The *A*rtificially *I*maginative tide gauge observer

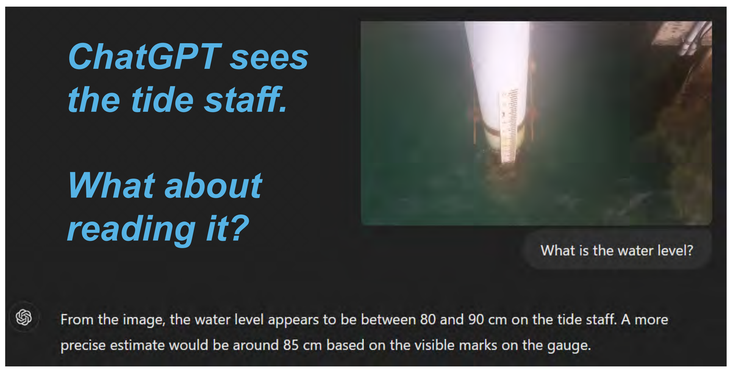
UNIVERSITY OF HAWAI'I SEA LEVEL CENTER

COOPERATIVE INSTITUTE FOR MARINE AND ATMOSPHERIC RESEARCH CIMAR UH • NOAA

Motivation

- Human observers record water levels on tide staffs, which is tedious and error prone, but necessary to validate sensor measurements.
- Mechanical water level "switches" are an alternative (automatic) approach, until biofouling occurs.

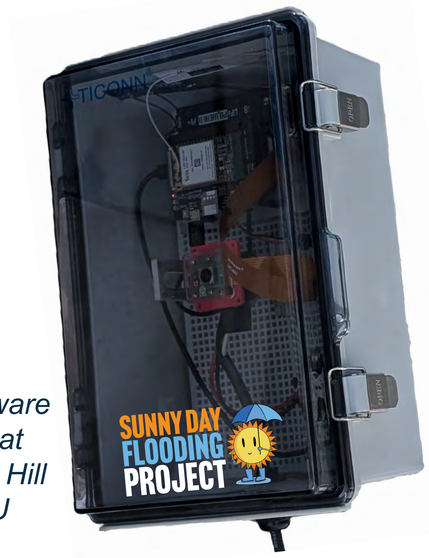
AI offers opportunities
for more reliable maintenance of water level sensor calibrations.



Equipment

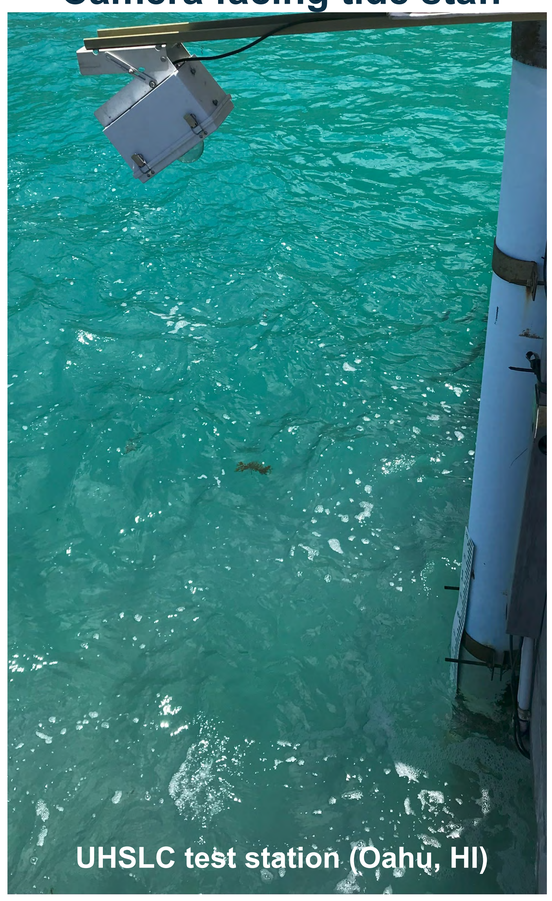
Camera ($25), computer ($50), modem ($150), and power ($200)

- Raspberry Pi Camera module 3 (autofocus)
- Raspberry Pi Zero 2 (computer)
- Sixfab modem (with SIM card)
- $LiFePO_4$wered/Pi+ battery (uninterrupted power)
- Solar panel and DC battery (not shown)



Camera software developed at UNC-Chapel Hill and NCSU

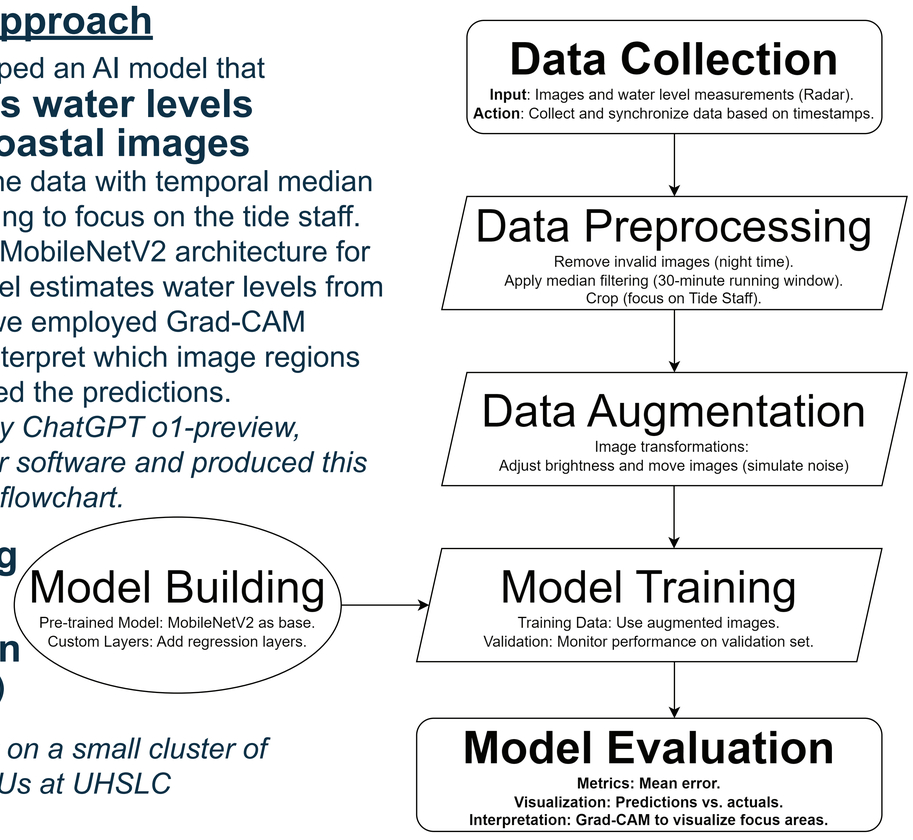
Camera facing tide staff



Approach

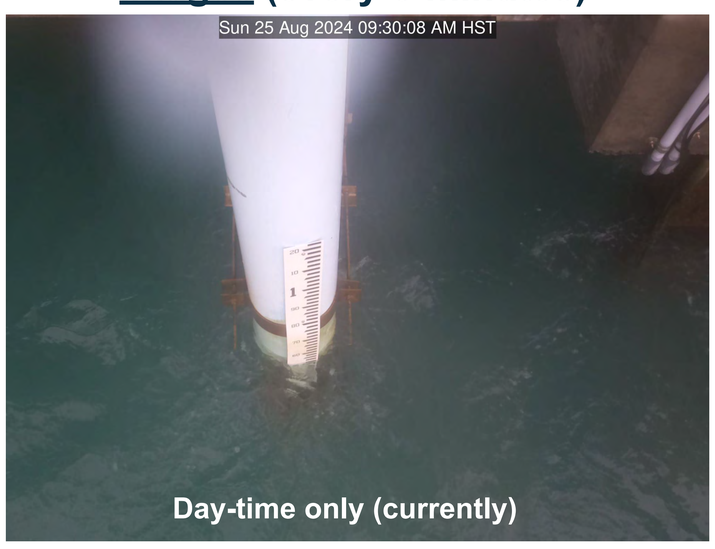
We developed an AI model that
predicts water levels from coastal images
by preprocessing the data with temporal median filtering and cropping to focus on the tide staff. Using a fine-tuned MobileNetV2 architecture for regression, the model estimates water levels from images, and we employed Grad-CAM visualizations to interpret which image regions influenced the predictions.
--Described by ChatGPT o1-preview, which reviewed our software and produced this flowchart.

Transfer Learning and Image Regression (on Radar water level)

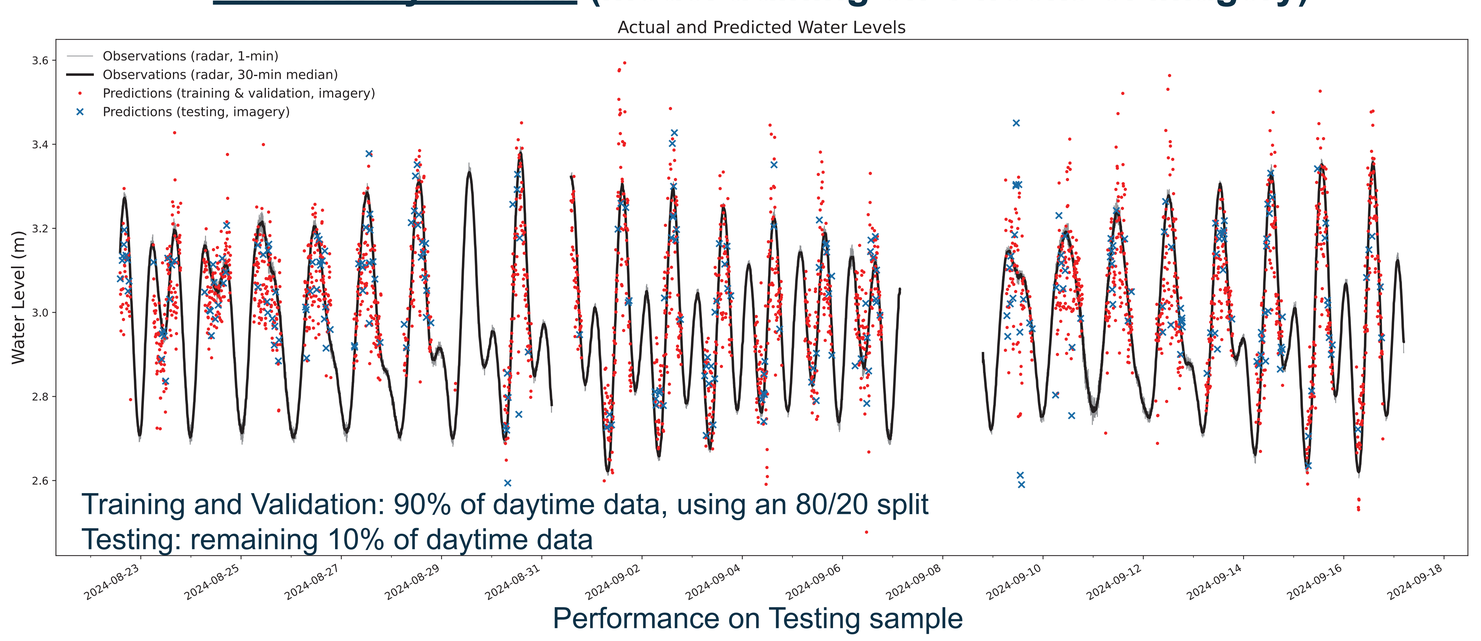


Computing on a small cluster of GPUs at UHSLC

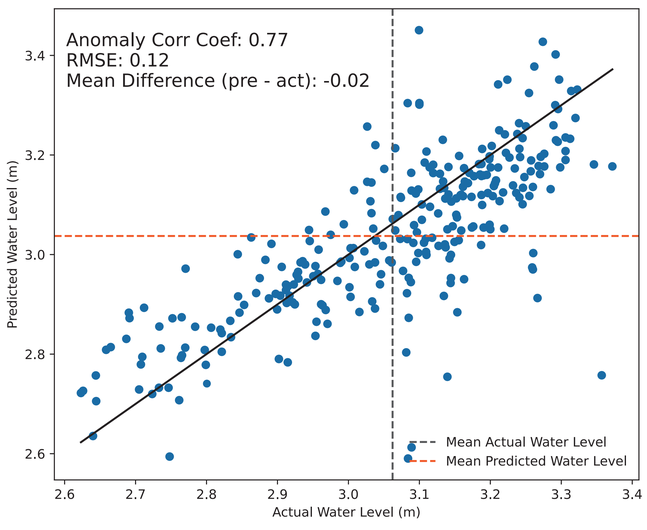
Images (every 6-minutes)

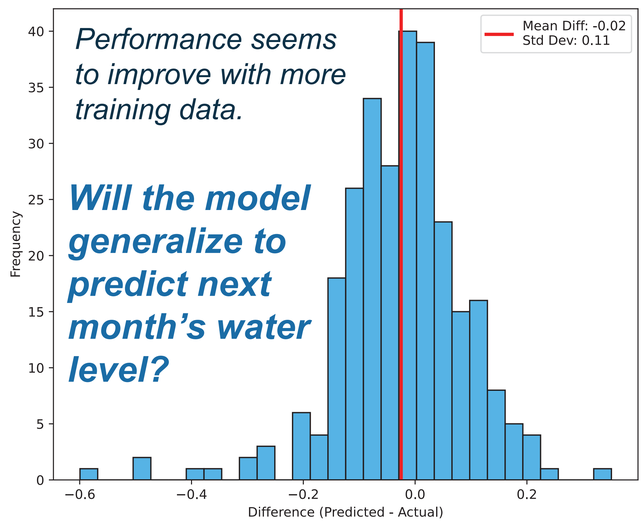


Preliminary Results (model training on 4 weeks of imagery)



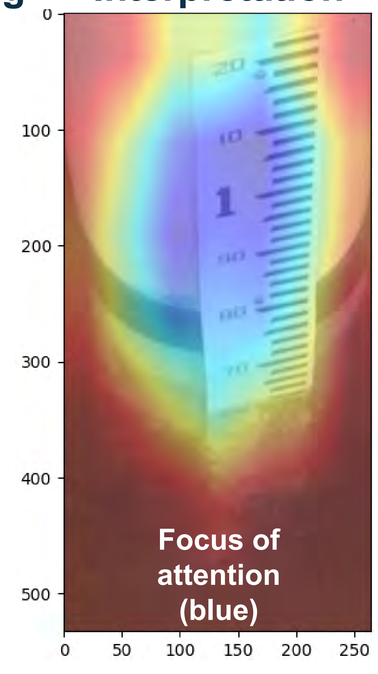
Performance on Testing sample





Filtering and Cropping

Interpretation



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