

Auditory Attention Classification with Contrastive Learning

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This thesis aims to obtain a possible solution for the cocktail party problem, this is, train a neural network to identify which sound a person is attending to from EEG measurements

On many occasions you might find yourself on a party where there are many people talking, possibly background music and noise but you are still able to maintain a conversation with another person. We easily and unconsciously ignore everything except what we actually want to attend to, this, however, is very difficult to do for a computer algorithm. This is commonly known as the “cocktail party problem” and is what this project is trying to solve. Finding a solution to this problem could be helpful in many areas but specifically helpful for hearing aids. People with hearing disabilities which need hearing aids in their day to day lives find it difficult to be in situations where a lot of sounds are present as the hearing aids still can’t successfully identify and isolate whatever the user wants to listen to, this causes the users to avoid a lot of the common social situations and lowers their quality of life. This is why a solution to the cocktail party problem is needed.

With the increasing popularity of machine learning in almost every area of study it has naturally been applied to the cocktail party problem. The basic idea is trying to teach a neural network to identify what we want to listen to. With various sensors placed in specific parts of a persons head an electroencephalography (EEG) reading can be measured, this is a recording of the electrical activity in our brains. If this person is listening to many things but attending only one the hypothesis is that this will be recorded in the EEG. We want to be able to give this EEG to the neural network and in return obtain a reconstruction of the attended audio. We also provide the network with the audio signals the person was listening to and the network should respond which one of those was the attended one. There are many machine learning techniques that have been applied to the problem in the most recent studies but in this project we focus specifically on one technique called contrastive learning which influences the way the network handles the information in order to learn the necessary patterns to obtain a good classification.