

Technical Note: Fishcluster Vision-Based Fish Measurement Prototype

Objective

To provide aquaculture farmers with visibility into pond fish size, weight, and biomass using low-cost computer vision tools. This prototype demonstrates a pipeline for fish detection and measurement in realistic field conditions.

Design Choices

- Model: YOLOv5s (pretrained) chosen for lightweight inference on low-cost hardware.
- Detection: Bounding boxes used to approximate fish length (pixel -> cm proxy).
- Weight Estimation: Fisheries formula applied: $W = a * L^b$, where constants $a = 0.012$, $b = 3.0$ tuned for tilapia/catfish.
- Outputs: Average fish size and weight, size distribution, total biomass, average detection confidence, annotated video with bounding boxes and overlays.

Assumptions

- Camera is static above or beside pond.
- Scale factor = 0.01 cm/pixel (approximate).
- Constants tuned for tilapia/catfish species.
- Bounding boxes may merge overlapping fish -> inflated weights.

Limitations

- Murky water, occlusion, and reflections reduce detection accuracy.
- Length estimates are approximate without calibration.
- Pretrained YOLOv5 not specialized for fish datasets.

Path to Improvement

1. Calibration: Use reference object to refine pixel -> cm conversion.
2. Model Training: Retrain YOLOv5 on fish-specific dataset for tighter bounding boxes.
3. Deployment: Optimize for GPU/edge devices to enable real-time monitoring.
4. Integration: Connect with feeder logic, harvest prediction, and financing systems.

Deliverables

- detect.py (code)
- Annotated video output (runs/detect/fish_detected.mp4)

- Console metrics (size, weight, biomass, confidence, distribution)
- Technical Note (this document)
- Demo video (2-5 mins walkthrough)

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Fishcluster Paid Trial Task