Pattern Detection and Recognition using Deep Learning

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Introduction

Pattern Detection and Recognition:

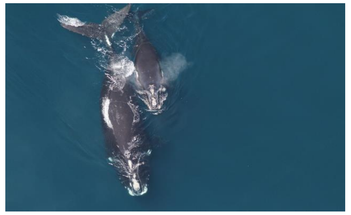
- The act of taking in raw data and taking an action based on the identified “category” of the pattern.

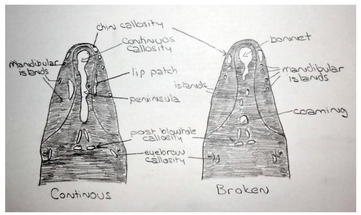
Deep Learning :

- New Era of Machine Learning Research, introduced with the objective of taking machine learning closer to one of its original goals : Artificial Intelligence.
- Earning multiple levels of representation and abstraction that help to make sense of data such as images, sound, and text.

Right Whale :

- Right whale is an **endangered species** with fewer than 500 left in the Atlantic Ocean. Each right whale has **unique callosity pattern** on the head.





Objectives & Challenges

Objectives :

- Knowing the health and status of each whale is integral to the efforts of researchers working to protect the species from extinction.
- The current identification process is extremely time consuming and requires special training.
- The objective behind this project is **to automate the right whale recognition process using a dataset of aerial photographs of individual whales.**

Challenges :

- Variable image quality
- Overexposed and underexposed images
- Non-uniform head orientation

Method

Convolutional neural network is a feed-forward multilayer perceptron. It is inspired by the way biological nervous systems works and processes information inside the brain providing state-of-the-art results for computer vision problems.

Our problem can be divided into Localization and Classification task. For each task different CNN architecture is built. In localization, the whale head is detected from entire image. Head localizer is the regression-based problem and gives output as two numbers which represents blow-hole and bonnet point for whale head in whole image.

This localized head part is given to CNN classifier to extract the features and classify them into different 447 categories of right whales.

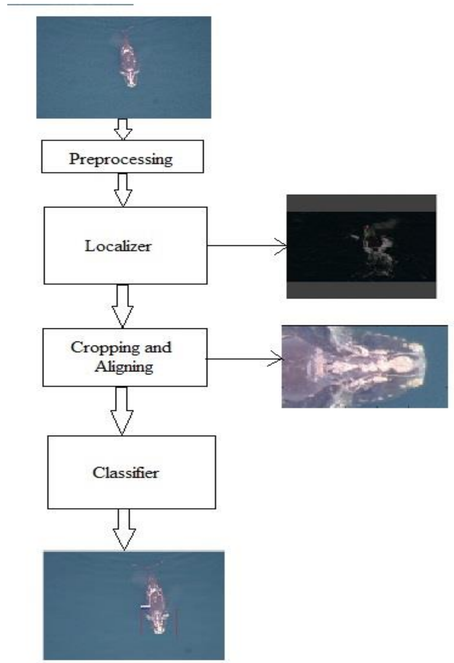
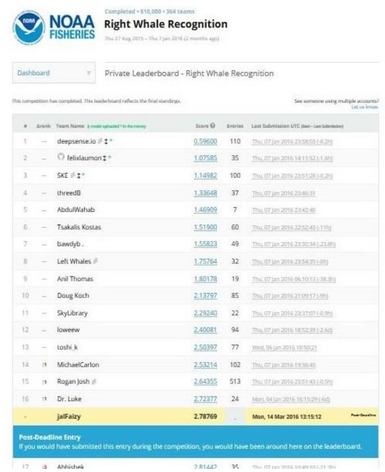


Fig. Block Diagram

Results



Dataset:

- Train images : 4544
- Test images : 6925

Conclusion

Here we present CNN for whale detection and recognition from aerial photographs. In comparison to other algorithms, CNN requires minimal pre-processing as it works in a hierarchical manner to extract relevant features. We show that on evaluation, CNN proves to be a state-of-the-art architecture for whale recognition problem.

References

[1] Krizhevsky, Alex, Ilya Sutskever, and Geoffrey E. Hinton. "Imagenet classification with deep convolutional neural networks." *Advances in neural information processing systems*, 2012.

[2] Honari, Sina, et al. "Recombinator Networks: Learning Coarse-to-Fine Feature Aggregation," *arXiv preprint arXiv:1511.07356*, 2015.

[3] Simonyan, K., and A. Zisserman. "Very deep convolutional networks for large-scale image recognition. arXiv preprint." *arXiv preprint arXiv:1409.1556*, 2014.