Journée Jeunes Chercheurs et Jeunes Chercheuses en Interface Cerveau-Ordinateur et Neurofeedback - JJC-ICON'21

Book of abstracts

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Chapter 1

Presentations - session 1

Prediction of Cybersickness using EEG-based markers

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Despite the recent release of performant head mounted display for all ages, an adverse side effect has prevented this technology from gaining in popularity. When moving in a virtual environment, 20% to 80% of users report symptoms of a subcategory of motion sickness called cybersickness (Monaco et al., 2017). The aim of this work is to study the prediction of cybersickness by identifying EEG-based markers occurring before the onset of symptoms. Cybersickness is commonly divided in three categories of symptoms: nausea, oculomotor and disorientation, that can be sorted according to their intensity $D > N > O$ (Kennedy et al., 1993). It was recently found that balance perturbation was always followed by a cortical activation called perturbation-evoked potential (PEP) that can be successfully detected (Ditz et al., 2020). As vertigo is one of the main components of disorientation, this work aims at exploring the possibility of a PEP at the early stage of cybersikness. Vection is a feeling of self-motion induced by a visual stimulus without any actual motion sensed by the vestibular system. As it was shown that the phenomenon of vection could be identified using EEG-based markers (Palmisano et al., 2015), this work should also try to distinguish vection with cybersickness as it is commonly admitted that vection is a necessary but not sufficient prerequisite for cybersickness (Keshavarz et al., 2015).

Keywords: Cybersickness, EEG, Vection, Virtual Reality

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Uncovering neurophysiological markers of the sense of agency in virtual reality

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When "I" perform an action, it is usually clear that "I am the one who is causing or generating this action" [Gal00]. This phenomenon, called the Sense of Agency (SoA), is important to study, e.g., to better understand people with the alien hand syndrome, who feel like a part of their body (the hand) acts by itself and not by their voluntary action. The SoA has been studied intensively in order to understand the underlying neurophysiological [NKG+11] and cognitive processes [PGFSV+16, TLH10]. The Virtual Reality (VR) community also investigated the SoA [BWF02, FFG+01, SY05]. A recent experiment [JAAL18] based on the literature in psychology demonstrated that it is actually possible to alter the SoA in VR using a visually biased feedback. In our study, we analyse surface EEG data recorded during the experiment presented in [JAAL18] to determine whether neurophysiological markers could objectively characterize the SoA. The experiment (N=24 participants, 162 trials/participant) consisted in performing 3 different right-hand movements where half of the trials were manipulated (by biasing the VR feedback to alter the users' SoA) while in the other half the participants were provided with a correct feedback. Our results show (1) consistent with the literature [FF02], an increase of the signal power over the parietal and left-central areas in the theta frequency band in the non-manipulated condition compared to the manipulated condition; (2) differences in ERPs over the central areas (e.g., C1). Particularly an N200 appears in the manipulated condition only. This could correspond to a conflict monitoring process [EGKPH10]. This result has, to the best of our knowledge, never been reported before in an ecological setting. Those results could pave the way to a more objective evaluation of the SoA in VR using EEG.

Keywords: Virtual Reality, Agency, Neurophysiological markers, EEG, Embodiment

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Identification of EEG markers that reflect expertise in attentional focus and motor imagery: Heading for neurofeedback procedures to improve sport performance

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Elite athletes' expertise is characterised by the development of precise internal models including appropriate motor predictions, which enable the improvement of movement precision and velocity [1]. We aim to enhance these characteristics through an electroencephalography (EEG) neurofeedback-based cognitive training procedure. We will target motor imagery (MI) and attentional focus (AF) abilities, which have been shown to impact significantly sport performance [2], and to be underlain by specific EEG pattern modulations, including sensorimotor rhythms (SMRs) [3]. MI is a "perception-like process in the absence of any external stimulus input" [4]. MI usually consists in the retrieval of past motor experiences from long term-memory to reproduce them mentally, without overt movement. Practically, there is ample evidence that combining MI with physical practice enables athletes to improve movement accuracy, speed and coordination [5]. Attention is a multimodal process that is involved in sport training and performance. MI and AF training procedures are limited by the difficulties in assessing performance in real-time. Indeed, these cognitive processes are mainly underlain by modulations of brain activity that cannot be directly perceived by the athletes or their staff. EEG-neurofeedback will allow us to overcome this limitation by providing athletes with some feedback about their capacity to self-regulate the appropriate brain activity. In our experiment, we aim to identify specific markers of MI and AF that correlate with expertise. While measuring their EEG, we will ask experts in internal martial arts (e.g., Tai Chi Chuan) -who are also experts in MI and AF- and novices to perform specific movements (e.g., pinch, push and hit), MI and attentional tasks. With machine learning tools, we will identify specificities in EEG modulations that translate expertise. We will then use these patterns as markers for a future EEG-neurofeedback training protocols.

Keywords: Neurofeedback, Attentional Focus, Motor Imagery, SMR, Tai Chi, Athletes

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Etude du lien entre agentivité, contrôle par le regard et activité du cortex moteur, vers une interface cerveau machine hybride avec Eye Tracker

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Les interfaces cerveau machine autilisant l'imagination motrice ont montré certaines limitations concernant la qualité de contrôle. Afin d'améliorer cette technologie, certaines équipes s'orientent vers le développement d'ICM hybridées à différentes technologies notamment l'eyetracker. L'eyetracker apporte une nouvelle modalité d'information pour le contrôle d'un robot, tout en étant robuste au changement de sujet, ce qui permet au robot de réaliser des mouvements plus complexes. Cependant, l'utilisation d'un eye tracker pour le contrôle d'un bras robotique peut, de fait, affecter le sentiment d'agentivité de l'utilisateur et possiblement activer les régions du cerveau requises lors de la tâche d'imagination motrice (eg le cortex moteur). Dans le cadre du développement d'une ICM hybride, nous tentons d'évaluer les possibles phénomènes d'overlapping d'activité cérébrale entre les tâches de contrôle par le regard et d'imagination motrice. Dans nos travaux bientôt publiés dans le proceeding de la conférence IEEE-EMBS, nous explorons le lien entre le sentiment d'agentivité et l'activité du cortex moteur. Pour cela, nous avons recours à un bras robotique virtuel contrôlable par l'eye tracker projeté sur une surface. L'utilisateur regarde plusieurs cibles mouvantes, si son regard reste plus de 150 ms sur l'une, le robot place son effecteur sur la cible. Pour 8 sujets (4 Hommes, 2 gauchers), nous observons une activité apparaissant dans le cortex moteur durant la tâche de contrôle par le regard ainsi que lorsque l'on observe le robot bouger de lui-même, cette activité étant identifiée par une diminution de la puissance spectrale dans les bandes fréquences alpha et beta (8-30 Hz) par rapport à la condition de repos. L'observation suscitant une activité motrice imaginée est un résultat connu de la littérature. Néanmoins, il subsiste une différence significative d'activité entre observation et contrôle par le regard, ce qui nous pousse à penser que le sentiment de contrôle renforce l'activité dans le cortex moteur.

Keywords: Hybrid BCI, Sense of Agency, Robotic control

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Should frequency band selection algorithms include neurophysiological constraints?

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Introduction: In order to build a reliable BCI, it is useful to calibrate the BCI system considering the characteristics of each user's ElectroEncephaloGraphy (EEG) [1]. A concrete approach is to select user-specific frequency bands based on data. Our previous work suggested a correlation between online BCI performances and the selected user-specific frequency bands [2]. In particular, users with the highest performance were the ones for whom the selected frequency bands' width was larger than 3.5Hz, and selected frequency band mean belonged to α-lowβ (5-16 Hz). However, it did not reveal whether the selected user-specific frequency band in α-lowβ causes higher performance or if users with higher performance have their user-specific frequency bands in α-lowβ range. In this study, we developed a frequency band selection algorithm to select user-specific frequency bands only from α-lowβ range and investigated how the online BCI performance change [3].
Methods and Results: We conducted a Motor Imagery (MI) BCI experiment with the same protocol as our previous work [4] with 12 healthy users who performed left or right hand MI. Their user-specific frequency bands were selected restrictively between 5-20 Hz and the minimum width was set as 3.5Hz. Then the average online BCI accuracies were compared with control users who have selected user-specific frequency band between 8-30Hz and without restriction for width from our previous study in [4]. The comparison results showed no significant difference ($p=0.26$) in online BCI performance. We will still continue this investigation with several users but this current result may suggest the users with higher performance can modulate their α-lowβ range activity well and their user-specific frequency bands belong to α-lowβ range as a result.
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Keywords: motor imagery, frequency band selection, online BCI, user feedback

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Modélisation de l'acceptabilité des procédures de rééducation post-accident vasculaire-cérébral (AVC) basées sur les interfaces cerveau-ordinateur (ICO)

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Les nouvelles technologies ne cessent d'évoluer et permettent des avancées importantes, y compris dans le domaine de la santé. Les ICO, qui favorisent la rééducation post AVC [1], en sont un parfait exemple. Il est donc important de comprendre ce qui permet à ces nouvelles technologies d'être mises en œuvre et acceptées, de manière à ce qu'elles soient le plus efficaces possible. L'acceptabilité des utilisateurs est en effet un facteur essentiel qui affecte non seulement la décision d'usage de la technologie, mais aussi son efficacité [2]. Il ne faut cependant pas se focaliser uniquement sur l'acceptabilité du patient. Son environnement social joue aussi un rôle majeur et affecte directement sa motivation et son acceptabilité [3]. C'est pourquoi il est important de prendre en compte l'acceptabilité de ses proches, et plus largement de la population générale. Il existe plusieurs modèles d'acception des nouvelles technologies. Tous se basent sur la TAM 3 [4] qui stipule que l'acceptabilité est déterminée par l'intention d'usage (IU), elle-même conditionnée par l'utilité perçue (UP) et la facilité d'utilisation (FUP). Sur la base de ces modèles, nous avons construit et diffusé un questionnaire de manière à identifier les facteurs conditionnant l'acceptabilité des ICO comme outil de rééducation post-AVC dans la population générale (N=753 répondants). Afin d'expliquer l'IU, nous avons utilisé des modèles de régression basés sur des forêts aléatoires [5]. Il en est ressorti que les facteurs influençant le plus l'acceptabilité, en termes d'IU, sont l'UP, la pertinence scientifique, l'aspect ludique et les normes subjectives. Nous allons maintenant adapter cette approche aux soignants et aux patients, en y intégrant des facteurs spécifiques tels que le niveau de formation ou la motivation intrinsèque, respectivement. Ces modèles permettront à terme d'améliorer l'efficience des procédures de rééducation ICO en optimisant leur acceptabilité et ainsi l'engagement des différents protagonistes.

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Keywords: Interface Cerveau-Ordinateur, Acceptabilité, Rééducation Post Accident vasculaire-Cérébrale, Modélisation, Neurofeedback

Towards understanding the impact of mental task execution on user's state, experience and performances in Mental Imagery(MI)-based Brain-Computer Interfaces

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Improving BCI user-training methods requires to understand the influence of user's psychological traits and states. To do so, recent studies have focused on user's cognitive traits (e.g. attention or task-related abilities) [Jeunet17] and state (e.g. mood or anxiety) and their effect on MI-BCI performance [Felton12;Jeunet17]. Learning how to use a MI-BCI can be considered as a demanding task in term of cognitive resources [Gerjets14]. According to the Cognitive Load Theory, optimal learning occurs when the learning material requires a balanced amount of cognitive workload for the user [Puma19]. Assessing users' cogni- tive workload during MI-BCI training might then help adapting the amount of cognitive resources required by the task to users' state evolution. Currently cognitive workload in MI-BCI experimentations is mostly assessed with indirect and discrete subjective measures (e.g. NASA-TLX) [Emami20,Felton12,Hart88] and must be complemented with objective and continuous direct measurements. We suggest a protocol in which users will, before the MI-BCI training, complete two different cognitive tasks involving a high and low cognitive load. Meanwhile, EEG activity would be recorded and used to build a classifier to assess in real-time the cognitive load level of users during training. The second part of the study will compare, between subjects, traditional instructional design with one based on compatibility between the feedback and the MI task (i.e. transparent mapping) [Vlek14]. This should im- prove the sense of agency [Vlek14], reduce task-related cognitive load and, hopefully, allow users to learn faster than the control group.

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Keywords: MI, BCI, Training, Cognitive Load, Learning, transparent mapping, sense of agency

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Chapter 2

Presentations - session 2

EEG-based mental workload estimation using precise electrode positions

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Since EEG has a high temporal resolution but a low spatial resolution and volume conduction effects, most studies focus on time-frequency analyses instead of spatial analyses. What is even much less investigated is the influence of using precise electrodes positions instead of standard head model. To fill the gap, we recorded the precise 3D coordinates of 62 electrodes along with EEG signals of 9 subjects who performed an MATB-II task under easy/medium/difficult conditions (1 block per condition, 10 min per block). The continuous EEG signal was cut into 2-second epochs. For each subject, a personalized mesh was constructed from the 3D coordinates of electrodes. Then the Laplacian of the mesh was computed. The eigenvectors of Laplacian form an orthonormal basis for square-integrable functions over the scalp and capture the geometry of electrodes' position in a hierarchical way. Analogous to Fourier analysis, we could decompose the EEG signal into a weighted sum of eigenvectors of Laplacian. Most energy was concentrated on the first few components and by dropping the tail in the weighted sum, we could reduce dramatically the dimension of the EEG signal while retaining the essential information [1]. We show the effectiveness of the proposed dimensionality reduction method for mental workload estimation. Additionally, we compared the results obtained using real and standard 3D electrode coordinates and suggest that precise electrode positions might help for other EEG spatial analyses.

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Keywords: EEG, BCI, Laplacian, electrode positions, mental workload

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Improving user experience of SSVEP-based BCI through the use of low amplitude visual stimulations

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The Steady-States Evoked Potentials (SSVEP) characterize neural responses to the presentation of periodic visual stimuli. The sustained rhythmic entrainment of visual cortex neuronal populations to the frequency of the stimuli can be recorded with surface electroencephalography. BCI applications have capitalized on the robustness of the SSVEP effect to achieve unequalled classification performances (e.g., Information Transfert Rate over 300 bits/mins for a 40-classes keyboard application) which has further established the SSVEP as a ubiquitous approach for reactive BCI. Although SSVEP-based paradigms have proven to be an efficient approach for BCI applications, several concerns regarding their use have been raised. For instance, the repetitive presentation of visual information are straining on the eyes, may cause epileptic seizures and are reportedly deemed annoying/frustrating by the users. A potential remedy to overcome these issues is to reduce stimuli intensity. It has however been widely documented that the magnitude of the SSVEP signal is positively correlated with the luminance and contrast difference between alternating states of the stimuli. The present study aims to investigate whether reduced amplitude modulation improves visual comfort and quantify the trade-off between luminance amplitude reduction and the strength of the SSVEP response in a systematic way. To this end, subjective assessment of visual stimuli, signal-to-noise ratio of SSVEP responses and classification performances on a four-class problem using wet-EEG setup were compared across luminance amplitude modulation ranging from 100, 50, 40, 30, 20 to 10% of the maximal amplitude depth. Preliminary results reveal the relationship between amplitude modulation depth and SNR/classification performance. We achieved satisfactory results starting with 30% of intensity modulation. The results are discussed in terms of their implications for the ergonomic design of SSVEP-paradigms which aim to optimize system performance while taking user experience into consideration.

Keywords: BCI, SSVEP, EEG, Human Factors, Neuroergonomics

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Comparaison des méthodes de classification pour le paradigme SSVEP

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Dans le domaine des Interfaces Cerveau-Machine non-invasives, des algorithmes de décodage tentent interpréter les signaux électrophysiologiques de l'utilisateur afin de les transformer en commande. L'utilisation de stimulations nommées Steady-State Evoked-Potentials (SSVEP) représente un approche très efficace pour le suivi des informations sensorielles sur lesquels se concentre l'utilisateur. Ce sont des stimulations visuelles périodiques qui induisent une réponse neuronale synchronisée en fréquence. Nous nous proposons ici de faire une comparaison des principales méthodes de classification des SSVEP sur un jeu de données récolté dans notre laboratoire. C'est un problème à 4 classes (9,10,11 et 12Hz avec une phase nulle) avec 12 sujets. Nous avons utilisé un électro-encéphalographe à 32 voies à gel avec une fréquence d'échantillonnage à 500Hz. Les méthodes instiguées peuvent être divisées en trois grands types. La famille des méthodes les plus populaires utilise la correspondance entre les signaux recueillis lors de la stimulation avec une référence. Cette référence peut-être soit prototypique telle qu'un sinus ou cosinus à la fréquence SSVEP soit apprises et individualisée. La correspondance se fait de manière classique à l'aide d'une "Canonical Correlation Analysis". Les méthodes récentes utilisent des banques de filtre pour tirer parti de la localisation fréquentielle de la réponse induite et ses harmoniques. Ces méthodes peuvent également apprendre des filtres spatiaux. Une technique nommée Task Related Component Analysis (TRCA) regroupant tous ces éléments a attiré l'attention en atteignant un taux de transfert d'information (ITR) de plus de 300bits/min pour un problème à 40 classes. Par ailleurs, les méthodes de classification utilisant des éléments de géométrie Riemanniennes sont aussi en vogue. Ces méthodes utilisent la covariance entre électrodes du signal EEG comme caractéristiques. La géométrie de l'espace couvert par les covariances mesurées encode les dépendances spatiales du signal. Enfin les méthodes reposant sur les réseaux de neurones ont elles aussi été étudiées. Nos conclusions préliminaires semblent montrer la supériorité de la méthode TRCA dans le cas où les stimulations sont courtes, avec une amplitude réduite pour un meilleur confort visuelle et des données de calibration peu nombreuses. Néanmoins le gros point faible de cette méthode est son approche synchronisée qui nécessite de connaître l'instant du début de la stimulation. De plus, cette technique s'avère limitée pour faire du transfert d'apprentissage entre sessions ou sujets.

Keywords: BCI, SSVEP, Machine-Learning

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Influence of dry-electrode setup and classification algorithm on right and left-hand motor imagery BCI performance

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While motor-imagery Brain-Computer Interfaces (MI-BCIs) are most promising for various applications ranging from assistive technologies to video games, they remain barely used mainly due to complications of taking them out-of-the-lab. There is a need for compact EEG systems that can be efficiently incorporated into BCIs and provide accurate feedback to their users. The compactness might depend on a minimal quantity of electrodes, where dry electrodes could be the best practical option for out-of-the-lab applications. This work hypothesizes that the optimal signal processing method could depend on the location and number of dry electrodes. Seven different electrode sets, decreasing from 32 until eight dry electrodes were defined. For each setup, four signal processing methods were used to classify right and left-hand motor imagery: (1) regularized Common Spatial Pattern (rCSP) + Linear Discriminant Analysis (LDA), (2) rCSP + Support Vector Machine (SVM), (3) Minimum Distance to Riemannian Mean (MDRM) and (4) SVM in the Riemannian Tangent Space (RTS). Ten subjects participated in one recording session each. The results show that the classification accuracy of MI-BCI for all processing methods can achieve above chance-level results with a minimum of 16 channels (p ¡ 0.01). Post-hoc analysis suggests that methods (1) rCSP+LDA and (2) rCSP +SVM have better performance with the highest numbers of electrodes (28 and 32). For method (4) SVM+RTS working with 20 and 24 channels, the classification accuracy is above chance level. These preliminary conclusions show how crucial the selection of EEG channels' quantity and location, signal processing, and classification methods can be to obtain the desired outcome in MI-BCI. In future studies, further data should be collected to assess the relevance of these promising results on long-term performance and evaluate the influence that the selected method may have on the participants' ability to learn how to control an MI-BCI efficiently.

Keywords: Motor Imagery, BCI, EEG, Dry-electrodes, Classification accuracy

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EEG-based visual Brain Computer Interface forgaze-free communication

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EEG-based visual Brain-Computer Interfaces (BCIs) have applications in providing communication pathways bypassing speech and other forms of muscular activity a for patients devoid of these abilities [1]. Visual BCI paradigms,like the P300 speller, can offer a solution in cases where the user can redirect their gaze onto the desired target (overt attention), but lack in performance for patients with limited eye control but who can still mentally focus on targets in their visual periphery (covert attention) [5].We aim to improve event related potential (ERP) target decoding perfor-mance both in the overt and the covert case, which will support the development of comfortable visual BCIs for ALS and trauma patients with Locked-in Syn-drome and Total Locked-in Syndrome.In the overt attenction case, multiple ERP components (P1, N1, P2, N2, andP300) are evoked, whereas fewer (mostly N2 and P300) and less pronounced potentials are detected in the covert case [2]. Hence, when taking only the P300component into account, BCI performance will suffer in the covert attention case. Our working hypothesis is that we can improve ERP classification accu-racy by individually detecting multiple ERP components and by relying on the ensemble of detection results to predict the target. We aim to develop the multi-component beamformer, a new decoding approach based on the spatiotemporal LDA-beamformer [3,4]. We aim to show that for, ERP data with high and low spatial resolution,component-specific activation patterns can be obtained via matrix decomposition of the average target/non-target difference wave, which in turn can be used to construct an array of spatiotemporal beamformers. The beamformer outputs will be combined in a step-wise logistic regression classifier to yield a performance accuracy on par with state-of-the-art single component spatiotemporal LDA beamforming.

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Keywords: p300 speller, covert attention, spatiotemporal filtering, classification

Functional Connectivity for BCI: OpenViBE implementation

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A possible way of interpreting electroencephalography (EEG) data is in terms of functional connectivity between channels, describing how brain areas mutually interact. Brain connectivity can be modeled as graphs, and mental states have been shown to be characterized by particular graph statistics (e.g. node strength or node efficiency) (1). Linking connectivity features to mental states can be a path to enhancing BCI performance. OpenViBE is an open-source C++ based framework allowing real-time acquisition and processing of EEG data in a modular way, but algorithms and solutions for measuring and post-processing connectivity information are missing. Based on previous works (3) , we implemented different connectivity algorithms in OpenViBE: magnitude squared coherence and imaginary part of coherence (2). We ensure low complexity by using the Eigen library (4) for algebraic operations, and implementing Welch's method (5) for computing the periodograms. We also developed matrix manipulation methods for post processing, and Graph Laplacian denoising (3). We show this implementation is feasible for real-time Motor Imagery experimental protocols, as computing a single connectivity measure across 2 seconds of signal sampled at 512Hz, using 74 channels and 128 frequency bins takes less than 25ms on a typical workstation. When using 256 channels, this measure takes approximately 150ms, and 300ms when also using 256 frequency bins. Research is currently ongoing to use functional connectivity as the basis for graph representation of the underlying brain networks, or with classification algorithms as an alternative feature to spectral power to discriminate between different Motor Imagery tasks: rest vs activity.

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Keywords: Functional Connectivity, Coherence, OpenViBE, Implementation, Real Time

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Decoding of articulatory and acoustic speech features from intracranial brain signals

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Speech BCIs aim at providing a real time control of an artificial speech synthesizer through the online decoding of neural activity. Among the multiple approaches to design such system, two frameworks stand out: 1. the direct decoding of the acoustic features of speech and 2. the indirect prediction of speech through the decoding of articulatory movements of the vocal tract followed by articulatory-to-speech synthesis. Recent findings suggest the second approach is more efficient. Here we tested both approaches by combining partial least squares (PLS) regression and deep neural networks in a real-time compatible fashion. A female patient was implanted with an ECoG grid of 72 electrodes as a presurgical evaluation of her intractable epilepsy. Over 3 days, she read and repeated out loud a total of 641 vowels sequences or short sentences from the BY2014 corpus. Synchronized audio and ECoG recordings were processed into acoustic and neural features, respectively. Both f0 and 25 Mel-cepstrum coefficients were extracted from audio recordings using SPTK. The power spectrogram of neural recordings was computed in 10-Hz bands up to 200Hz together with LFPs low-passed below 5Hz. The patient's articulatory trajectories were estimated from the BY2014 corpus using dynamic time warping. We then used PLS regression to decode 1. acoustic features and 2. articulatory features, combined with a neural-network-based articulatory synthesizer. Decoded speech was synthesized from acoustic features using a MLSA filter. Direct decoding of Mel-cepstrum yielded a median Pearson correlation of 0.49, whereas the indirect prediction yielded a correlation of 0.45. Moreover, f0 was decoded with a mean correlation of 0.58. Articulatory features were only decoded with a median correlation of 0.18 across articulators. Despite good correlation levels, intelligibility of reconstructed speech from PLS regression needs further improvements. A promising alternative would be a neural-network-based approach, focusing on a real-time compatible model.

Keywords: Speech BCI, ECoG recordings, PLS, articulatory synthesis, deep learning

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Much ado about neurotechnologies

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La presse se fait régulièrement l'écho des miracles des neurotechnologies : des personnes paraplégiques remarchent, des patients en état végétatif communiquent par la pensée , des aveugles retrouvent la vue. Les exosquelettes, les bras robotisés, la neurostimulation profonde ou les interfaces cerveau-ordinateur s'imposent dans le paysage médiatique comme des traitements suites aux atteintes neurologiques. Pourtant, le contraste avec le quotidien des services de rééducation est saisissant. Ces outils high-techs y sont quasiment absents.

Ce n'est pas le seul domaine où les médias sont sensationnalistes, mais il existe ici des facteurs particuliers qui aggravent le décalage avec la réalité du terrain, avec des conséquences parfois très dommageables. Les premières victimes sont les patients et leurs proches, car un espoir démesuré menace la possibilité d'un consentement éclairé, nécessaire à une recherche et un soin éthique.

Tout d'abord, le grand public n'a généralement qu'une vague idée du fonctionnement et de l'efficacité réelle de ces technologies révolutionnaires, souvent combinées (intelligence artificielle, robotique...). De même, la complexité du système nerveux est sous-évaluée, à la faveur d'une vision simpliste d'une réparation mécanique . De surcroit, la perception du handicap est biaisée vers un misérabilisme , qui mène à dénigrer les dispositifs utiles comme le fauteuil roulant, au profit des outils sensés restaurer la normalité comme des exosquelettes, pourtant bien inférieurs en termes de fonctionnalité quotidienne.

Les médias relaient ainsi de manière peu critique une approche qui a pourtant été délaissée depuis des décennies en clinique, au profit de compensations fonctionnelles, bien plus efficaces pour améliorer la qualité de vie des personnes handicapées. Au cœur de cette médiatisation déraisonnable, on peut notamment pointer le manque de journalistes scientifiques, amenant les médias à se faire le relai, voire à amplifier, les stratégies de communication de certains acteurs de l'innovation peu scrupuleux.

Keywords: Ethique, Neurotechnologies, Médiatisation

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