A Small Cloud Enabled Passive Acoustic Monitoring Array for Real-time detection of vocalising Marine Megafauna

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Various species dolphins, porpoises and dugongs have been known to inhabit the waters in Singapore. There have been many anecdotal reports and sightings, but this is yet to be quantified and their spatio-temporal visitation patterns are yet to be characterized. Due to their rare surface expression and poor visibility of local waters, it is costly and unproductive to conduct regular boat sighting survey for population density estimation. This project focuses on underwater monitoring of marine-mammal vocalisations in Sisters' Island Marine Park in Southern Singapore We have designed and assembled a 4-channel high frequency Passive Acoustic Monitoring system using a 4-channel high frequency hydrophone array (up to 160kHz) with real-time detection and localization capability for this purpose. The real-time detection is performed by a machine-learning (ML) model training using a combination of limited local data and freely available online data. The setup also includes an in-air video camera that can be triggered to rotate and point towards the direction where hydrophone array estimated sound source is located. This will provide a good visual ground truth when the image of the subject surfaces in conjunction with the acoustic detection of the vocalization. A variety of environmental sensors and shipping data was also acquired in-situ to provide a holistic dataset to study the relationship between the presence of the animals and the environmental conditions.

We will present the setup of the PAM system that consists of a solar powered Surface Unit deployed on shore and an Underwater Unit deployed on the seabed connected by a 100m underwater cable providing power and communication.

We achieved real-time processing of the continuous acoustic recording, and a detection by the ML detector with the acoustic data, would trigger the camera to point towards the intended target.

A cloud instance is also deployed to receive uploads of detected signal, camera footage and metadata for human verification. Preliminary results of our integrated setup with automated detection, localization, camera control and data snippet upload are presented