Distributed Sensor Signal Acquisition, Analysis, and Representation for Environmental Surveillance Monitoring Applications (ESM)

By: Yuji Yunes, MS Student

Advisor:
Prof. Domingo Rodriguez

WALSAIP

Automated Information Processing Laboratory (AIP)
University of Puerto Rico, Mayagüez Campus (UPRM)
May 2007

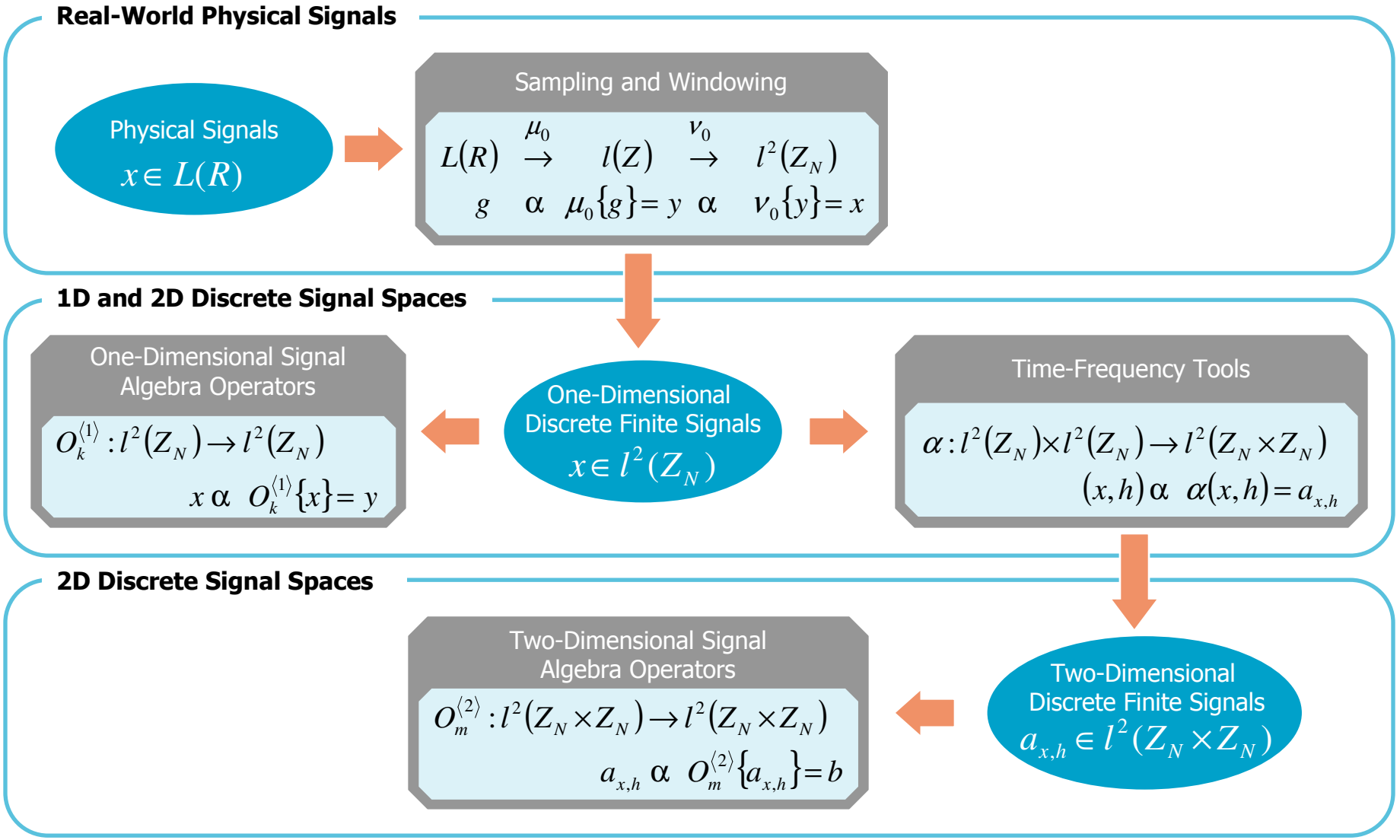
Problem Formulation

1. How to develop high-resolution, efficient, time-frequency representations of acoustic signals.
2. How to design DFT beamforming algorithms to detect direction of arrival (DoA) of acoustic sources.

Justification:

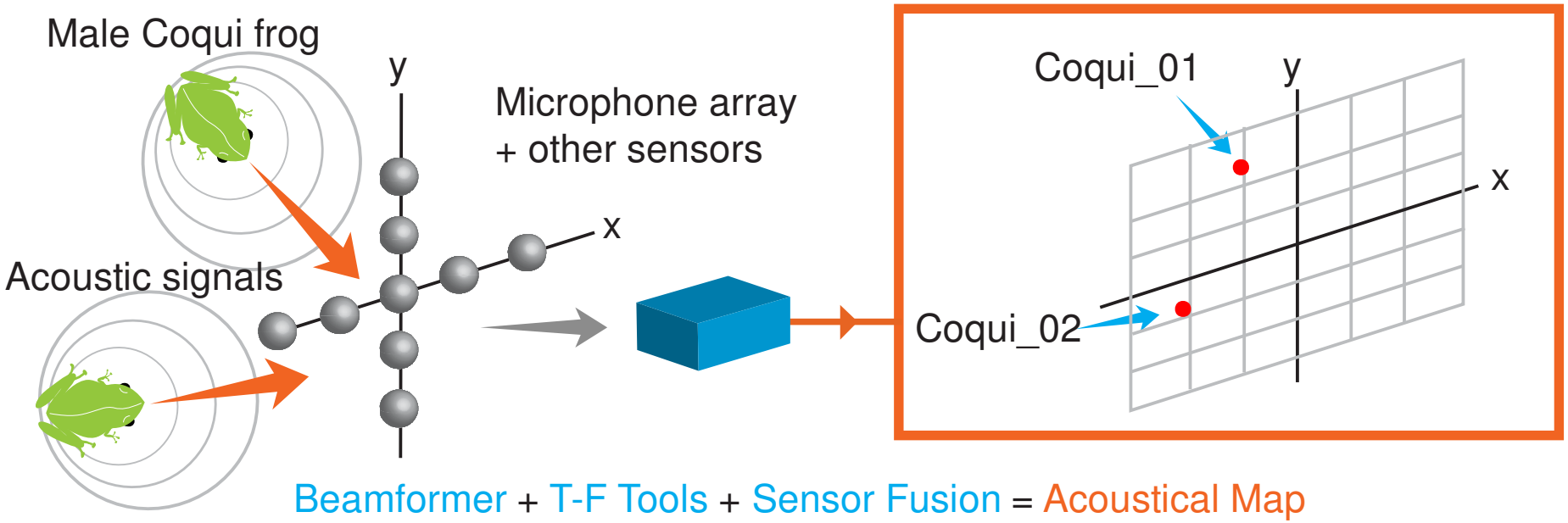
- There is a need to explore new and efficient ways for the monitoring and surveillance of the environment.
- There is also a need to map spatial coordinates of acoustic sources (A-MAP).

Methodology (Operator Approach to Signal Analysis)



Application Tools

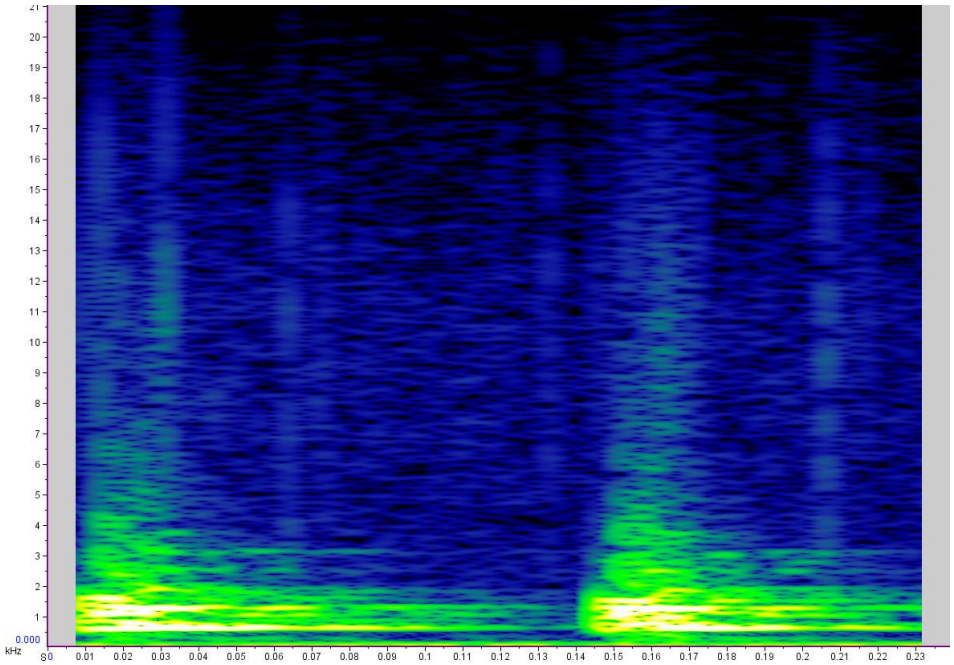
- MATLAB is being used for development and testing of the algorithms.
- Raven is a time-frequency (T-F) tool product developed by Cornell University.
- TI 6713 (floating point) DSPs with Code Composer Studio IDE.
- Xilinx Virtex 4 and Virtex II-Pro FPGAs with ISE and System Generator v8.1.
- Crossbows mica2, mica2dot, and micaZ motes (WSN).
- Tmote Invent and Sky motes (WSN).
- Gumstix Embedded PCs.
- AOpen i945GTt-VFA Core 2 Duo Mobile Embedded PC.
- Data Translation DT-9816 Data acquisition boards.

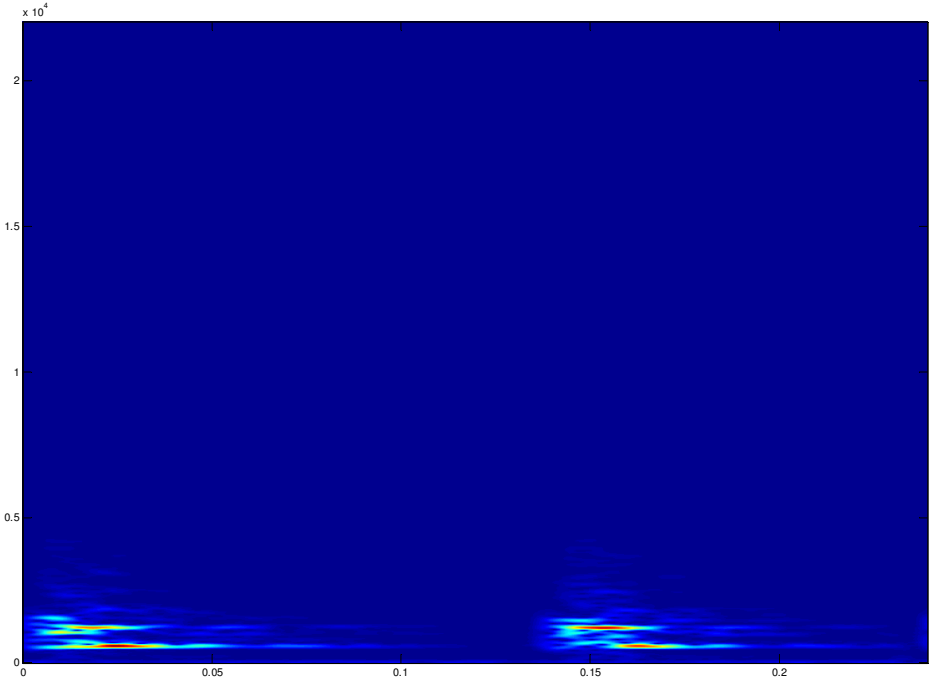


Beamformer + T-F Tools + Sensor Fusion = Acoustical Map

Research Results

Raven vs. Cyclic Short Time Fourier Transform (CSTFT) of a Bufo Lemur frog calling





- Raven's Spectrogram
- CSTFT's Spectrogram