Using Machine Learning to Census Fin Whale Calls

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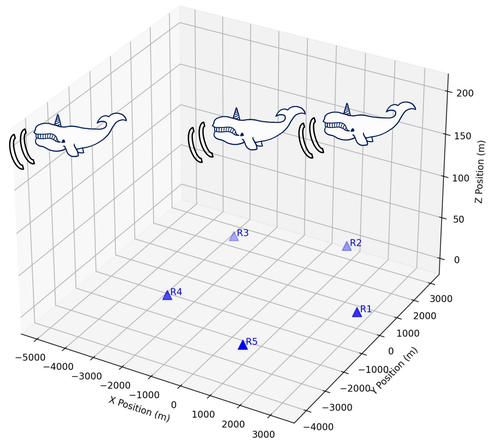
Introduction

Estimating the number of whales in the ocean is difficult, current methods include:

- **Visual surveys (air or ship-based)**
- **Acoustic localization and tagging**
- **Capture-recapture techniques**

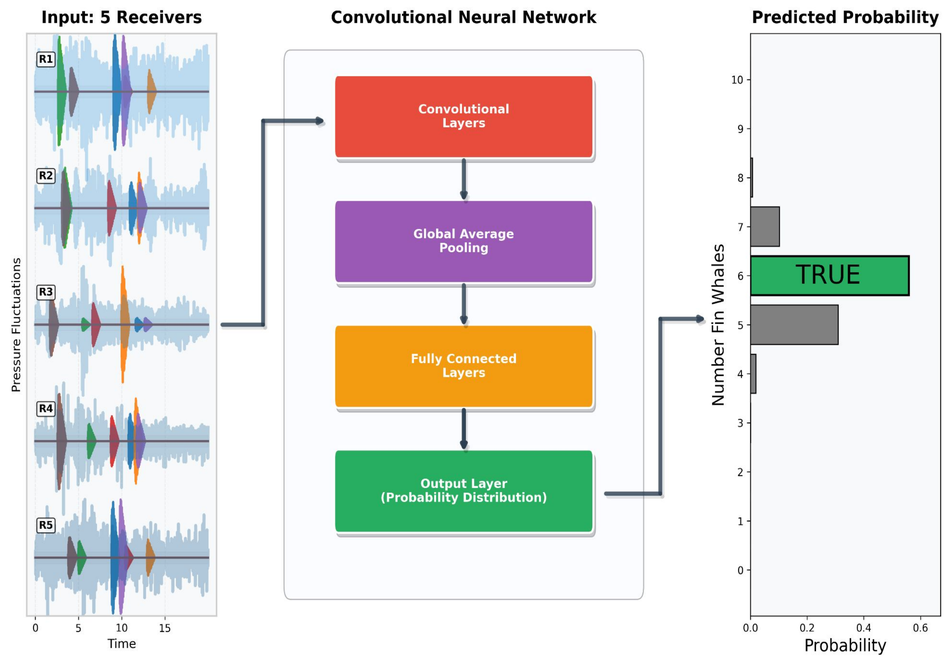
These are costly or limited in scope.
Naturally this begs the question, what information can we glean from passive acoustic monitoring, and what can we do with machine learning?

Setup



Five receivers in a pentagonal formation uniformly spaced around a circle with radius 3000 m. 0 to 10 sources are generated with their positions randomized

Methods



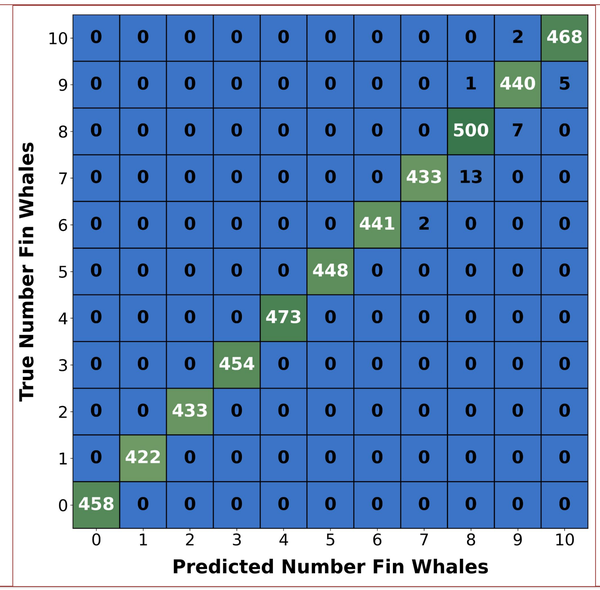
Training Details:
Input: 5 Receiver Timeseries
Architecture:

- **Convolutional Layers (2D): Extract local time-frequency features from the stacked input (treated as 2D with 5 channels).**
- **Global Average Pooling: Aggregates temporal features across the time axis.**
- **Fully Connected Layers: Map pooled features into a dense representation.**

Output Layer: Final Layer outputs a probability distribution. We select the largest probability. Model trained on 50,000 samples, using ReLU for activation

Training was halted after 10 epochs of no improvement in loss

Results



Accuracy: 99.40%
Precision: 99.41%
Recall: 99.43%

Future Work

Models were trained on simulations:

- **Important to validate results with data gathered from the ocean itself.**

Furthermore, we can census accurately and we can locate accurately (see Chinmay Govinds Poster):

- **Combine both methods to locate multiple sources.**

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