



Classification of Marine Mammals using Frequency Coefficient Extraction



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Introduction

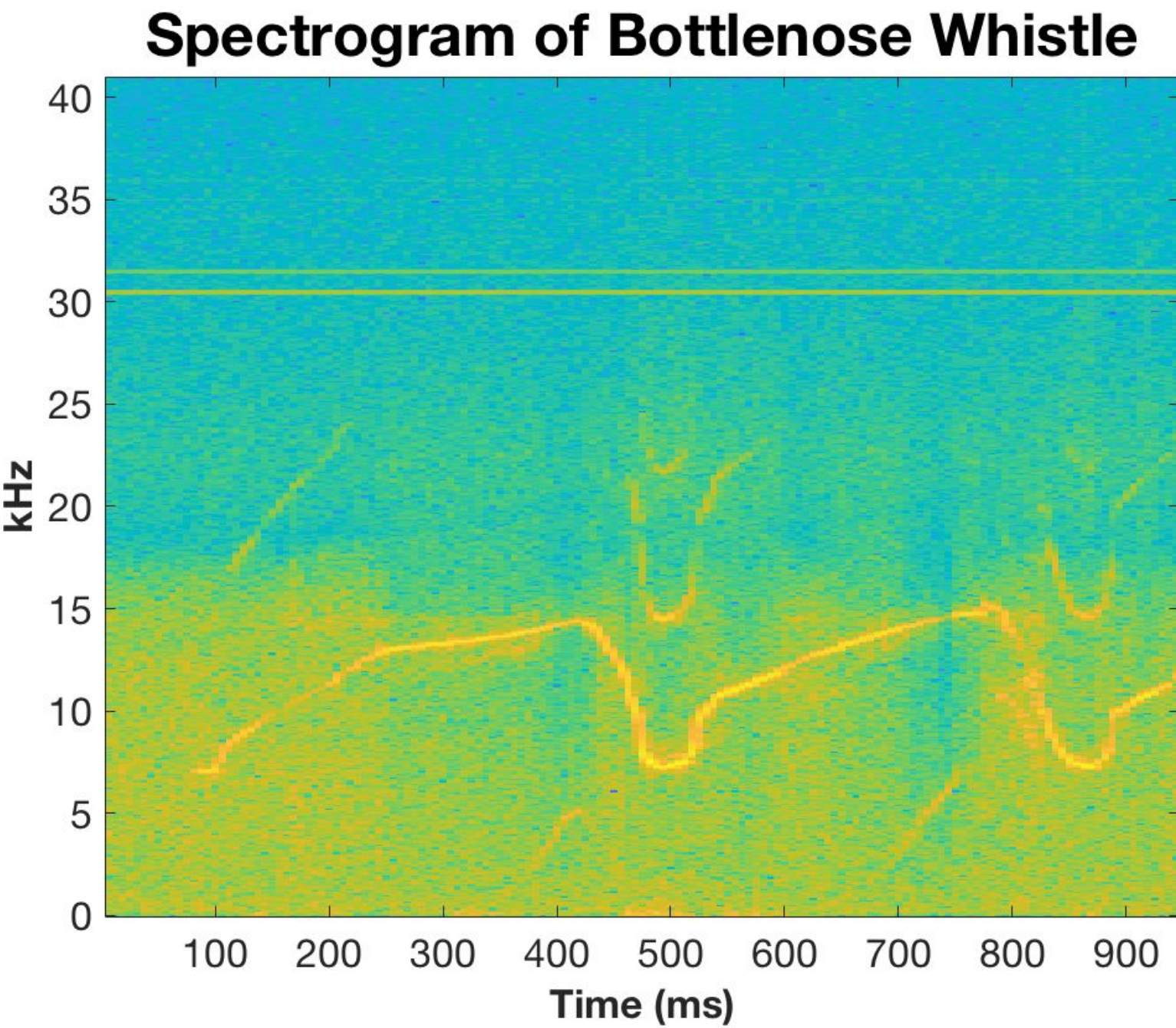
Audio cues are an extremely effective way for marine researchers to monitor the behavior of marine mammals. The goal is to implement a machine learning algorithm that can recognize marine mammals based on audio data.



Figure 1. Bottlenose Dolphin

Dataset

The data was gathered from two sources: a 2017 Australian study that gathered 336 whistles from Bottlenose Dolphins, and from the Woods Hole Oceanographic (WHO) Institution's audio database which includes 100-300 whistles from 12 other species.



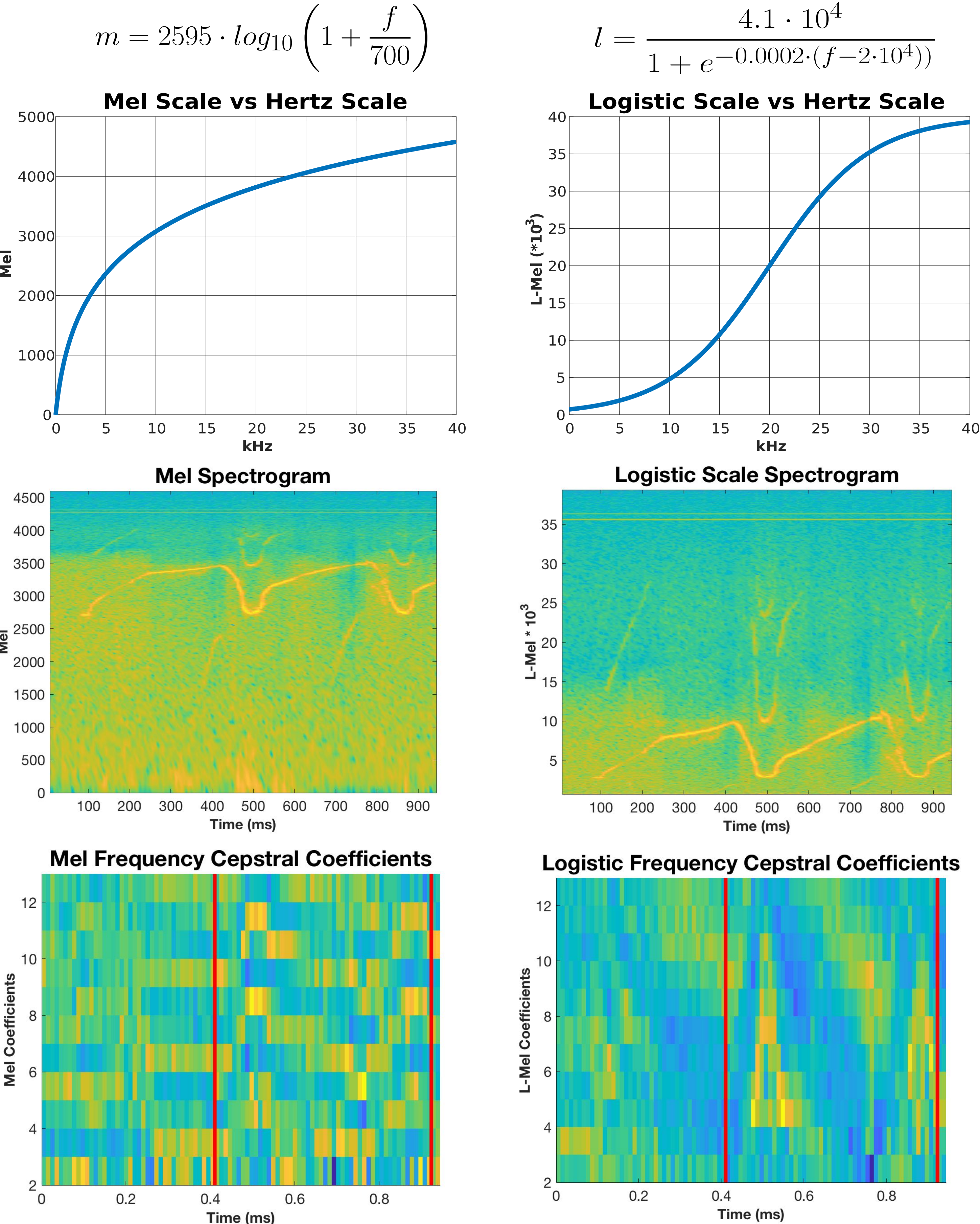
Feature Extraction

Mel Scale

The mel scale highlights the humans hearing frequency range rather than placing equal emphasis on all frequencies.

Logistic Scale

The Logistic scale that transforms Hertz to put more emphasis on the frequencies that marine mammals whistle at, around 5-40 kHz.



Classification Results

3-fold Cross Validation was used to choose the model parameters. The results are compiled below

Table 1. Comparison of Classifiers

Classifiers	Mel Scale Accuracy (%)	Logistic Scale Accuracy (%)
K-NN	55.17	55.41
PCA + K-NN	67.75	68.10
K-NN (weighted)	55.07	55.37
PCA + K-NN (weighted)	67.04	67.98
SVC (RBF)	60.84	60.07
PCA + SVC (RBF)	69.65	67.70
CNN	61.48	62.07

Table 2 showcases the accuracy between two specific species when classifying with Logistic PCA + K-NN.

Table 2. Accuracy of Logistic PCA + K-NN

	False Killer Whale	Bottlenose Dolphin	Striped Dolphin
Bottlenose Dolphin	77.27	--	67.65
Clymene Dolphin	72.73	64.58	54.41
Common Dolphin	85.00	60.00	62.50
False Killer Whale	--	77.27	77.28
Melon Headed Whale	89.29	75.00	67.86
Pantropical Spotted Dolphin	79.55	63.33	86.76
Risso's Dolphin	79.55	65.91	63.63
Short Finned Pilot Whale	88.64	68.97	74.14
Sperm Whale	75.00	66.18	76.47
Spinner Dolphin	82.14	60.71	71.43
Striped Dolphin	77.27	67.65	--
White Sided Dolphin	72.72	76.67	45.59
Versus All Species	81.82	61.33	63.24