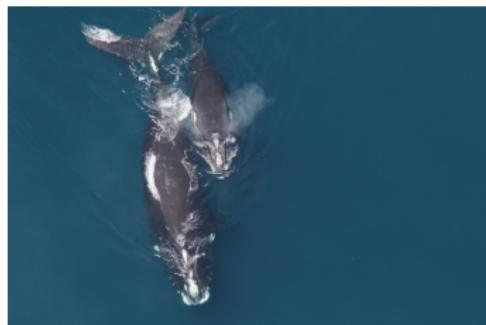


Right Whale Recognition

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Motivation

- Project from kaggle.com
- Less than 500 right whales remaining
- Biologists identify whales by hand
- Only a few researchers can do this

Goals

- Data set is photographs of right whales
- Problem 1: Find right whales
- Problem 2: Match whale to identification number

Strategy Overview

- Use photo recognition to find whales
- Crop found whales from photos
- Use various algorithms to identify

Recognition

Data Example



Figure: Example from data set.

Recognition

Data Example

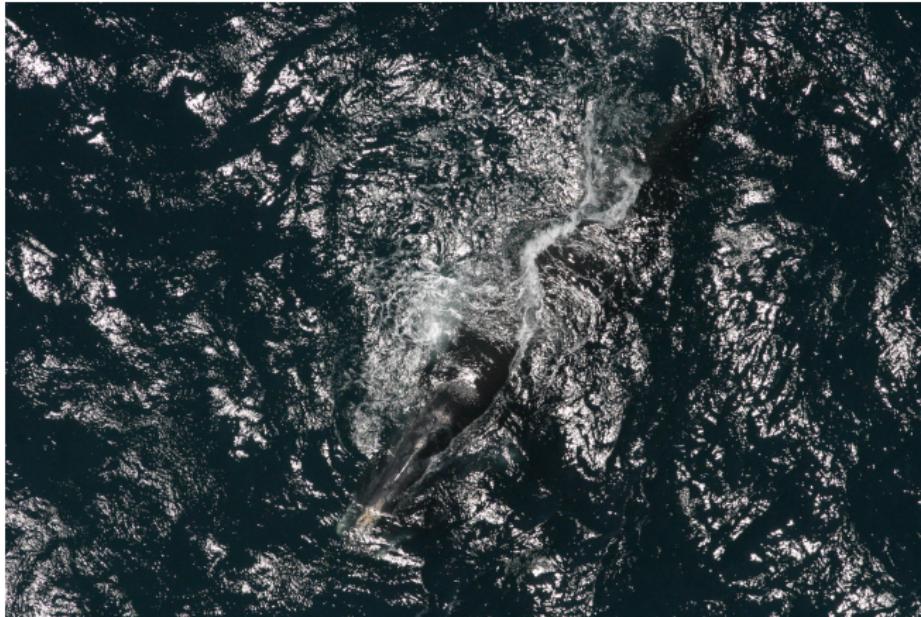


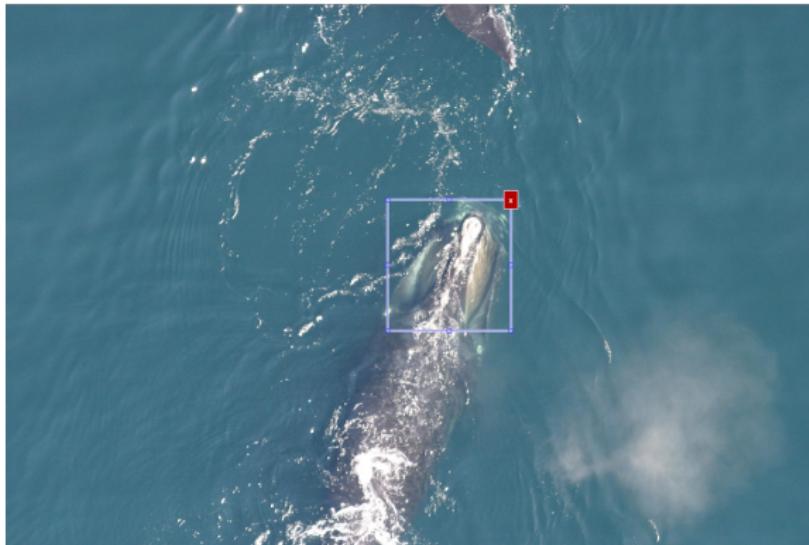
Figure: Different lighting and angle.

Noise in Data

- Other whales
- Dolphins
- Birds
- Surface reflectivity
- Dirty/clouded water

Training Data

- List of photos with whale ID provided
- Label whales by hand to teach recognizer.



Recognition

Matlab Cascade Object Detector

- Machine learning tool
- Trains in stages
- Requires positive and negative examples
- Alternatives: opencv haarcascade, edge detection

Recognition

Matlab Cascade Object Detector

Parameters:

- Number of Training stages: 7-11
- False Alarm Rate: .01

Recognition

Results



Figure: Worst case example. Boxes are “detected whales.”

Approaches

- Neural Network
- Deep-Belief Network

Neural Network

Choice: Neural Network

- Can handle image input
- Capable of classifying image to distinct outputs
- Could potentially be parallelized

Design Decisions

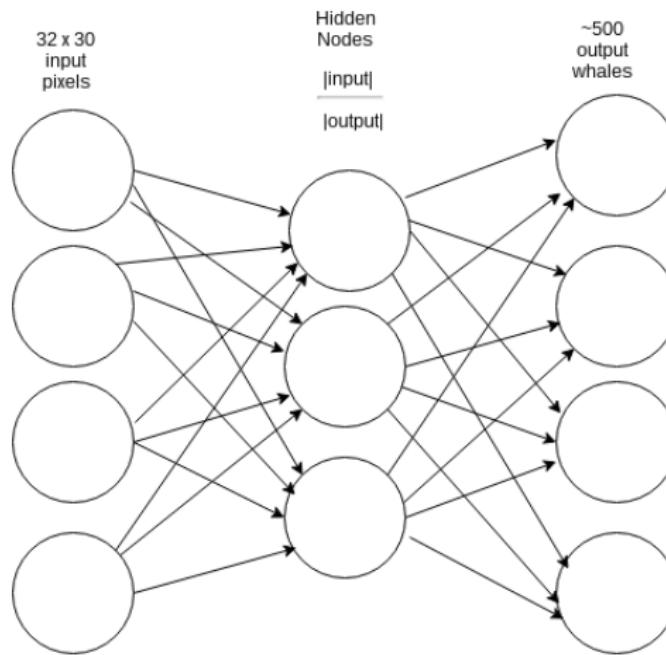
- Written in Java
- Input is pixels from 32x30 greyscale images
- Each pixel is one input
- Each layer is fully connected

Design Decisions

- Feed forward network
- Backpropagation for learning
- Multiple training epochs required

Neural Network

Visualization



Results/Issues

- Training requires large amount of time (hours-days)
- Full output set requires large amount of time
- Current Issue: input inconsistency from matlab

Deep Belief Network

Choice: Deep Belief Network

- Deep learning is new/popular
- Can understand image input
- Java library available
- Alternative: SVM

Deep Belief Network

Deep Learning 4 Java

- Framework for deep learning
- Can be used with Hadoop or GPUs (fast)
- Has data input/output system (Canova)

DL4J Statistics

```
=====Scores=====  
Accuracy: 0.7667  
Precision: 1  
Recall: 0.7667  
F1 Score: 0.8679245283018869  
=====
```

Figure: Statistical sample output from test program

Results/Issues

- DL4J has lots of examples, but bad documentation
- Belief network engine currently misinterprets input, does not currently produce output

Summary

So far we've discussed:

- Whale detection with matlab
- Whale identification with neural network
- Whale identification with deep belief network

Continuing Work

- Find solution for multiple whales recognized
- Identify training issue in DL4J
- Transfer neural network to batch learning and use MPI/Palmetto?

References

- (1) *Creating a "face detector" for whales.*

<http://www.kaggle.com/c/noaa-right-whale-recognition/details/creating-a-face-detector-for-whales>, Accessed: 2015-09-15.

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