NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE | Nanyang Environment and Water Research Institute

CLOSE-RANGE REMOTE SENSING OF COASTAL ENVIRONMENT

Abstract:

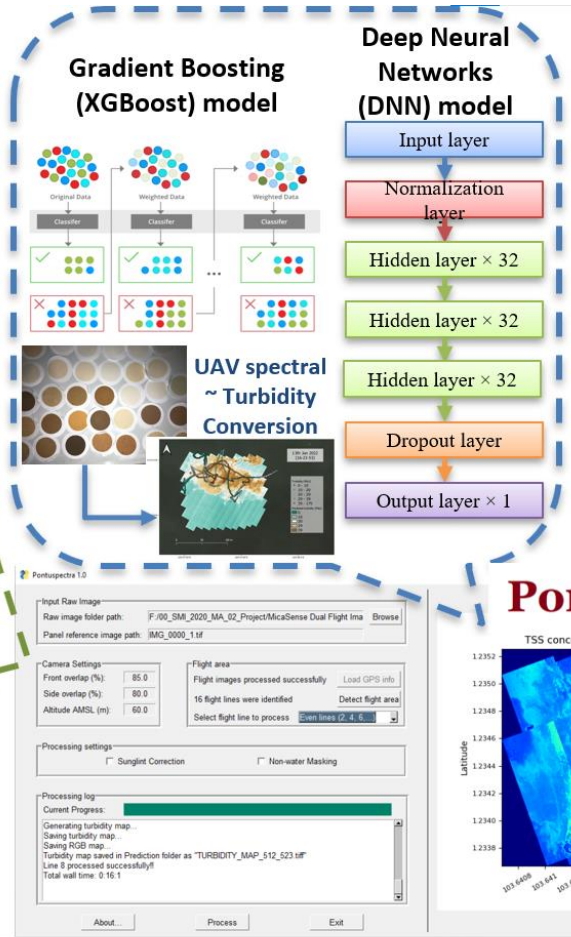
For land reclamation in Singapore, the monitoring of coastal water turbidity over large spatial areas is currently accomplished via field surveys in the Environmental Monitoring and Management Programme (EMMP) and aided by the use of satellite images to provide overviews of sediment plumes. The approaches for the field surveys are based on in-situ and water sampling, fixed-location monitoring and ADCP (acoustic Doppler current profiler) transects. They have the following limitations:

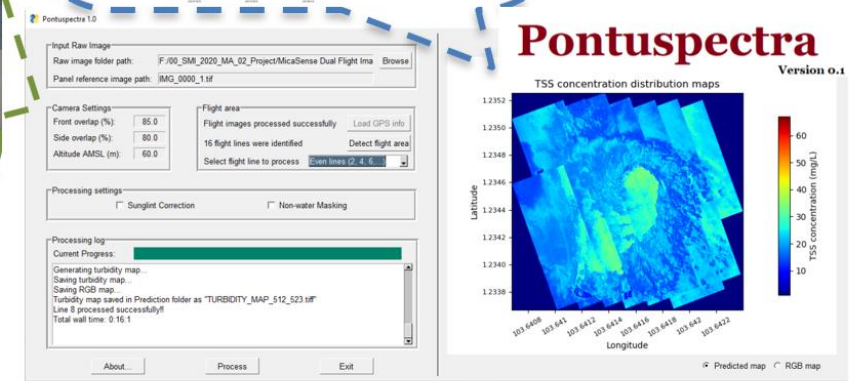
- Satellite images are often blocked by cloud cover in Singapore (>80% of the time).
- Field water sampling via boat access is accurate, but slow and only provides localised measurements. It is difficult to perform spatial analysis based on these point measurements.
- Fixed-location sensors provide the essential real-time monitoring but are limited in terms of the number of locations.
- ADCP transects are efficient, but are only used nearer to the spill sources and for model calibration due to high costs

To address the above limitations, a new remote sensing approach with Unmanned Aerial Vehicles (UAVs) shall be developed using both hyperspectral and multispectral cameras and aided by imaging analysis using the Convolutional Neural Networks (CNNs). The approach will enable the real-time monitoring of turbidity distributions in Singapore's coastal waters to be on demand. The accuracy of the derived turbidity contour maps will also be assessed through comparison with field samplings.

In Phase 1, a UAV (hyperspectral) will be flown to obtain the high-quality remote sensing data on turbidity distributions in coastal waters with field calibrations. Another UAV (multispectral) with lower costs for industrial applications will also be flown side-by-side simultaneously, with parallel calibrations based on the hyperspectral analysis to identify the suitable specifications under varying environmental conditions. A software to generate the turbidity contour maps will also be developed. In Phase 2, UAV (multispectral) monitoring shall be carried out in five different operation scenarios in coastal land reclamation in Singapore, for verification and demonstration purposes. Further development and refinement of the software will also be conducted with the additional information from these scenarios to provide an assessment of the accuracy.

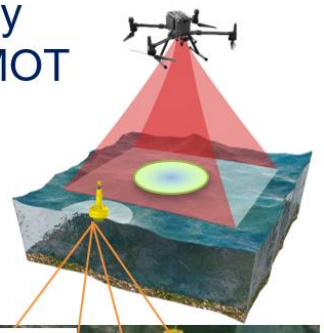
UAV Project funded by SMI ~0.8 Mil





NEWRI Licensed Software for Automated UAV Remote Sensing for Water Quality

SMI project (SMI-2020-MA-02, Sep 2020 – Aug 2023) nominated by MPA for IES Project Award & MOT Minister Award



Wave & Current Monitoring

X-band Radar – PUB CWR Project ~2.6 Mil

AskNEWRI@ntu.edu.sg www.ntu.edu.sg/NEWRI 1 Cleantech Loop, CleanTech One #06–08, Singapore 637141