Identification of Instruments Through Sound Characteristics

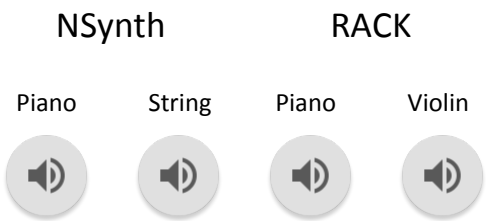
Avery Cameron, Raymond Knorr, Mason Lane, Kegan Lavoy

Problem Description

- Audio files for music purposes do not contain explicit information about which instruments are included
- Manual annotation of audio is slow and limited
- Developing individual classifiers to distinguish notes played on different instruments is vital for larger applications.
- Need a model that can generalize to different note lengths, pitches, and tones from the same instrument

Approaches

- Extracted features from WAV files for training
- Analyzed features for predictive strength
- Built datasets to CSV files



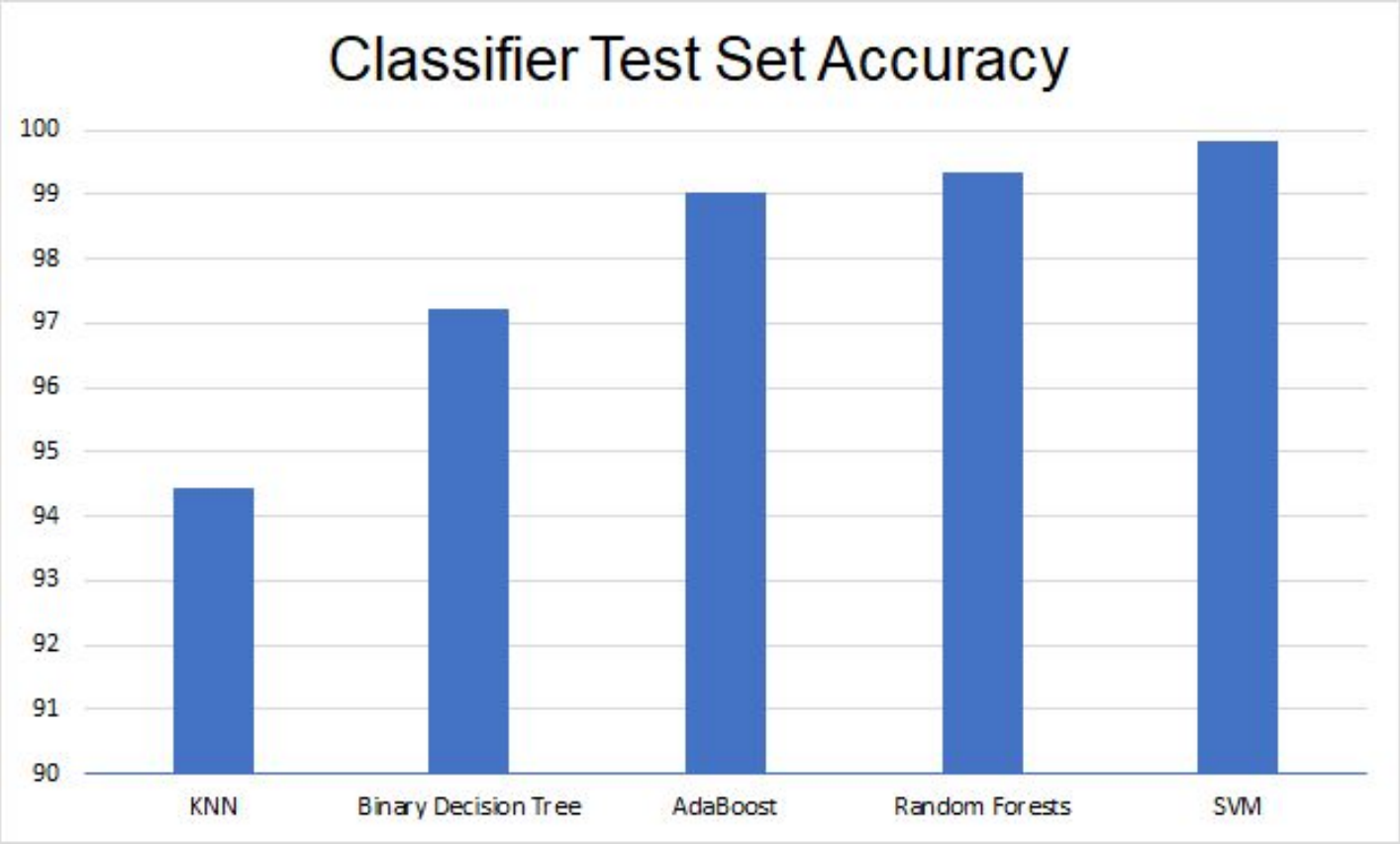
AdaBoost
Used Scikit-learn's AdaBoost classifier. Hyper parameter *estimator* value tuned to 98 using an automated search.

SVM
Used Scikit-learn's SVM implementation. Optimized parameters of an *rbf* kernel. *C* of 100, and a *gamma* of 0.00001 delivered the best results after running 64 combinations.

Random Forests
Used Scikit-learn's Random Forest Classifier. Hyper parameters were optimized using a Scikit-learn Randomized SearchCV.

KNN
Used a Scikit-learn KNN Classifier. Hyper parameter K was optimized manually to 27 and 17 for Nsynth and RACK datasets respectively.

Results


Classifier Test Set Accuracy
100
99
98
97
96
95
94
93
92
91
90
KNN
Binary Decision Tree
AdaBoost
Random Forests
SVM

References

Engel, J., Resnick, C., Roberts, A., Dieleman, S., Eck, D., Simonyan, K., & Norouzi, M. (2017). Neural Audio Synthesis of Musical Notes with WaveNet Autoencoders.

Kawwa, N. (2019, April 29). Can We Guess Musical Instruments With Machine Learning?

Pedregosa, F., Varoquaux, G., Gramfort, A., Michel, V., Thirion, B., Grisel, O., Blondel, M., Prettenhofer, P., Weiss, R., Dubourg, V., Vanderplas, J., Passos, D., Brucher, M., Perrot, M., & Duchesnay, E. (2011). Scikit-learn: Machine Learning in Python

Seipel, F. (2018). Music Instrument Identification using Convolutional Neural Networks

Xu, M., Duan, L.-Y., Cai, J., Chia, L.-T., Xu, C., & Tian, Q. (2004). HMM-Based Audio Keyword Generation. *Advances in Multimedia Information Processing - PCM*