

HAMBI

Hybrid Adaptive Muscle-Brain computer Interface

Valeria Tedeschi, Gaetano Tancredi Favazza, Tecla Coccozza, Pierre Nicolo, Martina Coscia

BACKGROUND AND OBJECTIVES

Stroke is the **third leading cause of long-term disability worldwide**, leaving millions of survivors with severe motor impairments that conventional rehabilitation cannot address [1,2].

3rd

leading cause of
long-term disability

~33M

stroke survivors
worldwide

6M

with severe chronic
upper-limb motor deficits

Motor imagery neurofeedback (**MI-NFB**) via brain-computer interfaces (**BCIs**) promotes neuroplasticity **without requiring overt movement** [2,3]. Hybrid EEG-EMG systems offer a more reliable and robust solution [4], yet current approaches rely on fixed signal fusion with no adaptation to the individual user.

HAMBI addresses this gap by **dynamically** selecting and weighting EEG and EMG features in real time based on each user's residual abilities.

SETUP



EEG: ANT Neuro **waveguard™** net, 64-ch semi-dry.

EMG: 8 muscles to capture proximal and distal upper-limb control.

Tasks: Right hand opening and grasping (ME and MI).

Feedback: Unity environment.

Synchronization: LSL + Arduino.

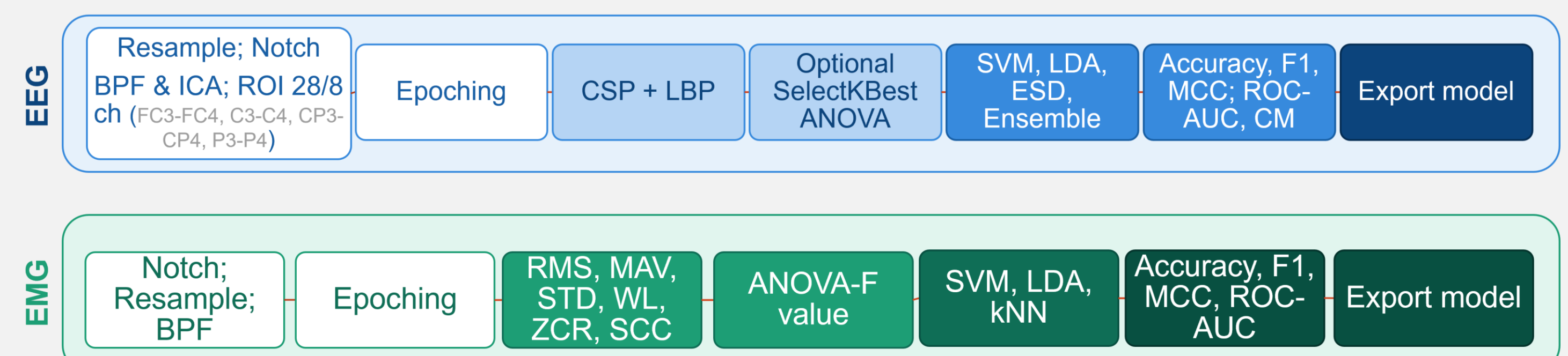
RESULTS

Preliminary offline results: n=2 healthy subjects, 30 repetitions/task

EEG → CSP + LBP features extracted over the sensorimotor ROI. MI decoding remains challenging, requiring parameters optimization.

EMG → Ensemble classifier successfully decoded ME Hand Opening vs. Grasping. Preliminary accuracies: 97.2% (P1), 98.2% (P2).

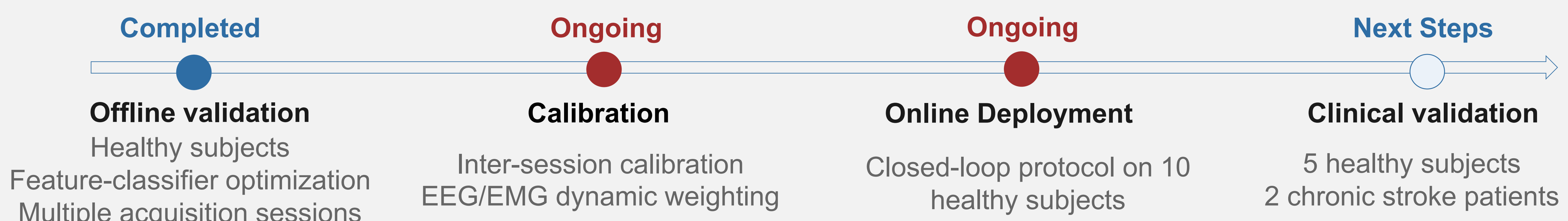
Parameter tuning in progress: CSP regularization and ensemble weighting strategy.



TRIAL DESIGN



CONCLUSION & NEXT STEPS



CONTACT

Human Engineering Laboratory (HEL), HEPIA
Campus Biotech, Chemin des Mines 9, 1202 Genève
Head of laboratory: Martina Coscia

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