

# Music Genre Classification Using Machine Learning

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# Project overview

**Goal:** Develop a machine learning model capable of classifying music genres based on various audio features extracted from songs.

**Application :** Several areas such as music recommendation systems, content-based music search engines, and music recognition apps.

# Dataset

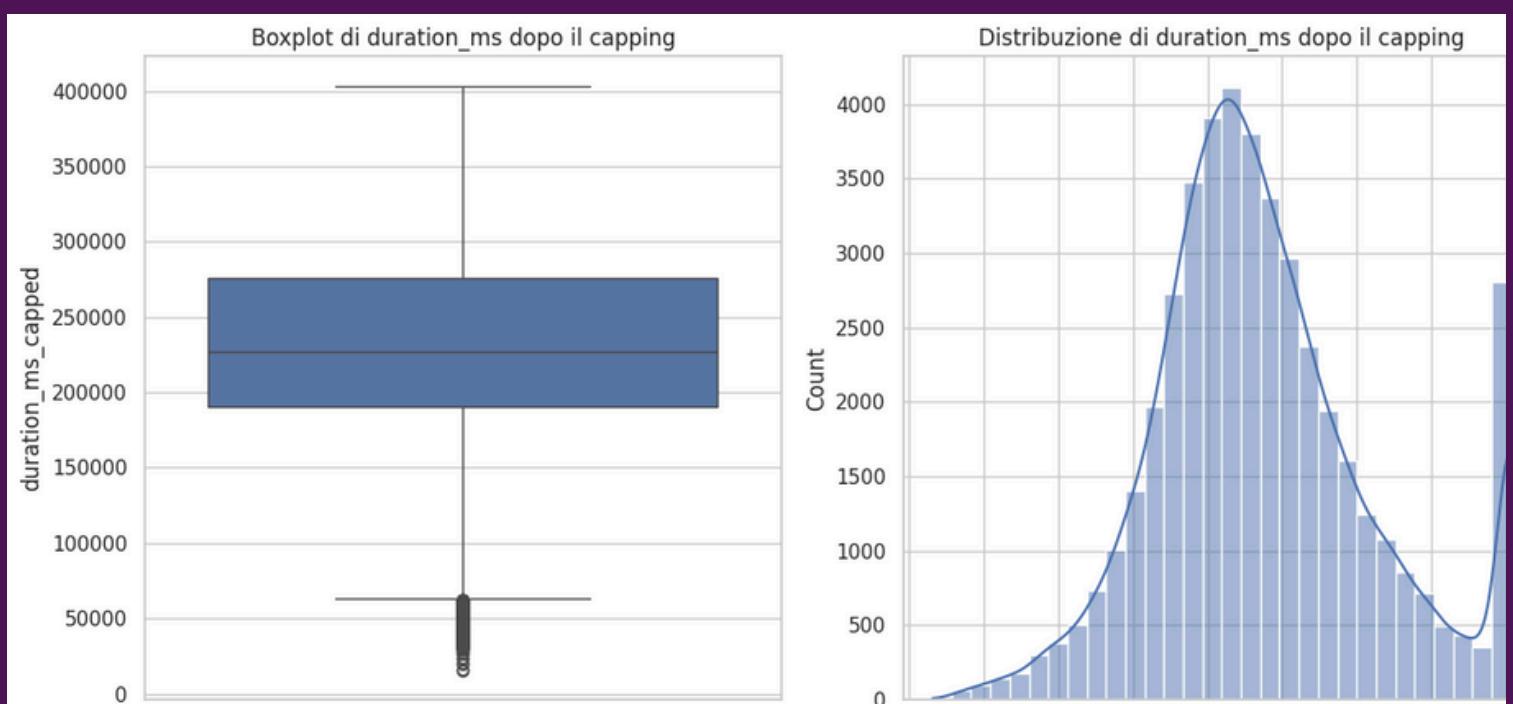
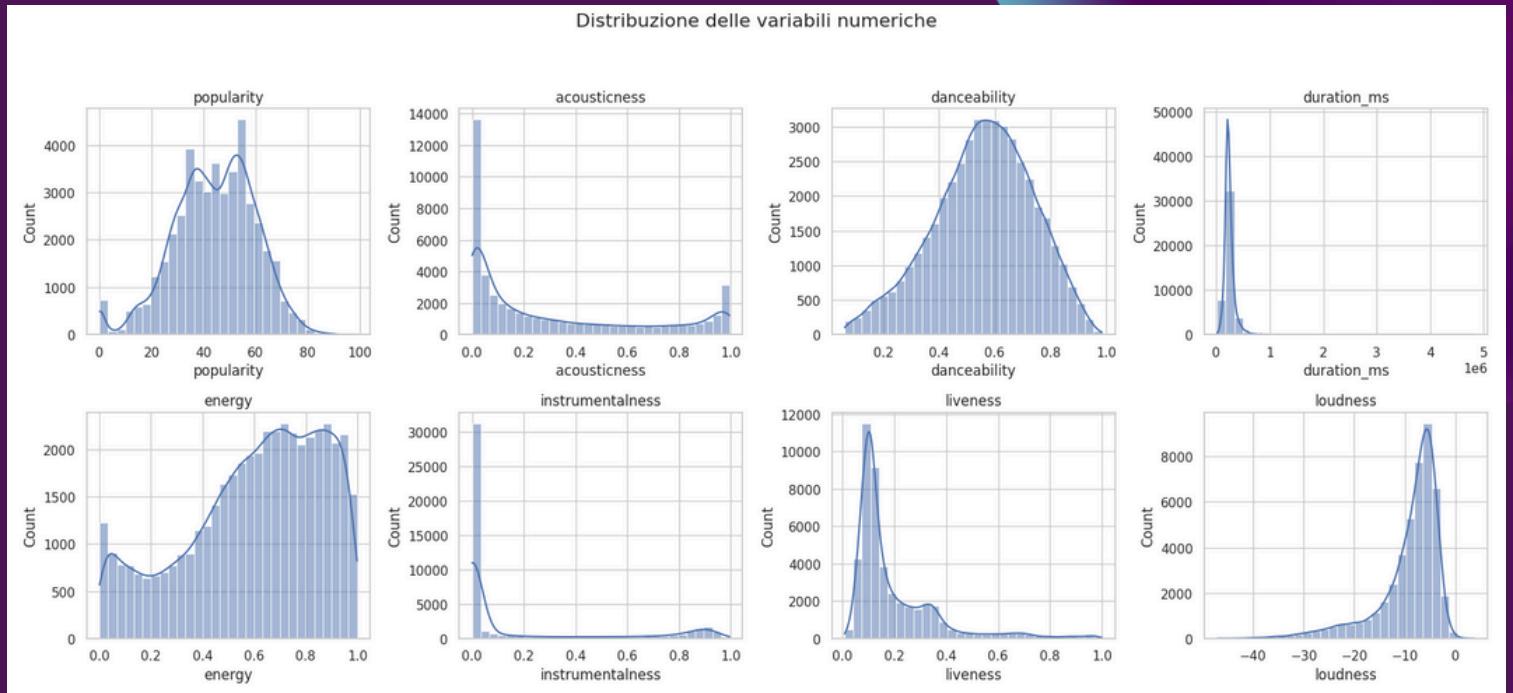
The dataset, available on kaggle, contains 50000 songs characterized with 14 features such as tempo, loudness, danceability, and acousticness, which are key predictors for genre classification

**examples:**

artist_name	track_name	popularity	acousticness
Kendrick Lamar	HiiiPower	63.0	0.179
Kendrick Lamar	LUST.	66.0	0.193
Kendrick Lamar	Backseat Freestyle	69.0	0.000739

# Dataset Analysis and Preprocessing

- **Initial Data Cleaning:** Missing values and anomalies were handled
- **Feature Exploration:** Key features like tempo, loudness, and energy were analyzed to understand their distribution across genres
- **Outliers:** Handling of extreme outlier that could have compromised the model



# Model Generation

## Model Used

SVM

Random Forest

AdaBoost

XGBoost

## Process for each model

First Step: Finding optimal parameter using GrindSearch

Second Step: First evaluation

Third Step: Improving of Model and evaluation

Forth Step: Graphic and statistic analysis

## Main idea of improving

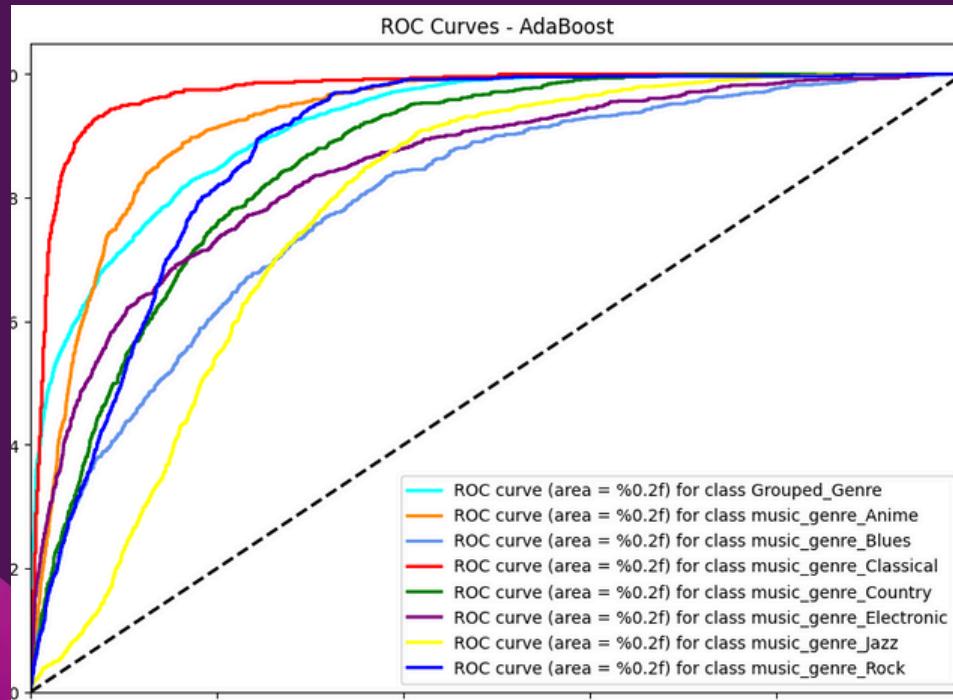
Create a less extensive but much more precise model by:

Removing some classes or

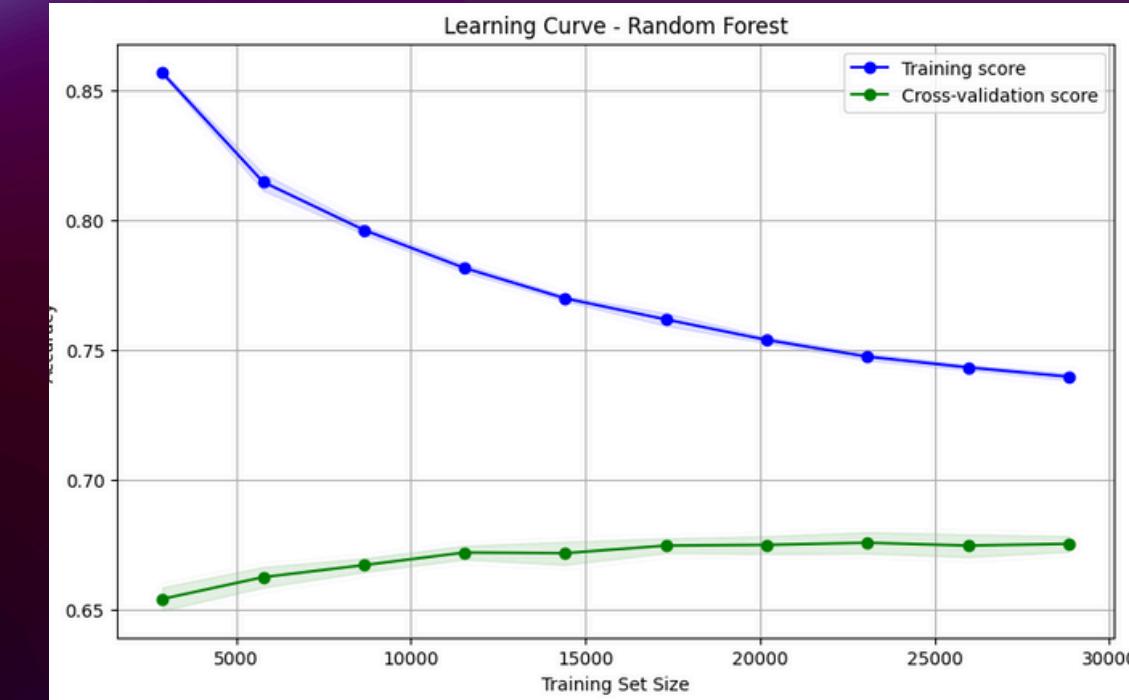
Grouping some classes

# Model Evaluation techniques

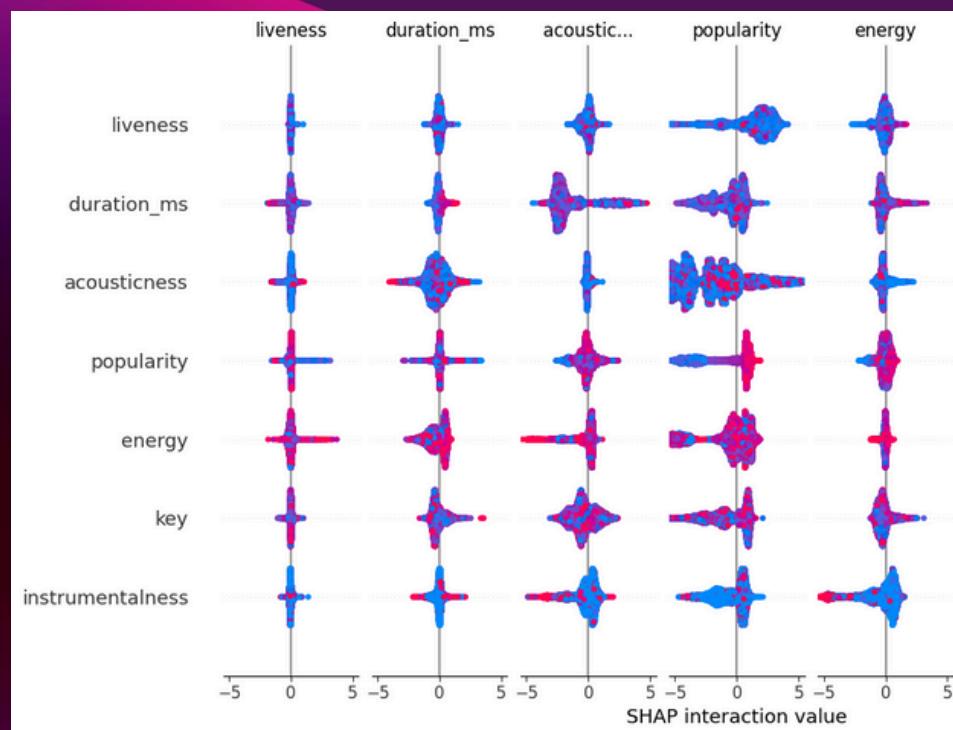
as well as accuracy recall and f1-score more metrics have been used such as:



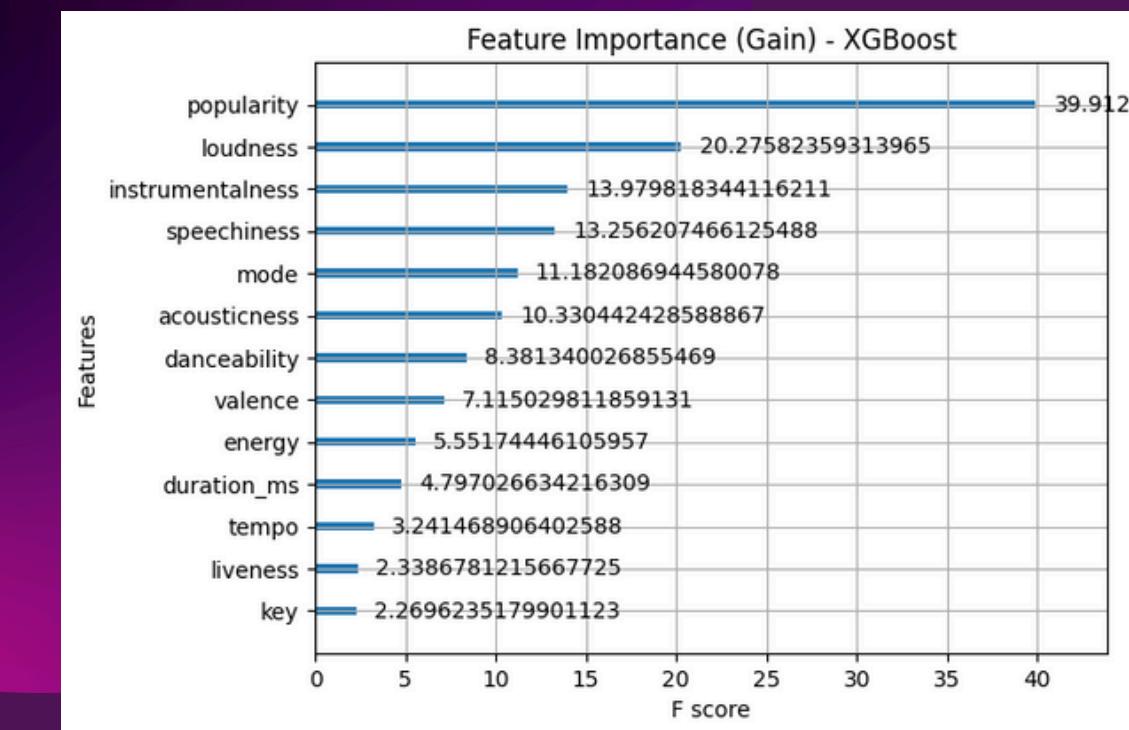
ROC curves



Learning  
Curve



SHAP



Feature  
importance

# Interface

The model adopted for the interface have been XGBoost, which achieved the best accuracy (71%) after optimizing and grouping genres.

**Music Genre Predictor** 🎵

Insert the audio parameters to predict the genre

The screenshot shows a user interface for predicting music genres based on audio features. The features listed are Popularity, Acousticness, Danceability, Duration (ms), Energy, Instrumentalness, Liveness, Loudness, Speechiness, Tempo, and Valence. Each feature has a corresponding slider or input field. Below these are dropdown menus for 'Key' (set to C) and 'Mode' (set to Major). At the bottom right is a teal button labeled 'Predict Genre'. The predicted genre is displayed as 'Predicted Genre: Country'.

Parameter	Value
Popularity	50.00
Acousticness	0.50
Danceability	0.50
Duration (ms)	250000.00
Energy	0.50
Instrumentalness	0.50
Liveness	0.50
Loudness	-30.00
Speechiness	0.50
Tempo	120.00
Valence	0.50
Key	C
Mode	Major

Predicted Genre: Country

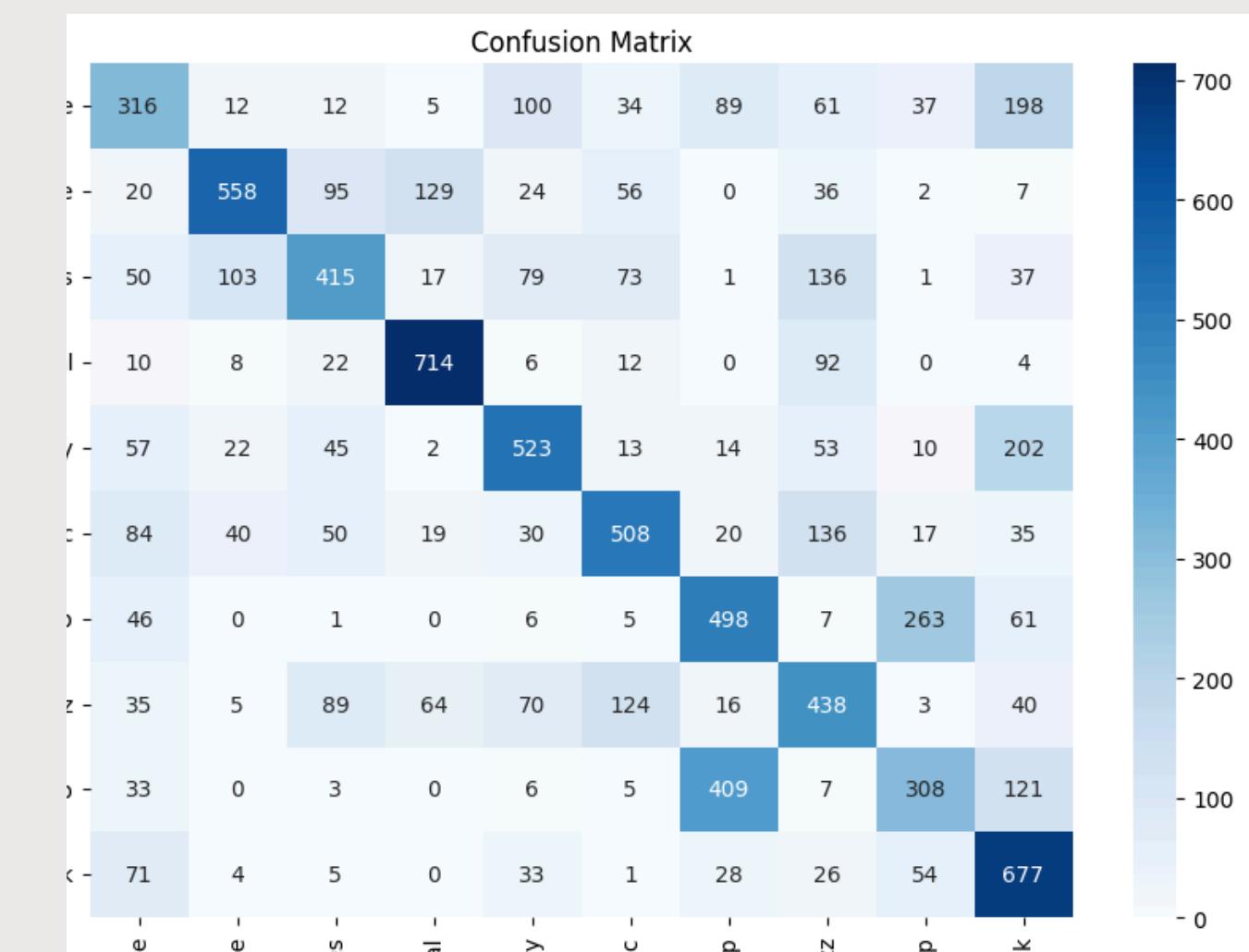
# Conclusion

**Best Model:** XGBoost achieved the highest accuracy at 71% with genre grouping.

Genre	Precision	Recall	F1-Score	Support
Anime	0.83	0.78	0.80	948
Blues	0.62	0.55	0.58	875
Classical	0.84	0.86	0.85	903
Country	0.64	0.65	0.64	853
Electronic	0.70	0.63	0.66	903
Jazz	0.58	0.57	0.57	908
Rap	0.84	0.83	0.84	917
Rock	0.63	0.80	0.70	902
<b>Accuracy</b>	0.71			
<b>Macro Avg</b>	0.71	0.71	0.71	7209
<b>Weighted Avg</b>	0.71	0.71	0.71	7209

**Next Steps:** Further exploration of feature engineering and enhancing model generalization for better classification accuracy.

although, the results emphasize that while machine learning can be powerful for genre classification, it faces limitations when genres share foundational traits



Thank you!