Annotated Bibliography

Gordon, S. M., Jaswa, M., Solon, A. J., & Lawhern, V. J. (2017). Real world BCI: Cross-domain learning and practical applications. Paper presented at the 25–28. doi:10.1145/3038439.3038444

The main topic in this article was to learn about different approaches of creating models for both cross-subject and cross-domain solutions for real-world BCI systems. The author focused on Deep Learning tactics such as Convolutional Neural Networks, which is an EEG-based classification system that is also cable of cross-domain learning. The author used this initial research to begin work on an eye tracking and EEG system. The system was able to integrate multiple streams of information and worked without user or domain specific training. This article is useful to my research because I am currently in the stage of trying to take multiple signals from a BCI device and map it to a function on a drone. For example, the brain sending a signal saying go and another saying stop, and being able to map those to the drones go and stop functions.

Kosmyna, N. (2015). Human-computer interaction – INTERACT 2015 towards brain computer interfaces for recreational activities: Piloting a drone. *Human-Computer Interaction - INTERACT 2015. 15th IFIP TC 13 International Conference,* 522; 522.

The purpose of this article is the proposition of having a “Co-learning BCI” which would reduce the amount of training and make it more suitable for recreational activities. Implementing this idea into my research would give the opportunity of making brain controlled drones available to the public. The author based the Co-learning system on the Minimum Distance Classifier which is a classification technique based on the pattern recognition literature. The author also used the LaFleur et al drone piloting task to compare the Co-learning BCI and regular BCI's. As for the results when comparing the BCI's in a short training timeframe the Co-learning BCI was superior but as the training time increased the regular BCI became superior in accuracy even though the accuracy level of the Co-learning BCI was continuing to increase. Incorporating a Co-learning model into my research would allow for a great amount of time an effort saved when running test because training would no longer be a time consuming.

Kos'myna, N., Tarpin-Bernard, F., & Rivet, B. (2014). Bidirectional feedback in motor imagery BCIs: Learn to control a drone within 5 minutes. Paper presented at the *Chi,* 479–482. doi:10.1145/2559206.2574820

The purpose of this article was to propose an architecture that would in turn cut the amount of time that would be needed to train a person to use a BCI device. The proposed architecture would only require a few seconds of calibration data which would allow the user to interact with the BCI device and the BCI device to interact with the user. The author performed experiments with 25 different participants using the proposed architecture and compared it to the normal BCI system. The system worked well with the users compared to the standard BCI system and had promising performance. Being able to train a user fast would allow me more time to focus on creating a method of being able to have a BCI map to different brain signals to different drone actions.

Kosmyna, N., Tarpin-Bernard, F., & Rivet, B. (2014). Drone, your brain, ring course: Accept the challenge and prevail! Paper presented at the 243–246. doi:10.1145/2638728.2638785

The purpose of this article was making BCI device interaction more practical to use in out-of-the-lab situations. The author brings to light the idea of Co-learning BCI devices where the user gives feedback to the BCI device to train it. In the article, the author uses four commands to control the drone: left turn, right turn, take off, and land. The BCI gives feedback to the user by graphically displaying a polygon whose corners are a direct representation of the four classes. This is amazing that by limiting the learning curve the user is able to do more like turn left or right. Although the drone automatically moves forward when takeoff is commenced the ability to differentiate left from right with the BCI device would be breakthrough for my research.

Kosmyna, N., Tarpin-Bernard, F., & Rivet, B. (2015). Brains, computers, and drones: Think and control! *Interactions, 22*(4), 44–47. doi:10.1145/2782758

The main purpose of this article was to inform the reader about BCI devices and what they can do. The author talks about how training plays a key role in all BCI systems, Feedback I also a major part of BCI training and if it was to be modified it would have a considerable influence on both user perception and the resulting control performance. It listed various BCI devices and the companies that make them which will allow me to have a good guide on what BCI device would be suitable for flying drones if the need arise for me to switch devices.

Markopoulos, K., Mavrokefalidis, C., Berberidis, K., & Daskalopoulou, E. (2016). BCI-based approaches for real-time applications. Paper presented at the 25:1–25:6. doi:10.1145/3003733.3003785

This paper provides information on BCI Devices while also focusing on how the produce for collecting data can be used in real world applications. The paper gives a brief overview of how BCI devices work and why they were created and this understanding of the device as a whole will enable me to better use it as a tool in controlling drones. The author goes over things like data acquisition, pre-processing including signal enhancement, feature extraction from the data, classification, and how to evaluate the performance. Learning how all these function in relation to controlling drones using the BCI system will assist me in achieving my goals in my research.

Wahlstrom, K., Fairweather, N. B., & Ashman, H. (2016). Privacy and brain-computer interfaces: Identifying potential privacy disruptions. *SIGCAS Comput. Soc.*, *46*(1), 41–53. doi:10.1145/2908216.2908223

The purpose of this paper is to identify potential privacy disruptions when using BCI devices. The author gave a brief overview of what privacy is and then went on to describe whagt the potential privacy disruptions for three different BCIs, that he called active, reactive and passive BCIs, would be. He gave explanations on how different theories explain privacy and where those BCIs fit in those theories. From his conclusions, you can infer that passive and hybrid BCIs are more likely to disrupt privacy that active ones. The paper used typology to classify the BCIs into the three groups mentioned. Knowing the privacy restrictions will allow me to build an experiment using human subjects that the IRB will accept since I will be able to avoid a breach in privacy.

Wolpaw, J. R. (2012). Brain-computer interfaces: Progress, problems, and possibilities. Paper presented at the 3–4. doi:10.1145/2110363.2110366

This paper focuses on four man points: the need for better signal-acquisition hardware for BCI devices, convincing clinical validation is required for real life usefulness of BCI systems for people with disabilities, BCI dissemination still need effective strategies, BCI reliability must be greatly improved. Finding BCI devices that have taken these problems into consideration and knowing how to combat these issues will allow for my research to move forward smoothly.

Won, J., Seo, S., & Bertino, E. (2015). A secure communication protocol for drones and smart objects. Paper presented at the 249–260. doi:10.1145/2714576.2714616

This paper is linked with the previous paper by Wahlstrom which spoke on privacy and BCI devices. I consider them linked not because the paper themselves are linked but because I have linked the ideas. This paper focuses on creating a secure communication protocol between drones and smart objects. Smart objects like a BCI device which already has its privacy issues. The author proposes to do this by using an efficient Certificateless Signcryption Tag Key Encapsulation Mechanism (eCLSC-TKEM). The author concluded that the eCLSC-TKEM reduces the amount of time required to establish a connection between the drone and a smart object while also improving the drones efficiency.

Yu, Y., He, D., Hua, W., Li, S., Qi, Y., Wang, Y., & Pan, G. (2012). FlyingBuddy2: A brain-controlled assistant for the handicapped. Paper presented at the 669–670. doi:10.1145/2370216.2370359

This paper was about the FlyingBuddy2 which is a brain-controlled assistive system. The system is used to aid the handicapped in mobility. It uses the brain EEG signals to directly control a quadrotor. This is much like my research project controlling drones with BCI devices that use EEG signals. The EEG headset that the author uses sends signals wirelessly to a computer, then these signals are decoded and converted to trigger the quadrotor to move in 3D space. The methods and ideas used to control this quadrotor could also be used to help me identify how to take in multiple signals using my BCI device and map them to multiple commands on the drone.