AI-MEG: Automated detection and identification of seabirds from aerial imagery

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Figure 1. Aerial images collected in the North Sea

Introduction

A transition is underway in seabird monitoring from aircraft visual observations to high-definition digital camera image collection.

Currently, the detection and identification of the birds in the imagery is carried out by specially trained ornithologists. To make this more time- and cost-efficient, the apparent option is to automate this processing step through an AI setup.

An international consortium is currently carrying out a project to develop an AI approach to automatically process digital HiDef aerial images for seabird surveys.

The AI models are trained using images collected at two offshore windfarms in the Dutch part of the North Sea.

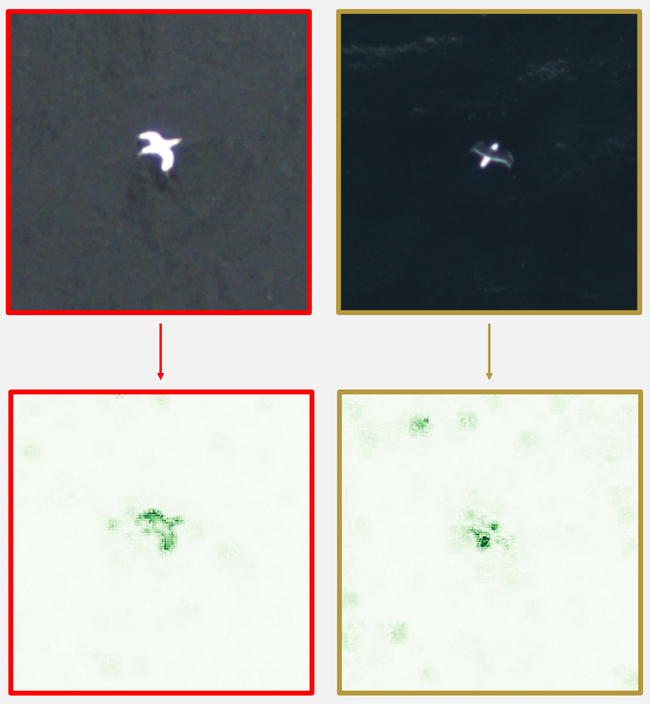

Figure 2. Detected objects of interest. **Top:** Crops from original imagery (left: gannet, right: greater black-backed gull). **Bottom:** Heatmaps highlighting areas which influence the model's decision strongly.

Objectives

- Train AI model, leveraging temporal information[1] of labelled imagery.
- Utilizing not only the specific labels on the species level, but also the broader 'parent' classes.

Methods

- Aerial images (Fig. 1) collected by Bioconsult[2,3].
- Objects of interest automatically selected from imagery (Fig. 2), using object detection (now only seabirds, in future also marine mammals).
- Heatmaps generated to interpret model predictions.
- Classification of detected birds to most specific possible taxonomic level.

Results – improving identification

Quality test of annotated pictures

480 images were assessed independently by two raters and reviewed by a third rater.

- Agreements, including species groups ≈ 90%
- Disagreements ≈ 10%

Conclusion: Annotations of higher quality than expected (hard/soft mistakes), as annotators can use more information than available in single images, including size (Fig. 3).

Video Classification

To improve the ID we used multiple consecutive images of a bird, predicted them separately, and then combined the AI model's identification from all the images:
Accuracy increases with 2-3%, on top of a baseline of 82% (swimming birds) and 86% (flying birds – have more features for a good ID).

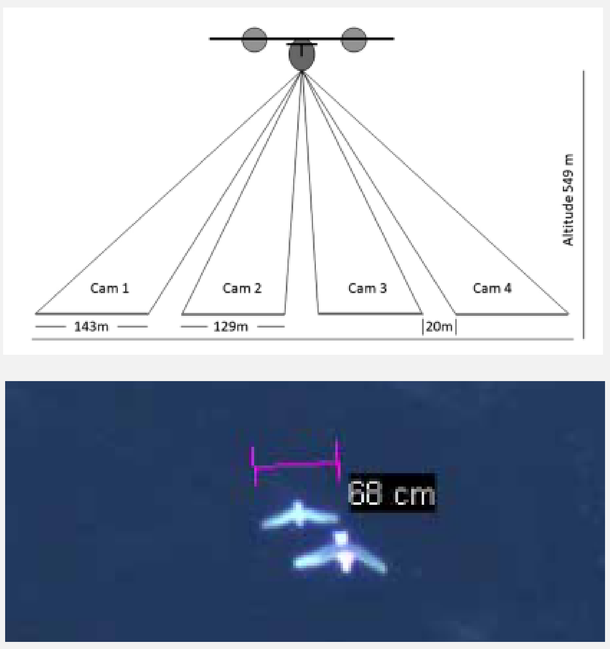

Figure 3. Top: Camera configuration at the survey airplane. **Bottom:** Size of the birds at the pictures can be determined based on altitude and the individual camera angle, an extra tool for the annotator for identification.

Improvements

Several next steps possible to improve the AI-model and come to a complete automated pipeline: Detection -> tracking -> identification

Next steps to incorporate on the short term:

- Improve model performance with, e.g., a video approach, attention-based pooling
- Camera configuration – indirect size information
- Tracking of birds – to secure accurate counting

Developments

Better cameras are coming with higher resolution data.

New data available of larger area to improve and train our model further.

Outlook

- 2025 : Develop a workable open-source AI model.
- 2025 : Two draft papers and publish results in 2026.
- 2026>: Apply the model to other regions/seasons in follow up projects.

References

[1] Grundlehner A, Leopold M, Kersten A. This is EPIC: Extensive Periphery for Impact and Control to study seabird habitat loss in and around offshore wind farms combining a peripheral control area and Bayesian statistics. Ecological Informatics, 85, Article 102981. https://doi.org/10.1016/j.ecoinf.2024.102981 (2025).
[2] Žydelis R, Dorsch M, Heinänen S *et al*. Comparison of digital video surveys with visual aerial surveys for bird monitoring at sea. *J Ornithol* **160:** 567–580 (2019).

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