Generating Timbre for Multiple Instruments Through Auditory Nerve Models and Its Relevance to Cochlear Implants

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Bridge UnderGrad Science (BUGS) ***Summer Research Program***

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Abstract

How is timbre encoded in the auditory nerves? The auditory nerve runs from the cochlea to the nucleus, transmitting auditory information from the cochlea to the inner ear to the brain. The programming platform MATLAB has been used to model the auditory nerve reaction to various instrument timbres. The objective is to look at the differences between the auditory nerve model and the cochlear implant model.

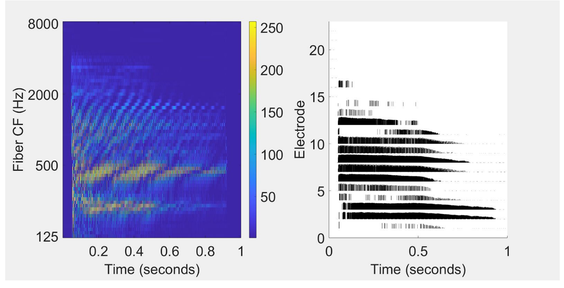
Looking at the timbre from this algorithm allows exploration and observations of the cochlear implant users' experience of how their auditory nerves are impacted. The instruments of piano, saxophone, bassoon, electric guitar, and triangle utilized different notes, highlighting the discrepancies between the auditory nerve model and the cochlear implant model.

The observations would show timbre discrimination between the multiple instruments used in the auditory nerve model. This refers to the model being able to distinguish the different instruments and their generated timbre.

These observations can lead to the development of cochlear implants and the brain's adaptability to auditory input.

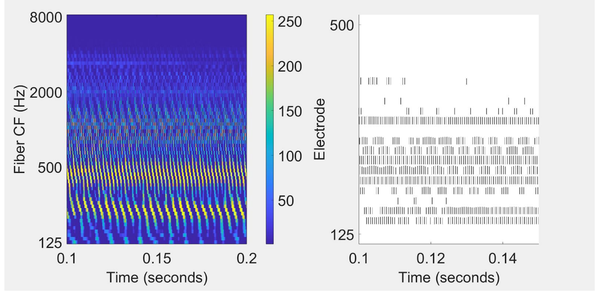
Auditory Nerve Models & Cochlear Implant Models Of Piano

Auditory Nerve Model and Cochlear Implant Model of Piano



The more yellow the color plot, the active the stimuli.

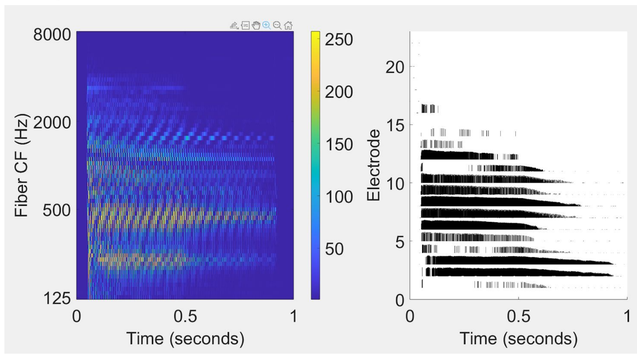
Auditory Nerve Model and Cochlear Implant Model of Piano (Zoned In)



The cochlear implant model showcases electric stimuli. The black portion of the model means there is no fundamental.

Auditory Nerve Models & Cochlear Implant Models Of Bassoon

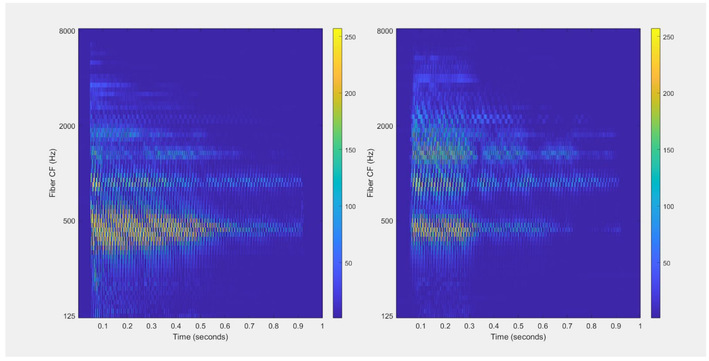
The cochlear implant model is limited with the maximum of electrodes being 25.



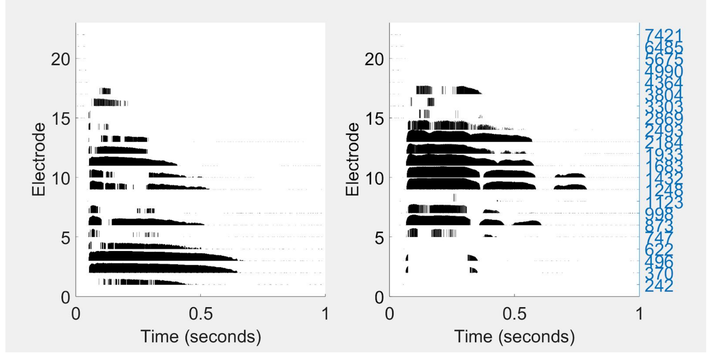
These models are zoned in to better showcase the tibre section of the bassoon.

Comparing Auditory Nerve Models & Cochlear Implant of Piano and Saxophone

Auditory Nerve Model of Piano (Left) and Saxophone (Right)



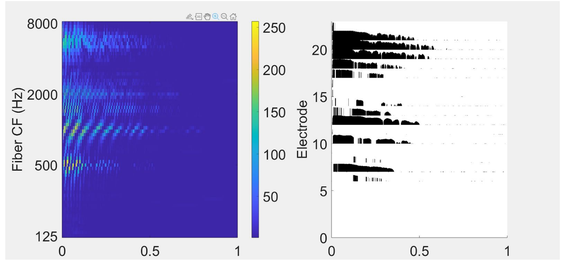
Cochlear Implant Model of Piano (Left) and Saxophone (Right)



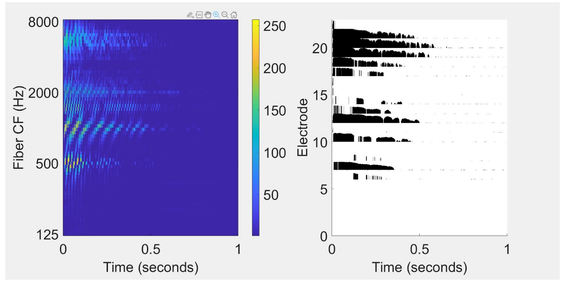
The saxophone was more explosive at the beginning of the note. The piano has a stronger fundamental that ends slowly.

Auditory Nerve Models & Cochlear Implant of Electric Guitar and Triangle

Auditory Nerve Model and Cochlear Implant Model of Electric Guitar



Auditory Nerve Model and Cochlear Implant Model of Triangle



The fundamentals are fading. The cochlear implant model is missing fundamentals, making it less accurate.

Summary

1. The auditory nerve transmits auditory information from the inner ear to the cochlea to the brain, and MATLAB has been used to model the discrepancies of various instruments between the auditory nerve model and the cochlear implant model.
2. The objective is to examine the difference between the auditory nerve model and the cochlear implant model.
3. The auditory nerve models highlight the difference between the timbres of the various instruments will lead to advancement in cochlear implant technology and understanding of the brain's adaptability to auditory input.

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