How Long Is A Fish?

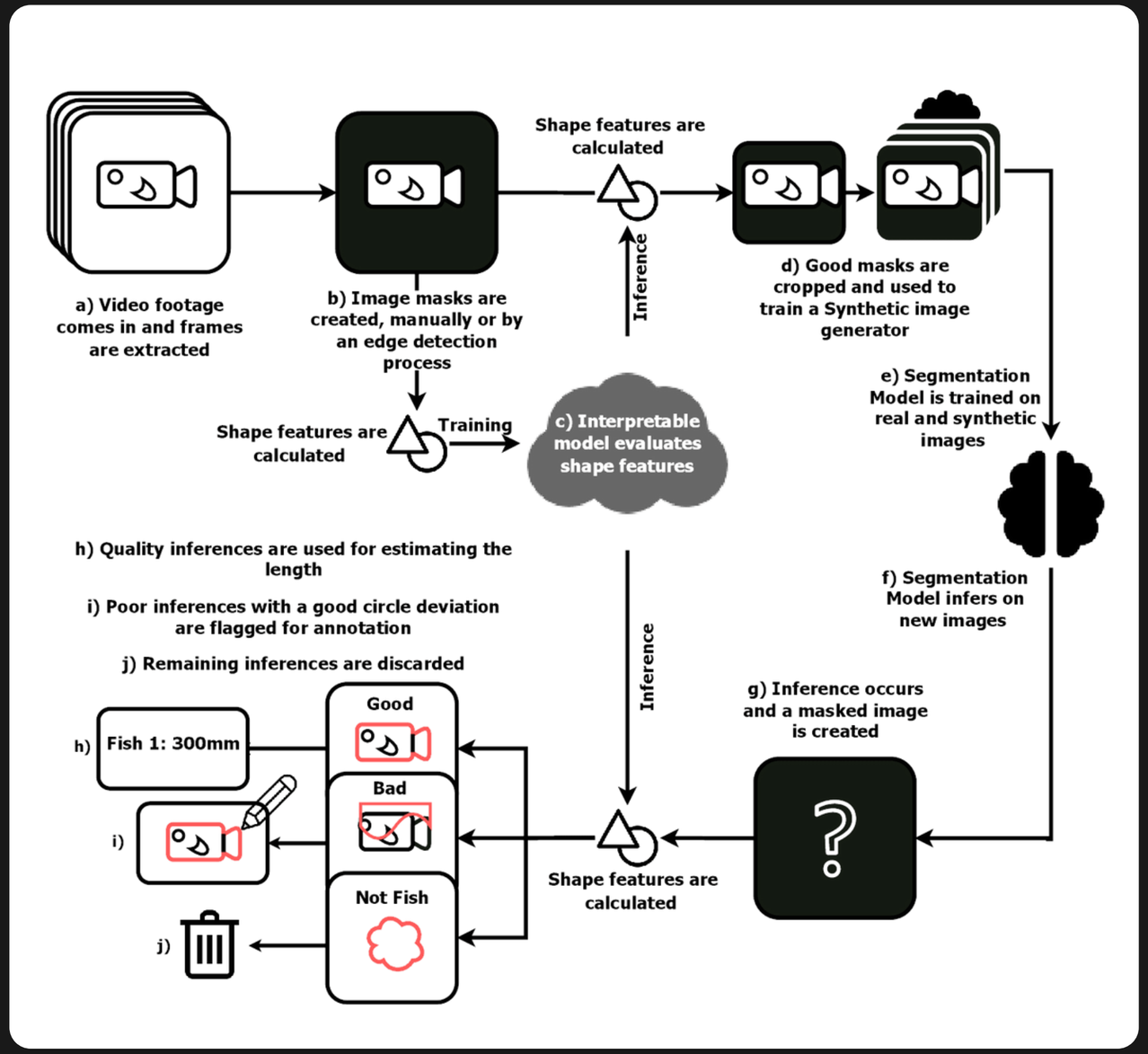
Estimating the Length of Tarakihi Using Machine Learning

Michael Stanley

Lynker ANALYTICS

FISHERIES INSHORE NEW ZEALAND

teem.fish MONITORING

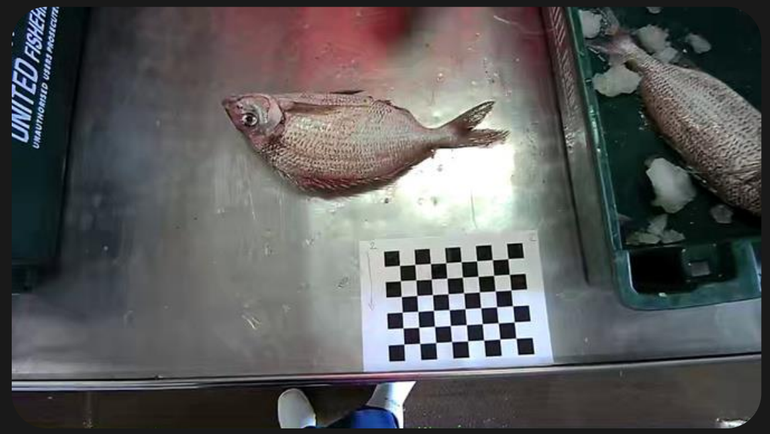


Content

- Data Collection & Handling
- Contour Evaluation
- Synthesizing Training Data
- Image Segmentation
- Length Estimation

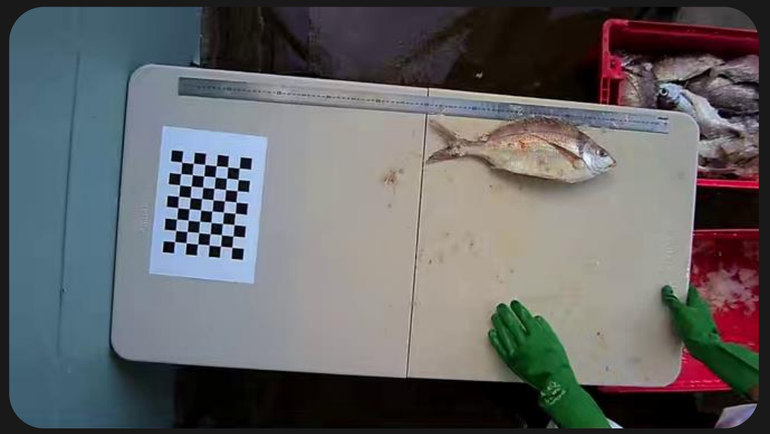
- Future work

The 3 Factory Visits



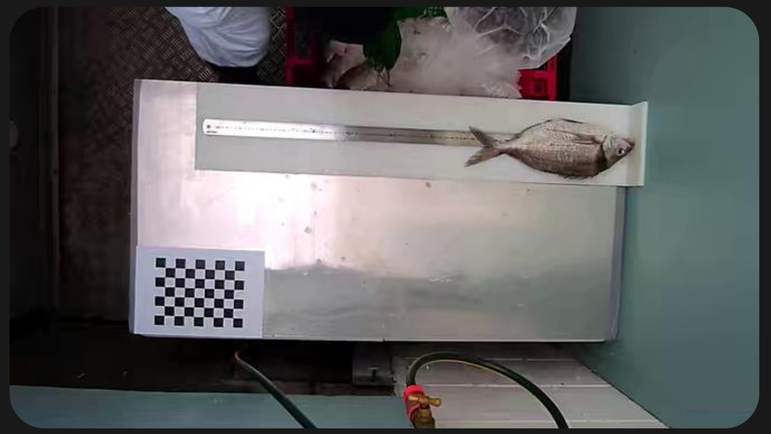
Free Camera approach

+ A variety of camera angles
- Inconsistent scale factor
- Multiple individuals in the scene



Fixed Camera

+ Consistent scene is easily cropped
+ Scale factor mostly consistent
- Limited observation angle

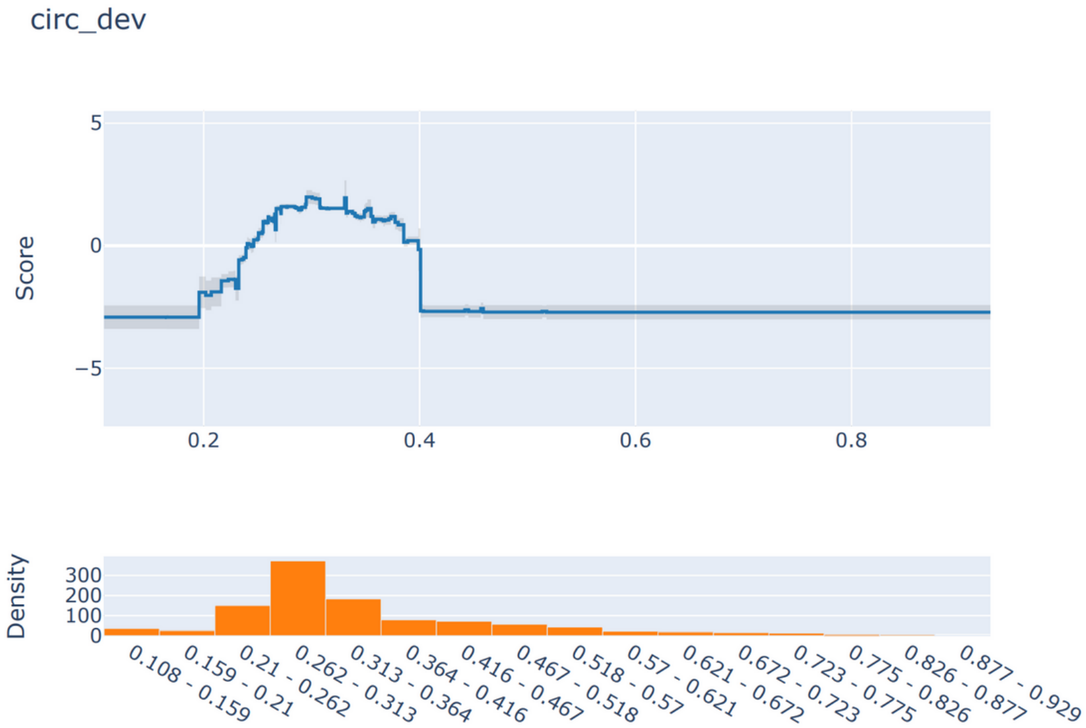


Fixed Camera & Metallic surface

+ Surface is more similar to fishing vessels

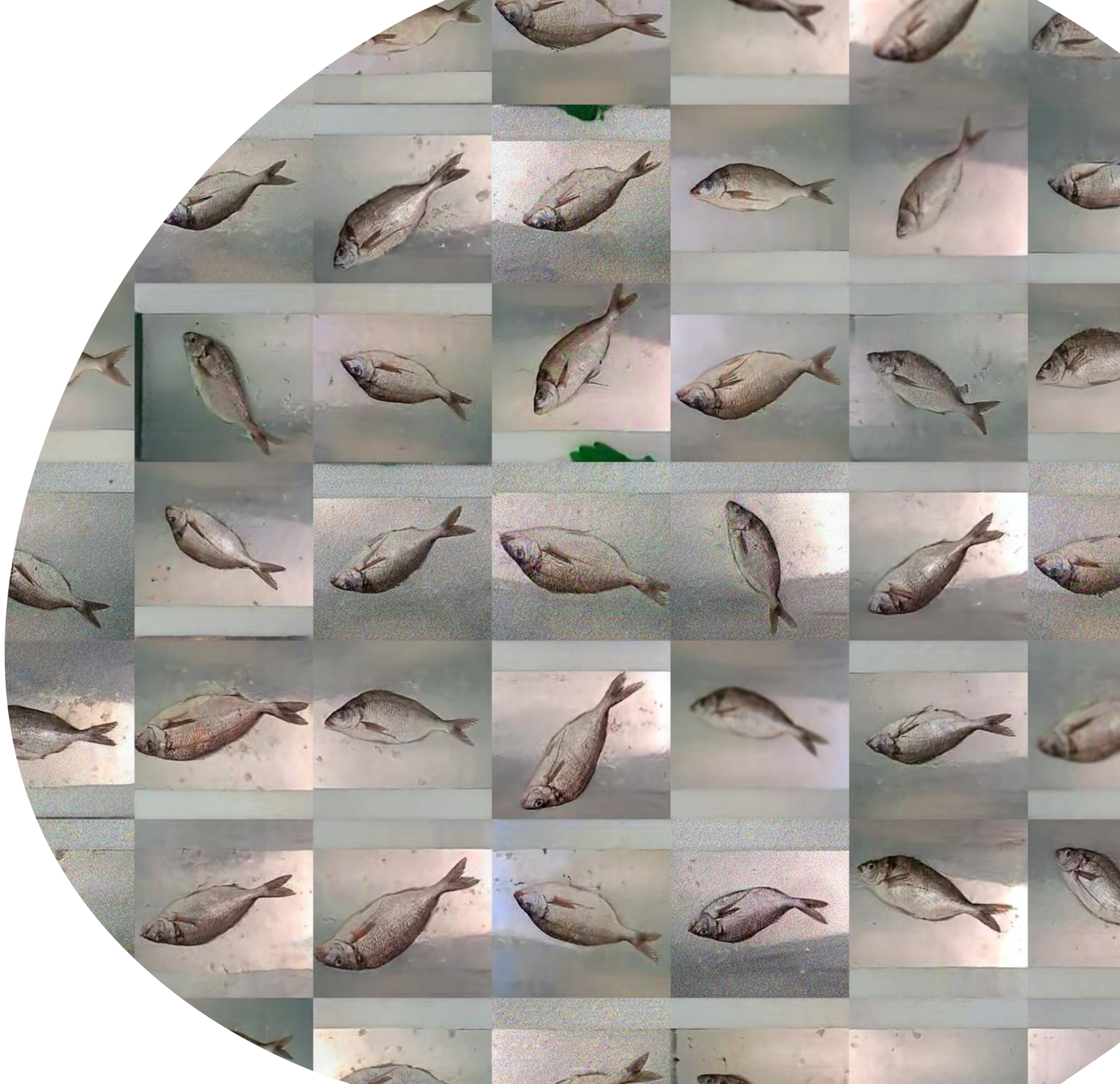
Interpretable Methods for Evaluating Contours

Morphological features are analysed with interpretable machine learning techniques to remove poor inferences from affecting the measured lengths



Synthetic Image Generation

Images from the third factory visit were cropped and used to train a StyleGANs model to create synthetic images of tarakihi.



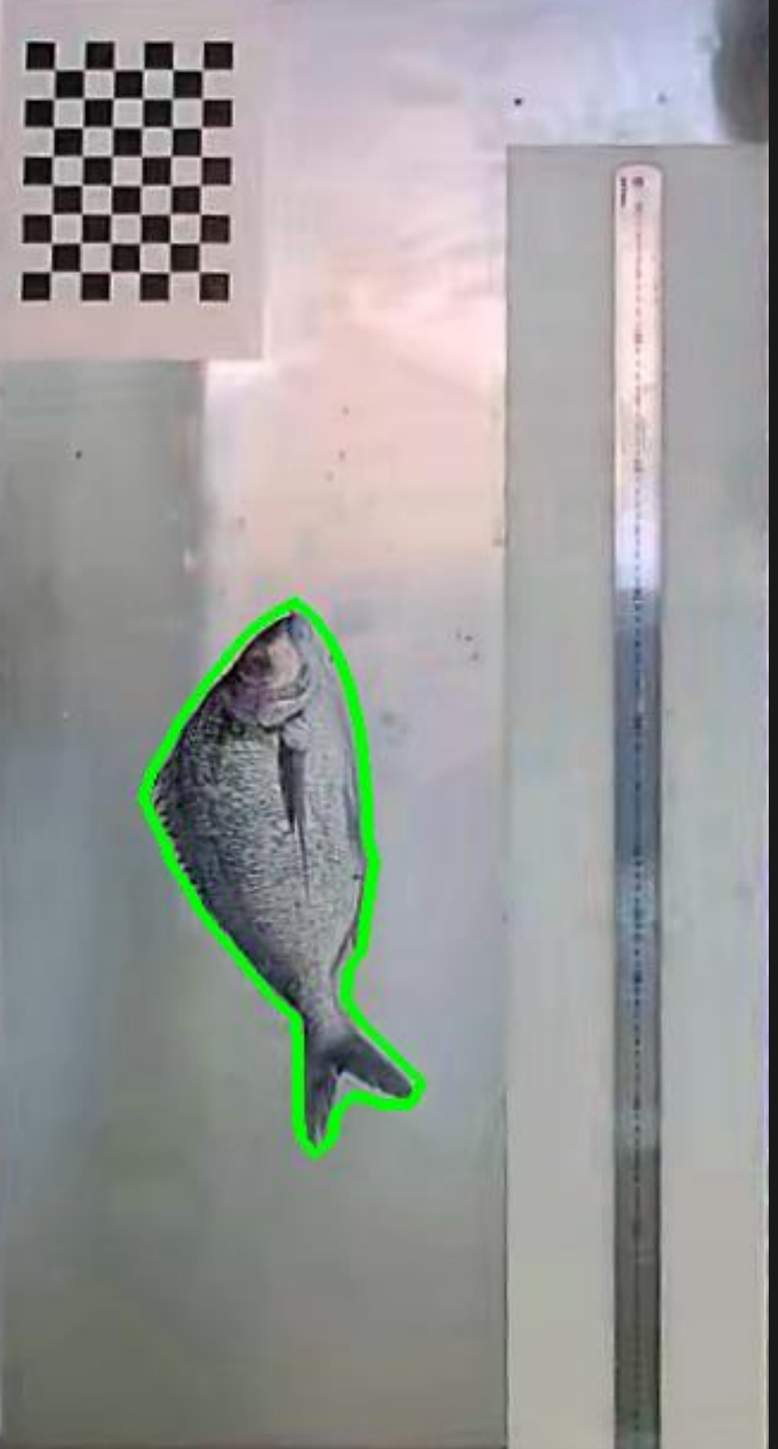


Image **Segmentation**

✔

1) Inferences are defined by an arbitrary number of points

2) Geometric properties of the inference may be found

3) Easy transition to instance segmentation

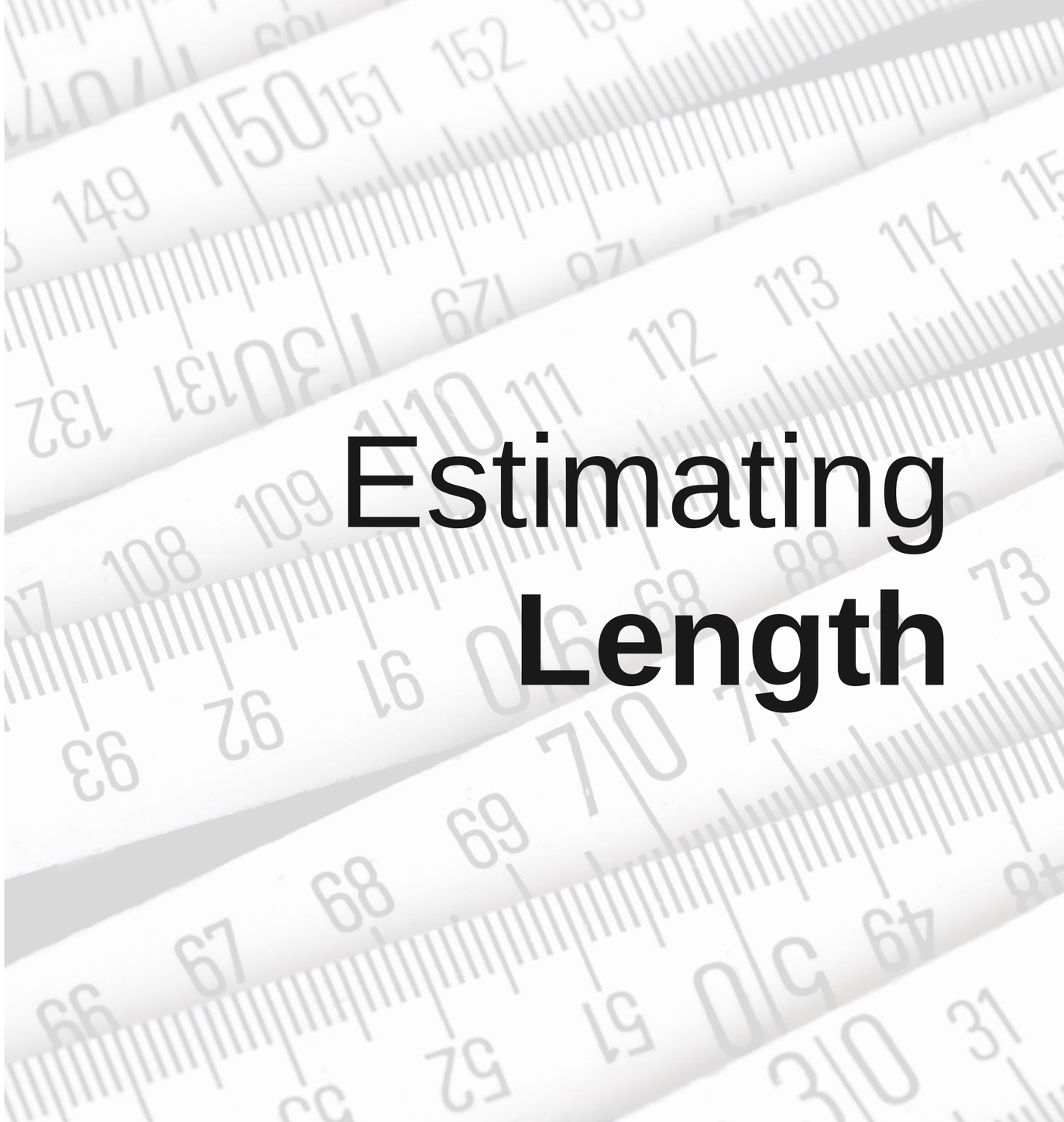
✘

4) Greater number of points required for training

1. Estimating pixel Length from an image

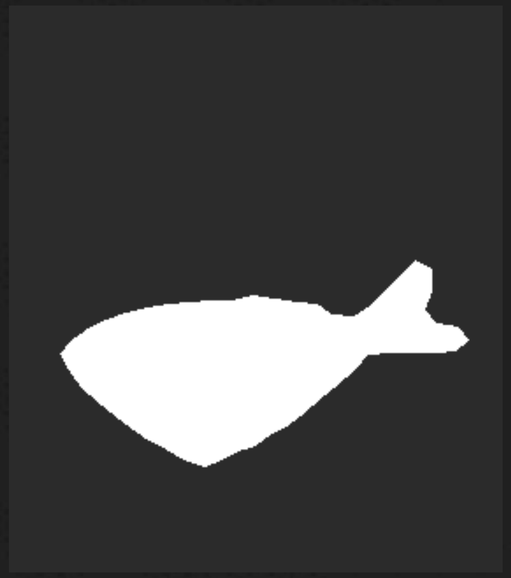
2. Converting the length to millimetres

3. Selecting the best length from a series of images

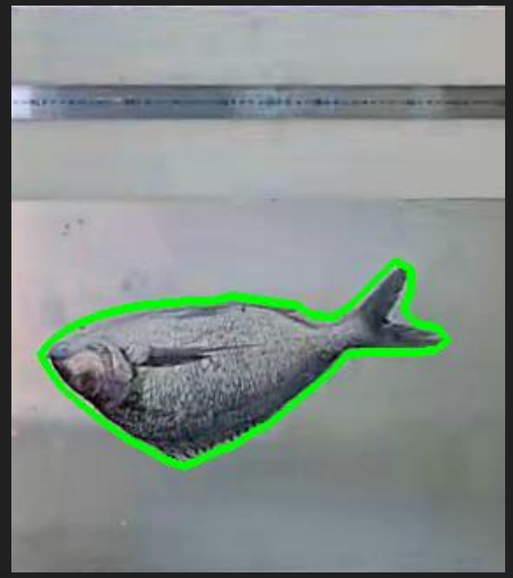


Estimating **Length**

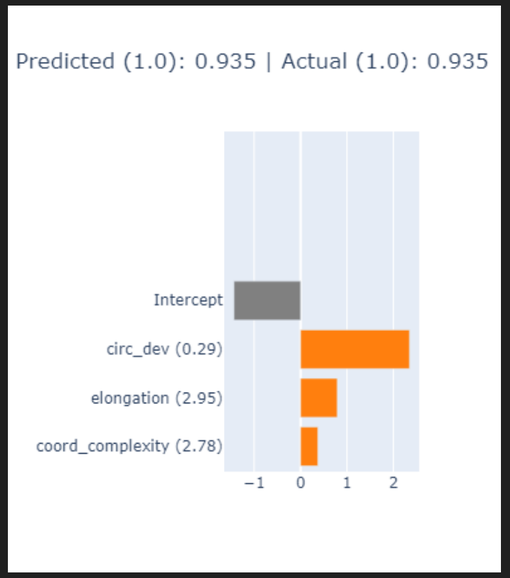
Pixel Length



An inference is made by the algorithm



Contours of inferred objects are found



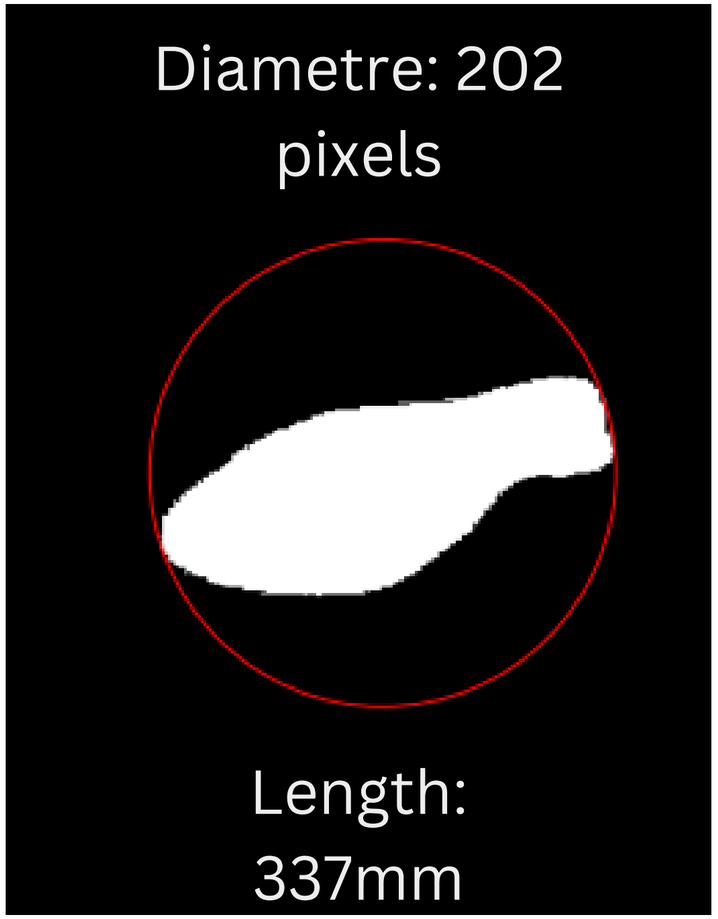
Geometric properties are evaluated to determine which contours are discarded

A minimum enclosing circle is applied, the diameter of this is the pixel length

Pixel to **Millimetre** Conversion

The calibration pattern is used to find the pixel to millimetre ratio

This is applied to the pixel length from the minimum enclosing circle



Length Estimation From Video

Lengths paired to an individual

Lengths over multiple frames are paired with an individual based on their location in the image

These are stored for later finding the individuals length

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Lengths within 10 mm of the median length are stored for each individual

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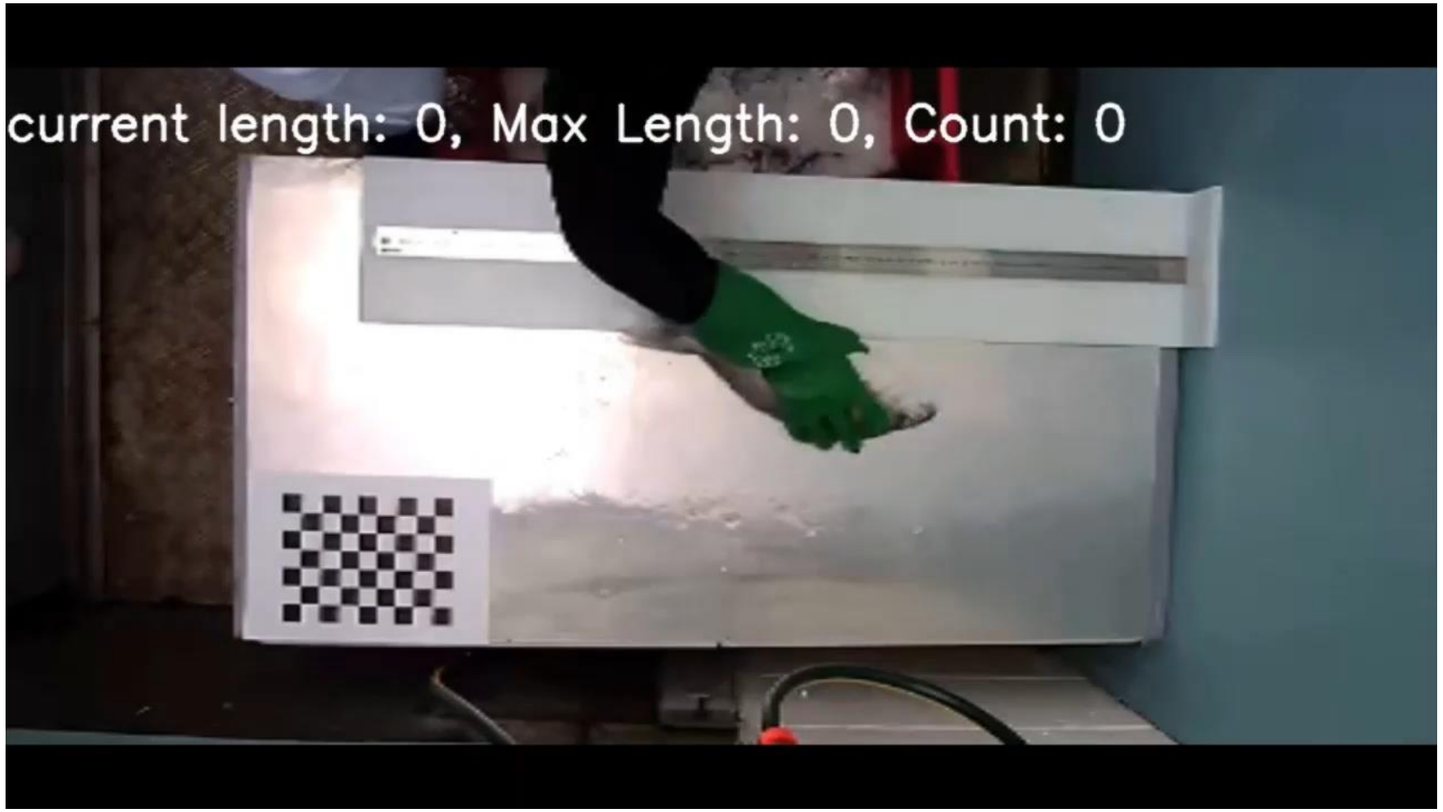
Final recorded length

A final length is calculated as the median of all stored lengths

A line per fish is outputted to a CSV file at the end of processing the video

RESULTS



7.523

Absolute average difference, in millimetres, between predicted and true lengths after a linear adjustment.

11.254

Absolute average difference, in millimetres, with no adjustment

0.9523

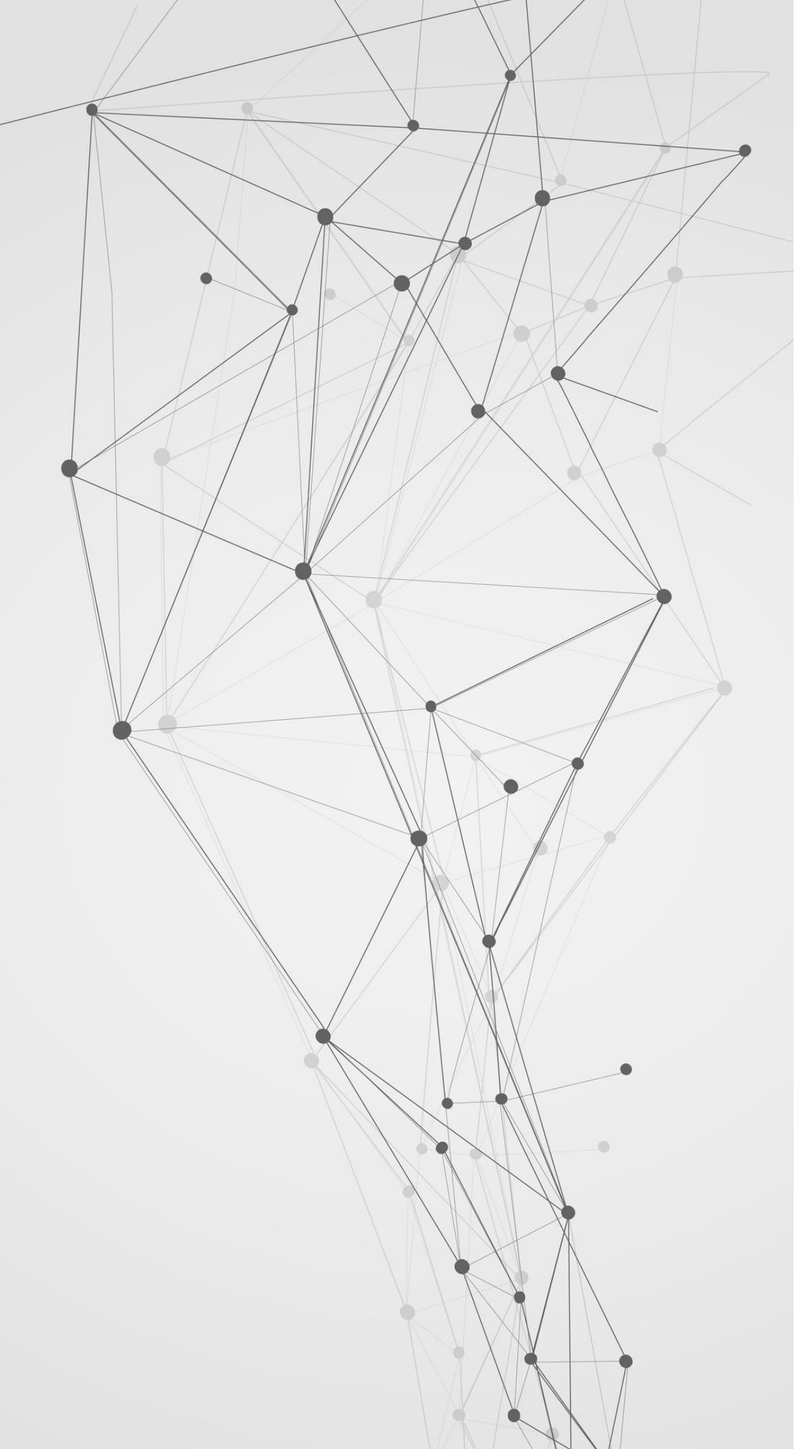
R^2 value for the adjusted length predictions

Current Work

The methods and models developed in this research are being run on video footage from inshore vessels.

The value of developing practical models for monitoring commercial fisheries

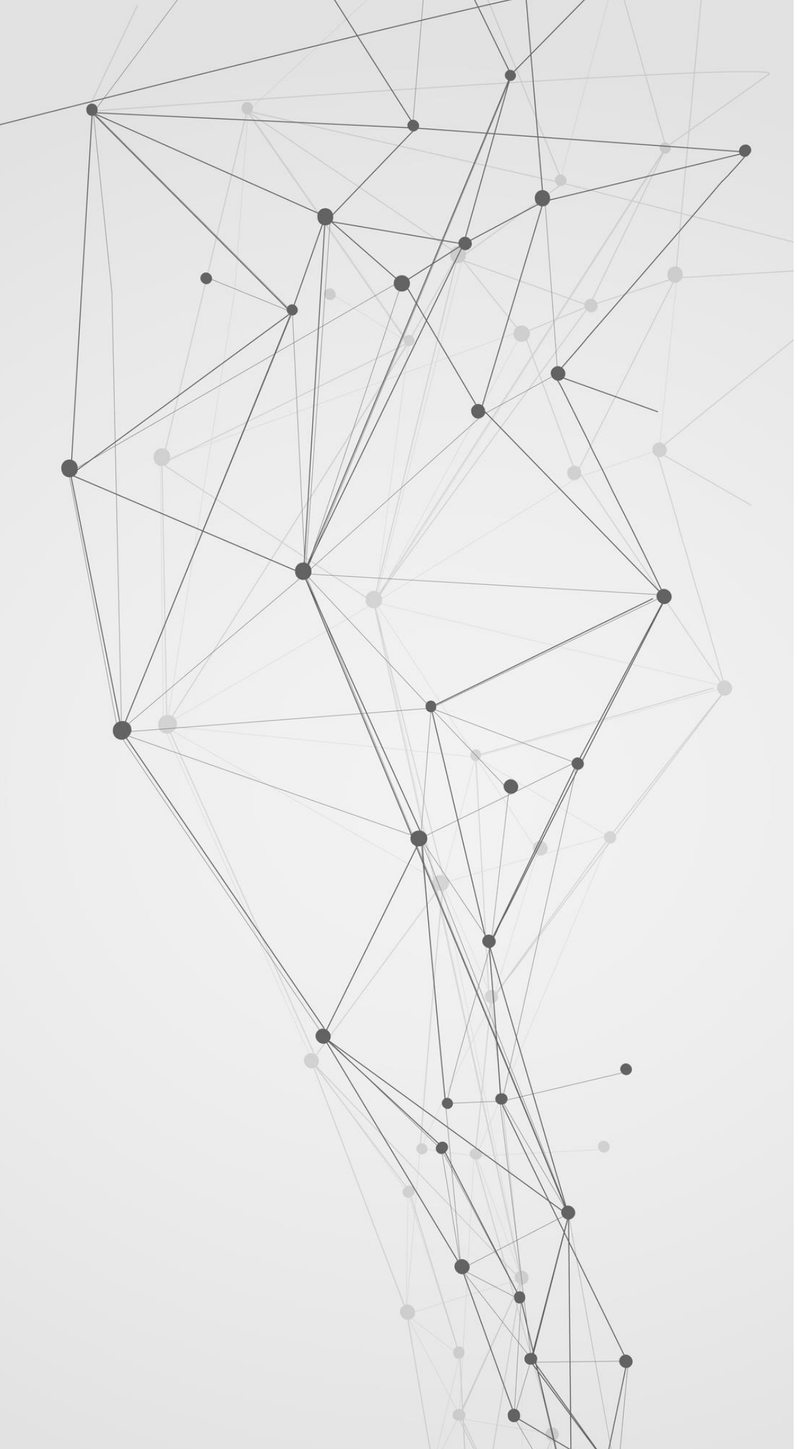
Recommendations for Future Work



Future Work

How may the current system be further developed?

1. Instance segmentation for better tracking of fish
2. Multi-species classification
3. Edge device integration for real-time analytics



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What can be done to unlock valuable insights into marine life?

4. Birds-eye view in a controlled environment - greatest accuracy
5. On-vessel camera for live catch and bycatch estimates
6. Large-scale adoption for data collection across many vessels
7. Analysis of footage from a trawl cam

Thank you!

Michael Stanley

Find me on Linked in:

Amanda Barney

Ali Kennard

teem.fish MONITORING

Local focus. Global impact.

Lynker ANALYTICS

FISHERIES INSHORE NEW ZEALAND

michael.stanley@lynker-analytics.com