



SenSIP
Sensor, Signal and
Information Processing Center



NSF Research Experience
for **TEACHERS (RET)**

A Bright Idea


Dr. Anna Haywood



**GLENDALE
COMMUNITY COLLEGE**

A MARICOPA COMMUNITY COLLEGE



- People  sea turtles.

This project is funded by NSF Award 1953745

Research Motivation

Issue:

- **Bycatch** - accidental capture of non-target animals in fisheries

Impact:

1. Marine Populations
2. Commercial Fisheries Netspace & Income

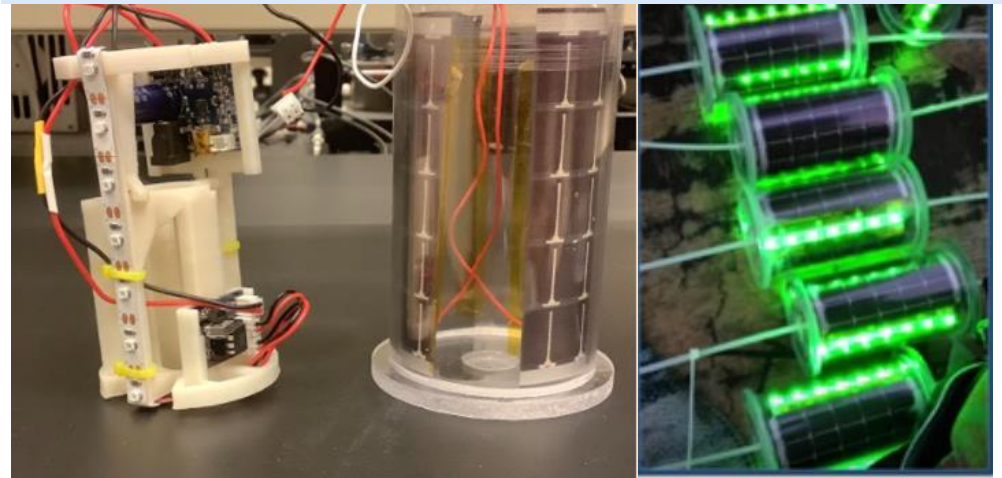
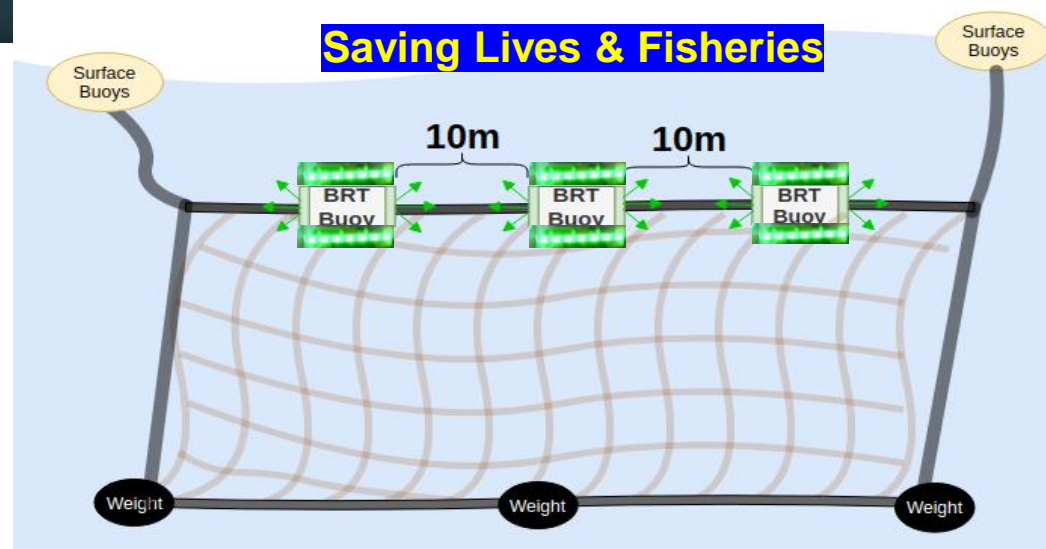


ASU BEST Lab

Solution#1: Light Bycatch Reduction Technology (LBRT)

Results!

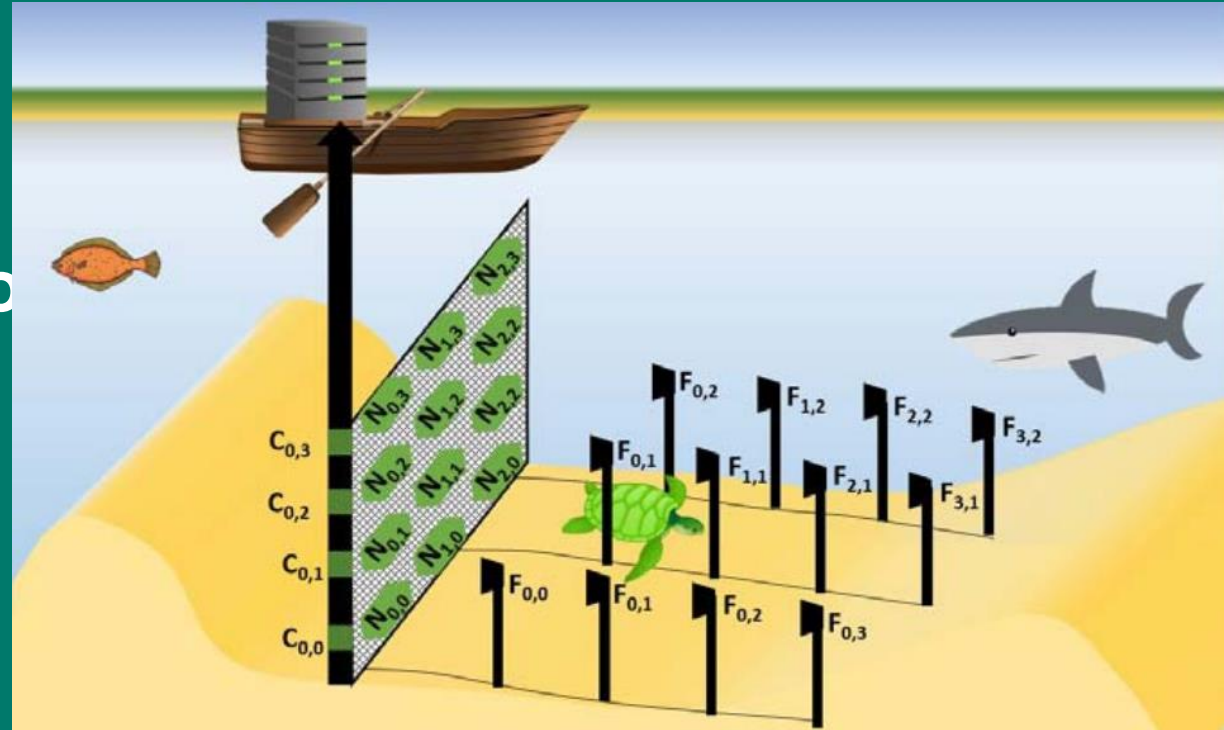
- Field tested
- Realized 65-70% bycatch reduction

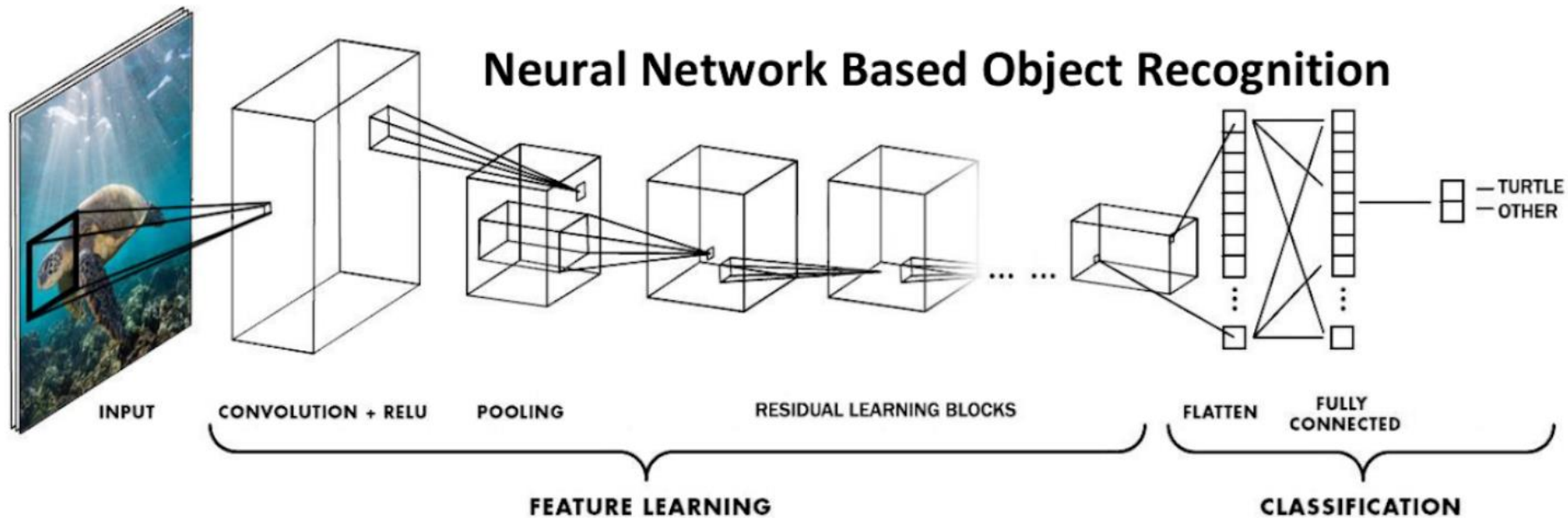


Solution#2: CyberPhysical System (CPS)

Current Work in Progress!

Design a **CPS**
“**Smart-Net**” with
Machine Learning to
incorporate more
effective deterrent
strategies





Species Detection Algorithm

Object Recognition Example

Pre-trained using ~25000 images. Currently achieves a 97.2% accuracy in recognition.

- Trained to recognize turtles for now
- Uses a predefined number of frames to provide a confidence level in detection.

How to translate into the classroom?

- Access to & Training on MATLAB Online (procedure)
 - Tested online & it's faster! (Mathworks server+GPU)
 - Stat&Machine Learning Toolbox
 - CNN Deep Learning Pretrained ResNet50 network
 - Trials runs
 - Accuracy on subsets (95.83%)
 - Accuracy on full 8k dataset (TBD)
- More graphs for students to interpret

MATLAB ONLINE

Apps



HOME

PLOTS

APPS



Design App



Get More Apps



Install App



Optimization



PID Tuner



Curve Fitting



Classification Learner



Deep Network Designer



Neural Net Clustering



Neural Net Fitting

FILE

APPS

Deep Network Designer - Design, visualize, and train deep learning networks (deepNetworkDesigner)

MATLAB Drive

Current Folder

Name

- TurtleSubset
- Shared
- Published (my site)

Workspace

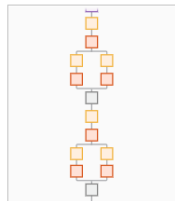
5GB Storage

Deep Network Designer Start Page

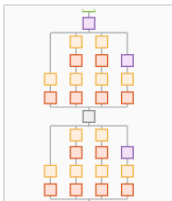
MATLAB Deep Network Designer

[Getting Started](#) | [Compare Pretrained Networks](#) | [Transfer Learning](#)

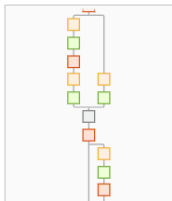
Pretrained Networks



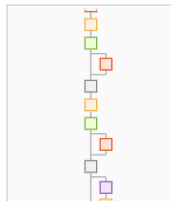
SqueezeNet



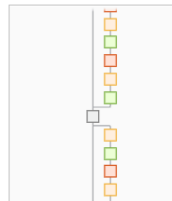
GoogLeNet



ResNet-50



EfficientNet-b0



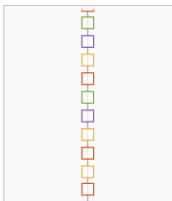
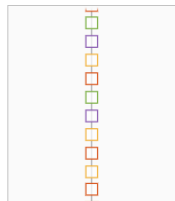
DarkNet-53



DarkNet-19

[Show more](#)

Sequence Networks



ResNet50

Design App Get

IMPORT

DATA

Import Data

Designer Data Training

Current Folder

Name

- Turtle
 - turtle_00
 - turtle_00
 - turtle_00
 - turtle_00
 - turtle_00
 - turtle_00
 - turtle_00
 - turtle_00
 - turtle_00



Data: Training

Source: .../TurtleSubset

Observations: 56

Classes: 2

Most observations: nonturtle (28)

Fewest observations: nonturtle (28)




Workspace

Name

Show random observations of: <All classes>



TRAINING

 Training Options
 Train
 Export

OPTIONS TRAIN EXPORT

Designer Data Training

Current Folder

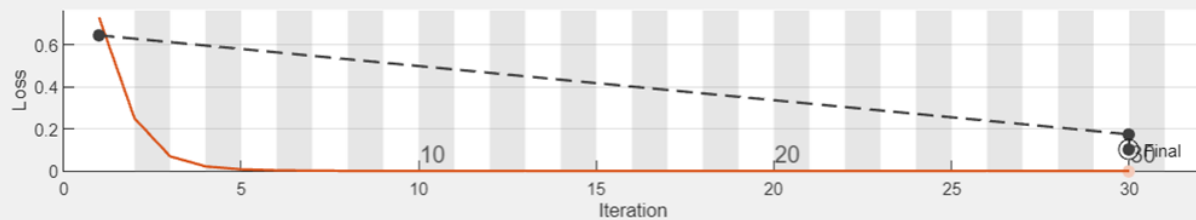
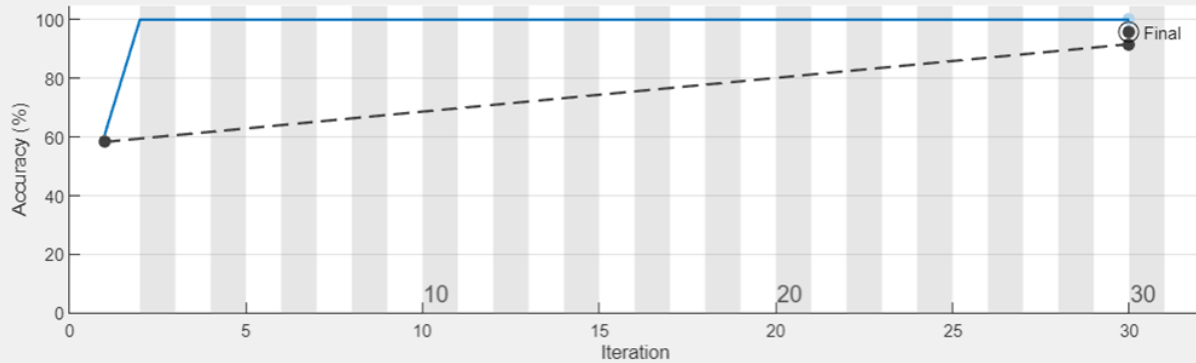
Name

- TurtleSub
- Shared
- Published

Workspace

Name

Training Progress (24-Jun-2021 04:20:49)



Results

Validation accuracy: 95.83%
 Training finished: Reached final iteration

Training Time

Start time: 24-Jun-2021 04:20:49
 Elapsed time: 6 min 26 sec

Training Cycle

Epoch: 30 of 30
 Iteration: 30 of 30
 Iterations per epoch: 1
 Maximum iterations: 30

Validation

Frequency: 50 iterations

Other Information

Hardware resource: Single CPU
 Learning rate schedule: Constant
 Learning rate: 0.01

[Learn more](#)

Lesson Plan Objectives

- ❖ Meet MCCCDC Course Competencies
 - Graphing
 - Bar graphs - MATLAB shows
 - Line graph?
 - Reading & interpreting graphs
 - Model real world problems
 - Making graphs to first rep datasets then use ML
 - ML procedure
 - Train on subset, augment, test on 8k (time consuming so for homework)?? order?

Deliverables

- ❖ Digital Design Research Workbook
 - Teacher can grade as you go using Sheets Grading Rubric
 - Student present at end of each lesson session
 - Student final presentation
 - Similar to RET weekly and then final

Pre-Lesson Plan Prep

1. Ask students in advance to bring in a digital device with WiFi Access
2. Team up students in advance
3. Share Google Slide link to Digital Dynamic Research Workbooks

Lesson Plan Procedure & Grading Sheet for Teachers

THANK YOU



A Bright Idea

presented by
Arizona State University

NSF Award 1953745



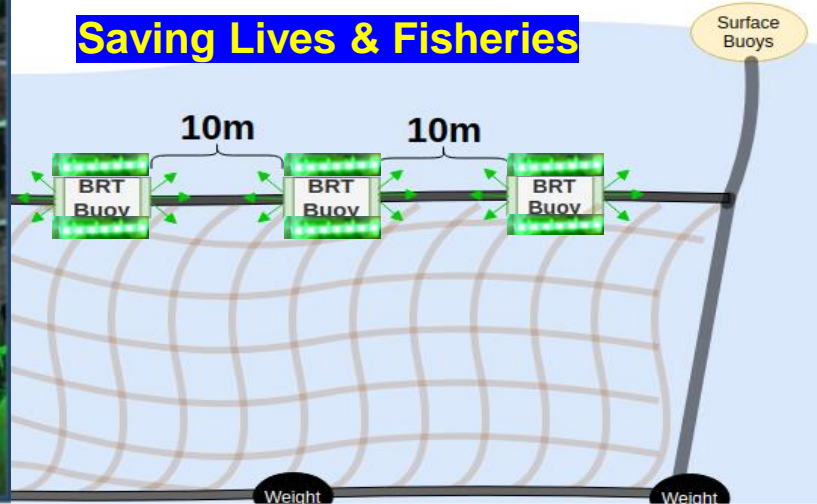
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- People love sea turtles.



Saving Lives & Fisheries



Let's say goodbye to bycatch.

