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

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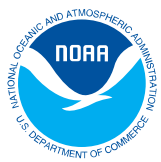


AIP Group 2

Automated Information Processing

Problem Formulation

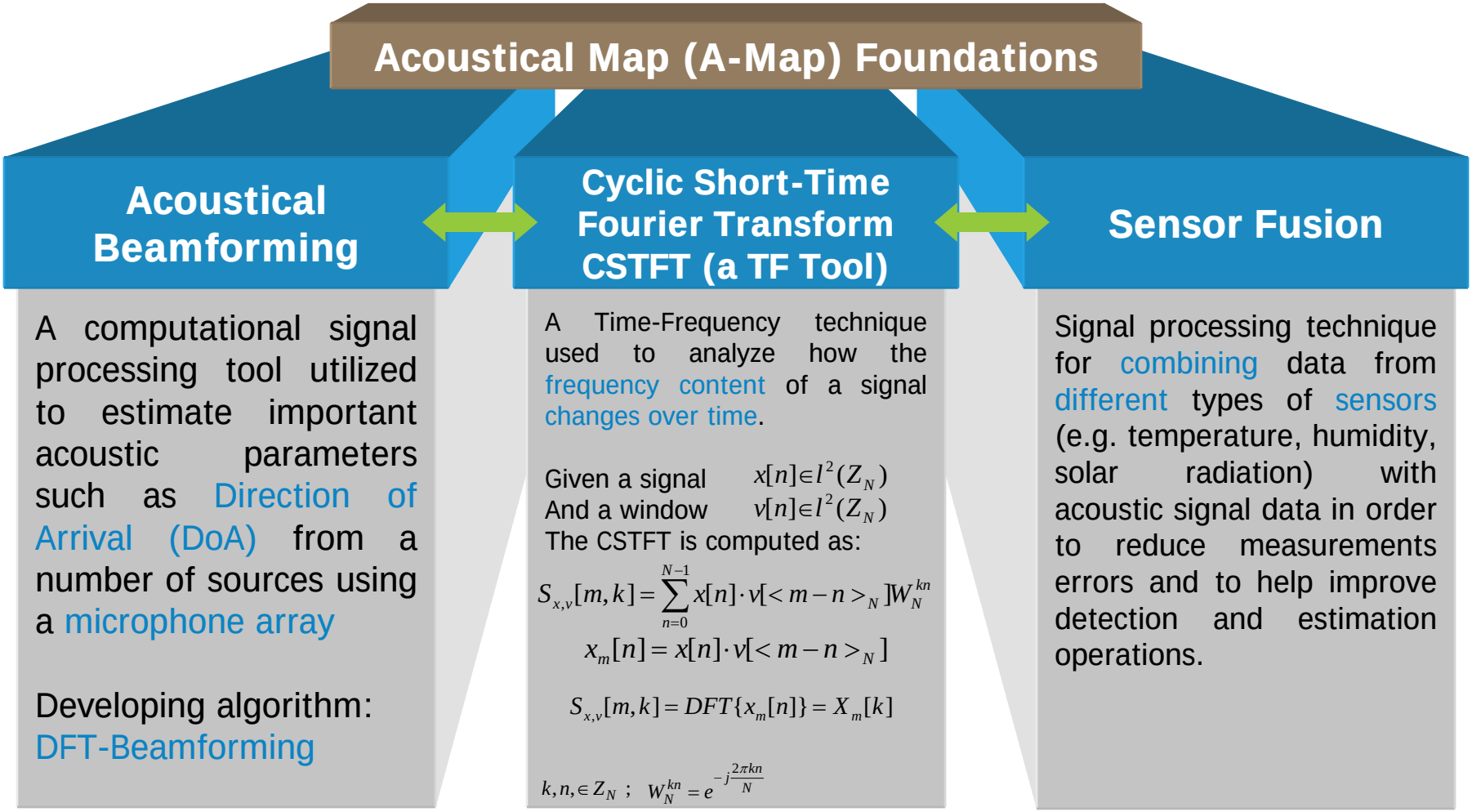
- There is a need to explore new and efficient ways for the monitoring and surveillance of the environment.

- Two types of monitoring: Remote vs. In-situ
  - In-situ Monitoring: physical contact between sensor and phenomenon (e.g. Microphones, Thermometers, Wireless Sensor Networks WSN, etc)

- Can acoustic signals (sound) be used for ESM applications?
  - Sound is an excellent carrier of information
  - Omnidirectional propagation
  - Light absence immunity
  - Low cost hardware
  - May exploit new tech standards such as High Definition (HD) Audio

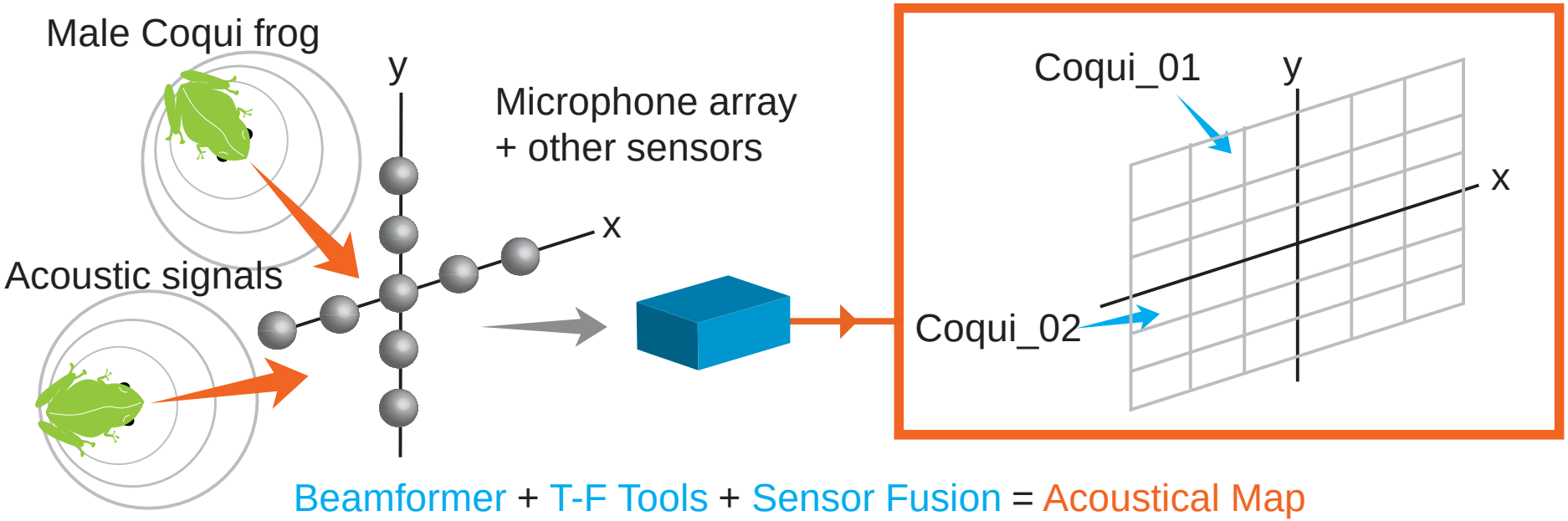
Proposed Solution: Acoustical Map (A-Map)

- How we extract information relevant to an user? Use an **A-Map**



Acoustical Map (A-Map) Depiction

- An A-Map result produces imaging representation of detected acoustic sources (e.g. coqui and/or bufo lemur frogs, native birds, human-made sounds, etc) for time-frequency analysis as well as a map of their estimated location in an environmental observatory.
- The A-Map tool is being designed to interact with the WALSAIP Visual Terrain Explorer Application.



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

- Inside each blue-box, a master sensor node (MSN), may exist a configuration of DSP's and/or FPGA's, with an embedded computer to deal with the processing tasks.

A-Map Tools and Development Environment

- MATLAB is being used for development and testing of the algorithms.
- A MATLAB-based A-Map is currently under development.
- 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.
- Elite PMI8M w/Pentium M 1.6G Embedded PC.
- Data Translation DT-9816 Data acquisition boards.