SRI Acoustics Team

July 24th, 2014 Update

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Overview

● Introduction
● Methodology
● Results
● Recommendations
Panga & Jet Ski
Slipping Under the Radar

AIS from marinetrack.com

Jet Skis on Hudson River

Courtesy of the SRI Synergies Team
Passive Acoustics

- SPADES
- Capabilities:
  - Detection
  - Tracking
- What is missing?
  - Automatic Classifier
Acoustic Fingerprint

Panga:

Jet Ski:
Resources

● Vessel Acoustic Data Sets
● Signal Analysis Algorithms
  o Extraction of key characteristics
● WEKA
  o Classification tool
Process Flowchart

- Unknown Vessel
- Hydrophone
- Signal Analyzer
- Machine Learning Data Base
- Classified Boat
Blind Testing of Classifier

- An automatic classification algorithm was designed using the extracted data.
- Blind data set had 3 possible options for classification: Panga, Jet Ski, or Other
## Blind Testing Results

### Blind Test 2

<table>
<thead>
<tr>
<th>Trial</th>
<th>Actual</th>
<th>Predicted</th>
<th>Probability: Other</th>
<th>Probability: Jet Ski</th>
<th>Probability: Panga</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Panga</td>
<td>Panga</td>
<td>0.11</td>
<td>0.008</td>
<td>0.882</td>
</tr>
<tr>
<td>2</td>
<td>Panga</td>
<td>Panga</td>
<td>0.11</td>
<td>0.008</td>
<td>0.882</td>
</tr>
<tr>
<td>3</td>
<td>Panga</td>
<td>Panga</td>
<td>0.413</td>
<td>0.015</td>
<td>0.572</td>
</tr>
<tr>
<td>4</td>
<td>Panga</td>
<td>Other</td>
<td>0.616</td>
<td>0.195</td>
<td>0.19</td>
</tr>
</tbody>
</table>

- Actual: Panga
- Classified as: Panga
  - 3 of 4 instances correctly identified

### Blind Test 5

<table>
<thead>
<tr>
<th>Trial</th>
<th>Actual</th>
<th>Predicted</th>
<th>Probability: Other</th>
<th>Probability: Jet Ski</th>
<th>Probability: Panga</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Other</td>
<td>Other</td>
<td>0.914</td>
<td>0.01</td>
<td>0.076</td>
</tr>
<tr>
<td>2</td>
<td>Other</td>
<td>Other</td>
<td>0.914</td>
<td>0.01</td>
<td>0.076</td>
</tr>
<tr>
<td>3</td>
<td>Other</td>
<td>Other</td>
<td>0.641</td>
<td>0.068</td>
<td>0.291</td>
</tr>
<tr>
<td>4</td>
<td>Other</td>
<td>Other</td>
<td>0.641</td>
<td>0.068</td>
<td>0.291</td>
</tr>
</tbody>
</table>

- Actual: Other
- Classified as: Other
  - 4 of 4 instances being correctly identified
Conclusions

- Overall performance indicates automatic classification is promising
- Jet Skis prove to be more easily identifiable than Pangas
- Pangas similarity to other vessels makes classification a challenge
Recommendations

- Make the feature extraction automatic
- Obtain more data to create a larger database
- Exploration of the usefulness of other features
- Integration with Magello
Acoustic Shape Method

Power Spectrum Data → Acoustic Shape → Compare in Database → Classifies Vessel
Planned Integration with Magello
Thank You

Beth Austin DeFares, Dr. Barry Bunin, Dr. Alexander Sutin, Dr. Julie Pullen, Dr. Hady Salloum, Mykhail Tsionsky, Alexander Yakubovsky, Alex Pollara
Questions?

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