

Automated Shark Detection System Trial: NSW DPI



1. Introduction

Scout Aerial has been working on an automated shark detection algorithm for the past six months and this report details some of the results that were achieved during testing. Due to the innovative approach to this project, Scout Aerial needed a lot of sample data in order to build a baseline algorithm specific to NSW DPI's requirements. Once we have identified the data requirements, and have developed a machine learning tool for this algorithm, we can then build a solution that is scalable and suited to the shark management process. By undertaking a pilot project, we are able to collect the data required, identify the particular environments (type and state), build a base algorithm and understand the scale requirements. The report details the findings below.

2. PROFESSIONAL SERVICES

2.2. RESOURCES

Scout Aerial has assigned a fulltime effort to developing the base algorithm and the main focus has been on training the algorithm which is an extremely manual process. A team of four pilots, two aircraft and supporting hardware and software was sent to Ballina to test the system. Algorithm development time to date has been in excess of 600 hours.

2.2.1. TECHNOLOGY

We have been working on the hardware design so that it may be attached to any RPA and will be fit-for-purpose for this project. The hardware can be offered in multiple configurations or "As-required" (Multispectral, RGB, NIR,) and we will collect multiple different data samples in order to "train" the base algorithm in "layers" to make it more accurate over time.

2.2.2. PERSONNELL

A dedicated project team will be allocated to this project. The tasks they were responsible for include the following:

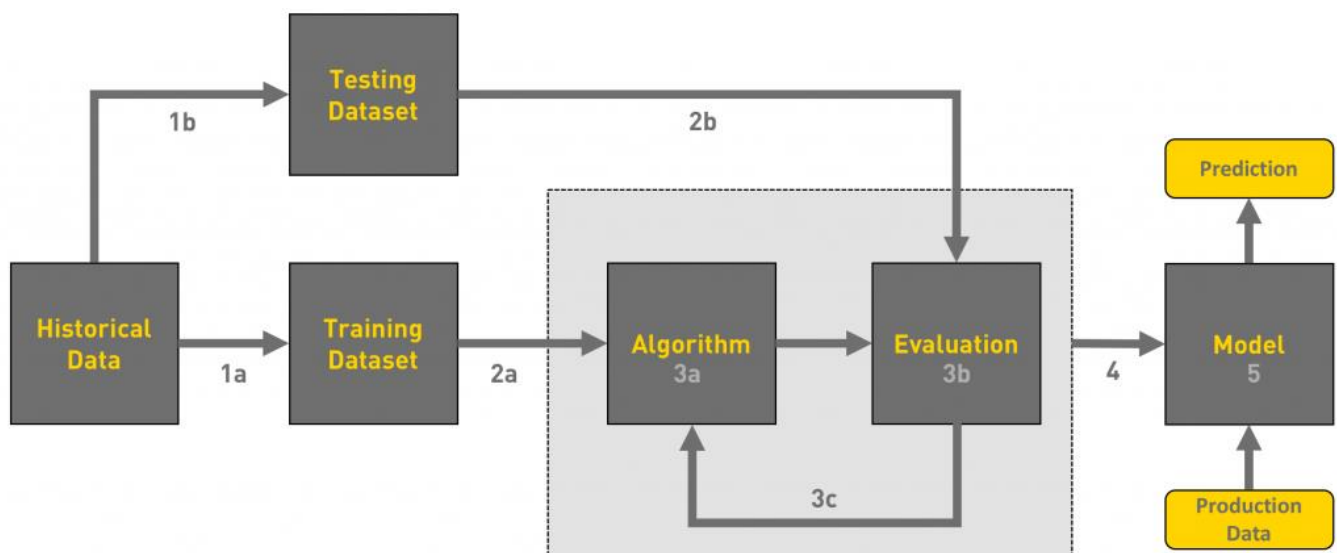
- Data processing
- Data Management
- Algorithm Development
- Machine Learning application
- Testing and evaluation

2.3. PROGRAM METHODOLOGY

The methodology combines conventional flight procedures with our RPA's. Once the data has been collected, it will be processed and analysed for the purpose of building an algorithm that will be able to automatically detect sharks and other features. Once the baseline Algorithm has been completed, this will allow NSW DPI to develop a scale strategy to roll out the product to the remaining stations.

In regards to developing an algorithm, the required specification aids in the identification and reduction of subconscious biases. By using an algorithm, decision making becomes a more rational process.

In addition to making the process more rational, use of an algorithm will make the process is more efficient and more consistent. Efficiency is an inherent result of the analysis and specification process. Consistency comes from both the use of the same specified process and increased skill in applying the process. An algorithm develops and becomes "self-learning" over time, meaning a constant improvement in efficiency. The very first step to developing an algorithm is the collection of data that will be used as the foundation to build it.



Step 1a: Select dataset for training, Historical and actual

Step 1b: The smaller part of the dataset is considered for testing.

Step 2a: The training dataset is passed to an ML algorithm like Linear Regression.

Step 2b: The testing dataset is populated and kept ready for evaluating.

Step 3a: The algorithm is applied to each data point from the training dataset.

Step 3b: The parameters are then applied to the test dataset to compare the outcome.

Step 3c: This process is iterated till the algorithm generates values that are a close match to the test data.

Step 4: The final model is evolved with the right set of parameters tuned for the given dataset.

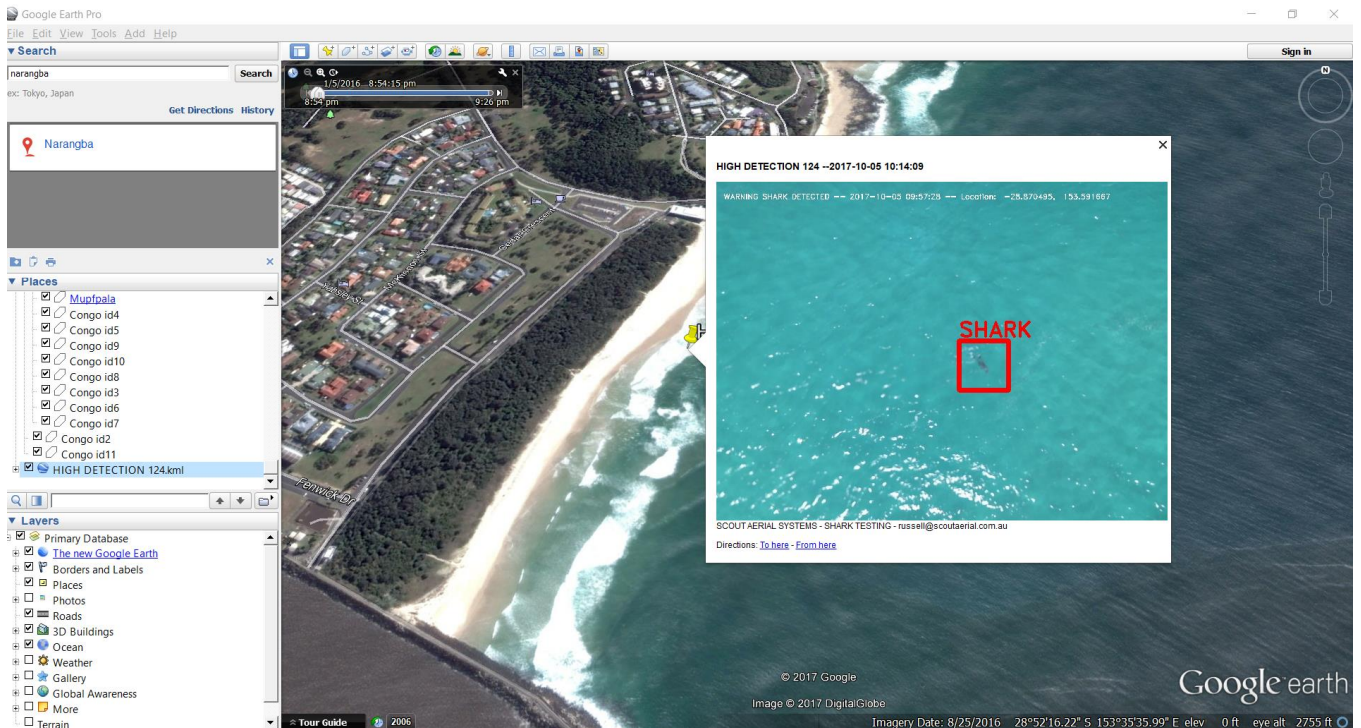
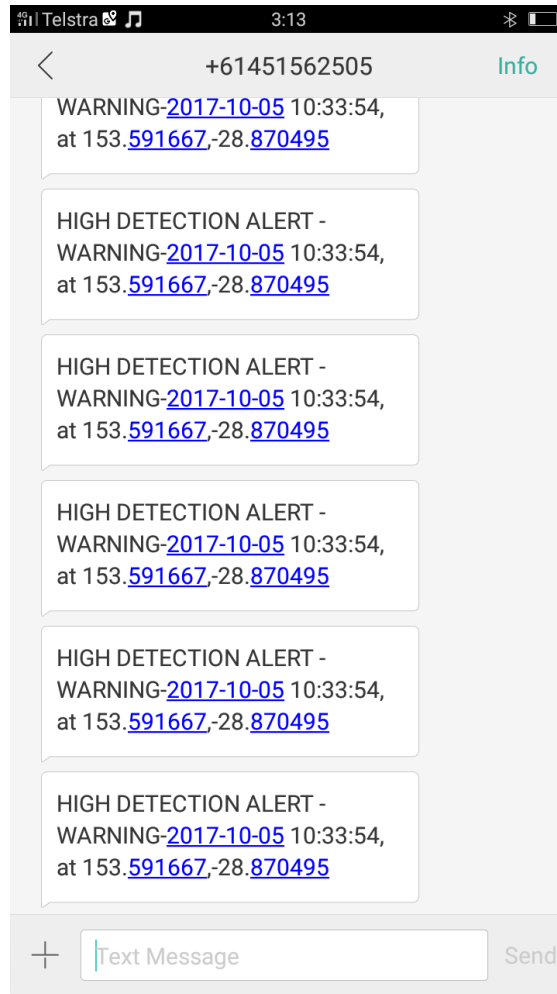
Step 5: The model is used in production to predict based on the new data points.

2.3.1. FLIGHT DETAILS

The suggested flight profile will be conducted in line with CASA and Air Services Australia requirements. All flight planning is conducted with safety as a priority and efficiency as a secondary focus. We believe that BVLOS operations with the right fixed wing systems will be the best solution for shark management in the future. This will allow us to have a mechanism in place to cover broad areas and to demonstrate other capabilities (Turtle track, mammal counts, erosion, etc.) during the projects.

2.3.2. DATA DELIVERY

The data output can be in many forms. We have chosen SMS with an Alert and geolocation, this can be attached to a KML and opened immediately in Google Earth. This can easily be pushed into an App if required. See below SMS example:



2.4. EXPECTED RESULTS

Throughout the pilot project, our aim was to develop new automated tools and operational procedures for shark management. The project deliverables include:

- Google earth KML files of the detections
- Base algorithm Development
- Sample video/photos
- Automated Geotagging and SMS alert
- A database containing all data of the which can be used at any time to extract information
- Marketing and PR video content for DPI

3.6. DEVELOPMENT

Scout Aerial would recommend developing this algorithm and integrating it with existing procedures. We would like the opportunity to scope a live demo for DPI over 2-3 days to showcase the possibilities. We are confident we can develop this tool with the required data and the right platforms.

4. Conclusion

Scout Aerial is committed to delivering Aerial services in Australia, and most importantly, committed to research and development, while maintaining industry leading levels of safety and efficiency. We trust that the above information demonstrates Scout Aerial's willingness and ability to provide effective services for this project. We would be pleased to work with NSW DPI to jointly discuss requirements in further detail where the aim is to provide the most economical and comprehensive solution for aerial services. Should you have any questions, or wish to discuss this expression of interest further, please do not hesitate to contact me directly.

Yours sincerely,
Patrick Weeden

Samples:

****Please note that due to the lack of shark activity in Ballina on 5/10/2017, we increased the sensitivity and chose to show detections using dolphins. All detections were done in the live environment, in real-time, processed onboard and SMS messaged sent back to the operators*****

WARNING SHARK DETECTED -- 2017-10-05 09:57:28 -- Location: -28.870495, 153.591667



05/10/17

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