

Intro to Machine Learning

Key Words

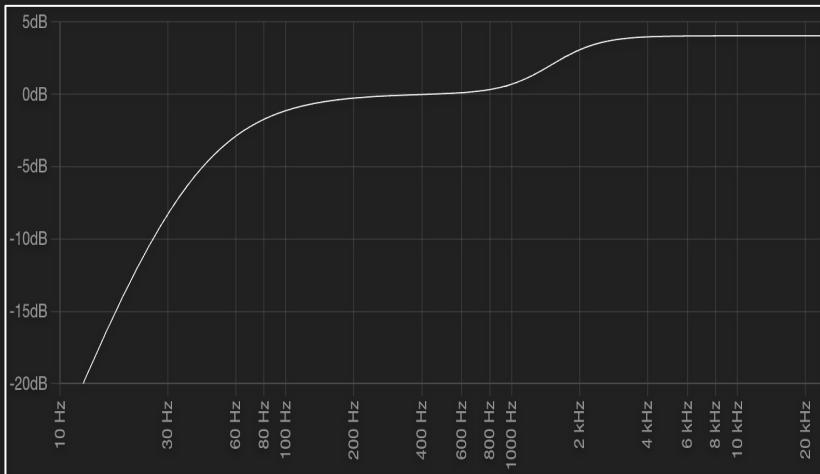
- Data Collection
- Training / Test Sets
- Training Process
 - Epoch / Iteration
- Metrics
 - Loss / Accuracy
- Issues
 - Overfitting / Underfitting
- Neural Network
- Prediction Vs. Generalization

Audio Classifiers

Analyzing our audio for processing

Loudness

An audio descriptor that attempts to model such characteristics of human hearing according to the EBU R128 specification.



Spectral Shape

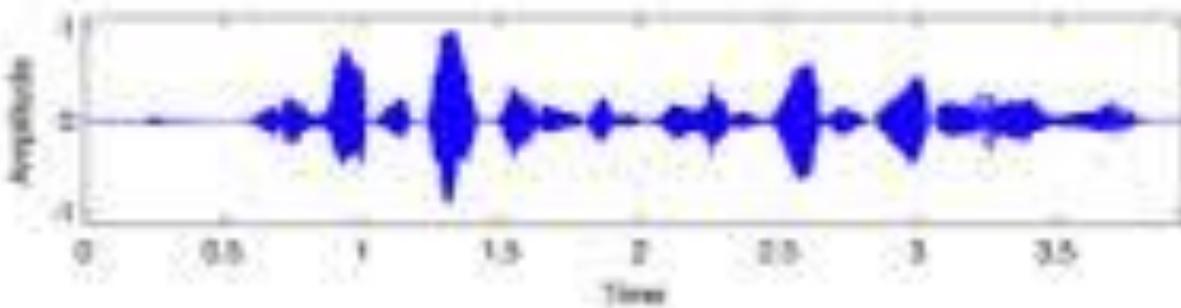
An object that calculates several audio descriptors and bundles them together. This collection of audio descriptors describe the shape of a spectrum, and might tell us something about the characteristics of a sound.

- Spectral Centroid
- Spectral Spread
- Spectral Skewness
- Spectral Kurtosis
- Spectral Rolloff
- Spectral Flatness
- Spectral Crest

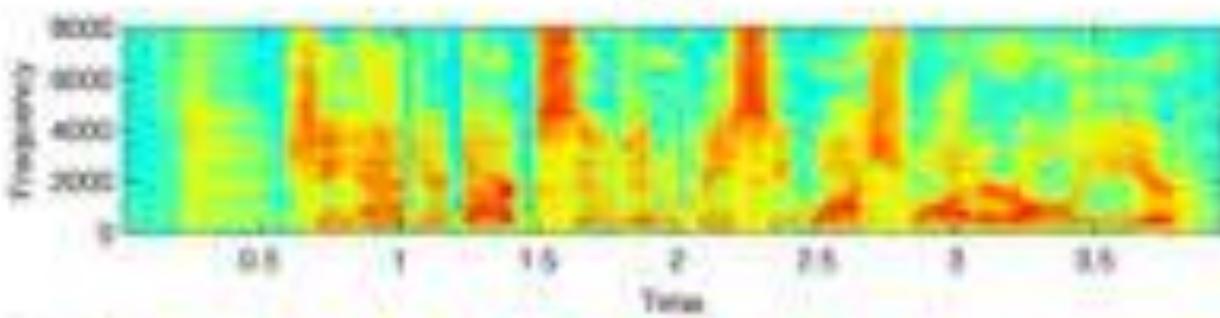
Mel-Frequency Cepstrum Coefficients (MFCC)

An audio classifier that is often used for timbral description and timbral comparison. It compresses the overall spectrum into a smaller number of coefficients that, when taken together, describe the general contour of the spectrum.

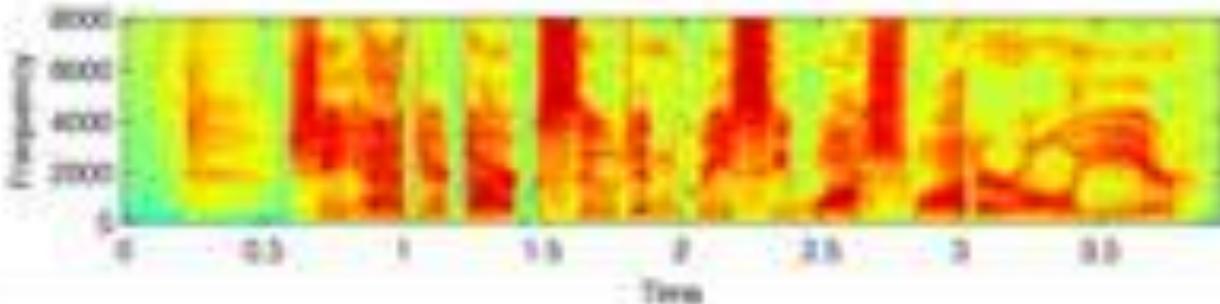
Time Domain Waveform



Spectrogram



MFCC Spectrogram



Hidden Markov Model (HMM)

A statistical model used to predict a **sequence** of **hidden events** based on a set of visible **observations**

Characteristics

- Supervised Learning
- Non-Parametric

Main Components

- Hidden States (S)
- Observations (O)
- Transition Probabilities (A)
- Emissions Probabilities (B)
- Initial Probabilities (π)

Example 1: George's Routine

George is in the city and calls their mother every evening. He says what he did that day and the mom is curious what the weather is and can base it off of what he did that day.

The last 3 days he:
Went on a walk, went shopping, then cleaned their apartment

Transition Layer

Current State	Next Sunny	Next Rainy
Sunny	0.8	0.2
Rainy	0.4	0.6

Observation Layer

Current State	P(Walk)	P(Shop)	P(Clean)
Sunny	0.6	0.3	0.1
Rainy	0.1	0.4	0.5

Max Example

Melody Generation

K-Nearest Neighbor (KNN)

A supervised machine learning algorithm used for classification (sorting data into groups) and regression (predicting a number), and search (finding similar points) by looking at the 'k' closest neighbors in the dataset

Characteristics

- Supervised Learning
- Non-Parametric
- Choosing K

Pipeline

- Choose K
- Measure distance
- Identify Neighbors
- Vote / Average

Example 1: Dogs vs Cats

Example 2: Netflix and Spotify Recommendations

Max Example: Snare Vs. Kick