

## Motivation

- Genre classification is a useful task for song recommendation systems and music analysis.
- Marathi music has a lot of genres and they can be distinguished using acoustic characteristics.
- Analyzing the acoustic features can give insights into what are the key features in determining the genre of a song.

## Goal

Building a genre classification system for Marathi music and analyzing the performance

- 3 genres chosen: Bhaktigeet, Bhavgeet, Lavani
- Analyzing classifications to understand acoustic differences between the genres

## Dataset Details

### Dataset

- Total 154 Songs across the three genres, across multiple artists
- Each song approximately 3-4 minutes long

Genre	No. of Songs	Total Duration
Bhaktigeet	53	188 min 38 sec
Bhavgeet	53	185 min 11 sec
Lavani	48	173 min 33 sec

Table 1: Details of our dataset

### Characteristics

- Audio format: Mono, Sampling rate: 44.1 kHz

### Data Processing

- Each song was divided into 30 second excerpts, with 20 second overlap between 2 excerpts (start time of two consecutive excerpts separated by 10 seconds)
- Source separation was carried out to give 2 more sub-datasets: Accompaniment and Vocal.
- Audio features were extracted from each excerpt using Librosa.
- Each of the three sub-datasets was split into training and testing parts in the ratio 4:1 using a group-shuffle split.

Dataset dimension: 2913 x 26 x 3

## Support Vector Machines

- Non-probabilistic binary classifiers based on supervised learning
- To find the "maximum-margin hyperplane" that divides a set of points into two subspaces
- Kernel trick: Transforming a set of points to a higher dimensional space in which linear separation can be done
- For 3-class classification we use the "One-vs-One" approach using Scikit-learn and train three classifiers; one between every pair of classes

## About the Genres

### Bhaktigeet: A devotional-music genre

- Relaxed melodic style
- Steady notes with vibrato
- Glides from one note to another (meend)
- Prominent instruments: Cymbals, Tabla, Harmonium, Flute, Sitar
- Bhajini-theka 'taal' highly popular

### Bhavgeet: An emotional-music genre

- Higher number of notes in a given duration
- Faster tempo than Bhaktigeet
- Playful or romantic mood
- Prominent instruments: Guitar, Harmonium, Violin, Western percussions

### Lavani: A folk-dance music genre

- Highest local fluctuation in pitch
- Focus on beats rather than melody
- Prominent instruments: Dholak, *ghoongroo*, harmonium

## About the Features

- **Chroma STFT**: Mean of the normalised energies for all chroma bins at all frames.
- **Root Mean Square Value**: A measure of the intensity of the signal
- **Spectral Centroid**: A measure of the 'brightness' of the sound
- **Spectral Bandwidth**: A measure of the spread of frequencies present in the audio signal
- **Spectral Rolloff**: Frequency below which a specified percentage of the total spectral energy (here 85%) lies
- **Zero-Crossing Rate**: A measure of the signal's noisiness and a measure of frequency content
- **MFCs**: Small set of features (here 20 in number) that concisely describe a spectral envelope's overall shape.

## Classification Performance

### Confusion Matrices (Excerpt-level)

		Accompaniment			Vocals			Mixed		
		PREDICTED			PREDICTED			PREDICTED		
T R U E	Bk	24	42	22	67	2	19	46	42	0
	Bv	35	75	31	26	74	41	12	83	46
	L	7	13	66	28	3	55	4	0	82

Table 2: Confusion matrices of the classifications on the three sub-datasets

### Classification Accuracies

- The excerpt-level accuracy values on the test-data were: **52%** for Accompaniment, **62%** for Vocals and **67%** for Mix
- For a song in the test data, the genre predicted for a majority of the excerpts in that song was considered as the prediction for that song
- Out of 16 songs in the test data, the accompaniment model classified 9 songs (**56%**), the vocals model classified 11 songs (**68%**), while the mix model classified 10 songs (**62.5%**) correctly

## Sample Result

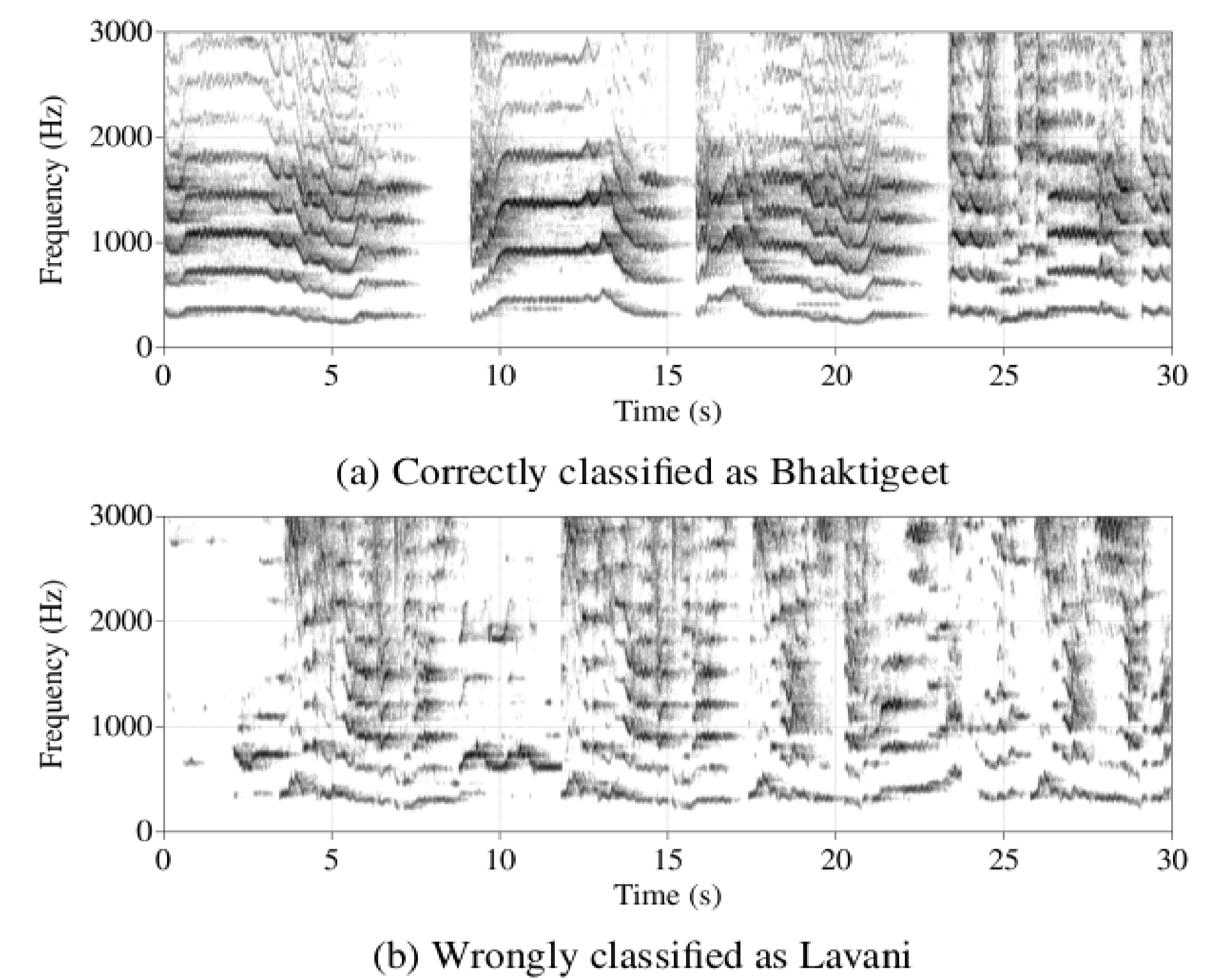


Figure 1: Spectrograms of two vocal excerpts from the same Bhaktigeet song classified differently.

## Subjectivity of a 'Genre'

- The classification accuracies are low and the main reasons behind this according to us are the small data size, and the overlap between genres
- There is not only a large difference between songs in the same genre depending on the era they are composed in, but there are also similarities between genres.
- 'Genre' is a subjective characteristic of a song defined differently by different people [3].
- The mis-classifications can give insights into the genre characteristics, overlap and differences.

## Future Work

- Investigating whether the bottleneck is the ML algorithm or the data characteristics
- Developing a feature to capture the beat pattern
- Developing a tool for better source separation on Marathi (and other Indian) music
- Experimenting with other ML algorithms
- Increasing the data (collecting more songs) for making the system more robust

## Conclusion

- This work aims to classify Marathi songs into three genres: Bhaktigeet, Bhavgeet and Lavani. To the best of our knowledge, these are un-researched genres from the technical perspective
- The classification results and subsequent analysis give a promising direction for future work on Marathi music and we hope that the constructed dataset and this work can facilitate it.

## References

1. S. Kini, S. Gulati, P. Rao, "Automatic Genre Classification of North Indian Devotional Music", Proceedings of the National Conference on Communications (NCC), Jan 2011, Bangalore, India
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3. Nie Ke, "Inaccurate Prediction or Genre Evolution? Rethinking Genre Classification", Proceedings of ISMIR 2022, I.I.Sc Bangalore, December 2022