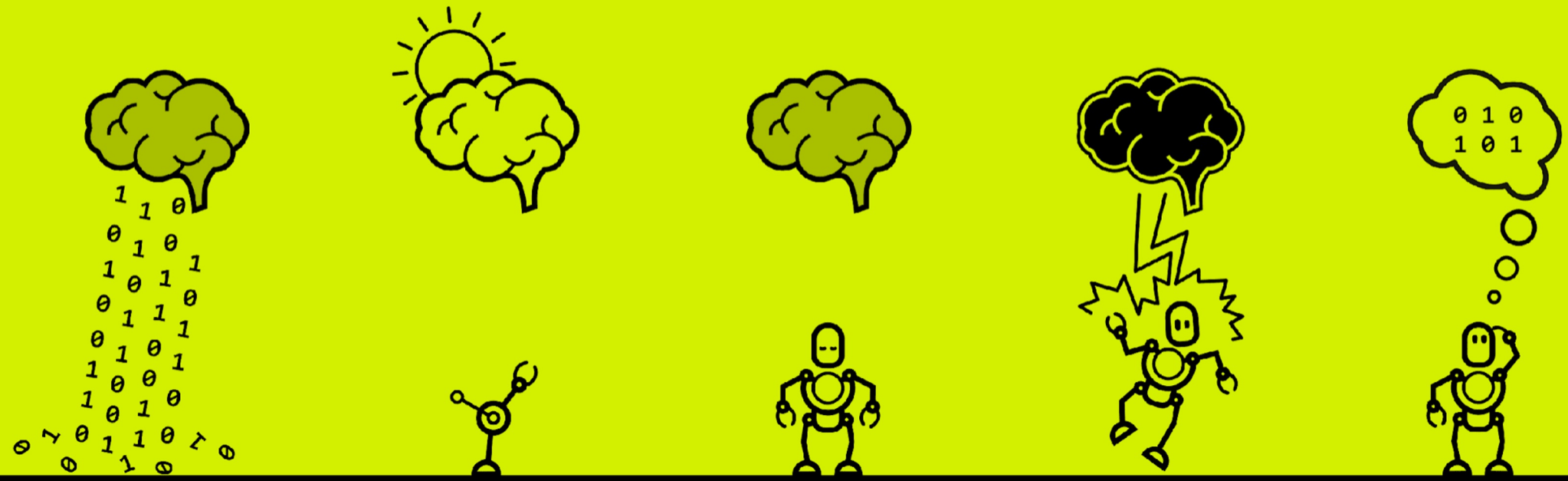

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THE BRAIN-COMPUTER INTERFACE DESIGNERS HACKATHON

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rECoGnise

Realistic **ECoG** **N**euro**I**maging **S**imple **E**stimator

Lorena Santamaria
Joao Pereira
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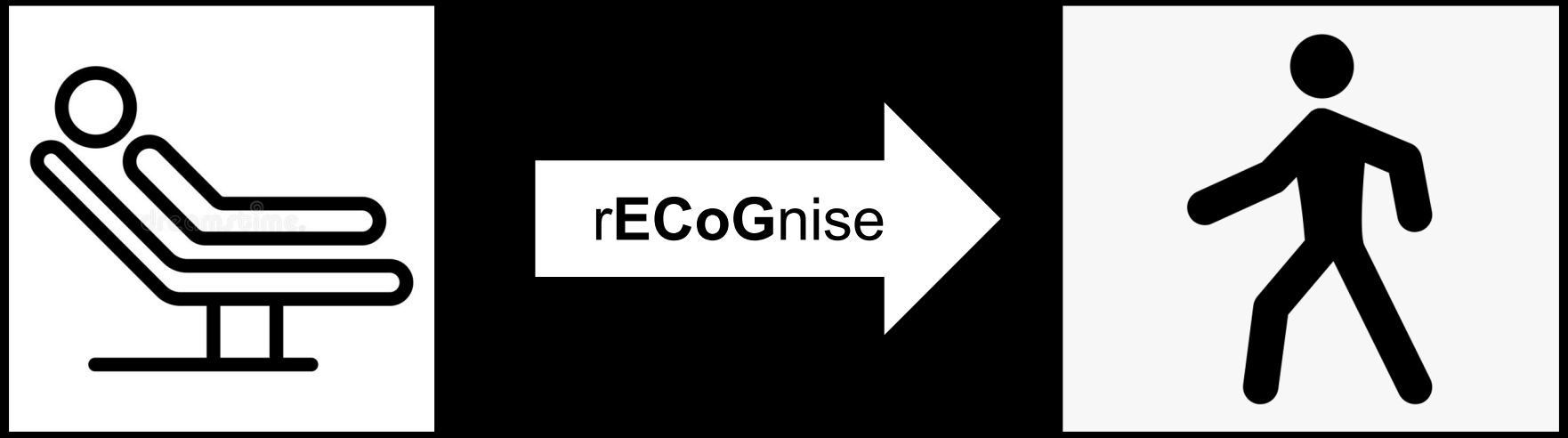
Mammad Jamali
Omid Mahdizadeh
Vahid Akbari
Mikolaj Kegler

r**ECoG**nising the problem

"(...) We might have already reached the ceiling (performance) for non-invasive BCIs (through Riemannian methods)"

M. Congedo (Noninvasive Mathematics, 2021)

Currently most ECoG-based BCIs are used exclusively in the lab conditions. We would like to take it *'for a walk'*.



r**ECoG**nising the solution

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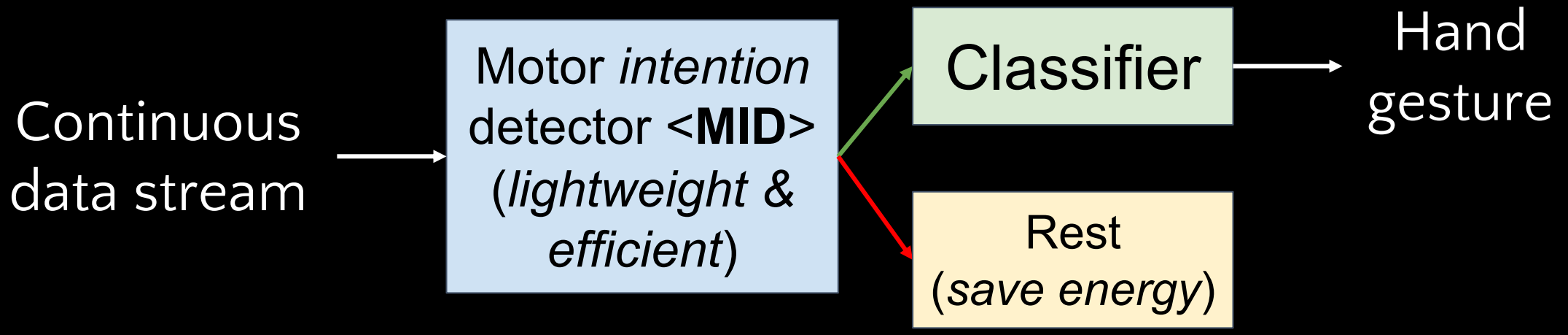
Typical ECoG BCI

rECoGnise (ours)

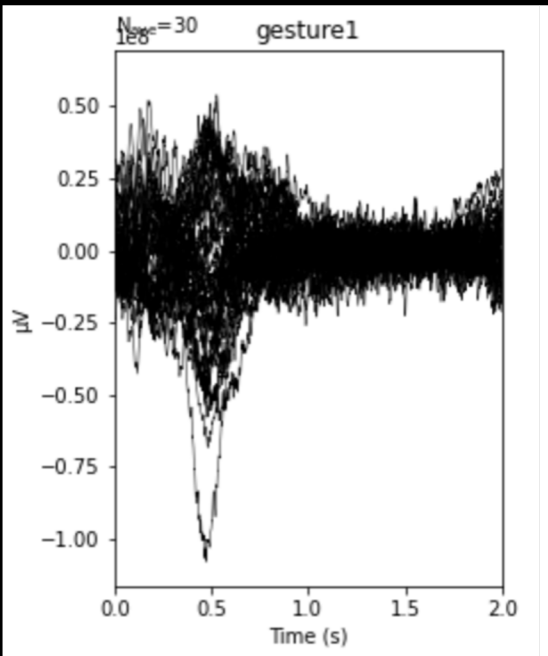


Motor intention detector <**MID**>

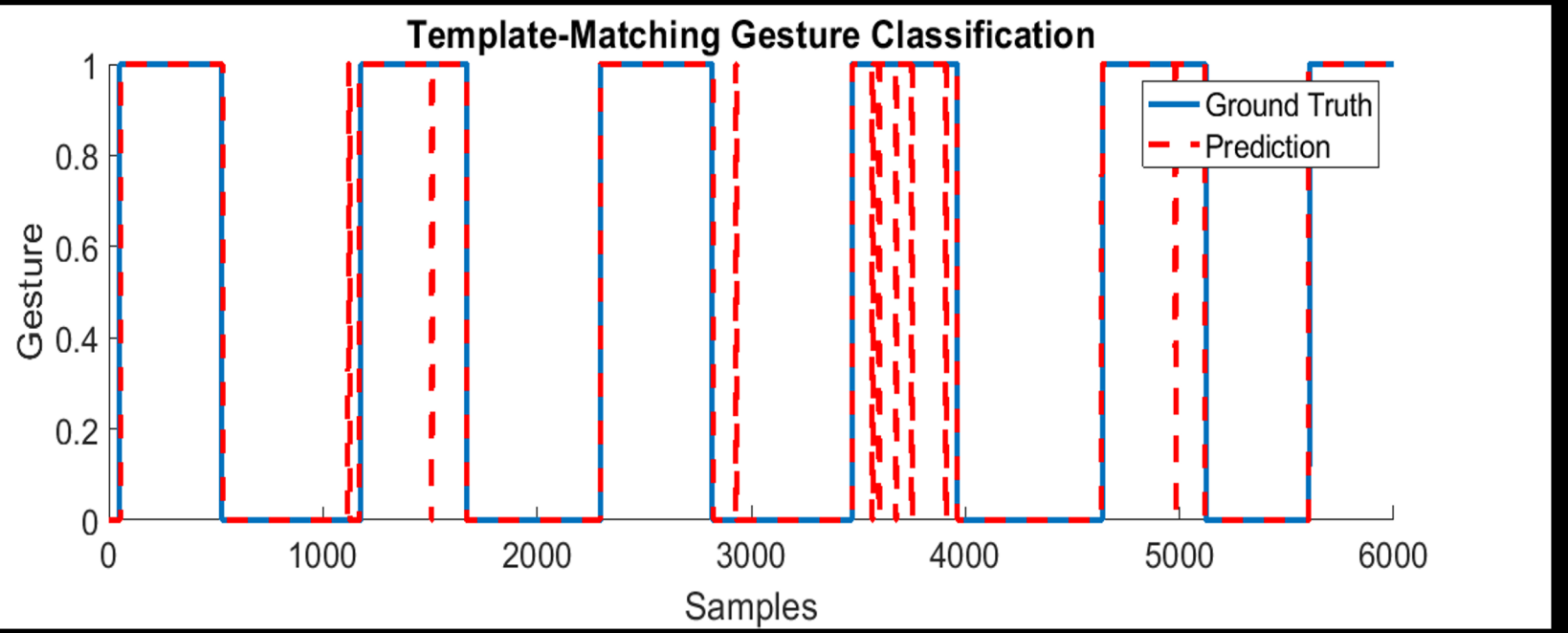
Do you even want to move?

Methods: response templates (broadband) were computed for each response/channel pair, and exponentially weighted average alignment for each pair were used as input features to a binary LDA classifier (rest vs action). **Results: (hit rate = 0.987% + rare false positives).**

Example template



Set-aside testing data

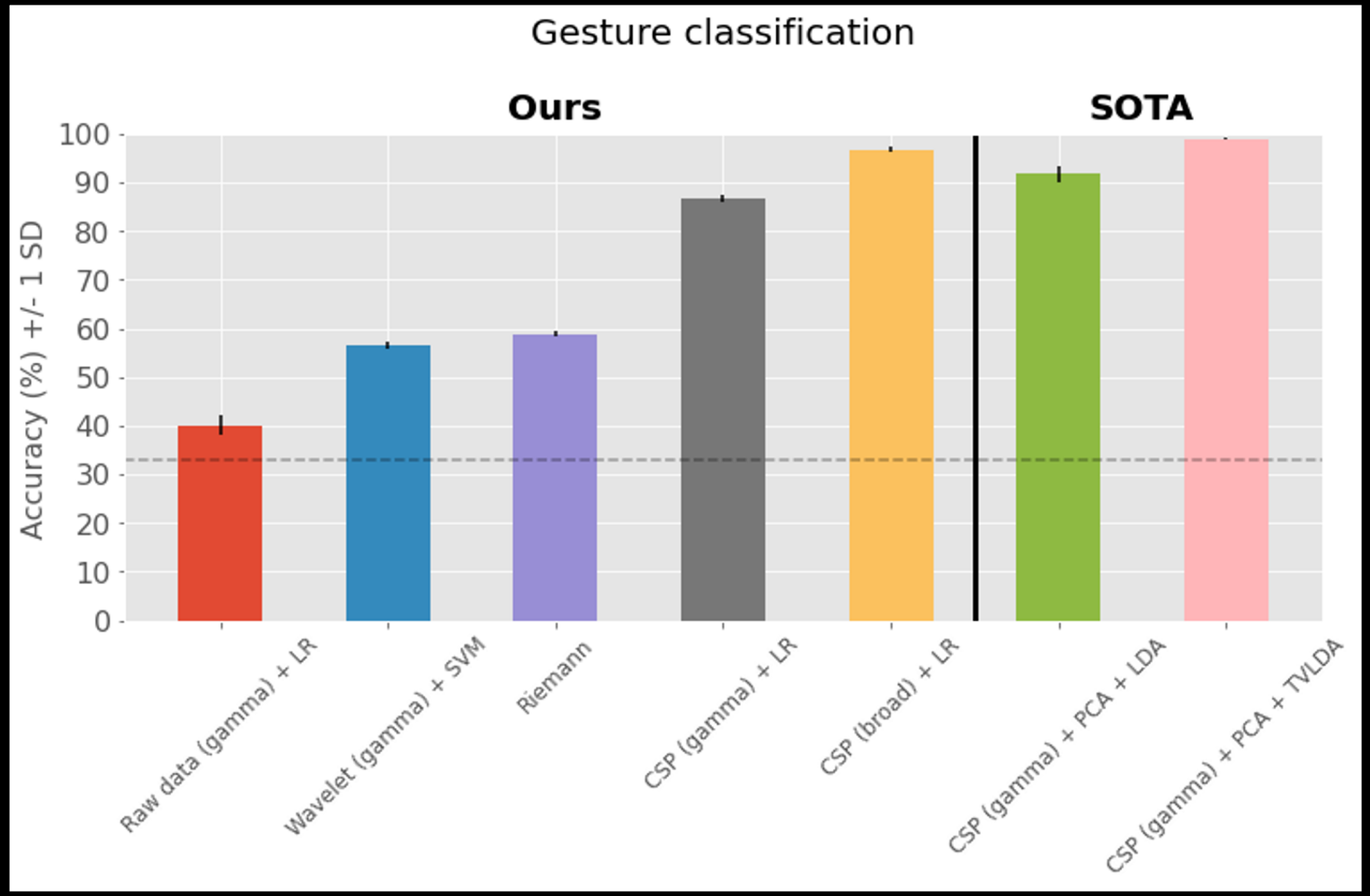


Multi-way gesture classifier

Don't underestimate low frequencies!

Low-frequency LFPs + high-gamma yields the best performance (97%) with no need for feature selection + minimal preprocessing.

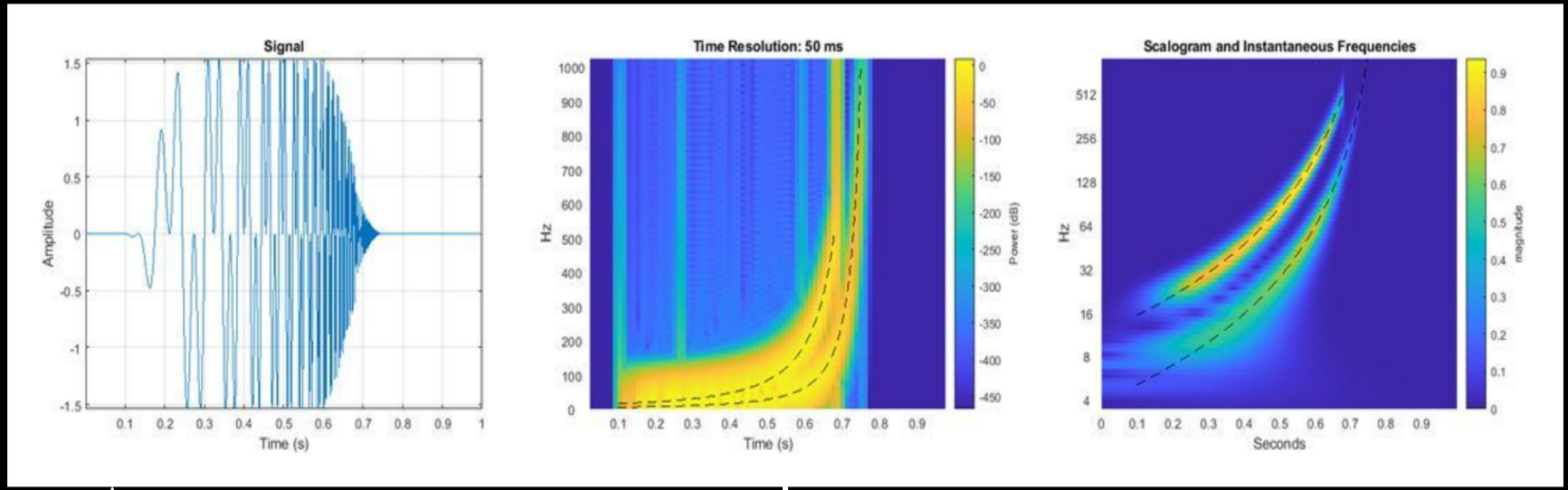
Our approach approx. matches the accuracy of the state of the art (SOTA, 91–99%).



End-to-end DNN

*One model to rule them all? (**work in progress!!!**)*

Simple wavelet-based features



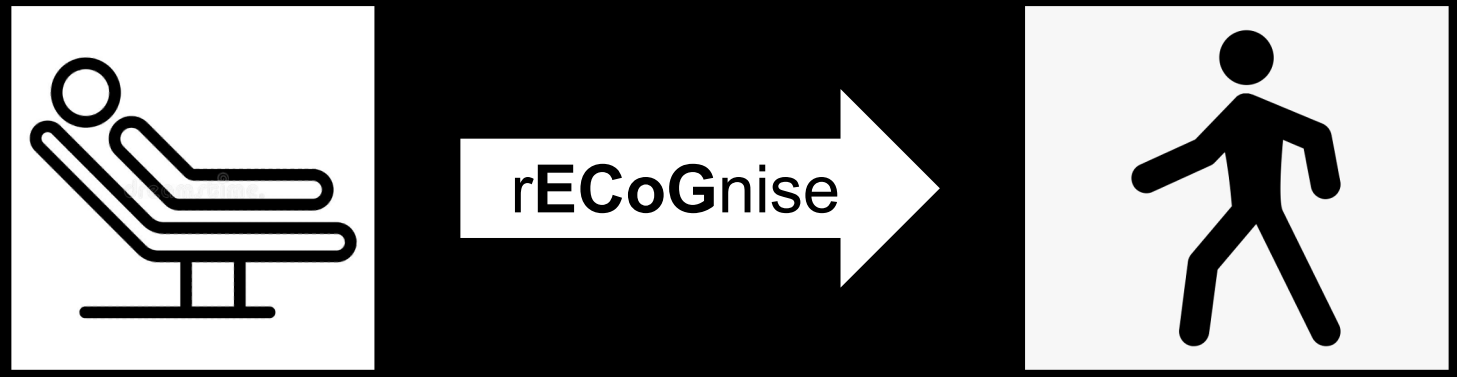
ECoG

ResNet CNN

Hand gesture
(or rest)

r**ECoG**nising conclusions & future work

- **(Liberation from the strict trial-based setup)** We proposed 2-step methods for 'real-world' ECoG-based BCI
- **(Low-frequency LFPs are important)** Most approaches focus on gamma-band power + feature engineering. Using low-freq. LFPs may alleviate some of the pre-processing (lighter algorithm).
- **(This is just the beginning…)** The work presented here is a *promising* prototype but thorough testing *in the wild* is required



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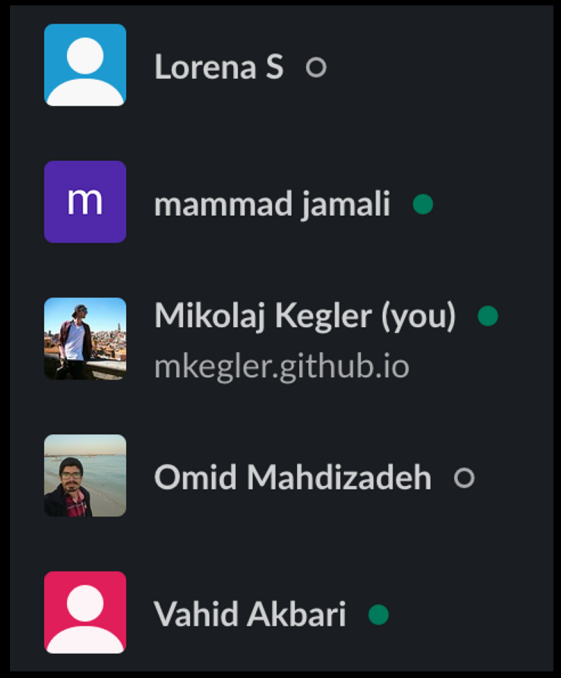
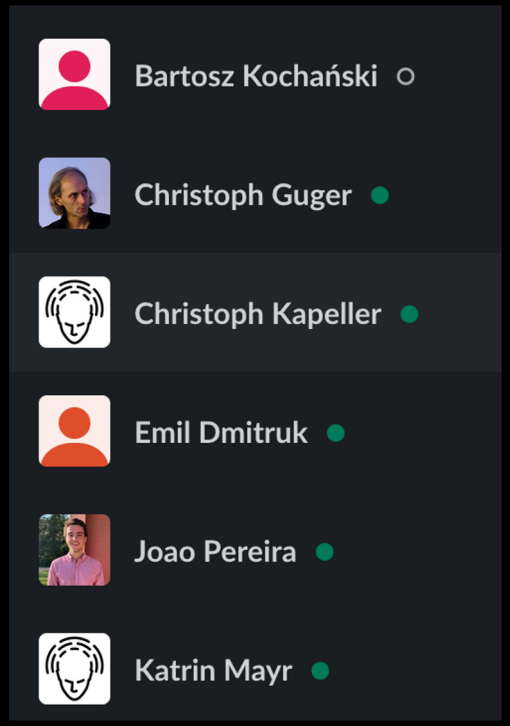
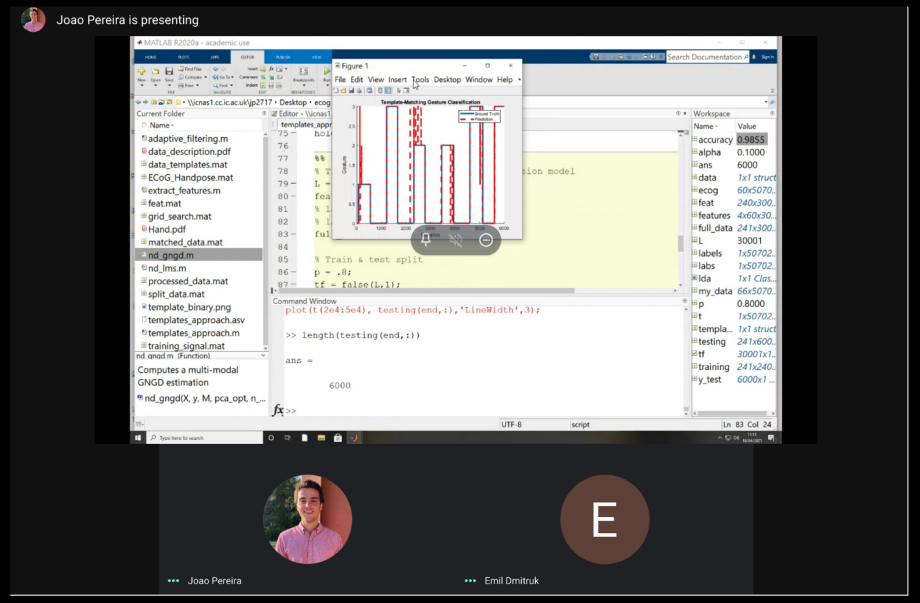
rECoGnising the team!

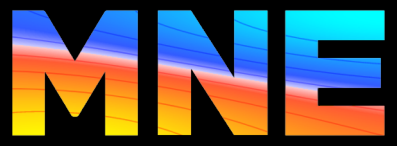






MKegler / ECoG_hack

The entire open-source community <3



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