Assignment 10: Spectogram Demo	
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a. What is a spectrogram?

A spectrogram is a visual representation of the spectrum of frequencies of a signal as it varies with time. It is a graphical representation of the frequency content of a signal over time. The spectrogram is a two-dimensional plot, with time on the horizontal axis and frequency on the vertical axis. The brightness or color of each point in the spectrogram represents the strength of the signal at that frequency at that point in time.

b. What are its uses?

Spectrograms are used in a wide variety of fields, including:

Audio analysis: Spectrograms are used to analyze the frequency content of audio signals, such as speech, music, and noise. They can be used to identify different types of sounds, such as human voices, musical instruments, and animal calls.

Speech recognition: Spectrograms are used in speech recognition systems to analyze the frequency content of speech signals. They can be used to identify different phonemes, which are the basic units of sound in speech.

Image processing: Spectrograms are used in image processing to analyze the frequency content of images. They can be used to identify different features in images, such as edges, textures, and objects.

Medical imaging: Spectrograms are used in medical imaging to analyze the frequency content of medical images, such as MRI scans and CT scans. They can be used to identify different features in medical images, such as tumors and other abnormalities.

Astronomy: Spectrograms are used in astronomy to analyze the frequency content of light from stars and galaxies. They can be used to identify different elements in the stars and galaxies, and to measure their redshift, which is a measure of how fast they are moving away from us.

2. Look for a signal processing research that utilizes a spectrogram for analysis. Describe its purpose, and explain how the spectrogram was used. Don't forget to include the link to the research

Research Title: "A Spectrogram-Based Approach for Automatic Diagnosis of COVID-19 Using Cough Sounds"

Purpose:

The purpose of this research was to develop a spectrogram-based approach for the automatic diagnosis of COVID-19 using cough sounds. The researchers hypothesized that the frequency content of cough sounds could be used to distinguish between healthy individuals and individuals with COVID-19.

Methodology:

The researchers collected cough sounds from a dataset of patients with COVID-19 and healthy individuals. They then extracted spectrograms from the cough sounds and used machine learning algorithms to classify the cough sounds as either COVID-19-positive or COVID-19-negative.

Results:

The researchers found that their spectrogram-based approach achieved an accuracy of 90% in classifying cough sounds as either COVID-19-positive or COVID-19-negative. This suggests that spectrograms may be a promising tool for the automatic diagnosis of COVID-19.

Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9975504/

3. Write a functional source code implementing a spectrogram function in python. (link to colab / ipynb file in gdrive)

- https://colab.research.google.com/drive/1Ie4LBlvtUIUmiCLOfJcQ-fgW2d21mOuV?usp=sharing
- https://dolby.io/blog/beginners-guide-to-visualizing-audio-as-a-spectogram-in-python/