

Glint De-Noising for Low Altitude Ocean Craft Altimetry

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Motivation

- Computational vision height estimation sensing techniques can struggle over varying maritime sea-states and sun glint.
- Accurate height estimation is critical for low-altitude (1-5 m) craft, like the REGENT Craft Viceroy seaglider or drones.



New Technique

- ResNet-50 single-image downward facing altitude estimation model
- Temporal Minimum Filter to de-glint data based on 10- frame subsequent images

Generate clean and "glinty" NADIR images with known heights [4]

Train ResNet-50 based height estimation model on clean images [3]

Run TMF Temporal Minimum Filter (TMF) to denoise images [1]

Run model to predict altitude on clean, glinty, and residual images and compare results

Related Work

- Multispectral-based glint removal, using multidimensional mode decomposition (FA-MEMD) [1]
- Geometric techniques for monocular vision-based height estimation using "self"-poses [2]
- Monocular above-land altitude estimation using ResNet50 [3]

References

- [1] Lee, J.-S., et al. (2025): "A Novel Method for Eliminating Glint in Water-Leaving Radiance from UAV Multispectral Imagery."
[2] Mao, J. & Zhang, L. (2025): "Basic theories and methods of target's height and distance measurement based on monocular vision."
[3] Arik, E. A. (2025). "Vision-Based UAV Altitude Estimation Using Deep Learning: A ResNet50 Approach."
[4] Cox, C. and Munk, W. (1954). "Measurement of the Roughness of the Sea Surface from Photographs of the Sun's Glitter." J. Opt. Soc. Am.

Experimental Results

- Mean Absolute Error
 - Cleaned images: 2.00m
 - Glinty images: 2.75m
 - Residual images: 11.56m
- Total Images: 2000 images
 - 1400 train, 300 val, 300 test

