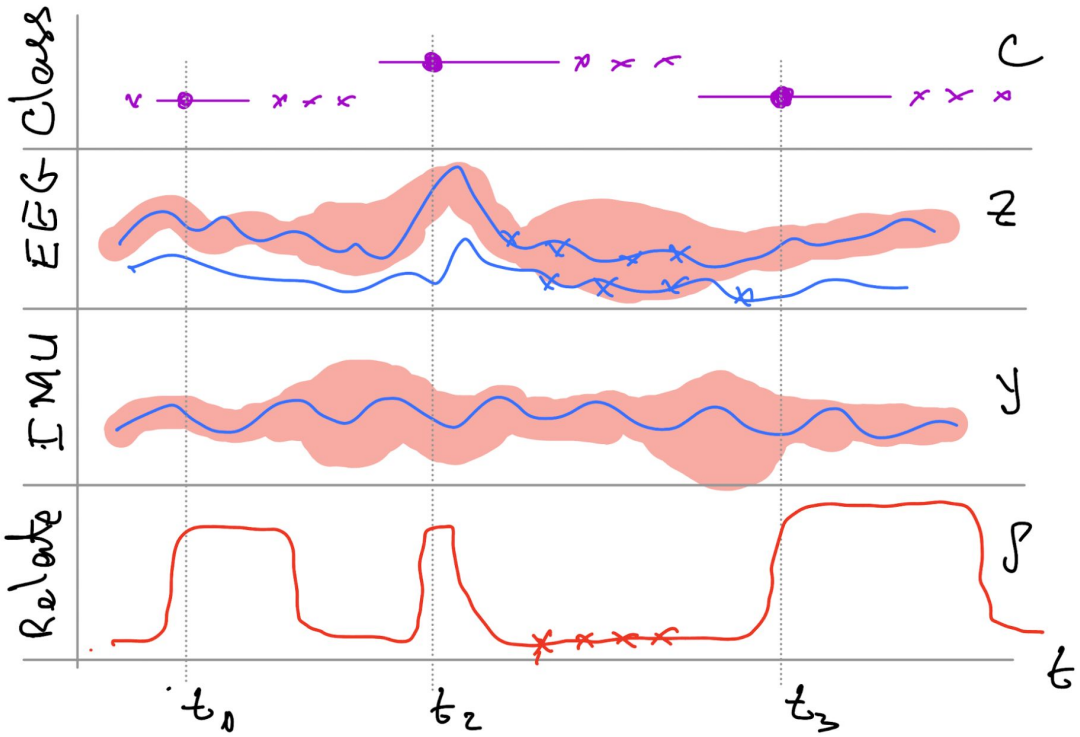
1) assign set of quality criterions (say, precision of the forecast),
2) gather the data,
3) select a model from a family of models
   and fix the model structure in a computational experiment

EEG data varies, so the model

has the same structure for all patients, while its parameters are different

1) for each participant,
2) for each session of a participant

It may require a tuning procedure before the session



Given a class c_t the brain state z_t relates to the body state y_t with probability p_t *for time t (or time segment).*

Models are

1) *z* reconstruction, 2) *y* reconstruction, 3) *y|z reconstruction,* 4) *(x,y|c) classification, 5) p relation*

Families of machine learning models for EEG

1. State-space models of discrete and continuous time
2. Non-parametric, Gaussian process models
3. Metric, Riemannian generative models
4. Convolutional, deep learning neural networks

Families of models for multimodal data

1. Cross-convergence method
2. Canonical correlation analysis
3. Transformers with attention mechanism

A scientific report expects a model comparison experiment

Roadmap for the computational experiment

1. Set goals and quality criterions
2. Approve basic and alternative models
3. Construct state space and feature space in both modalities

1. Plan experimental setup
2. Find open-source data or make preliminary measurements
3. Make a basic model
4. Plan the computational experiment
5. Analyze result, make adjustments in the experimental setup
6. **Gather the data**
7. Run the computational experiment
8. Refine structure of models
9. Make a report, submit a paper
10. …
11. Deploy the model