ΕΤΗΣΙΑ ΕΚΘΕΣΗ ΠΡΟΟΔΟΥ

(διάστημα από 8/11/19 έως 7/11/2020)

Αγγελάκης Δημήτριος

Α.Μ.: 1903

«ΣΥΝΤΟΝΙΣΜΕΝΗ ΚΙΝΗΣΗ ΠΟΛΛΑΠΛΩΝ ΒΡΑΧΙΟΝΩΝ ΜΕ ΧΡΗΣΗ ΔΙΕΠΑΦΗΣ ΥΠΟΛΟΓΙΣΤΗ ΕΓΚΕΦΑΛΟΥ»

Η παρούσα διατριβή ξεκίνησε από 8-11-2019.

Ακολουθεί συνοπτική ανάπτυξη του αντικειμένου της ΔΔ για το ακαδημαικο ετος 2019-2020

Παρουσιάζονται οι διαδικασίες που χρησιμοποιήθηκαν και τα αποτελέσματα που λήφθηκαν στο διάστημα του ενός έτους.

Η παρούσα διδακτορική διατριβή αφορά στον σχεδιασμό και ανάπτυξη υπολογιστικών εργαλείων εγκεφάλου-υπολογιστή (BCI) με χρήση ηλεκτροεγκεφαλογραφημάτων (EEG) και αλγορίθμων μηχανικής μάθησης , Ο στόχος είναι να δημιουργηθεί ένα σύστημα επικοινωνίας που θα μετατρέπει την εγκεφαλική δραστηριότητα σε εντολές ελέγχου για ρομποτικό σύστημα πολλαπλών βραχιόνων με 6 βαθμούς ελευθερίας (6Dof).

Αποδελτίωση βιβλιογραφίας σχετικής με το αντικείμενο της διατριβης

Συγγραφείς	**Τίτλος**	**Έτος έκδοσης**	**Χώρα Διεξαγωγής**	**Μεθοδολογία**
Yann Renard Fabien Lotte, Guillaume Gibert, Marco Congedo, Emmanuel Maby, Vincent Delannoy, Olivier Bertrand, Anatole Lecuyer	OpenViBE: An Open-Source Software Platform to Design, Test, and Use Brain–Computer Interfaces in Real and Virtual Environments	2010	France	interacting through cerebral activity, using a brain–computer interface

Luz Maria Alonso-Valerdi, Francisco Sepulveda	Python in Brain-Computer Interfaces (BCI): Development of a BCI based on Motor Imagery	2011	United Kingdom	**Python programming language**
P.J. DURKA , R. KU 1, J. —YGIEREWICZ1, M. MICHALSKA, P. MILANOWSKI1, M. £ABKCKI, T. SPUSTEK, D. LASZUK, A. DUSZYK, and M. KRUSZYPSKI	User-centered design of brain-computer interfaces: OpenBCI.pl and BCI Appliance	2012	Poland	This paper presents a complete software framework for BCI, a novel hardware solution for stimuli rendering in BCIs based on Steady State Visual Evoked Potentials (SSVEP), and a univariate algorithm for detection of SSVEP in the EEG time series.
Alexander Astaras, Nikolaos Moustakas, Alkinoos Athanasiou, and Aristides Gogoussis	Towards Brain-Computer Interface Control of a 6-Degree-of-Freedom Robotic Arm Using Dry EEG Electrodes	2013	Greece	A robotic arm prototype capable of moving along 6 degrees of freedom has been developed, along with an exoskeletal position sensing harness which was used to control it. Commercially available dry electrode BCI headsets were evaluated. A particular headset model has been selected and is currently being integrated

				into the hybrid system.
Sunny T.D., Aparna T., Neethu P., Venkateswaran J., Vishnupriya V., Vyas P.S.	Robotic Arm with Brain Computer Interfacing	2015	India	Electroencephalography (EEG
Ahmed Mohamed Elnady , Xin Zhang, Zhen Gang Xia, XinyiYong, Bubblepreet Kaur Randhawa, Lara Boyd and Carlo Menon	A single-session preliminary evaluation of an affordable BCI-controlled arm exoskeleton and motor-proprioception platform	2015	Canada	In this study,we developed a comprehensive BCI platform that Combines different rehabilitation and technological approaches. The platform consists of a BCI training device and a motor- Proprioception assessment protocol. The BCI training device pro- Motes user engagement via the use of motor imagery to trigger the Exoskeleton or FES.
Bastian Venthur	Design and Implementation of a Brain-Computer Interface System	2015	Berlin	configure method
Jianjun Meng, Shuying Zhang, Angeliki Bekyo, Jaron Olsoe, Bryan Baxter & Bin He,	Noninvasive Electroencephalogram Based Control of a Robotic Arm for	2016	USA	Statistical analysis

	Reach and Grasp Tasks			
Diego S. Benítez, Sebastian Toscano and Adrian Silva	On the Use of the Emotiv EPOC Neuroheadset as a Low Cost Alternative for EEG Signal Acquisition	2016	USA	To demonstrate the feasibility of using the EEG raw signals acquired by using the Emotiv system, an eyewinks' classification algorithm based on Artificial Neural Networks (ANN) was implemented as an example.
Sebastian-Daniel Rosca, and Monica Leba	Using brain-computer-interface for robot arm control	2017	Romania	We develop the model and simulate the entire system functioning, both the robotic arm control and the brain signals processing
Rabie A. Ramadana, Athanasios V. Vasilakos	Brain computer interface: control signals review	2017	Egypt	this survey reviews the current BCI technology in terms of hardware and software where the most used BCI devices are described as well as the most utilized software platforms are explained

Sebastian-Daniel Rosca, and Monica Leba	Using brain computer interface for robot arm control	2017	Romania	We present the existing devices and applications from the area of braincomputer interfaces with advantages and disadvantages. Further, we propose a solution for brain control of a robotic arm. We develop the model and simulate the entire system functioning, both the robotic arm control and the brain signals processing.
Latif, M. Y., Naeem, L., Hafeez, T., Raheel, A., Saeed, S. M. U., Awais, M., & Anwar, S. M.	Brain Computer Interface based Robotic Arm Control	2017	Pakistan	In the proposed experimental setup, brain signals are used to move the robotic arm and perform different tasks i.e., picking and placing. Electroencephalography (EEG) signals are recorded using a five-channel wearable headband.
Fabien Lotte, Chang S. Nam, Anton Nijholt	Introduction:Evolution of Brain-Computer Interfaces	2017	2017	The documents may come from teaching and research institutions in France or abroad, or from

				public or private research centers.
Qiang Gao,Lixiang Dou,Abdelkader Nasreddine Belkacem, and Chao Chen	Noninvasive Electroencephalogram Based Control of a Robotic Arm for Writing Task Using Hybrid BCI System	2017	China	MI-based BCI was used as single-pole double throw brain switch (SPDTBS). By combining the SPDTBS with 4-class SSEVP-based BCI, movement of robotic arm was controlled in three-dimensional (3D) space. In addition, muscle artifact (EMG) of "teeth clenching" condition recorded from EEG signal was detected and employed as interrupter, which can initialize the statement of SPDTBS.
D Angelakis, S Zoumis and P Asvestas	Design and Implementation of a Brain Computer Interface System for Controlling a Robotic Claw	2017	Greece	The system is based on the Emotiv Epoc headset, which provides the capability of simultaneous recording of 14 EEG channels, as well as wireless connectivity by means of the Bluetooth protocol. The system is initially trained to decode what user

				thinks to properly formatted data.
Zied Tayeb , Nicolai Waniek , Juri Fedjaev , Nejla Ghaboosi , Leonard Rychly , Christian Widderich , Christoph Richter , Jonas Braun , Matteo Saveriano , Gordon Cheng and J¨org Conradt	Gumpy: a python toolbox suitable for hybrid brain-computer interfaces	2018	Germany	gumpy, a free and open source Python toolbox for BCI applications.
Pablo Pelayo, Hemamalini Murthy, and Kiran George	Brain-Computer Interface Controlled Robotic Arm to Improve Quality of Life	2018	USA	The presented system utilizes Electroencephalography (EEG) signals to create a BCI which can control a robotic arm. Specifically, Steady State Visual Evoked Potential (SSVEP) based signals are captured from a user's brain to serve as the controller for three servo motors.
Seyed Sina Mirrazavi Salehian, Nadia Figueroa and Aude Billard	A unified framework for coordinated multi-arm motion planning	2018	Switzerland	We define a synchronous behavior as that in which the robot arms must coordinate with each other and with a moving object such that they reach

				for it in synchrony.
Xu Han , Ke Lin, Shangkai Gao and Xiaorong Gao	A novel system of SSVEP-based human–robot coordination	2018	China	an asynchronous BCI based on SSVEP was used as the system interface, and a novel asynchronous recognition algorithm was used to discriminate the electroencephalogram (EEG) signal.
Maryam Alimardani, Shuichi Nishio and Hiroshi Ishiguro	Brain-Computer Interface and Motor Imagery Training: The Role of Visual Feedback and Embodiment	2018	China	A typical training protocol for such BCIs includes execution of a motor imagery task by the user, followed by presentation of an extending bar or a moving object on a computer screen.
Eduardo Quiles , Ferran Suay , Gemma Candela , Nayibe Chio , Manuel Jiménez and Leandro Álvarez Kurogi	Low Cost Robotic Guide Based on a Motor Imagery Brain Computer Interface for Arm Assisted Rehabilitation	2019	Spain	In this study, a low cost robotic guide is implemented so that linear position can be controlled via the user's motor imagination of movement intention.
Attila Korik, Ronen Sosnik, Nazmul Siddique and Damien Coyle	Decoding Imagined 3D Arm Movement Trajectories From EEG to Control Two Virtual Arms A Pilot	2019	Israel	The analysis was performed on a dataset recorded from three subjects

	Study			in seven sessions wherein each session comprised three experimental blocks: an offline calibration block and two online feedback blocks.
B. J. Edelman, J. Meng, D. Suma, C. Zurn, E. Nagarajan, B. S. Baxter, C. C. Cline, B. He	Noninvasive neuroimaging enhances continuous neural tracking for robotic device control	2019	USA	We present and validate a noninvasive framework using electroencephalography (EEG) to achieve the neural control of a robotic device for continuous random target tracking
Andrea Kübler	The history of BCI: From a vision for the future to real support for personhood in people with locked-in syndrome	2019	Germany	Indirect methods include functional magnetic resonance imaging (fMRI) and functional near infrared spectroscopy (fNIRS).

Παρακολούθηση ειδικού 4μηνου σεμιναρίου δια βίου μάθησης Data science with Python Συγγραφή 3(τριών) κεφαλαιών διατριβής 8000 λέξεων

- Τεχνητή νοημοσύνη
- Μηχανική εκμάθηση
- Ανάλυση της γλώσσας Python η οποία θα χρησιμοποιηθεί στην διατριβή

Συμμετοχή σε ενισχυτική διδασκαλία εργαστηρίων ως Μέλος Επικουρικού Εκπαιδευτικού Προσωπικού

Αγγελάκης Δημήτριος

Υπ.Διδάκτορας,Τμήμα Μηχανικών Βιοϊατρικής