Whale Detection and Identification from Aerial Imagery
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Introduction
The North Atlantic Right Whale is a critically endangered species that lives along the east coast of the United States. There are only an estimated 500 whales left in the ocean and to aid conservation efforts, they must be tracked and catalogued from aerial imagery [1,2]. The task of identifying individual whales is usually performed by highly experienced researchers and marine biologists under strict time and budget constraints.

Currently, the manual matching is conducted with the aid of an online catalog and some custom software [3] which is extremely time consuming. This work is based on a Kaggle competition [1] that aims to use machine learning techniques to identify Right Whales in a large dataset of aerial imagery.

Dataset
Poor lighting and lack of contrast from reflections on water
Occlusions from the sea foam
Distortion from the water
Varying actions and orientations (breaching, feeding)

Color Space
- Convert RGB to HSV space
- Random sample to HSV space
- Differentiate whale, water and foam

Results
Detection
- K-means clustering, k = 4
- Largest cluster in ocean
- Invert to get whale mask

Identification
Wrong whale:
- 58 matches / 168 features

Future Work
Detection
- K means local minima
- Runs k means more
- Learn ocean and whale centroids and initialize to those
- Better water removal

Identification
- SIFT comparison improvements to reduce false positives
- Continue working on SVM
- Use other learning methods (e.g. Convolutional Neural Networks)
- Better SIFT features, or more localized to certain parts of the whale (e.g. “face”, back, tail)

Computation Time
- Identification Steps: Pruning, SIFT Matching, SVM Testing
- Detection Time: ~1s, ~80s, ~500s
- Identification Time: ~60s, ~10s, ~5s

Identification
- COD result
- K-means result
- Mask Manipulation