BACKGROUND

- **Artificial intelligence is a potentially powerful scientific tool**
- **Member agencies have expressed uncertainty about how they plan to use AI**
  - Or even whether they want to use it
- **CTAG believes SCCWRP should experiment with AI application**
  - If successful, we would pass on tools and serve as a resource for the member agencies
  - CTAG identified two projects they would like SCCWRP to conduct as pilot examples
- **Goals of this presentation: Orient the Commission to AI possibilities**
  - Plus describe the projects that CTAG selected for us

WHAT IS ARTIFICIAL INTELLIGENCE?

- **Software that uses learning to maximize chances of achieving a defined goal**
- **Baking a cake example**
  - Programming: Here are all the ingredients. Here is what you add in what order and amount
  - AI: Here is the product I want. Tell me what ingredients in what order and amount produces the best cake
- **AI learns from experience, whereas non-AI technology can’t improvise**
- **Dependent on a good training data set**
  - Needs to know what a good cake looks and tastes like

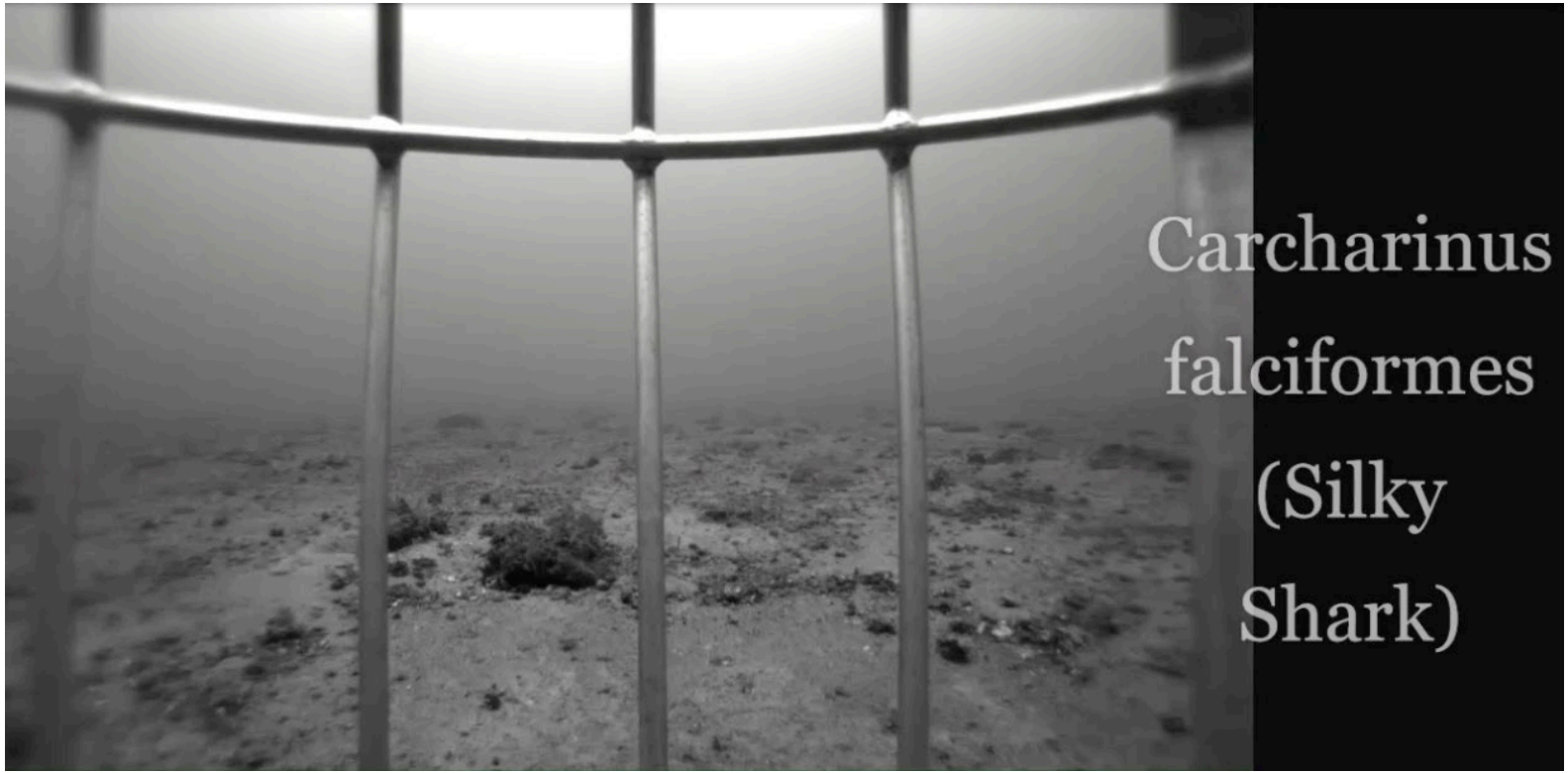
EXAMPLES OF ARTIFICIAL INTELLIGENCE

- **Product personalization**
  - Spotify learns the music you love
  - Vanguard uses robo-advisor to tailor investment advice
  - Siri customizes its responses to your history
- **Security**
  - Online purchase fraud detection
  - Email spam filters
  - Uber is using typing and walking patterns to determine if a potential rider is drunk
- **Real time language processing**
  - Google’s AI makes my dinner reservations

TWO MAJOR CLASSES OF ARTIFICIAL INTELLIGENCE

- **Generative AI**
  - Creates new material, such as text, images or software
  - Learns patterns from training data and generates material with similar characteristics
- **Vision AI**
  - Vision AI doesn't create new information, but automates and improves interpretation
  - Detect and classify visual information, such as facial recognition
  - AI enhances identification under low light or odd angle situations
- **Vision projects seem more appropriate for SCCWRP**
  - Generative AI is often customized to individual use, such as programming
  - Vision AI more apt to create assessment tools that transcend individuals and organizations

In situ Fish Surveys



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Journal of *Marine Science and Engineering*

MDPI

Concept Paper

A Biologist's Guide to the Galaxy: Leveraging Artificial Intelligence and Very High-Resolution Satellite Imagery to Monitor Marine Mammals from Space

Christin B. Khan [1,*], Kimberly T. Goetz [2], Hannah C. Cubaynes [3], Caleb Robinson [4], Erin Murnane [5], Tyler Aldrich [1], Meredith Sackett [1], Penny J. Clarke [3,6], Michelle A. LaRue [7,8], Timothy White [9], Kathleen Leonard [10], Anthony Ortiz [4] and Juan M. Lavista Ferres [4]

Artificial Fintelligence: Collaborating to Improve Automated Identification of Dolphin Dorsal Fins

Marks on the dorsal fins of dolphins are used to identify individuals, and catalogs of individuals form the basis of population assessments. Automated algorithms like *finFindR* reduce processing time by an order of magnitude relative to manual methods by tracing and matching the trailing edge of the dorsal fin. We are working with collaborators to extend the utility of *finFindR* to trace and match more of the dorsal fin and body and train the algorithm on species in the Pacific Islands, like the short-finned pilot whale pictured here.

Using Deep Learning to Listen for Humpback Whales

Underwater microphones provide data to examine whale movement and population trends. PIFSC and Google, Inc., worked together to train a deep learning convolutional neural network to identify humpback whale song in over 187,000 hours of acoustic data collected over a 14-year period at the 13 sites that make up the Pacific Islands Passive Acoustic Network. The collaboration provides open data access and open models so that other researchers can build upon the tool for other locations or species.

AI PROJECTS CTAG SELECTED

- **Fish identification**
  - Use videos to supplement trawling, particularly where it is impractical, such as in kelp beds
- **Wetlands tracking**
  - Measure change in wetland coverage (and type) over time using satellite imagery

WHAT WE HAVE LEARNED SO FAR

- **We are starting with the trawl application**
  - Dealing with satellite imagery is harder and we don't have easy access to the imagery
- **Even fish identification is not going to be easy**
  - Library development requires hundreds (to thousands) of images per species
  - Pretrained models (at least for our specific ocean applications) are not yet available
- **Starting by focusing on a limited number of species**
  - See if we can get counts correct for those species
  - If we can achieve counts for individual species, then achieving a community assessment is mostly a scaling issue
- **Piloting with two data sets**
  - LACSD trawl data
  - Crystal Cove Conservancy underwater camera data

LACSD TRAWL DATA

- **LACSD has a data set where they mounted a camera on a trawl**
  - Goal was to assess bias in net capture (e.g. what swims away from the net)
  - Great test data set for us, as they manually quantified what the camera captured
- **Focus first on sea stars**
  - Not many species and the angles are less challenging than for fish
  - We have been able to gather 2,247 annotated sea star images for our training data set
- **LACSD has shared with us 715 static images taken from the video**
  - Static images allow us to get started
  - LACSD is working to locate the original videos (which were taken 25 years ago)

CRYSTAL COVE CONSERVANCY UNDERWATER CAMERAS

- **Crystal Cove Conservancy deploys ship-based go-pro underwater cameras in kelp beds several times per week**
  - Collected as part of a school-based education program
  - Usually 5-15 minute videos
- **They volunteered to annotate footage for us, manually identifying fish**
  - These become data sets we can then use for training and validation
  - So far, they have provided us 5 days of video with clear water and 5 days with murky water
- **Focus will be on three target species: Garibaldi, Kelp bass, Sheepshead**
  - We have been able to obtain a training library of about 300 images for each species
- **Our hope is to show CTAG early results at their May meeting**

OTHER APPLICATIONS CTAG DISCUSSED

- **Bird identification**
  - Characterizing through either camera or sound
- **Neonate counting for toxicity testing**
  - Or sea urchin embryo development
- **Satellite imagery scanning for illicit activity**
  - Construction sites not enrolled in state and local permitting programs
  - Unregulated agricultural operations
- **ROV footage to assess changes in pipe condition over time**
- **Plume characterization using satellite imagery**