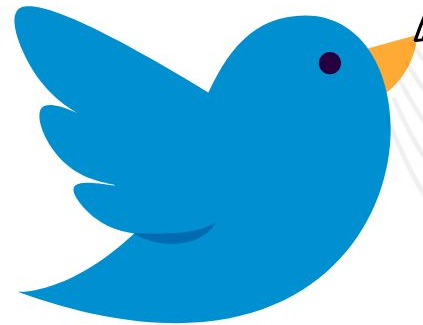
Who Tweeted That?

Project Proposal

SYSC 5405



Group 3
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Team Member Introductions

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B. Eng Computer. Systems
M.A.Sc.

Bardia Parmoun
B. Eng Software
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B. Eng Communications
M.A.Sc.

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B. Eng Biomedical Electrical
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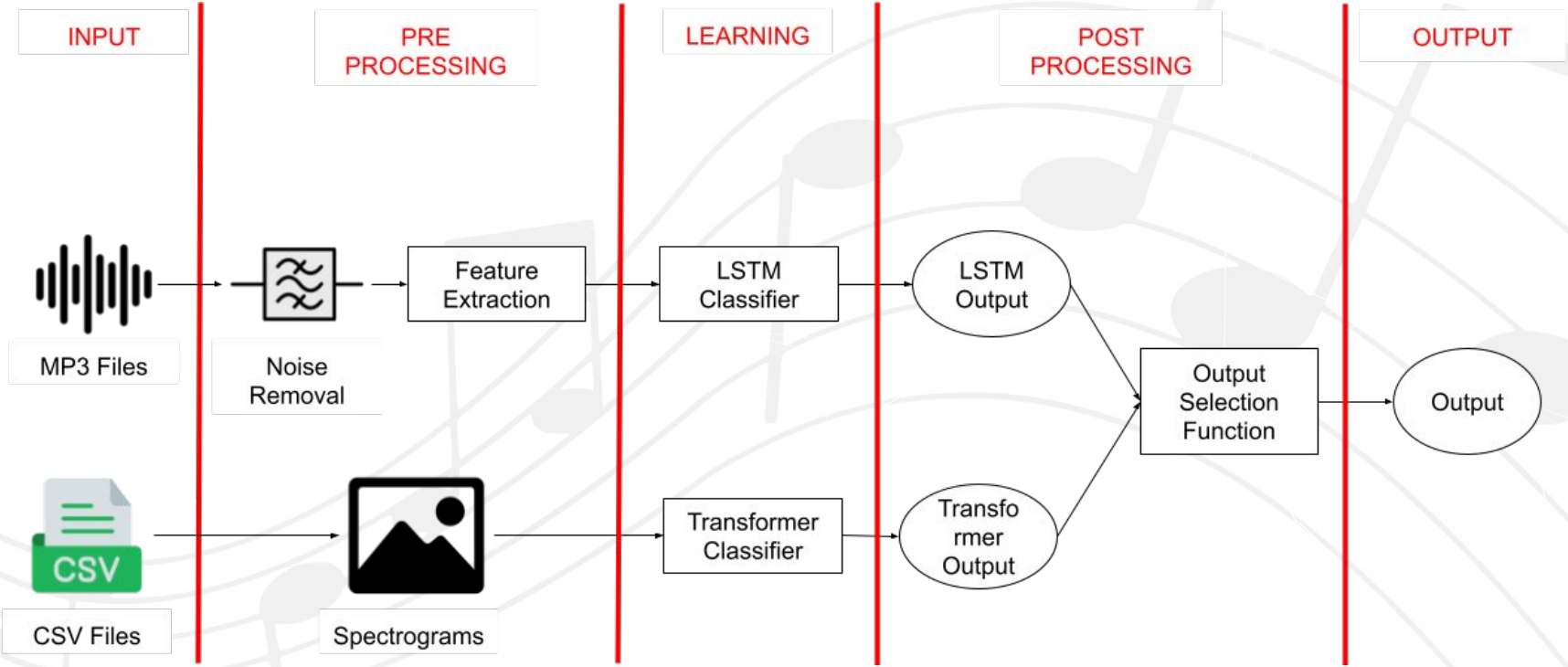
The Problem

- Class Imbalance
- Multi-class, Multimodal input problem
  - Audio + Image data
- Sequential Data
- Released test data will be unlabelled!
- Data Issues
  - Presence of background noise (cars, wind etc.)
  - Sampling Rate (audio)
  - Multiple bird songs overlapping (multi-class labelling)

Our Solution



Solution Justification

- Lack of priors and domain knowledge → **NO Bayesian**
- Wanted supervised learning →**NO KNN**
- Audio data is temporal in nature → **NO FNNs, Decision Trees...**
- Most likely not linearly separable → **NO SVMs**

- **LSTMs [1]** and **RNNs** are great for temporal data!
- **Vision Transformers [2]** and **CNNs** work great for spectrograms!
  - **BONUS:** People have used Bi-LSTMS for bird sounds! [3]

The Science behind Bird Sounds

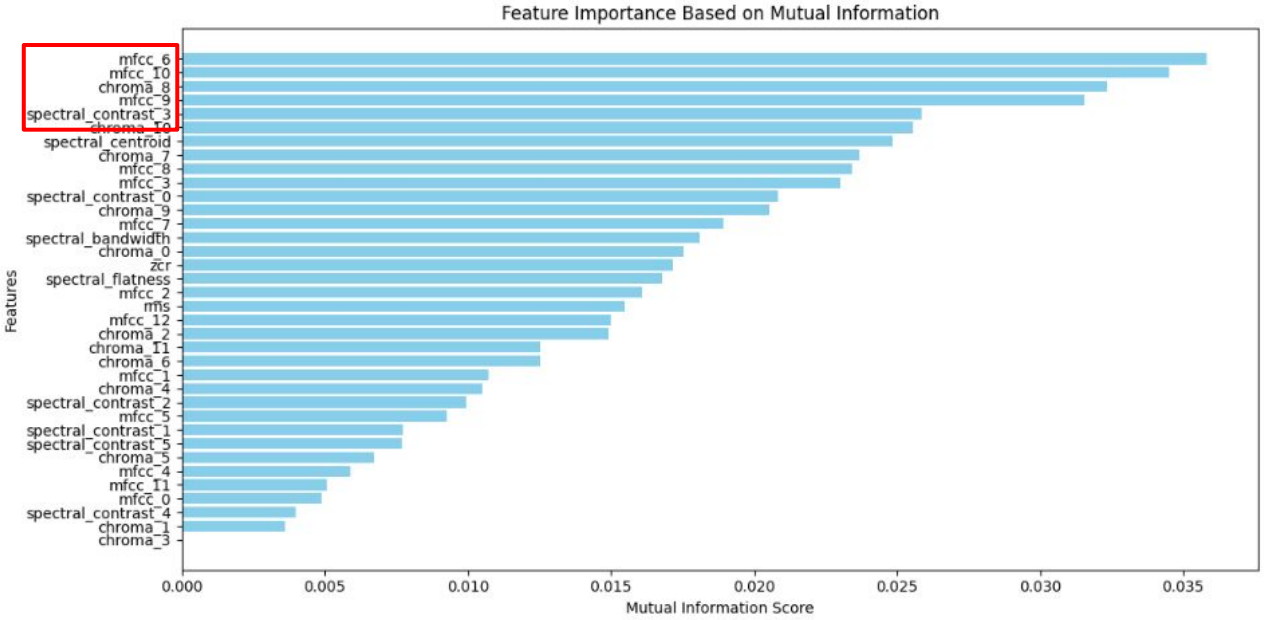
- Sampling rate of 16000 Hz (Based on Nyquist Theorem)
  - Frequency of bird sounds: 1000 Hz to 8000 Hz [4]

Extractable features of bird sounds:

- Temporal analysis (zero-crossing rate, rms)
- Frequency analysis (mel-frequency cepstral coefficients (MFCCs) [5], spectral centroid, bandwidth and contrast, chroma)
- Spectrogram

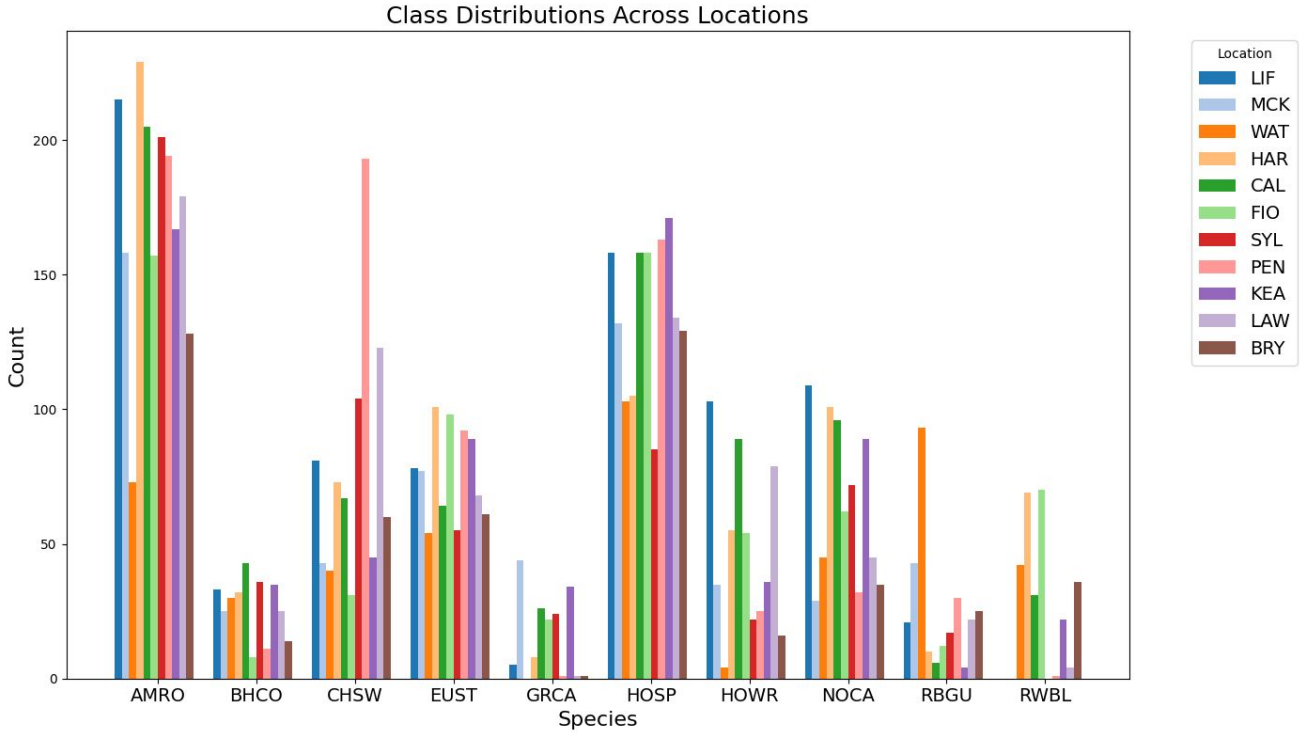
Data Visualization

Feature Importance Based on Mutual Information



Data Visualization

Class Distribution by Location and Bird Species



References

[1] S. Siami-Namini, N. Tavakoli and A. S. Namin, "The Performance of LSTM and BiLSTM in Forecasting Time Series," 2019 IEEE International Conference on Big Data (Big Data), Los Angeles, CA, USA, 2019, pp. 3285-3292, doi: 10.1109/BigData47090.2019.9005997.

[2] J. Bi, Z. Zhu and Q. Meng, "Transformer in Computer Vision," 2021 IEEE International Conference on Computer Science, Electronic Information Engineering and Intelligent Control Technology (CEI), Fuzhou, China, 2021, pp. 178-188, doi: 10.1109/CEI52496.2021.9574462.

[3] H. Liu, C. Liu, T. Zhao and Y. Liu, "Bird Song Classification Based on Improved Bi-LSTM-DenseNet Network," 2021 4th International Conference on Robotics, Control and Automation Engineering (RCAE), Wuhan, China, 2021, pp. 152-155, doi: 10.1109/RCAE53607.2021.9638962.

[4] "Do bird songs have frequencies higher than humans can hear?," All About Birds News. [Online]. Available: https://www.allaboutbirds.org/news/do-bird-songs-have-frequencies-higher-than-humans-can-hear/#:~:text=Many%20bird%20songs%20have%20frequency,sweet%20spot%20of%20human%20hearing.

[5] G. Rane, P. P. Rege and R. Patole, "Bird Classification based on Bird Sounds," 2021 8th International Conference on Signal Processing and Integrated Networks (SPIN), Noida, India, 2021, pp. 1143-1147, doi: 10.1109/SPIN52536.2021.9566071.