**Methods**

**Dataset**

The dataset used for this project will be from Kaggle. The dataset consists of 5 bird species with around 1000 wav files for each species.

**EDA**

* Preprocessing: Techniques such as noise reduction and normalization will be applied to the raw the data
* Waveform plots, Spectrograms and Fourier Transforms: These visualization methods will be used to understand the temporal characteristics of the sounds over time.
* PCA, t-SNE and UMAP**:** These dimension reduction visualizations will be employed to help identify clusters and patterns in the data.

**Feature Selection/Extraction**

Feature selection methods like RFE and Random forest feature importance will be explored. PCA, t-SNE and UMAP will be employed for feature extraction also given the high complexity of the data.

**ML Classifiers**

* Baseline Model: A simple logistic regression classifier will act as a performance benchmark.
* KNN: It is a simple but a powerful classifier. Different values of k will be used to check for underfitting and overfitting
* Random Forest: It is also a powerful classifier which is easy to interpret.
* Support Vector Machine: SVMs are flexible and are able to handle non-linear data by using the kernel technique.
* XGBoost: They are similar to random forest in terms of being tree based learners but we have the ability to use regularization techniques to prevent overfitting.
* Convolutional Neural Networks: CNNs are very powerful deep learning models that have shown promising results in various audio classification tasks.
* Recurrent Neural Networks: Since bird sounds have periodic behavior, RNNs can be useful in capturing the time dependent features.

**Intended Experiments**

The various methods mentioned above will be compared for their effectiveness in classification based on the evaluation metrics. The methods will be compared individually as well as in conjunction with other methods. For instance PCA, t-SNE and UMAP will be compared individually as well as with different classifiers for selection of an optimal pipeline.