Centro de Vision y Robótica

“On the water AI” to improve water use practices in shirmp farms

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OUTLINE

- Water use in shrimp farming (Ecuador)
- New tools for data processing
- Pond event detection system
- Results
- Future directions

Disclaimer
ECRobotics IP
Experimental work supported by
CENAIM-ESPOL
CADS – ESPOL
Shrimp producer company.

Ecuador Acuiculture Industry*

- Ecuador is the 4th producer of shripms (143000 MT)
- 1.432 “camaroneras”
- 213.000 Ha of land is used for shrimp production.
- A large proportion of producer are “small ” < 20 Ha (5-7 Ha/pond).
- Income 2.5 billion USD.

* 2016 BCE, FAO;ESPOL

Water use in shrimp farming

- Water is pumped from/to the ocean and streams
- In a medium-size farming operation between 5% to 20% of water is replaced daily.
- Reasons for water replacement:
  - Uneaten food
  - Shrimp waste
- **FCRs betwenn 1.5 and 1.7 are common**
- Re-circulation systems too expensives

Using data to improve water use

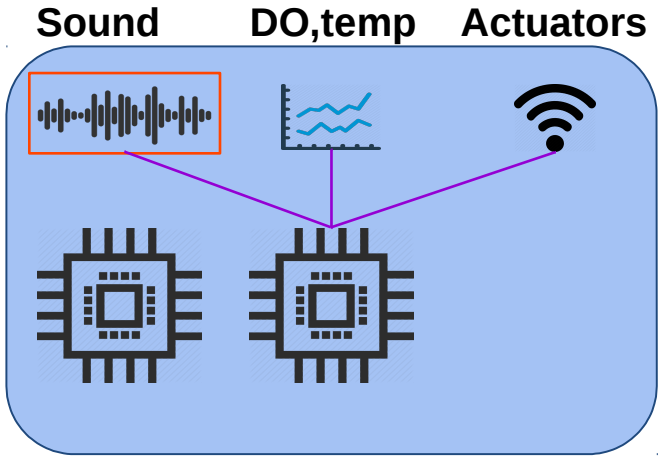
- Can we reduce water-replacement using real-time data? → feeding, water-quality
- Pond data is difficult to obtain
  - Data adquisition and transmition require investment
  - Historical data (Confidential)
- IoT and sensor technologies can help yet there are many challenges.

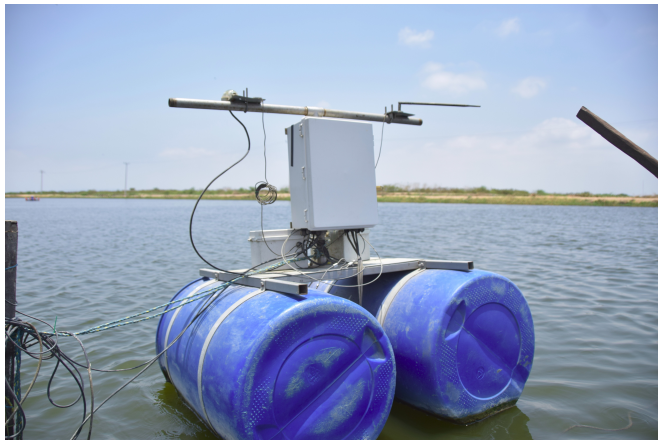
Engineering challenges

- Limited access to electrical grid.
- Poor energy quality (+/- 20v.)
- No network access (GPRS, 5G unrealistic)
- No IT infrastructure
- We need the full data processing pipeline on-site!

System on chip technology

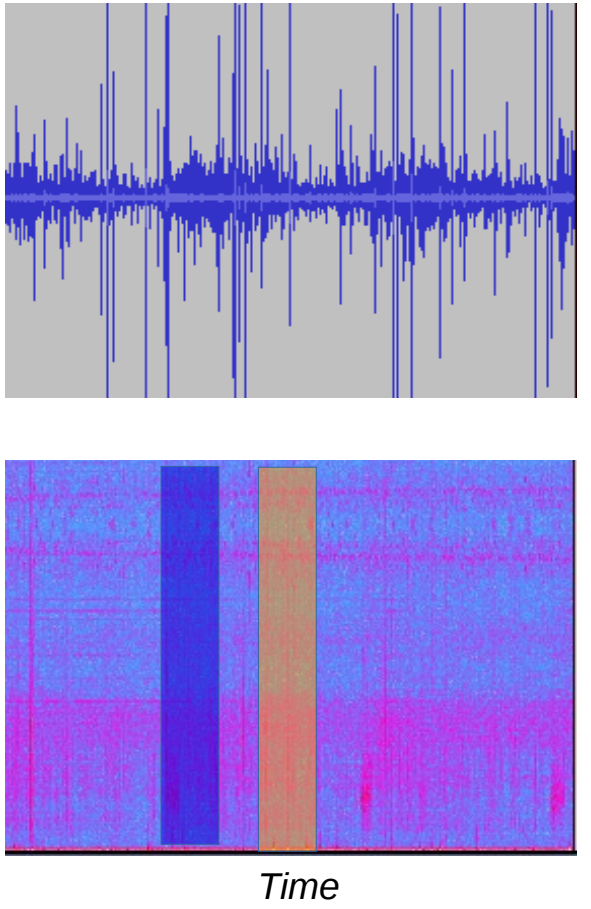
- Let us make IoT device cloud-less.
- Exploit System on Chip technology
  - Low energy comsumption
  - Parallel processing
  - Several comm interfaces
- With a clever firmware design we can have:
  - A data adquisition device.
  - A Machine learning engine.
  - A self-contained control system





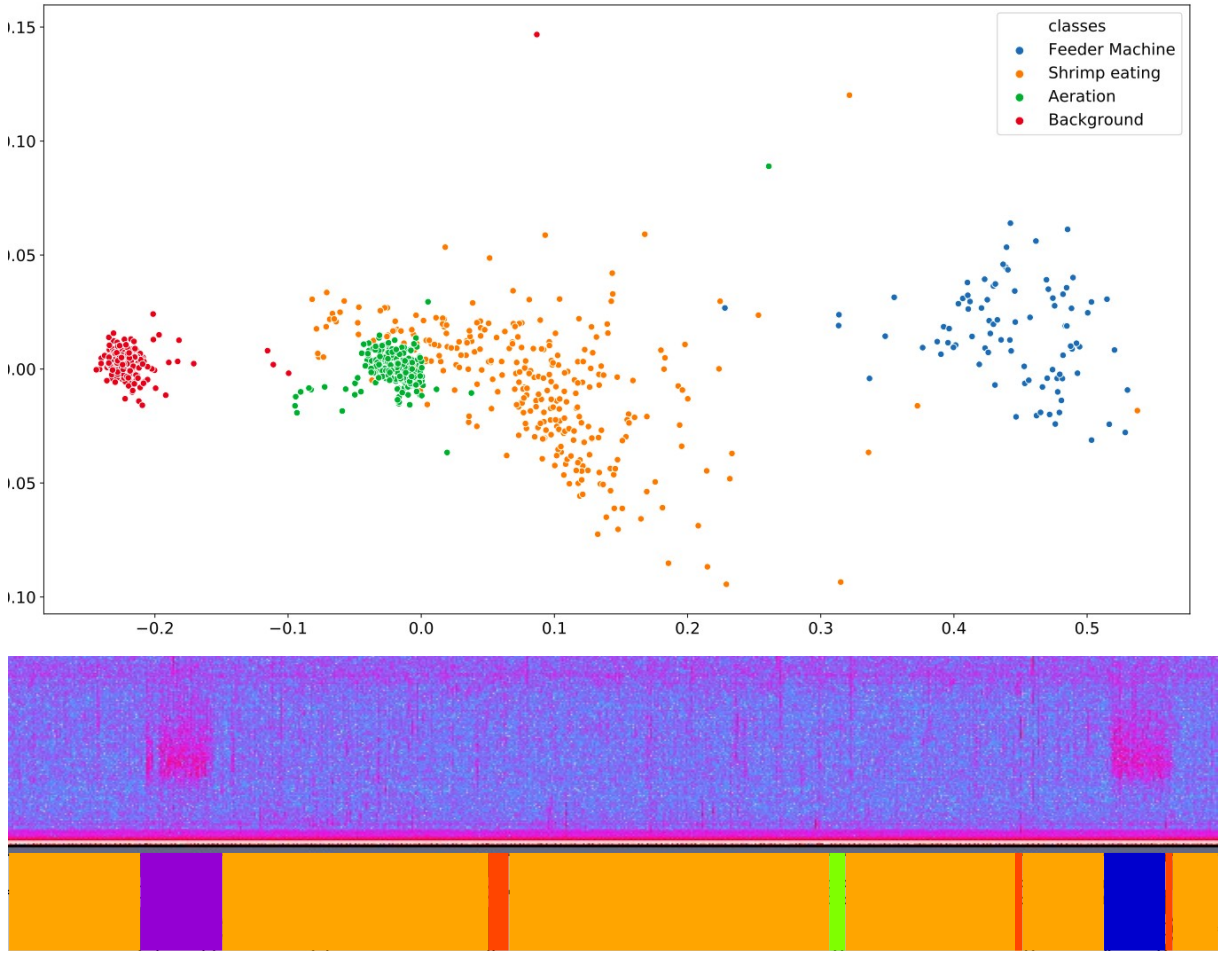
On the water IA

- Correlate Shrimp fedding activity with water quality parameters.
- First, we need to discriminate between feeding and other events.
- Sound events manually annotated
- On-line and off-line
  - Biologists in lab/field
- Feature design
  - Loudness Invariant

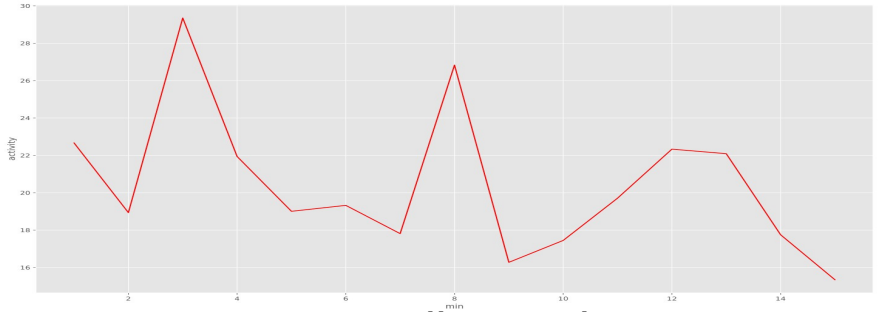


Machine learning

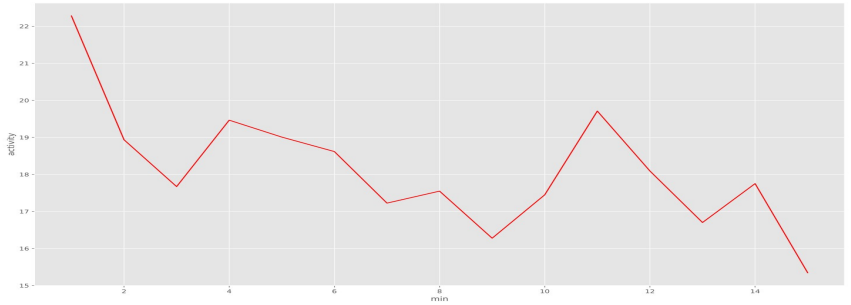
- Pond events:
  - Shirmp feeding
  - Feeding Machine
  - Aerator Machine
  - Backgound noise
- Classifier 96% accuracy
- We can measure:
  - Shrimp feeding activity.
  - Food distribution times.
  - Aerator effect on DO levels



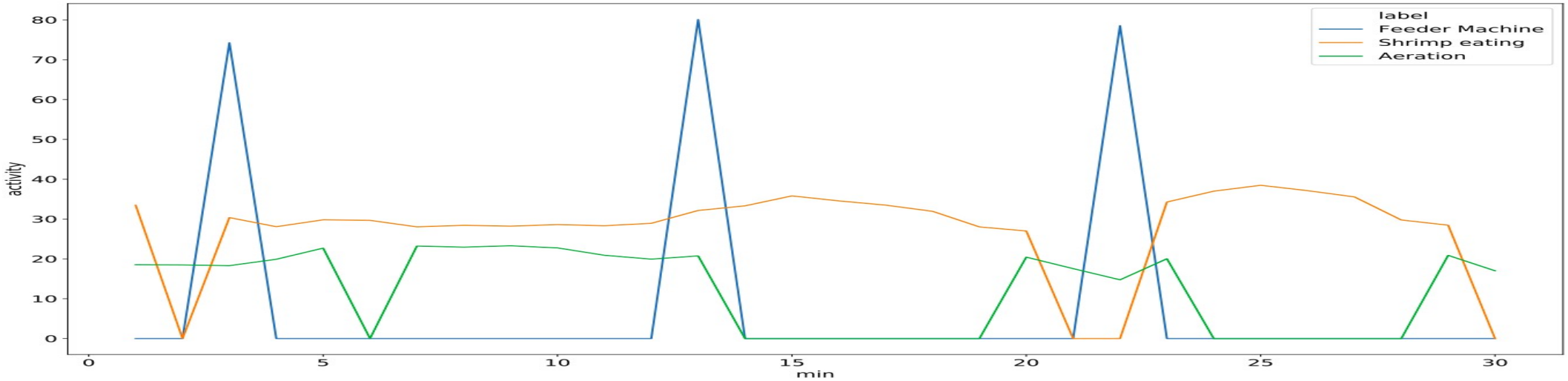
Machine learning



Full sound

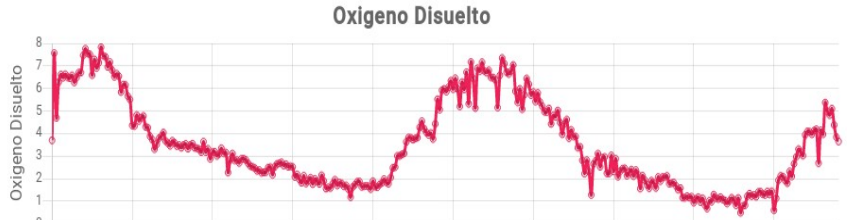


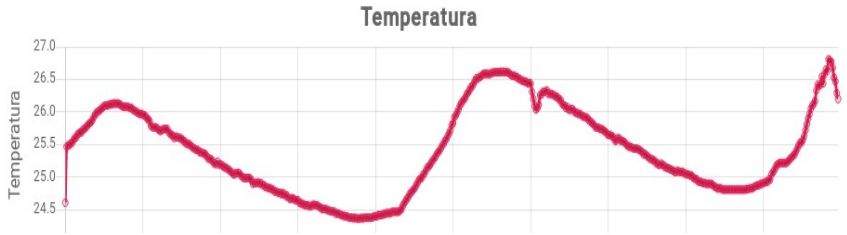
Shrimps only



Project status

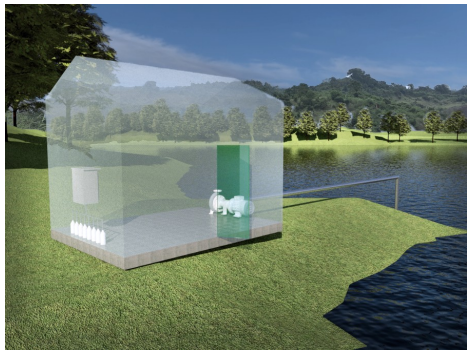
- Models being built:
  - Feeding curves → Reduce FCR
  - Aerator control algorithm
- Add sensor information:
  - DO and temp already recorded
  - Image data
  - Historical data (if possible)





Future work

- Adapt technology for other techniques:
  - On-site chemical tests.
  - Virtual sensors.
- Other settings
  - River
  - Streams



Questions?