Orca Detection

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Overview

- Animal-Spot: Open source repository for bioacoustic signal detection using a neural network.
- Orca-Sound: Open project that places hydrophones in the Salish Sea and makes datasets and live data available for free
- Just care about DETECTION for now, not analysis
- Mainly for conservationists and researchers

Data Understanding

- All recordings done in Salish Sea
- Different pods with different dialects included
- “Noise” files are mostly static and lack of sound
- Different call types/durations/volumes, 200gb of data

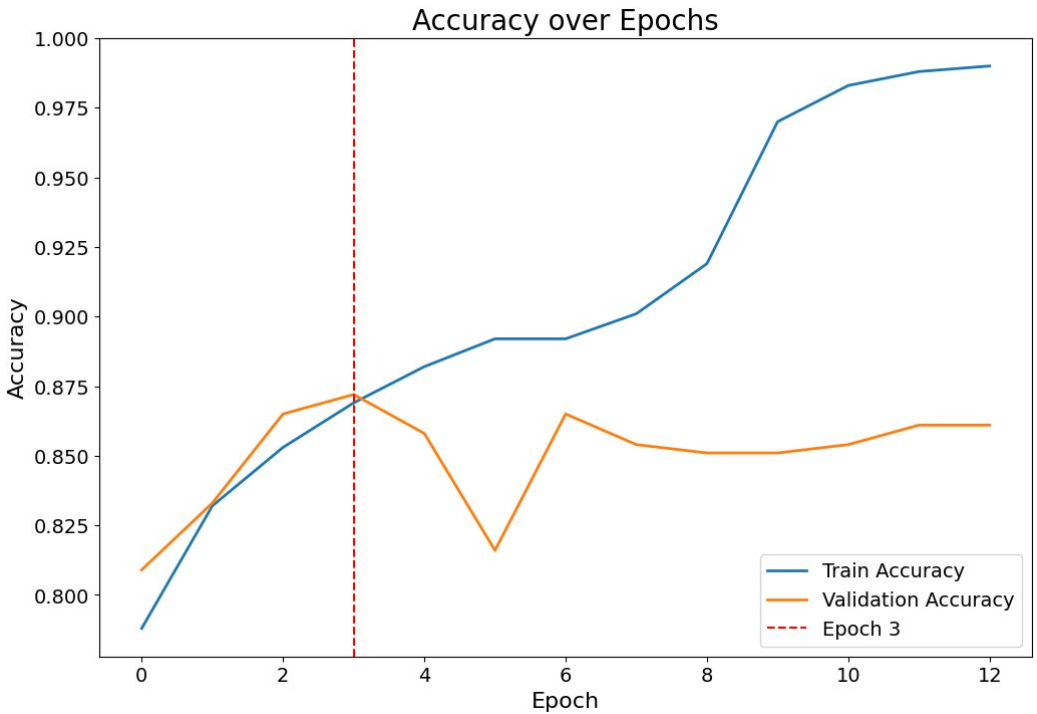
Data Preparation

- Long WAV files. Separate TSV with start/duration of bioacoustic signals.
- Split WAV into separate target and noise files to isolate signal
- 25% of total data used. Ratio of 1:2 target to noise.
- Program automatically detects and removes low volume/empty noise files. Actual ratio is closer to 1:1.8

Training Parameters

- Data Normalized to 0-1 DB
- Trained on 2.5 second segments of the .wav files
- Frequency below 500 or above 10,000 are ignored

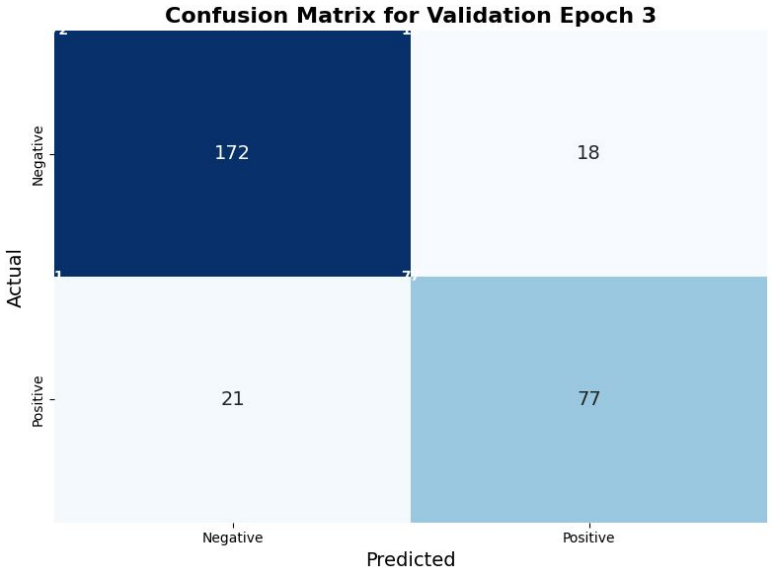
Final Training Results



- Final model's test accuracy: 84%
- Val accuracy: ~87%
- False positive less common than false negative (this is what we want)
- Test metrics poorly represent the model's capability due to tweaking that can be done after. Most of the false positives are empty segments of the data with no background noise
- Best result achieved on epoch 3

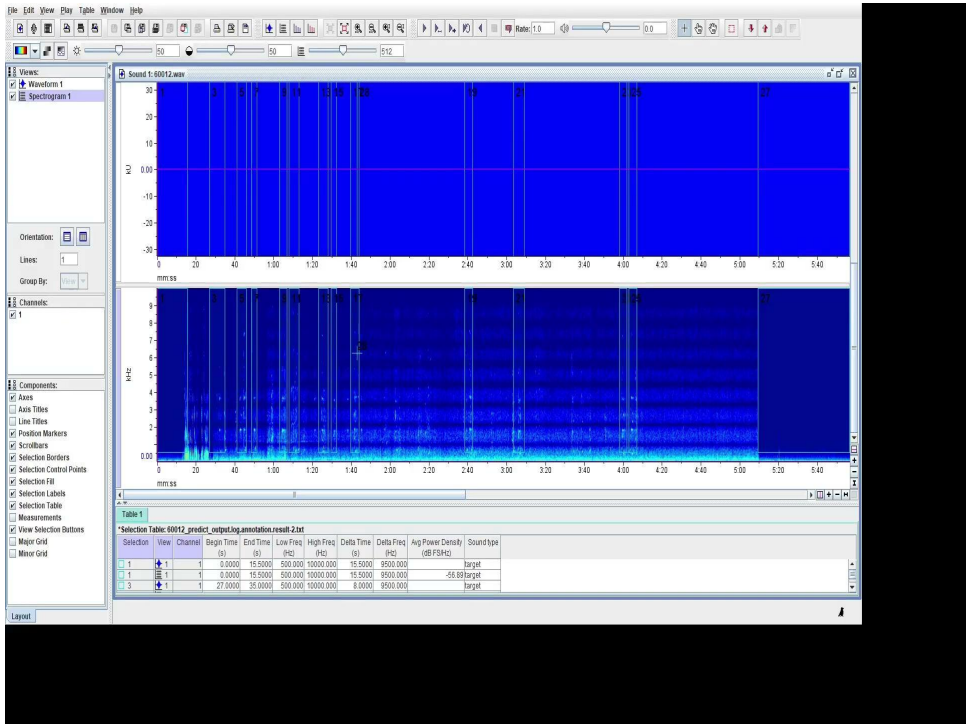
Evaluation

- Confidence threshold set at 15%
- Anything model is less than 15% confident in considered noise
- Experimentation showed this threshold produced the least false positives



Demonstration

- Numbered regions on the spectrogram indicate a detected call
- Calls are visible on spectrogram as spikes



Usage Recommendations

- Prevent collisions by detecting presence of Killer Whales in area
  - Bonus points for adding a directional microphones to boats to find their location. Orca Radar!
- Automate labeling of bioacoustic data for use in machine learning
- Optimize hydrophone audio recording by only saving segments that contain vocalizations
- Help whale watching expeditions locate and communicate with Orca pods

What Next?

- Train model with more data on better hardware using Google Cloud Compute or Amazon EC2
- Increase sensitivity of model and use another script to remove false positive predictions that are reliably only given for empty sound files
- Create a webapp that pulls the live data from hydrophones and analyzes it with this model
- Use the resulting expanded data to cluster orca vocalizations and train a neural network that can classify them

Thank you!