Literature Review

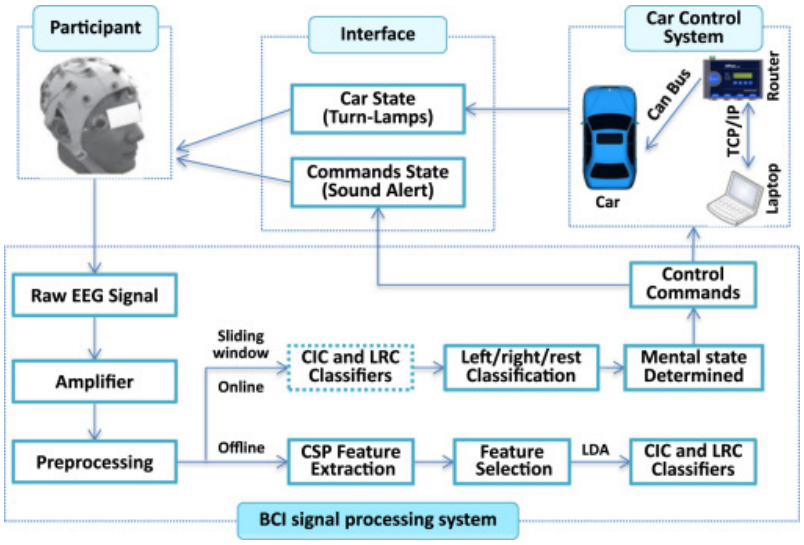
How to post:

1. Check if someone else has posted the paper.
2. Paste the title of the paper.
3. In bullet points, paste the doi (ask if you can't find it) and publication date.
4. In more bullet points, summarize significant takeaways from the paper including methods used, challenges, and relevance to our project.

You may need to use the campus VPN in order to access the papers.

The first few are pulled from searching "brain controlled car" in scholar.google.com.

"Toward brain-actuated car applications: Self-paced control with a motor imagery-based brain-computer interface"

- https://doi.org/10.1016/j.compbiomed.2016.08.010
- 2016
- Used motor imagery (MI) to control car
- Distinguished rest versus MI signals, then distinguished left versus right tasks
- 

- Passband: 8-34 Hz
- Offline training of classifiers -> online application of classifiers, data processed every 100 ms with 100 ms sliding window

"Design of Brain Controlled Robotic Car using Raspberry Pi"

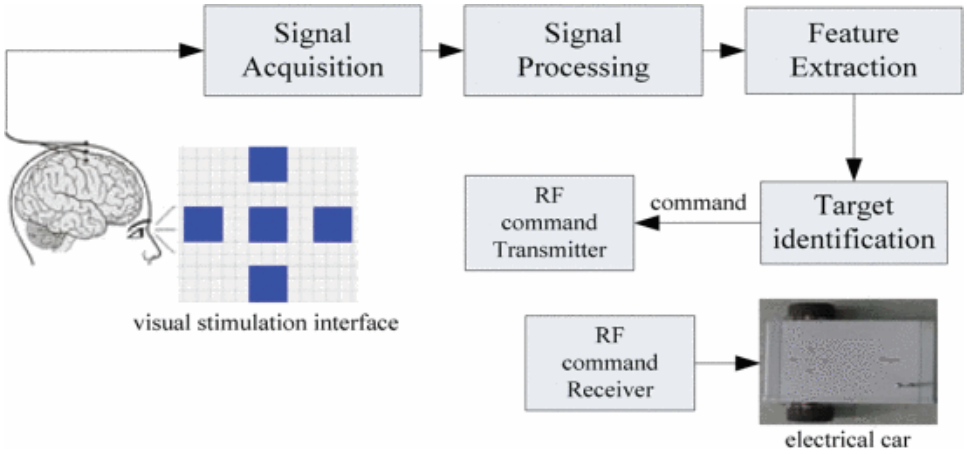
- https://doi.org/10.1109/ICOEI51242.2021.9452957
- 2021
- Not very in depth, don't use

"EEG-based asynchronous BCI control of a car in 3D virtual reality environments"

- https://doi.org/10.1007/s11434-008-0547-3
- 2009

- Uses virtual environment to test cars
- Uses motor imagery
- Paywall :(

“Remote control of an electrical car with SSVEP-Based BCI”

- https://doi.org/10.1109/ICITIS.2010.5689710
- 2010
- 

- Visual interface in order to distinguish intent
- Average signals and FFT used for feature extraction
- Not too much on the electrical car

“The control of a virtual automatic car based on multiple patterns of motor imagery BCI”

- https://doi.org/10.1007/s11517-018-1883-3
- 2019
- Usage of left hand, right hand, foot, and both hands motor imagery
- Passband: 8-30 Hz
- Motor imagery -> changes in passband
- Common average reference (CAR) filtering
- SVM used to classify signals
- Acceleration, deceleration, turning right, turning left

“Current status, challenges, etc of BCI”

- doi: 10.3389/fnbot.2020.00025
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7283463/

“Noninvasive neuroimaging enhances continuous neural tracking for robotic device control”

- Doi: 10.1126/scirobotics.aaw6844
- https://www.science.org/doi/10.1126/scirobotics.aaw6844

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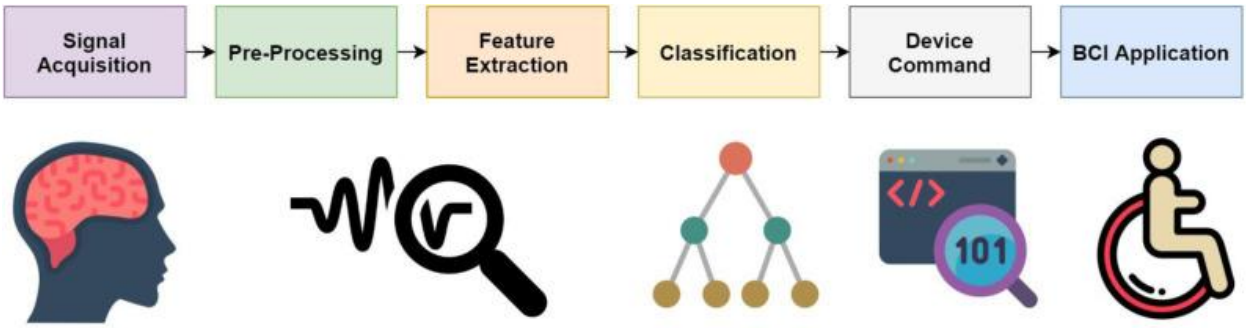


- Synchronous v asynchronous BCI, former is easier to build and more user-friendly, asynchronous generates mental task for BCI to complete at certain time
- Different types of potentials: movement-related cortical potential, error-related potential, slow cortical potential, steady state evoked potential; each have different purposes relating to what brain wants the body to do
- BCI that are real-time need removal methods that are automatic, the filtering methods can be automatically executed when they are given a reference signal
- Will need many reference signals, the more we have, the better
- Autoregressive modeling = “linear regression of the current observation of the series against one or more earlier observations.”
- Classification Methods: support vector machine, neural network, linear discriminant analysis, bayesian classifier, k-nearest neighbor, and deep learning approaches (described in depth in article)
- Performance evaluation: receiver operating characteristics and area under the curve
- Challenges: some modalities have signal processing issues, sometimes because of the nature of EEG signals (artifact prone, extremely nonlinear and nonstationary)
    - Too long of calibration period for specific candidate, not realistic results to use on a random person
    - Lack of adequate data analysis methods, some have more limitations than others
    - No standard performance evaluation amongst community

“Evaluating If Children Can Use Simple Brain Computer Interfaces”

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6369154/
- doi: 10.3389/fnhum.2019.00024
- measure signals using cohen’s kappa, goes under ML
- cohen’s kappa: relates to raters (quantitative to qualitative)
- lot of info on the trial itself

“A passive BCI for monitoring the intentionality of the gaze-based moving object selection”

- https://iopscience.iop.org/article/10.1088/1741-2552/abda09
- doi:10.1088/1741-2552/abda09
- moving ball, moving window of 867 ms in length
- filtered with zero-phase lowpass 4th order Butterworth filter, cutoff frequency =30Hz
- used linear discriminant analysis

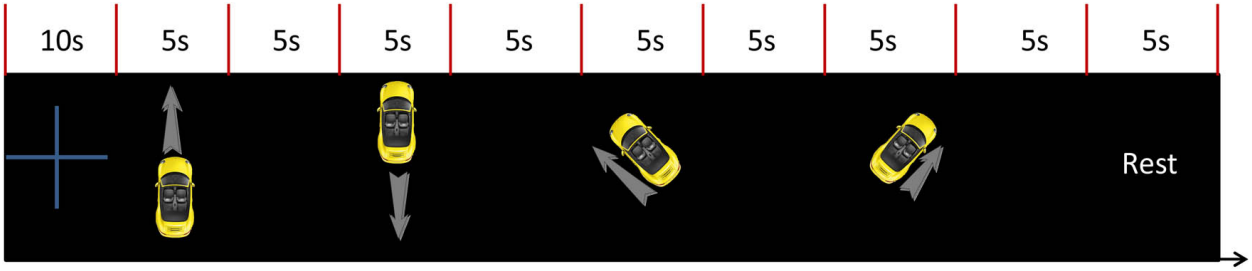
“Milo: The Brain-Controlled Wheelchair”

- McGill NTX Github
- eye blink = start, jaw clench = stop
- 250 Hz, 2s window
- PSD to extract mu and beta band power

“Brain Computer Interface for Controlling RC-Car Using Emotiv Epoc+”

- 2018
- 14-channel EEG
- SSVEP
- 12-20 Hz pass-band
- SVM classification of left, right, and forward signals using visual stimulus

“A novel strategy for driving car brain–computer interfaces: Discrimination of EEG-based visual-motor imagery”

- https://doi.org/10.1515/tnsci-2020-0199
- 2021
- visual motor imagery - imagining car turning R/L, reversing, and moving forward
- 

- Correlation between channels calculated for each motion
- Online implementation not tested
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