CPS: Machine Learning Enabled "Smart Nets" to Optimize Sustainable Fisheries Technologies

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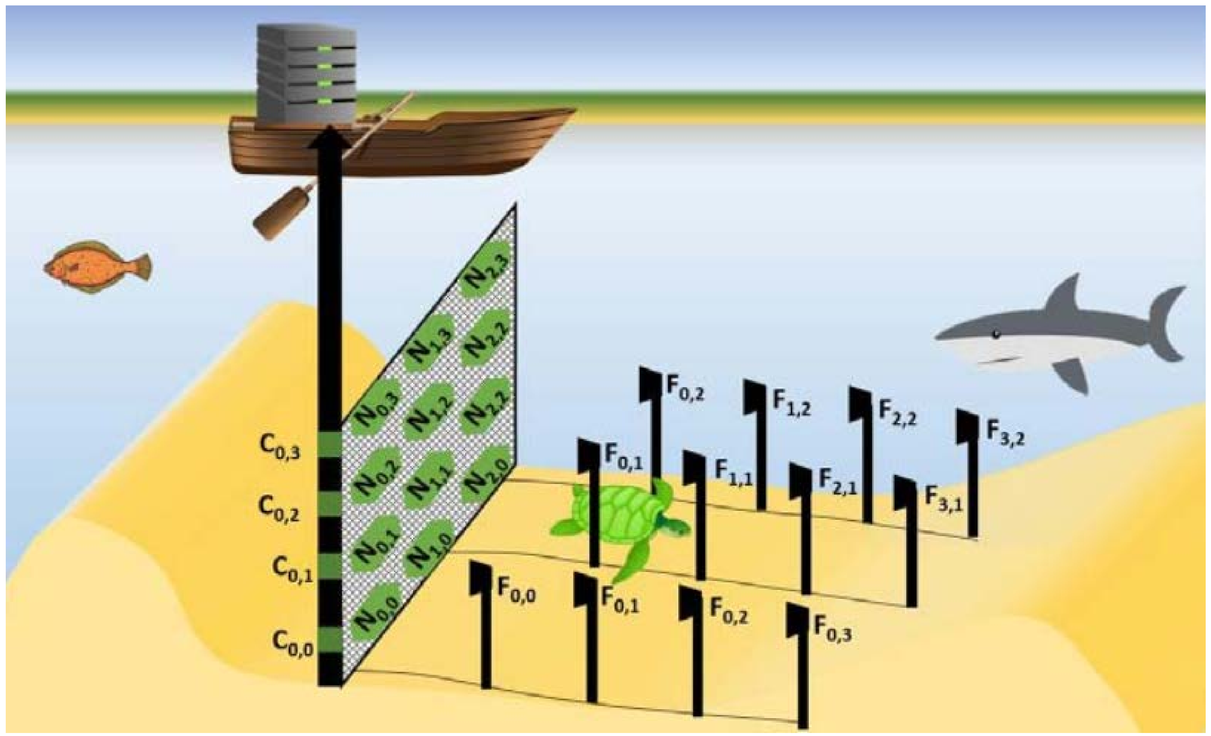
Challenge:

- Prevent the bycatch of endangered marine megafauna species in fishing gear



Solution:

- Emit sensory cues from the net to deter the marine megafauna
- Use machine learning to optimize the emitters for power and efficacy

Scientific Impact:

- Implement a machine learning system with reinforcement learning in a highly dynamic environment

Broader Impact:

- Prevent extinction of endangered sea life
- Empower artisan fishers to protect their livelihood and fish populations
- *Over 50% reduction in sea turtle by catch and 80% in sharks and rays*

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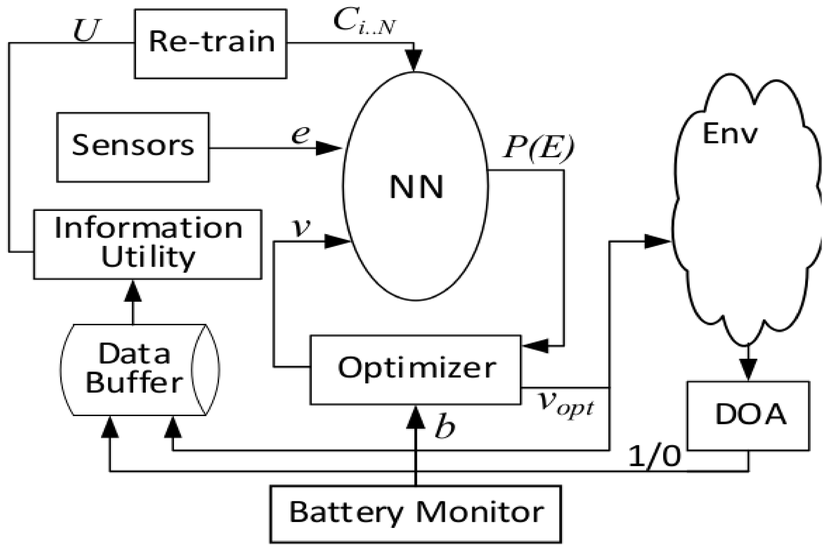
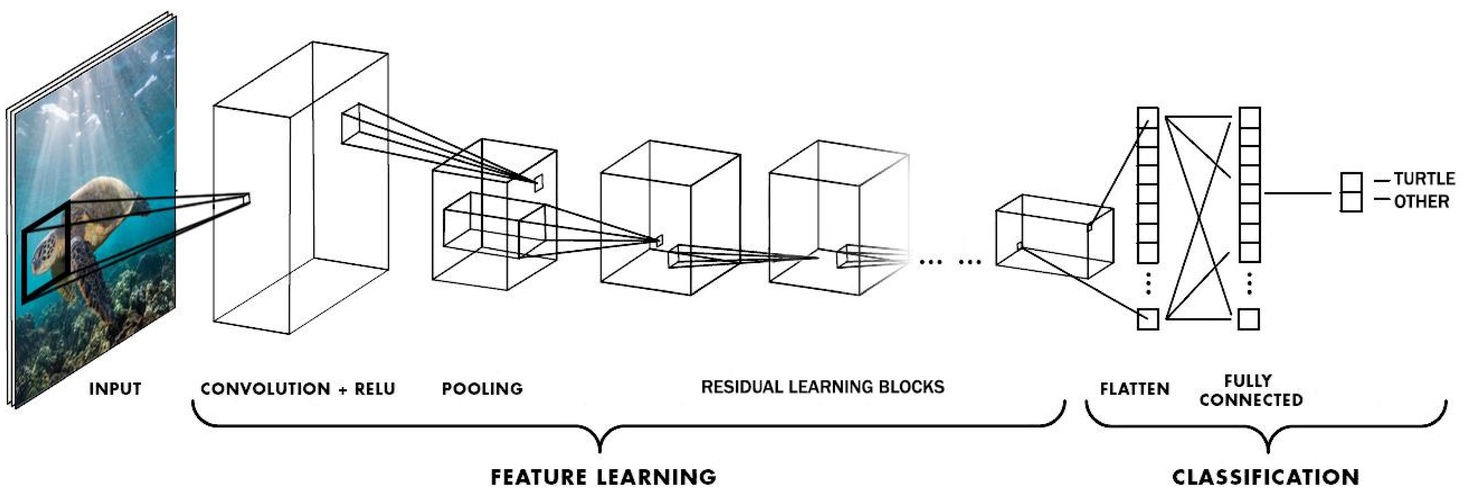
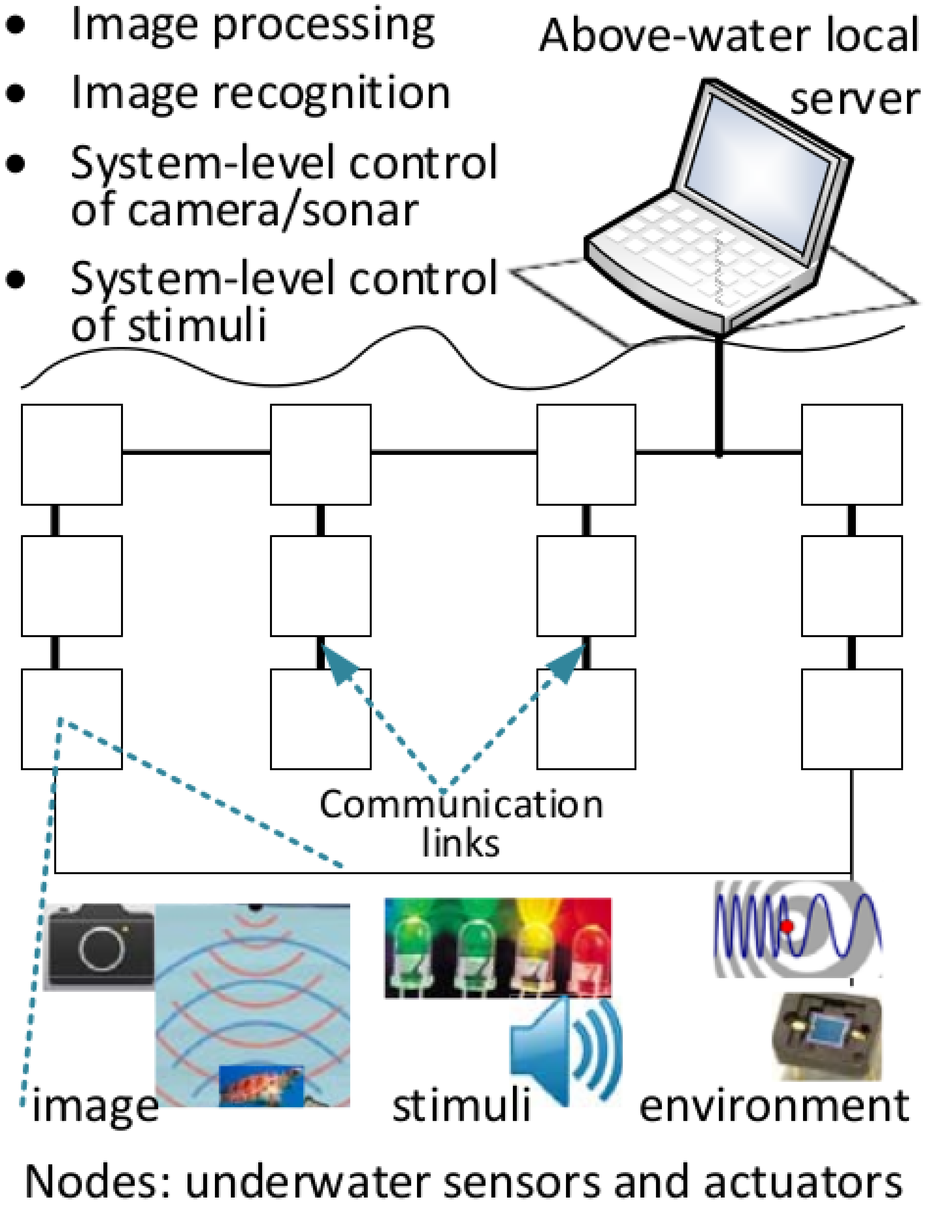
Self-learning Control System for Stimuli Settings

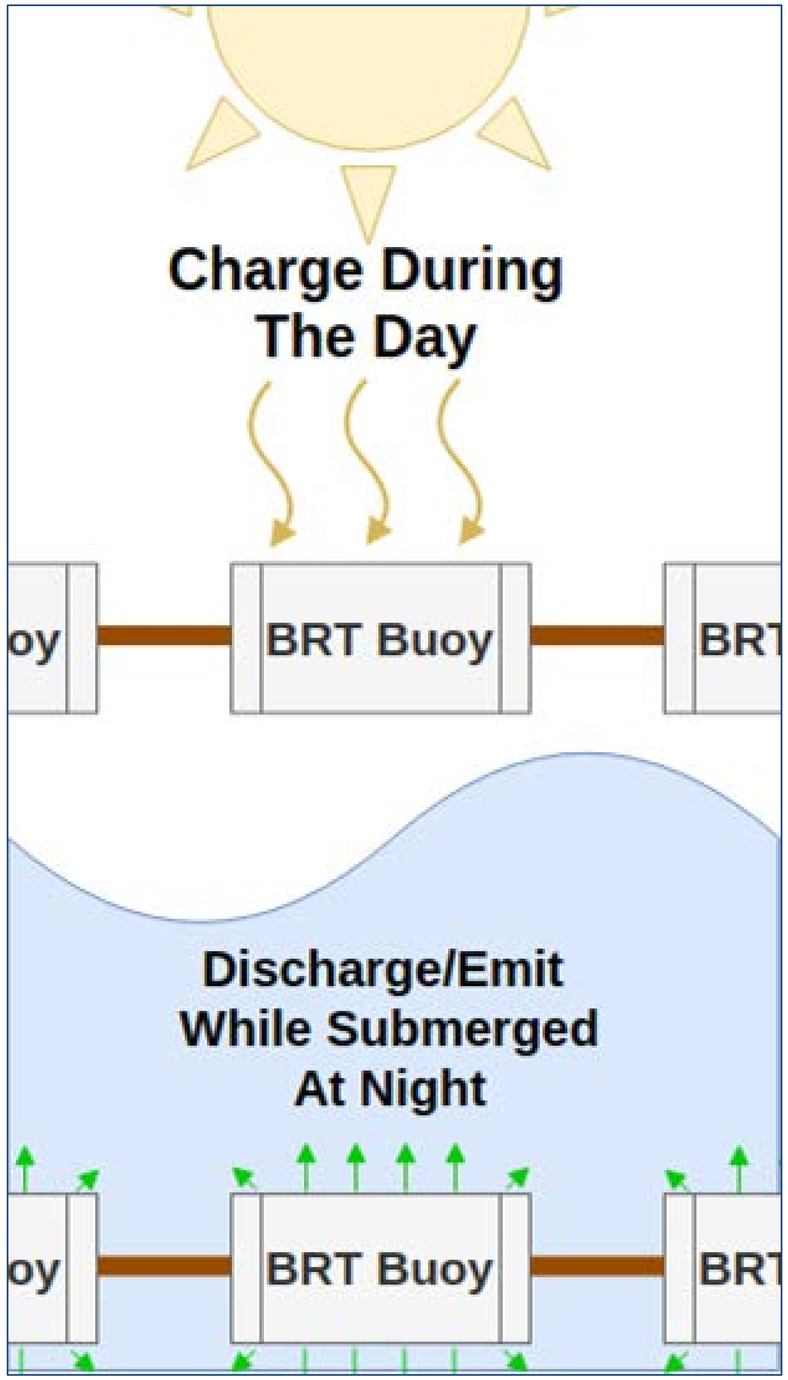
- Modelling Highly Dynamic Marine Environments
- Cataloging Behavior Response in Sea Life
- Developing an Autonomous, Multimodal, Closed-Loop CPS
- Identifying Power Efficient Design Parameters for BRT Stimuli

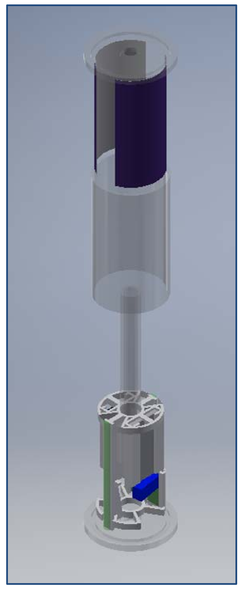


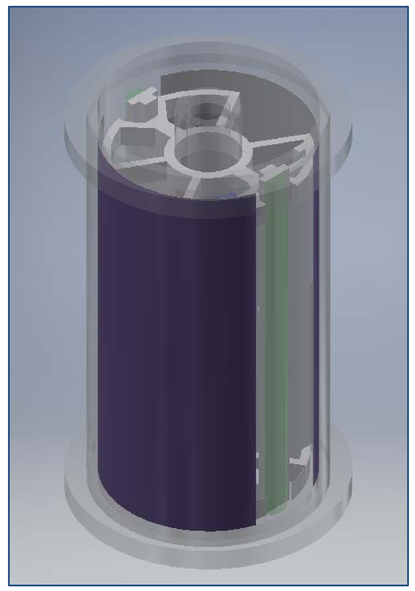


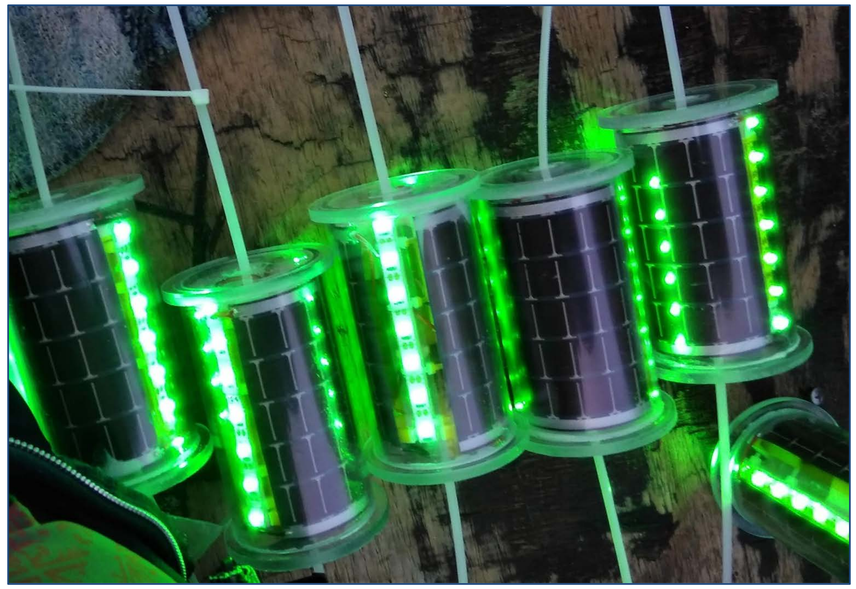
- Image processing
- Image recognition
- System-level control of camera/sonar
- System-level control of stimuli

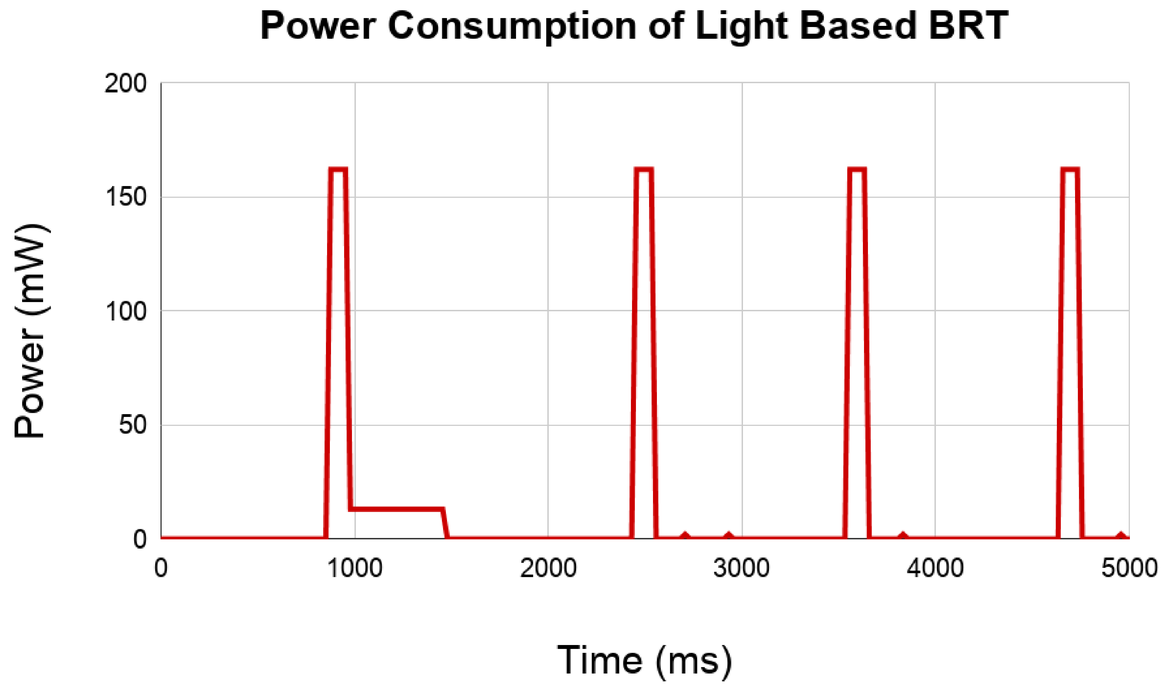



Charge During
The Day
oy
BRT Buoy
BRT
Discharge/Emit
While Submerged
At Night
oy
BRT Buoy
BRT








Power Consumption of Light Based BRT
Power (mW)
200
150
100
50
0
0
1000
2000
3000
4000
5000
Time (ms)

Interdisciplinary Research

- Conservation Biologists and Electrical Engineers at ASU work together to distill design requirements and implement real-world solutions.

Cross-Community Collaboration

- Trained local communities on light-based BRT bet.
- Taught principles of sustainable and renewable energy engineering.

Field Research

- Worked with regional NGO, Grupo Tortugeuro, to deploy a light-based BRT net with commercial fisheries.

Support of Local Communities

- Worked with local fisheries to determine commercially viable conservation strategies.