Orca Detection

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Overview

- Save researchers and conservationists time by **automating signal detection and labeling**
- **Animal-Spot**: Open source repository for bioacoustic signal detection using a neural network.
- Just care about **DETECTION** for now, not analysis

Data Understanding

- **Orca-Sound**: Open project that places hydrophones in the Salish Sea and makes datasets and live data available for free
- All recordings done in Salish Sea
- **“Noise”** files are **mostly static and background noise**. Empty files were excluded
- Different call types/durations/volumes, 200gb of data

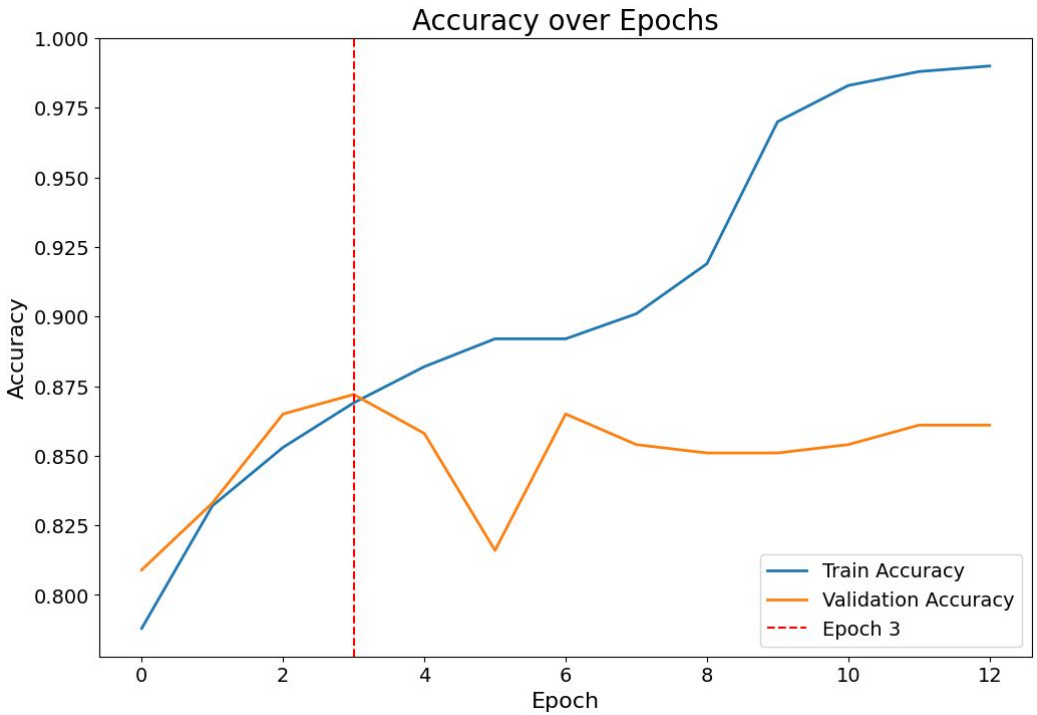
Data Preparation

- 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

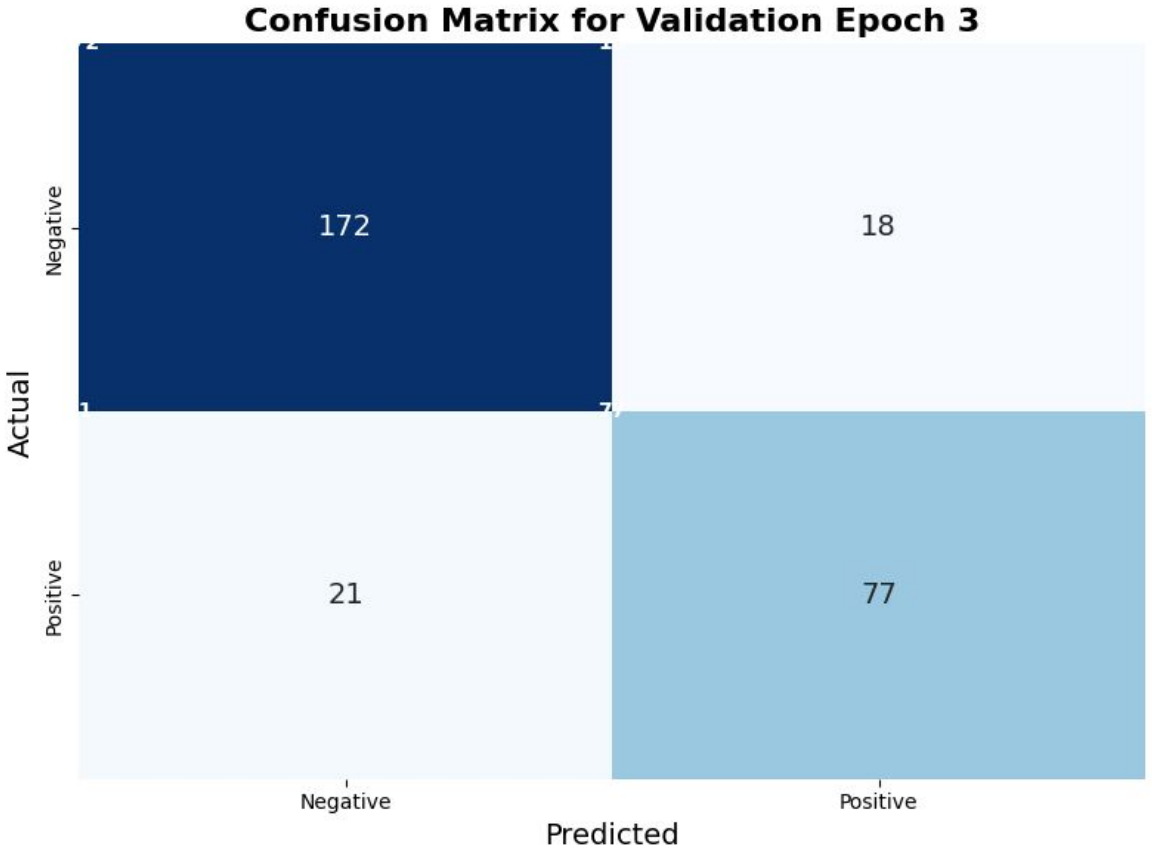
Final Training Results



- **Final model's val accuracy: 87%**
- Test metrics **poorly represent** the final model's capability.
- Best result achieved on **epoch 3**

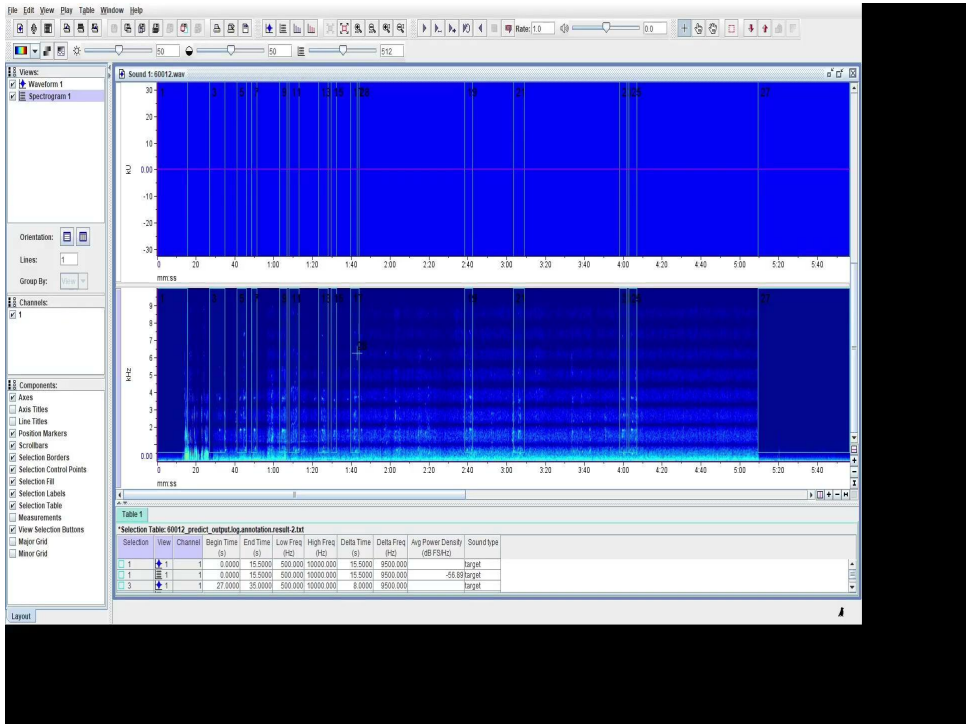
Evaluation

- **Confidence threshold set at 15%**
- Anything model is less than 15% confident in considered **noise**
- Experimentation showed this threshold provided a **compromise** between false positives and negatives

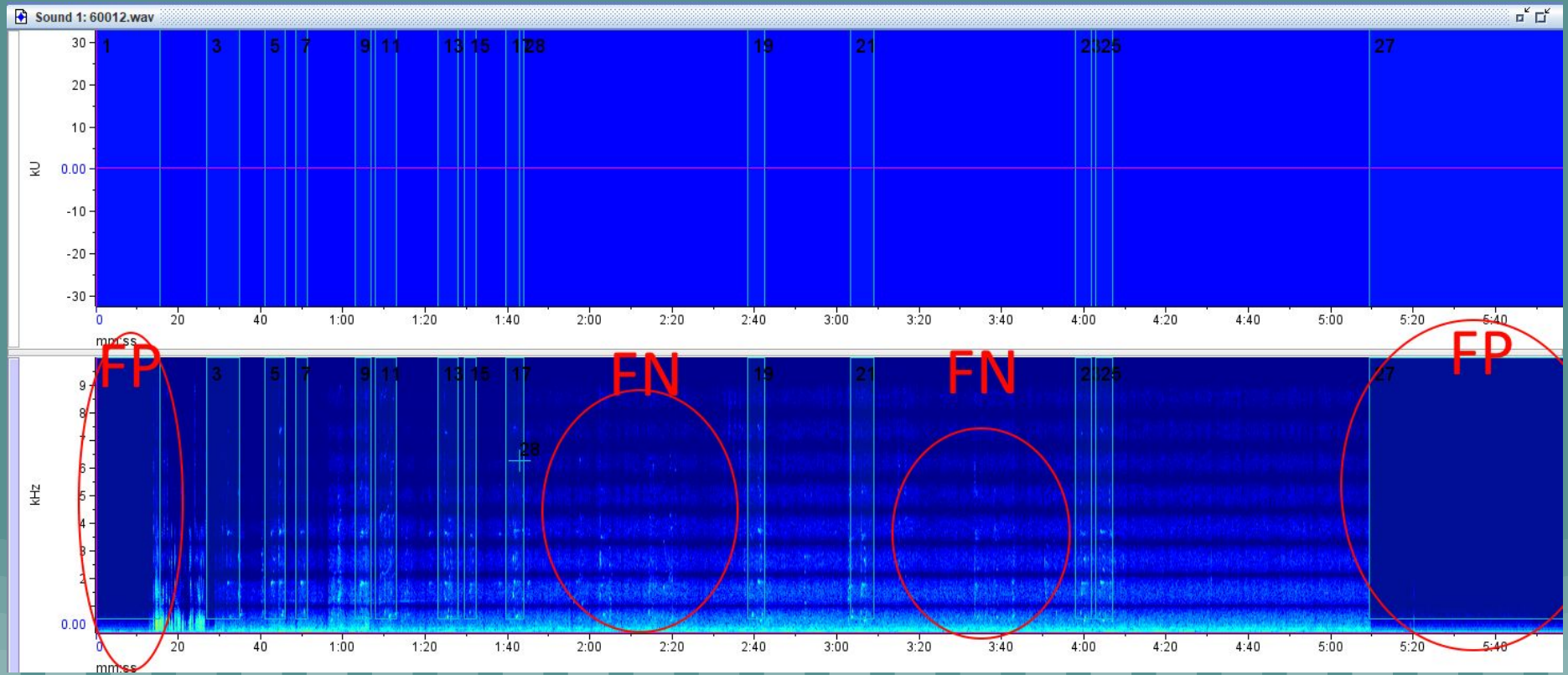


Demonstration

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



- Two false positives
- Multiple regions of False Negativity of varying size
- Maybe worth to **reduce detection threshold**?



Usage Recommendations

- **Prevent collisions** by detecting presence of Killer Whales in area
    - Bonus points for adding a **directional microphone** 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!