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Inria Research & Development for the Cybathlon BCI series

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Team NITRO: Neurotechnology Inria Team Racing Odyssey

INTRODUCTION

- Team NITRO, from Inria (French national research institute for digital technologies), gathers 2 Inria research teams: Potioc (Bordeaux) and Athena (Sophia-Antipolis).
- Team NITRO trains two Cybathlon BCI pilots, one in Bordeaux and one in Sophia-Antipolis.
- Both research teams work together on the BCI design [1] and implementation, based on OpenViBE [2].
- We introduce each pilot, as well as their BCI system and training procedure below.

PILOT 1 - Presentation

- Wilfried Panatier, Graphic Designer, president of Pratikable (<http://www.pratikable.com>), an association to highlight disabilities through boarding, skating and extreme sports for all. He is himself tetraplegic and a rider!



Wilfried Panatier, 32 (center) with NITRO team members

BCI system & training protocol

- 4-class mental imagery BCI
 - Left/right hand motor Imagery, mental subtraction, rest
- 46 active EEG channels, g.tec gUSBamp
- Classification: Adaptive Riemannian classifier [3]
 - Features: Spatial covariance matrices in 8-24Hz
 - Classifier: geodesic filter MDM with adaptive Rebias
- Progressive user training [4]
 - Pairs of 2 classes => 4 classes => Game control
 - 1 session/week => 2 sessions/week => 3 sessions/week



PILOT 2 - Presentation

- Karine Leclerc, who lives at the René Labreuille centre. She is president of the CVS (social life council) of the centre's residents.



Karine Leclerc, 32 (right) with her medical assistant Magali Mambrucchi.

BCI system & training protocol

- 4-class mental imagery BCI
 - Right Hand motor imagery
 - Language imagination
 - Music imagination or Left Hand motor imagery
 - Rest
- 23 EEG channels, ANT Neuro Refa8
- Classifier: Linear Discriminant Analysis (LDA)
- User training
 - Pairs of 2 classes => 4 classes => Game control

References

[1] Clerc, Bougrain, Lotte, ISTE-Wiley, 2016

[2] Renard et al, Presence, 2010

[3] Kumar, Yger, Lotte, BCI Winter conf, 2019

[4] Lotte et al., Frontiers, 2013