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STAGE
TRAINING COURSE

MASTER 2

Date of offer : 28/09/2017

TITLE :

Application of Riemannian Geometry for Transfer Learning in Brain-Computer Interface

SUPERVISOR :

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PLACE :
Departement “Images and Signal” of GIPSA-lab, CNRS, Grenoble Alpes University, Grenoble-INP, ENSE^3, Campus of Grenoble.

DURATION:
The training will last 5 months, starting on February 1st 2018.

CONTEXT :
This project is part of an ongoing research on ***brain-computer interfaces*** carried out at team ViBS (Vision and Brain Signal Processing) of GIPSA-lab since 2009.

SUBJECT :

Brain-Computer Interfaces (BCIs) based on electroencephalography are system that allows to send commands to a machine without using the muscles or the peripheral nerves, but using instead only “thinking”.
One major challenge of current BCIs is to get rid of the calibration that is needed prior to each use of the BCI to teach the machine learning algorithm how to classify EEG data into distinct commands. For this purpose, we have introduced the use of Riemannian geometry (RG), a branch of differential geometry that study curved spaces. Using RG data from previous users (for a naïve user) and/or from previous sessions of the user can be aligned. Such aligned data is set as an initialization for the machine learning algorithm. This allows the use of a BCI without calibration; once appropriately initialized the algorithm will then adapt to the user while s/he is using the BCI.

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The aim of this stage is to propose improvements of the transfer learning strategy adopted so far.

OBJECTIVS OF THE TRAINING :
The candidate will apply digital signal processing and classification algorithms for transfer learning and will evaluate their performance on several data bases. The evaluation will be performed in Python.

KEYWORDS :
Brain-Computer Interface (BCI), Riemannian Geometry, Transfer Learning.

CONDITIONS :
The training is remunerated 1/3 of French SMIC during 5 months.

COMMENTS :
The candidate should have good predisposition for data analysis and biomedical signal processing. Good programming skills in Python and machine learning would be an advantage.

REFERENCES :

Congedo M, Barachant A, Bhatia R (2017) Riemannian Geometry for EEG-based Brain-Computer Interfaces; a Primer and a Review, Brain-Computer Interfaces, 4(3), 155-174.
(Available at https://hal.archives-ouvertes.fr/hal-01570120/document)

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