

**Neuroimaging and ML  
for biomedicine**

**Final project**

# Explore dipole fitting in MNE library on sample data

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# Problem statement

- Have EDF sample
- Get independent components by applying ICA = decompose multivariate signal into independent additive signals
- Each component somehow corresponds to brain activity
- Want to represent each component as dipole (one signal source in brain)
- If we can't do that for component then component is smeared somehow over brain (= dipole can't be selected clearly)
- So we want to locate all components in good way thus neurophysiologist can analyze specific brain activities without excess (non-)brain activity

# Task

- Want to check whether we can find dipole for component
- Solve inverse task:
  - Given: component produced by ICA applied to EDF sample
  - Find: approximate it with dipole that could correspond to component
- Better approximation – better component is isolated

# Solution

- Read EDF sample
- Add montage
- Filter out frequencies  $< 1$  Hz &  $> 50$  Hz as non-informative for EEG
- Apply ICA & get components
- Fit dipole for each component: use standard forward model
- Evaluate approximation: ratio of residual\* variance to variance of component

\*Residual is M-EEG data channels with fitted dipolar activity removed

# Results

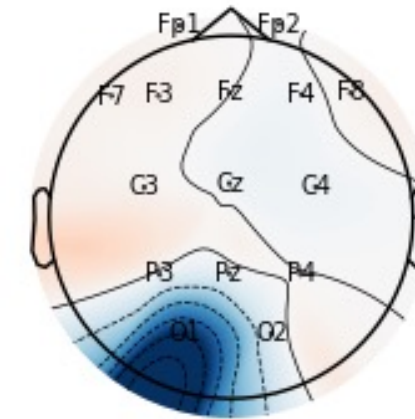
Ratio of residual variance to variance of component

```
component 1/14: var_ratio = 0.22025490932039965
component 2/14: var_ratio = 0.10633694375808853
component 3/14: var_ratio = 0.1434112294398905
component 4/14: var_ratio = 0.1111084467539122
component 5/14: var_ratio = 0.04046692538989693
component 6/14: var_ratio = 0.1021465589065628
component 7/14: var_ratio = 0.02320436803317471
component 8/14: var_ratio = 0.07142951154803684
component 9/14: var_ratio = 0.017773784195005367
component 10/14: var_ratio = 0.10684722231540665
component 11/14: var_ratio = 0.043181718360913134
component 12/14: var_ratio = 0.0051101953814287155
component 13/14: var_ratio = 0.18387206608511097
component 14/14: var_ratio = 0.009800589693373874
```

**Conclusion:** ICA is quite good

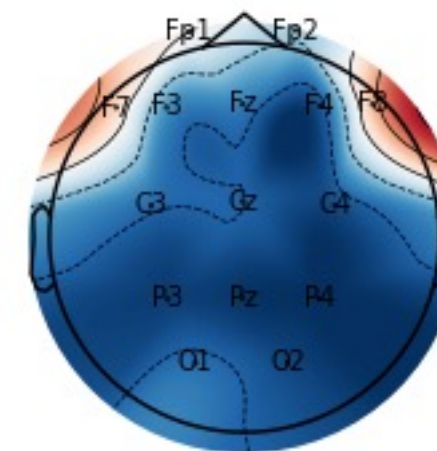
Component 12/14: var\_ratio=0.017031948955141193

ICA011



Component 4/14: var\_ratio=0.2615370330170093

ICA003



**Thx**