CPSC 8650 (Section 1) Data Mining Course Project

Background

Hearing loss is a partial or total inability to hear sounds in one or both ears. Hearing loss can result from damage or dysfunction at any point along the auditory pathway, from the outer ear to the auditory cortex in the brain. It can be caused by a variety of factors, including aging (presbycusis), genetics, exposure to loud noise, infections, ototoxic medications, and various medical conditions. Relevant research has indicated the metabolic and sensory components are strongly related to age-related hearing loss (https://pubmed.ncbi.nlm.nih.gov/35064426/).

Meanwhile, brain MRI imaging has been widely used by neurologists and neuroscientists in disease diagnosis and human brain study since the 1980s. Gray matter images are derived from brain MRI scans using specialized processing techniques. Understanding the association between age-related hearing loss and brain structure is crucial to identifying potential cognitive decline of hearing impairment. In general, hearing loss is measured using a pure tone audiometer, which refers to the quietest sound that an individual can hear and is measured in decibels (dB). Some subjects show greater hearing loss at lower frequencies, while others exhibit more hearing loss at higher frequencies.

Project Requirements:

Students need to develop data mining (preferably deep learning) methods to predict subjects' hearing thresholds based on gray matter images. The students will be given a dataset, which includes the subject's gray matter images of Brain MRI scans and their associated hearing thresholds at two different pure-tone frequencies. The students need to train at least three different prediction models to predict the hearing thresholds of the subjects at these two pure-tone frequencies based on gray matter images. Students need to compare the performance of these prediction models using various evaluation metrics and write a technique report to discuss their methods and performance study results.

Students who have finished the above basic requirements may further develop algorithms to identify and visualize the brain regions that are highly associated with age-related hearing loss.

Project Deliverables and Due Dates:

1. Project presentation slides, due on Friday, April 12, 2024
2. Final project report, due on Friday, April 19, 2024

Warning:

- Teams must finish the project independently. Any form of cheating will result in **0 (zero)** points for the project.
- Students must submit the project deliverables before the due dates. Late submission will not be accepted and will result in **0 (zero)** points for the project.