

Statistical Filtering of Whistle Detections in the *Silbido* Detector

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INTRODUCTION

- Silbido is an automated Odontocete whistle detection / extraction system.
 - Uses a graph-based algorithm to chain together peaks in a spectrogram.
- It performs well in many cases....
-But still generates false positives in the face of many sources of noise.

The goal is to remove false positives (increase precision) without removing good detection (sacrificing recall).

1. Noise Regime Change Detection

- Based on the Bayesian Information Criterion (BIC)
- Increases *Silbido's* noise compensation effectiveness

2. Graph-Based Filtering (pre-extraction)

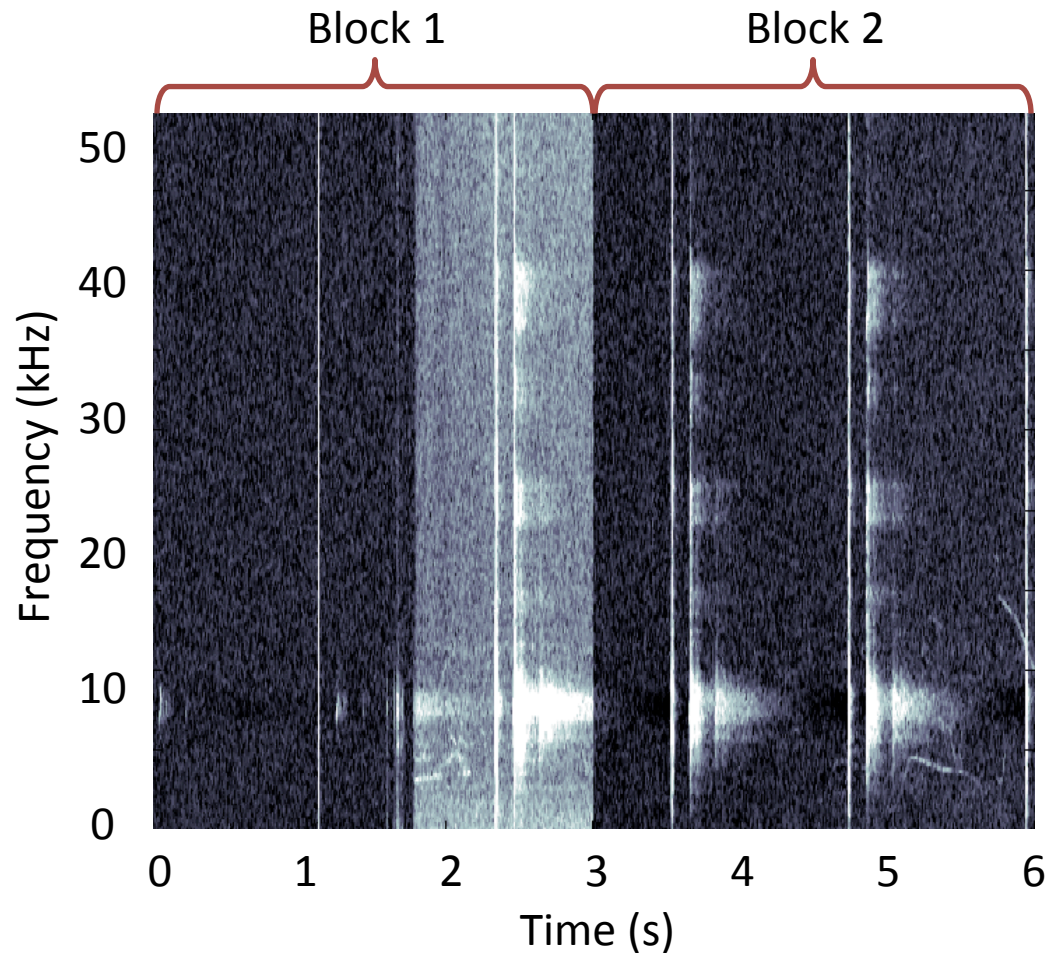
- Based on the characteristics of graphs
- Evaluates the internal structures during processing

3. Tonal-Based Filtering (post-extraction)

- Based on the characteristics of extracted tonals
- Evaluates the time-frequency nodes that make up the extracted whistles

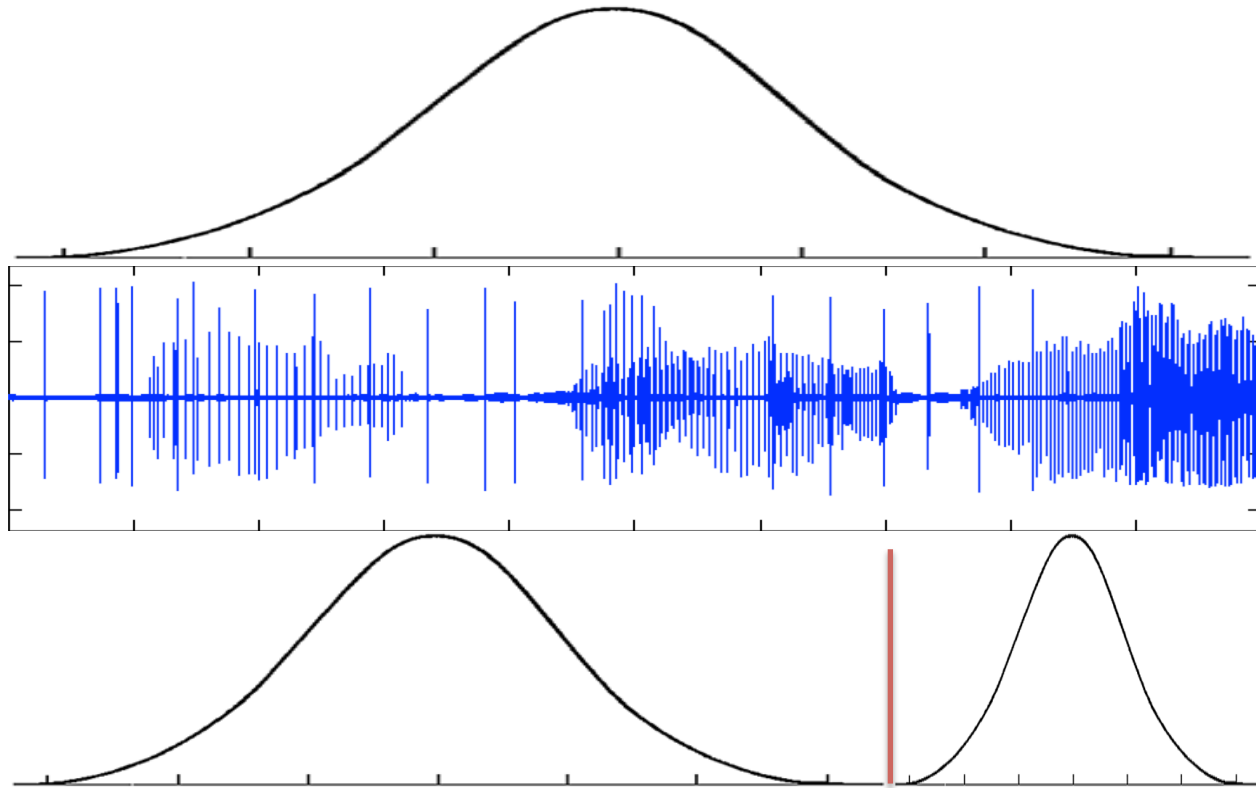
BIC-BASED CHANGE DETECTION

- Silbido previously processed audio in 3-second blocks.
- This poses challenges when noise changes dramatically within a block.



BIC-BASED CHANGE DETECTION

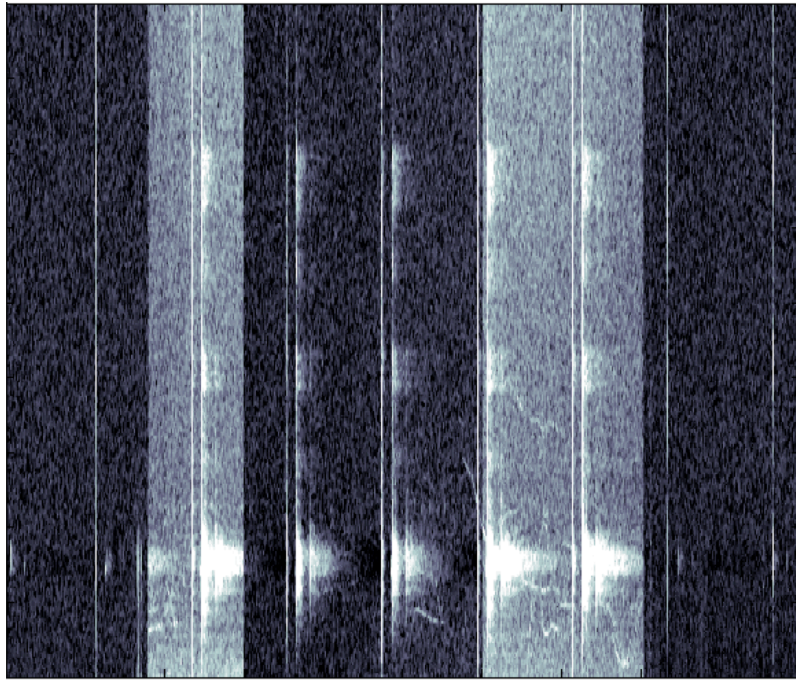
H_a : 1 Normal Distribution



H_b : 2 Normal Distributions

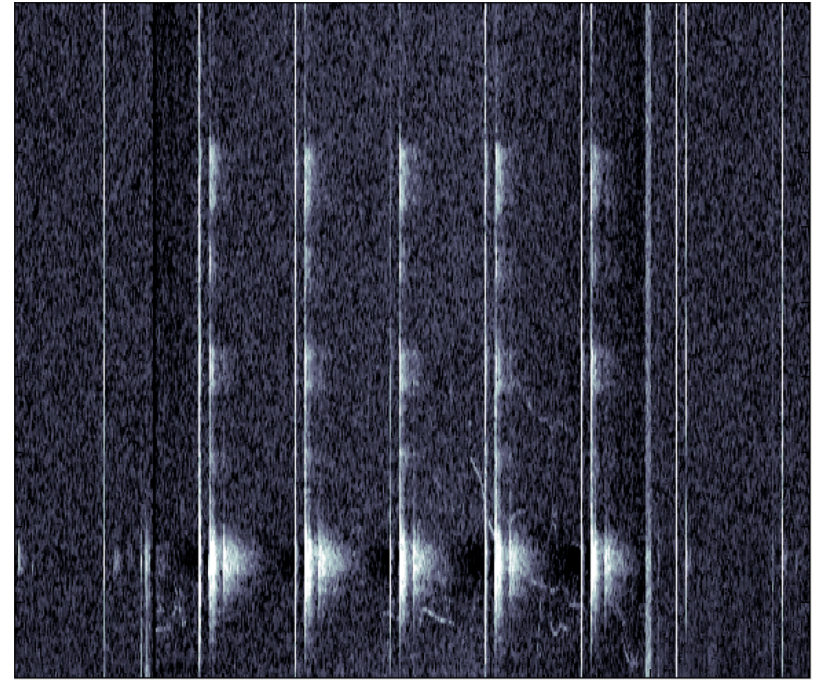
BIC-BASED CHANGE DETECTION

Without Change Detection



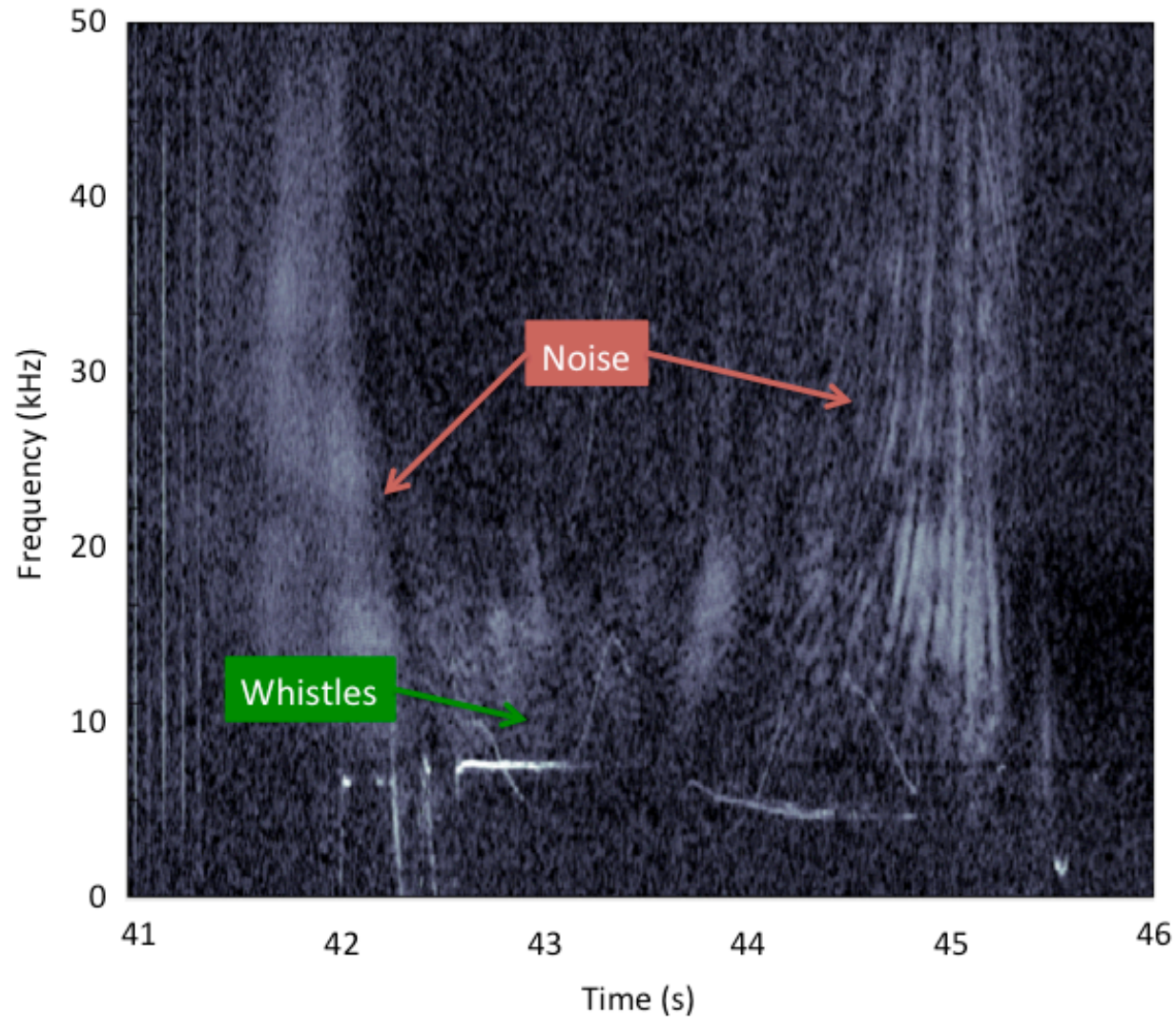
Time

With Change Detection

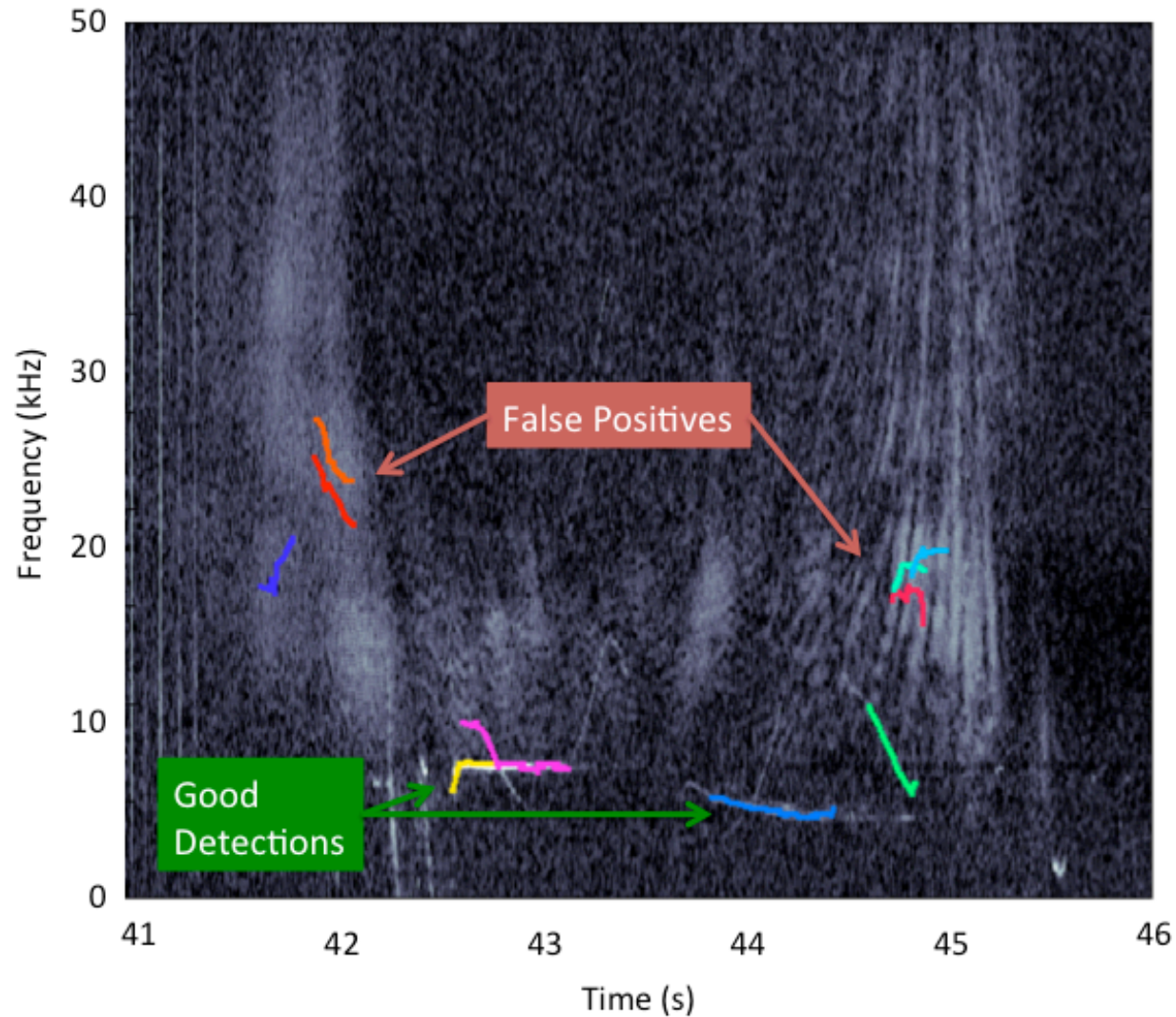


Time

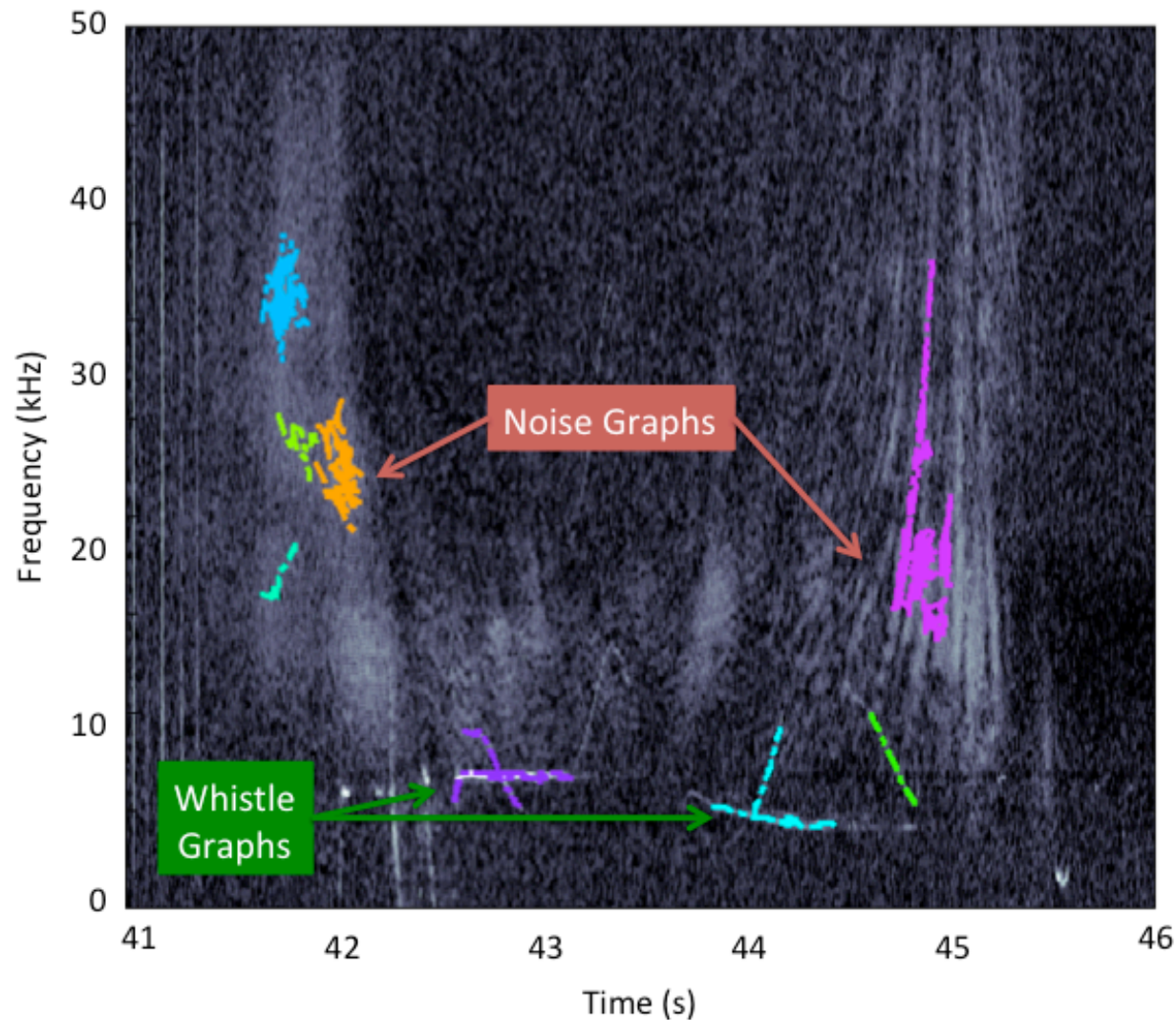
WHISTLES VS. NOISE



FALSE POSITIVES VS. GOOD DETECTIONS

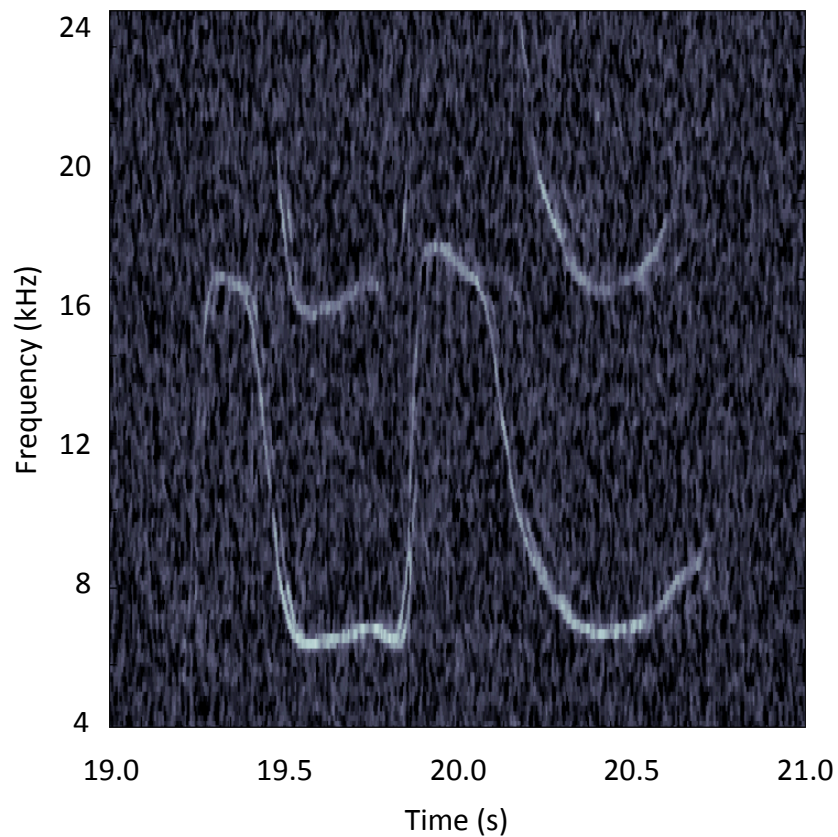


WHISTLES VS. NOISE (GRAPHS)

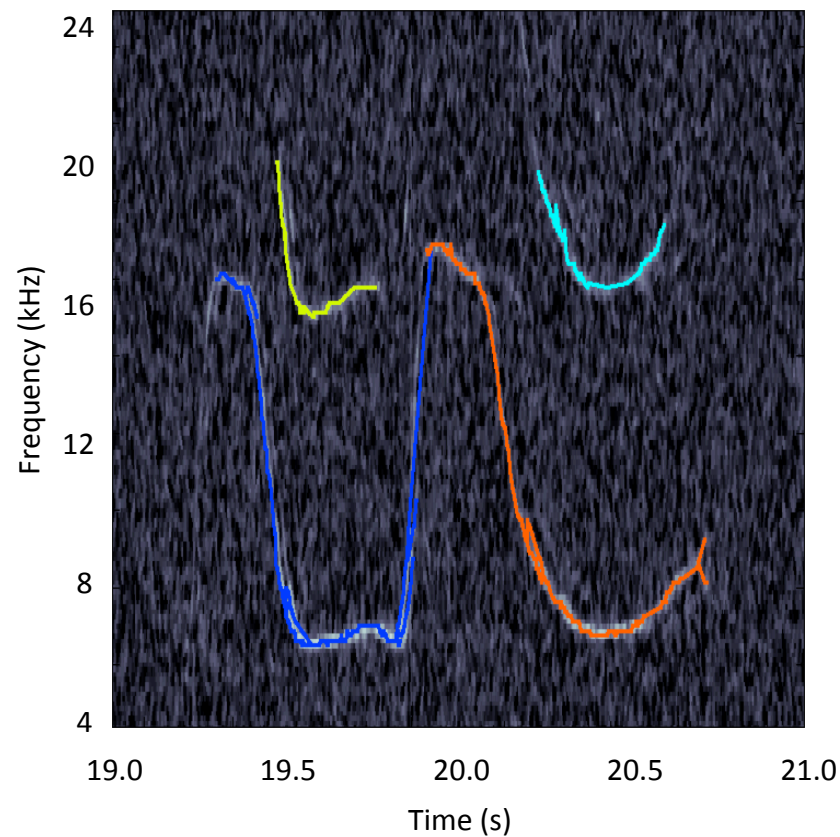


GOOD DETECTION GRAPHS

Input Spectrogram

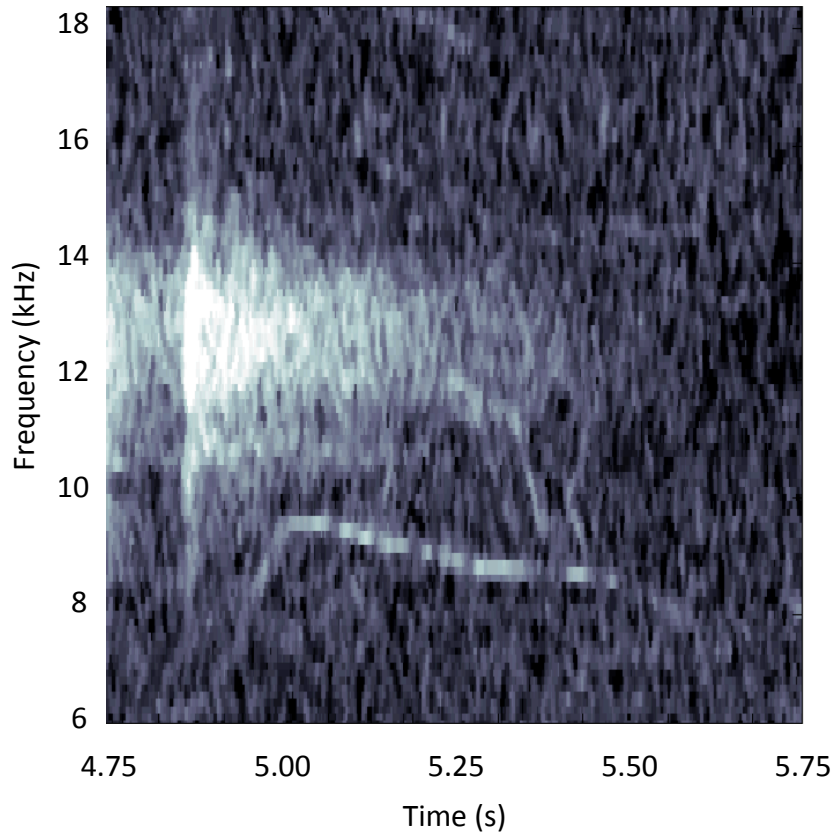


Detection Graphs

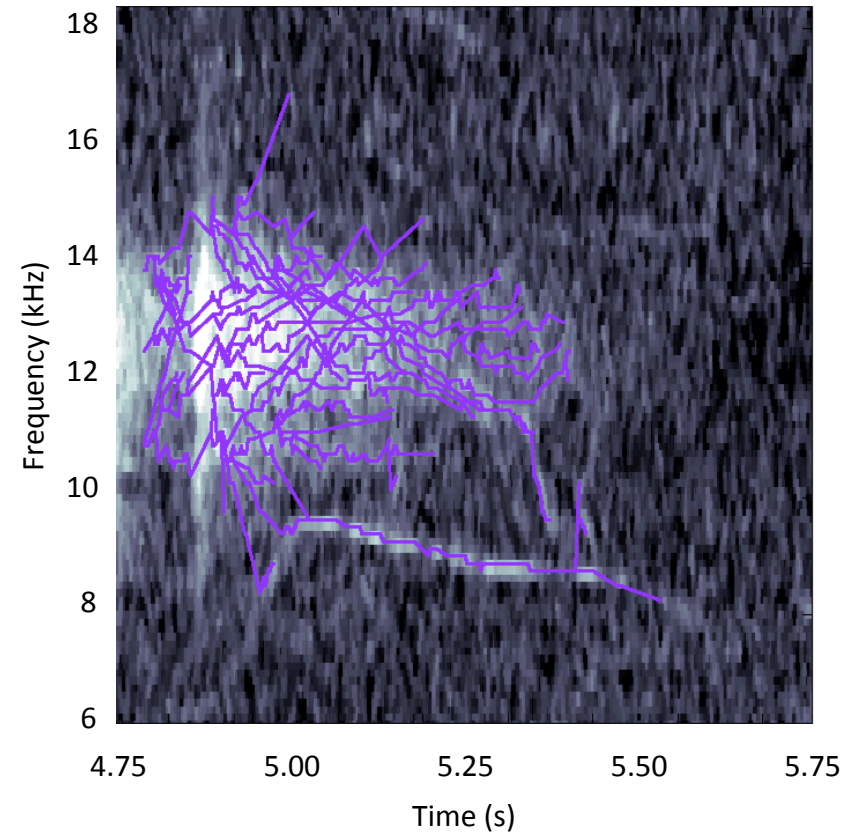


FALSE POSITIVE GRAPHS

Input Spectrogram



Detection Graphs



AUTOMATED FALSE POSITIVE FILTERING

- If humans can identify false positives just by looking at the graphs and tonals, can Silbido do the same?
- Yes!
- The challenge is identifying characteristics that can be used to differentiate good detections and false positives.
- Luckily we have a lot of label (sort of) data.

RESULTS

	Previous Version	Current Version
Precision	76.0%	89.7%
Recall	77.9%	77.8%
Fragmentation	1.2	1.2
False Positives	482	206

57% of the false positives were eliminated.

Thank You

Statistical Filtering of Whistle Detections in the
Silbido Detector