The Genre Factor

Project Presentation - ML Seminar 2023

Henry Krämerkämper
Christopher Breitfeld

13.07.2023

Technische Universität Dortmund

Introduction to the Problem

- Genre classification of songs based on the tracks features
- Dataset: Thousands of songs with diverse genres
- Challenge: Developing an accurate classification model

Feature	Value
Artist	Gorillaz
Url_spotify	`https://open.spotify...`
Track	Feel Good Inc.
Album	Demon Days
Album_type	album
Uri	spotify:track:0d28khcov6AiegS...
Danceability	0.818
Energy	0.705
Key	6.0
Loudness	-6.679
Speechiness	0.177
Acousticness	0.00836
Instrumentalness	0.00233
Liveness	0.613
Valence	0.772
Tempo	138.559
Duration_ms	222640.0
Url_youtube	`https://www.youtube...`
Title	Gorillaz - Feel Good Inc. (Official...
Channel	Gorillaz
Views	693555221.0
Likes	6220896.0
Comments	169907.0
Description	Official HD Video for Gorillaz'...
Licensed	True
official_video	True
Stream	1040234854.0

Description of the Data Set

Dataset from Kaggle: Spotify and YouTube

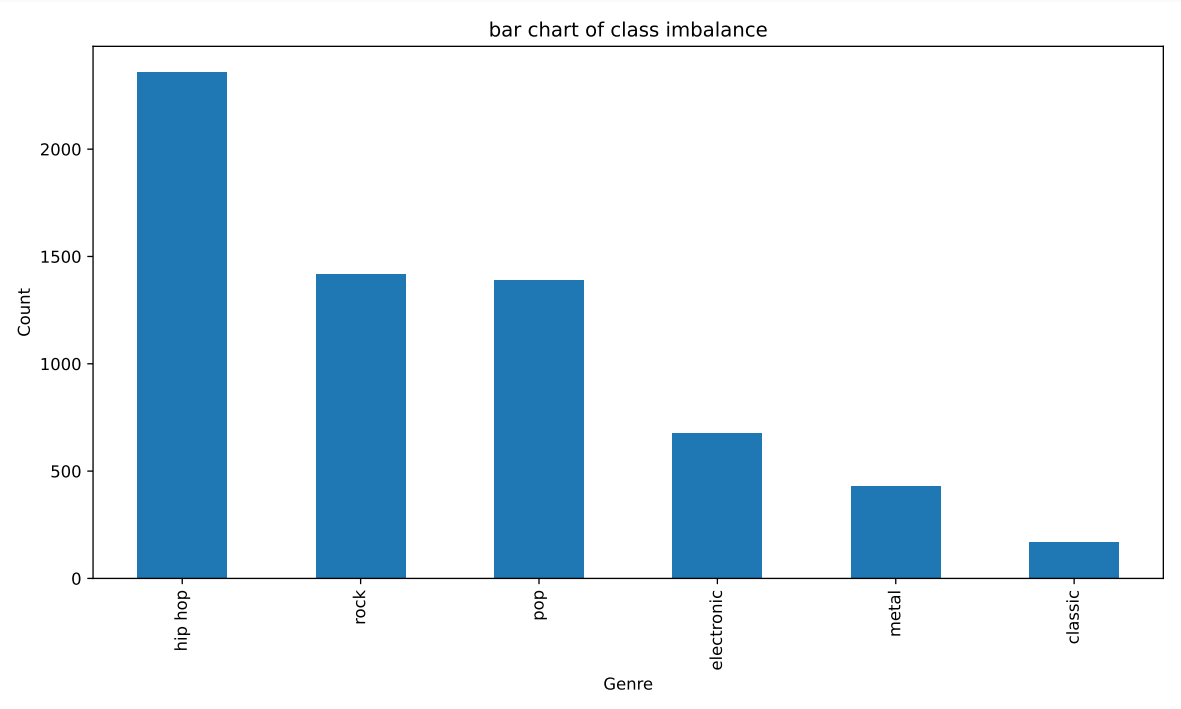
- Contains statistics of 20.7 k songs on Spotify and YouTube
- Does NOT include genre information.

Wikidata Query for the Top-Genre of the Artist

- Query artist's Wikidata page for genres
- Assign artists/album genre to song

Selection

- Group Subgenres into Supercategories
- Select sample of 6 Genres
- Remaining Songs: 6446



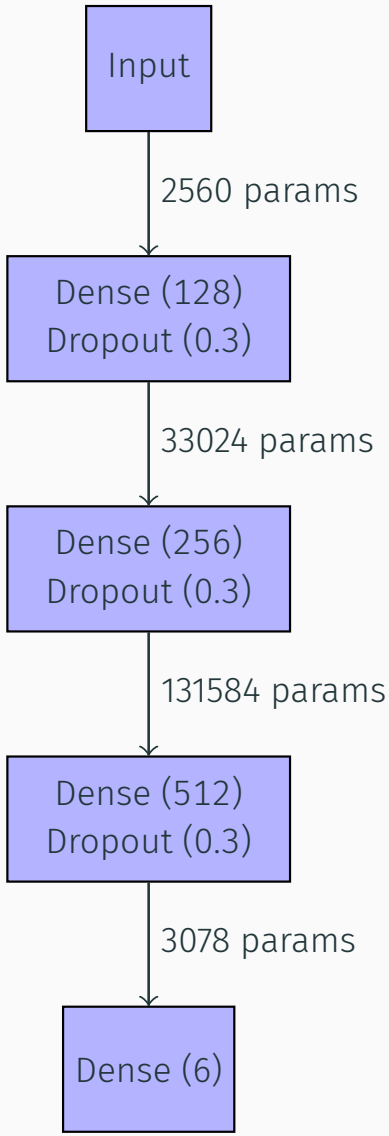
Network Architecture

Model

- 4 Dense Layers with Dropout
- Trainable parameters: 170 246
- Loss function: categorical crossentropy
- Optimizer: adam

Training

- Early stopping: Stops training when the validation loss function no longer improves
- Reduce learning rate: Decreases learning rate if validation loss function stagnates
  →better convergence
- Train the model using the training data with the defined set of hyperparameters.



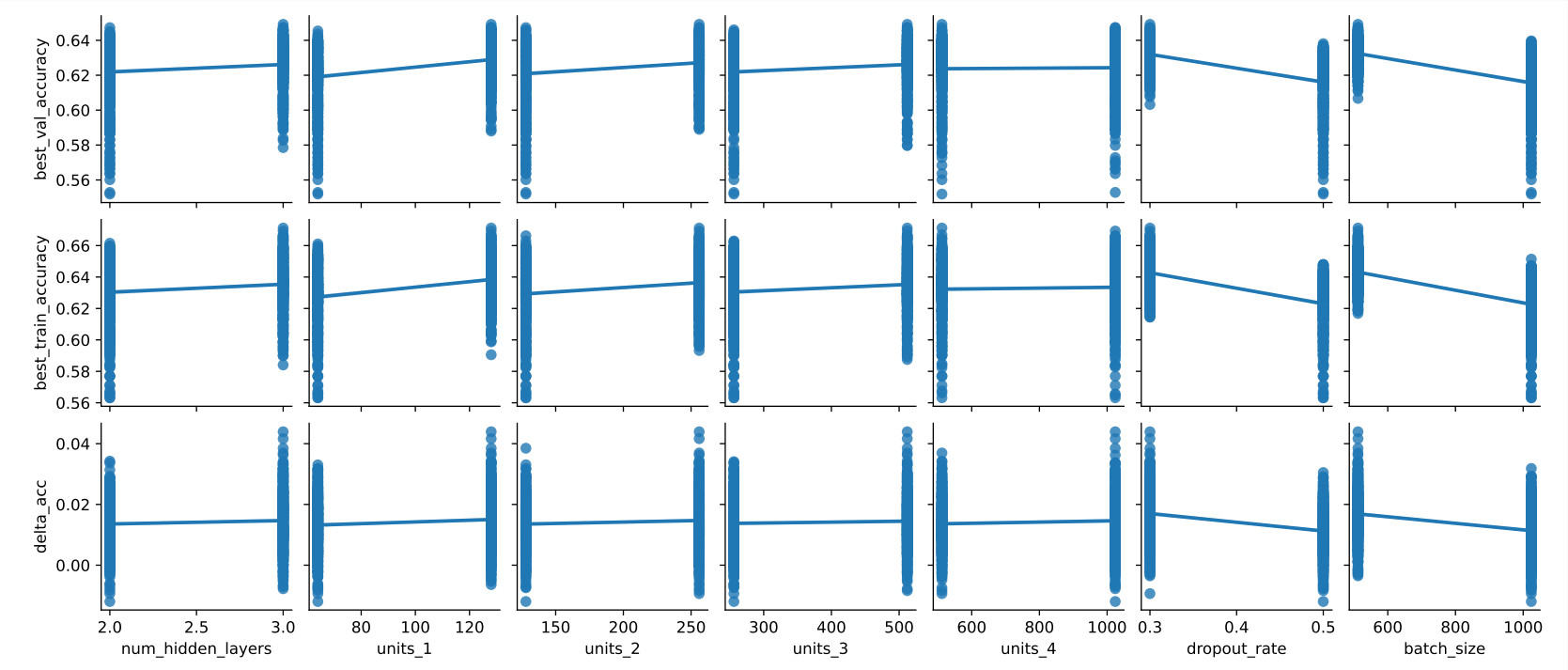
Hyperparameter Optimization

Method

- Grid Search: Train models with all combinations of hyperparameters

Validation

- $k = 3$ Cross Validation
- Save train/validation Accuracy and Loss

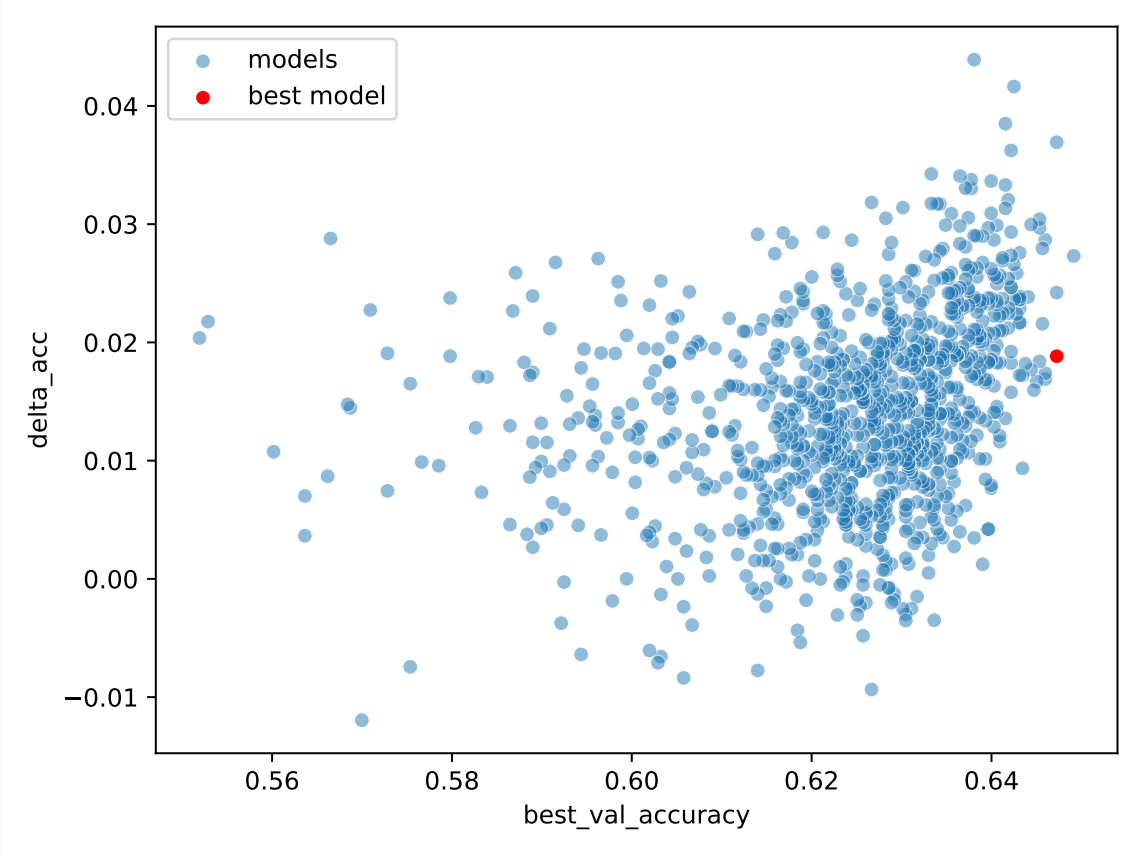


Overtraining Checks

Methods to prevent Overtraining

- Dropout
- Early stopping
- Minimize (Training Acc. - Validation Acc.) but maximize Validation Acc.

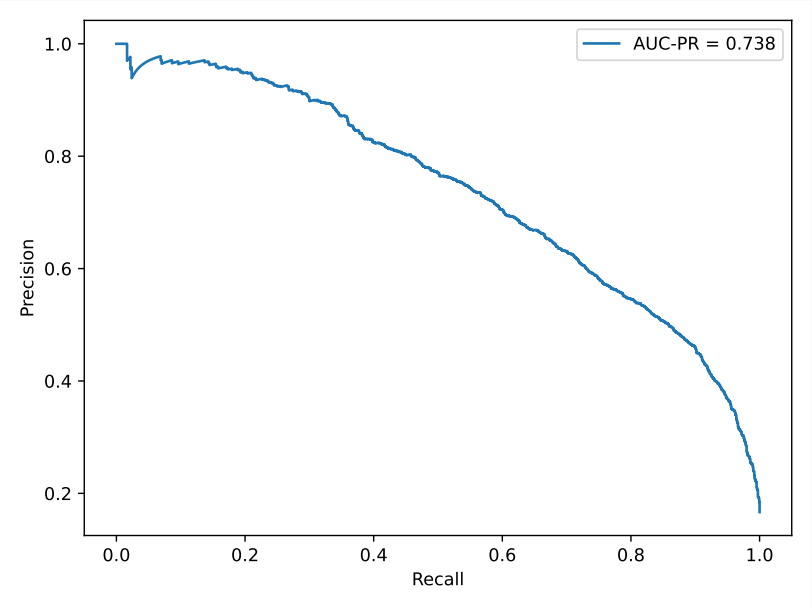
Try different values and decide after Hyperparameter Optimization

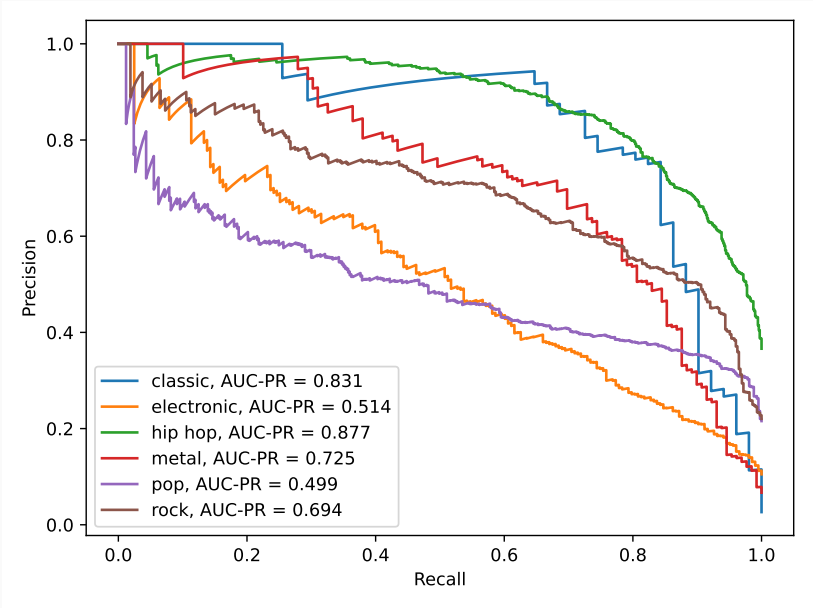


Results of our Neural Network

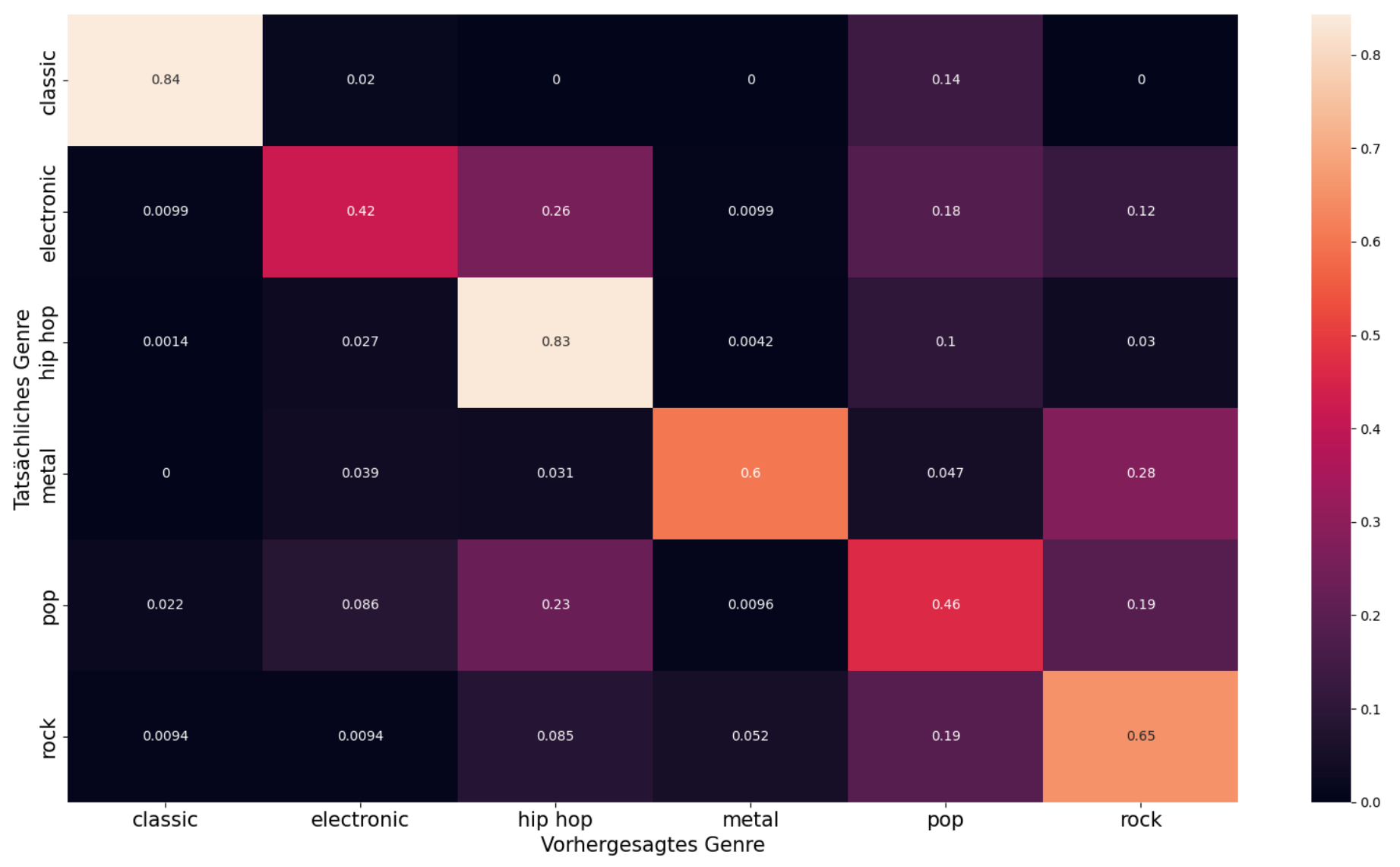
Accuracy and AUC-PR

- Results in an accuracy of $65.56\,\%$ on test data
- As well as an AUC-PR score of 0.738





Results of our Neural Network



Alternative Methods

K-nearest-neighbors

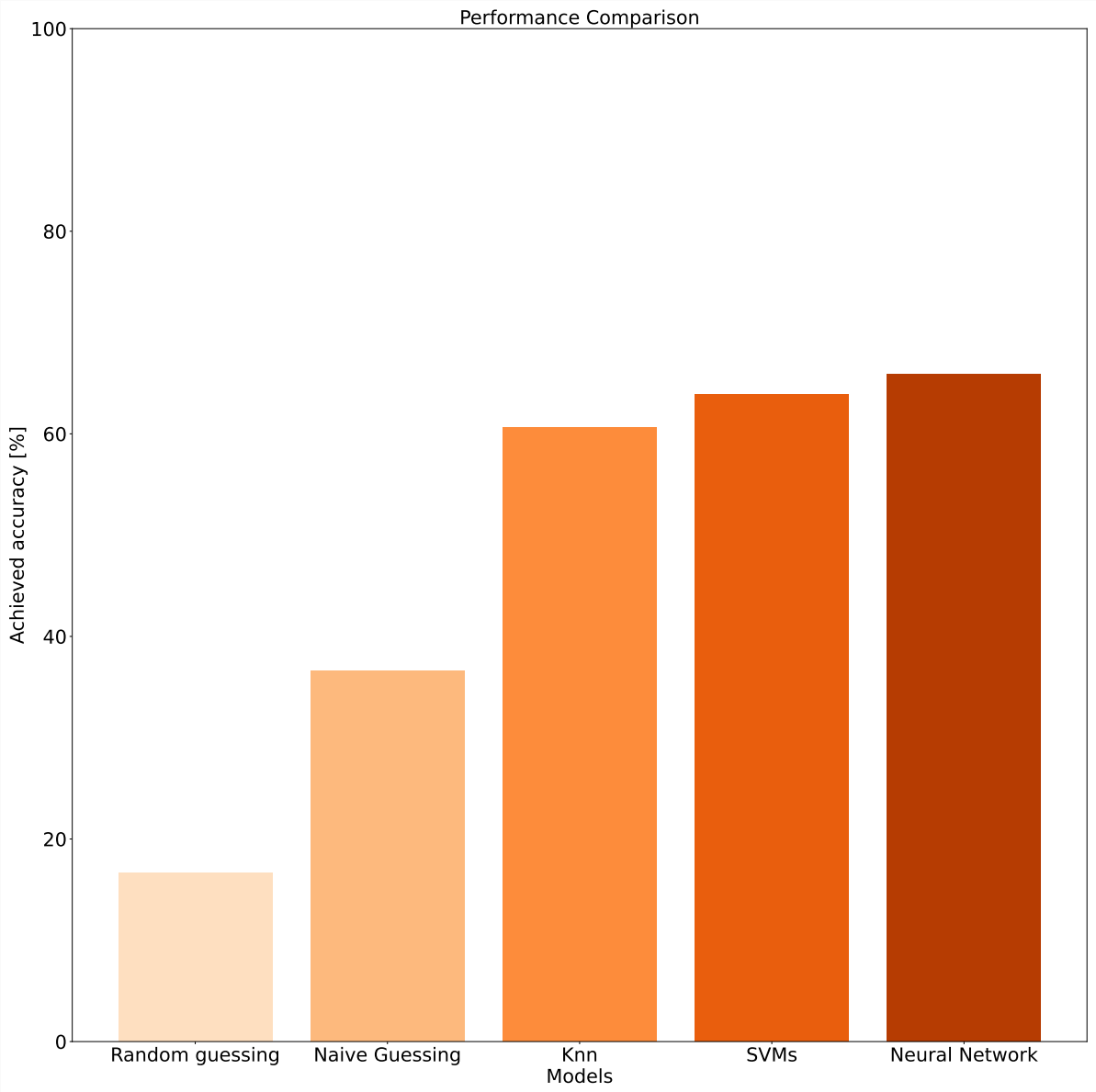
- Use $k = 12$ as it achieves the highest performance
- Results in an accuracy of $60.62\,\%$

Support vector machines

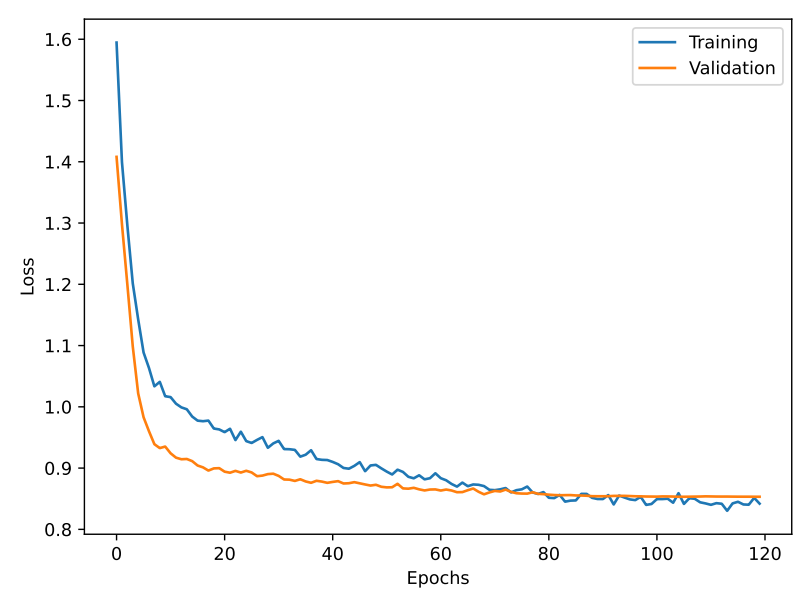
- Model that classifies data by finding the hyperplane that maximally separates different categories in a multidimensional space
- Use an One-vs-One approach to be able to do Multiclass-Classification:
  - A separate model is trained for each pair of classes, and a given data point is classified by majority voting among the classifiers
- The used kernel function is the radial basis function (RBF)
- Results in an accuracy of $63.88\,\%$

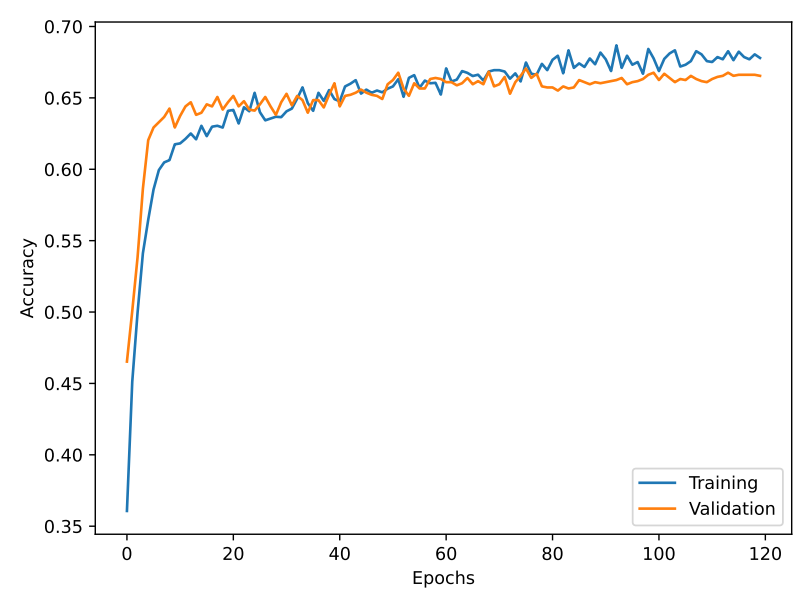
Conclusions

- NN achieves an accuracy of $65.56\,\%$ on test data.
- Diminishing returns for more complex models, we are constrained by the dataset

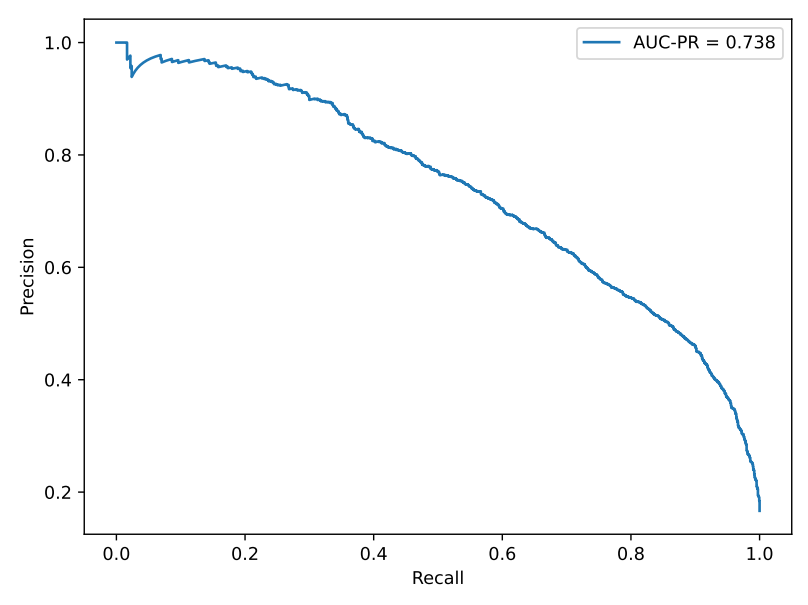


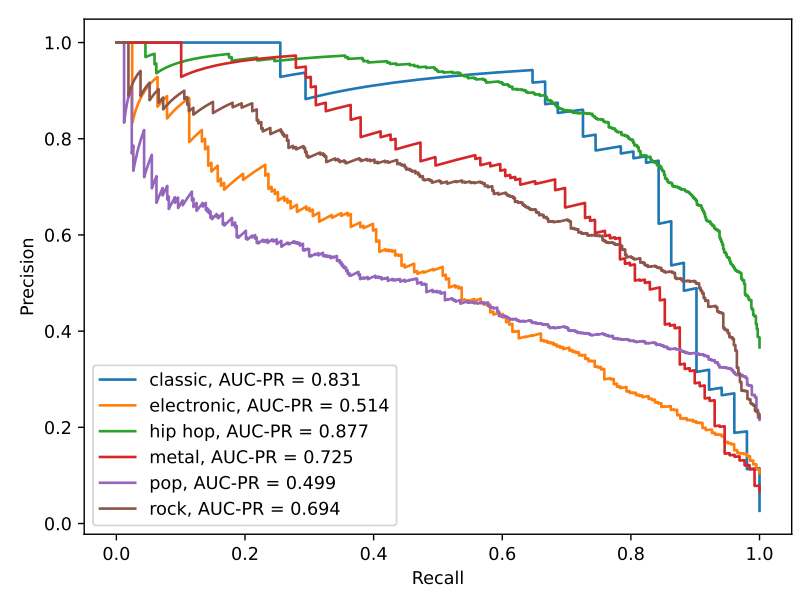
Appendix: Accuracy and Loss





Appendix: Precision-Recall Curve





Appendix: Substructure of Hip Hop