Friedrich-Alexander-Universität
Erlangen-Nürnberg

UNIVERSITY
OF WOLLONGONG
AUSTRALIA

MASTER THESIS

Abteilung für
Phoniatrie und Pädaudiologie
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To students within
Medical Engineering / Medizintechnik,
Computer Science/ Informatik / Artificial Intelligence,
Data Science, Computational engineering,

Title: Artificial Intelligence-Based Shark Detection and Classification from Drone Video Footage

Background: Uncrewed aerial vehicles (UAVs), commonly referred to as drones, are increasingly used for coastal surveillance because they can rapidly survey large areas of water without placing observers at risk. Drone-mounted cameras provide real-time aerial footage of swimmers, surfers, marine animals and changing ocean conditions. However, reliable identification of sharks from drone footage remains challenging because animals may be partially submerged, obscured by glare or waves, viewed at different depths and orientations, or visible for only a few video frames.
The New South Wales Government (Australia) has invested substantially in drone-based shark surveillance through the Shark Management Program, in which trained drone pilots conduct routine patrols at many beaches along the NSW coastline [1]. The program has demonstrated that drones are an effective tool for detecting sharks and improving beach safety while allowing beaches to remain open whenever possible. Currently, shark detections rely primarily on trained human observers monitoring live video feeds, making the process labour-intensive and dependent on operator experience, environmental conditions and sustained concentration. Artificial intelligence and computer vision offer the opportunity to complement these surveillance operations by automatically detecting, tracking and classifying sharks in drone video streams. AI-assisted recognition could reduce operator workload, improve detection consistency, provide confidence-based alerts and enable rapid communication with lifeguards and emergency services.

The overall goal of this project is to develop and evaluate an AI-based shark-recognition system for drone video footage.

Current State: Purcell et al. demonstrated that deep learning can successfully detect and classify sharks and other marine fauna from live drone video using footage collected during the NSW Department of Primary Industries drone surveillance program, highlighting the potential for AI-assisted coastal monitoring while identifying the need for further improvements in robustness and operational deployment [2]. To address this a collection of drone videos will need be assembled from field trials, existing research footage and controlled deployments.

Research Questions

1. Can sharks be reliably detected and tracked in drone video footage using modern deep-learning methods?
2. How effectively can the system distinguish sharks from dolphins, rays, seals, swimmers, surfboards and shadows?
3. Can a trained model operate in near real time to support coastal surveillance?
4. Can the AI system estimate shark size, species and behaviour from aerial video footage?

Methods & Tasks

1. Review literature on drone-based marine monitoring, shark detection and computer vision.
2. Develop a curated database of annotated shark and non-shark training videos. Collect additional shark videos.
3. Train and compare different machine learning models for object detection and segmentation models.
4. Design a prototype architecture linking drones, wireless communications and autonomous buoy-mounted shark deterrent systems.

Goal: Develop and validate an artificial intelligence system capable of automatically detecting, tracking and classifying sharks from drone video footage.

The work will be supervised by **Prof. Dr.-Ing. Michael Döllinger** (Member of Department Informatics & AIBE) and **Prof. Dr.-Ing. Kniesburges** at FAU. The thesis is in close **cooperation with Prof. Marc in het Panhuis** (University of Wollongong, Australia) who will co-supervise the student.

We search for a dedicated and motivated student with

- Very good grades
- Experience in programming language (Python)
- Very good background and knowledge in Machine Learning
- Good Mathematical understanding
- Good written and verbal communication skills in English (cooperation partner is English speaking)

Application: Please send CV and current transcripts.

Contact person: Prof. Dr.-Ing. Michael Döllinger (michael.doellinger@uk-erlangen.de)

References:

1. https://www.nsw.gov.au/ministerial-releases/major-boost-to-shark-spotting-drones-to-improve-beach-safety-120-million-shark-program, accessed 21 July 2026
2. Purcell, C.R., Walsh, A.J., Colefax, A.P., Butcher, P., et al. (2022). Assessing the ability of deep learning techniques to perform real-time identification of shark species in live streaming video from drones. Frontiers in Marine Science, 9, 981897. https://doi.org/10.3389/fmars.2022.981897