Thesis summary – use plain language

My current thesis work explores the possibility of building a music-based brain computer interface (BCI) using electroencephalography (EEG). Such a BCI could be used by patients that have severe motor deficits that are not able to communicate behaviourally. In this experiment I had participants listen to and then imagine short clips from 12 familiar pieces of music (nursery rhymes, Christmas carols etc.) while their EEG data was collected. I want to be able to tell from the EEG data what piece of music the participant was listening to or imagining.

Our first analysis involved using autocorrelations on task relevant event-related potentials (ERPs). This allowed us to estimate the tempo of the perceived and imagined music. These initial results were presented at the 1st International Workshop on Brain-Computer Music Interfacing. Our next step was to find a more robust method of classifying music from EEG data. For this we turned to machine learning algorithms. Using convolutional autoencoders as part of a convolutional neural net we ran two types of classification experiments. The first experiment tried to classify the stimuli into two groups based on the time signature of the music (either 3/4 or 4/4). The second experiment tried to identify each of the stimuli by classifying them into their 12 stimulus categories. These results were presented at the Society for Music Perception and Cognition 2015.

In the first experiment we were able to classify perception of music into two categories with a __% accuracy rate and imagination of music with a __% accuracy rate (chance for both is at 50%). In the second experiment we were able to classify perception of music in 12 categories with a __% accuracy rate and imagination of music with a __% accuracy rate (chance for both is at 8.3%).

Although all of these results are statistically above chance, the accuracy rates of our classification are not reliable enough to be used in a BCI. During the remainder of my Master's thesis work I will be working to try and improve these accuracy rates by modifying aspects of the analysis or the stimuli.

Key Words (up to 10)
- Electroencephalography (EEG)
- Brain computer interface (BCI)
- perception
- imagination
- music
- machine learning