Abstract

[Research Title]

Development of the Radar Image Analysis System for Distinguishing a Flight of Birds and Bats Aiming at an Application to Environmental Impact Assessment

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[Abstract]

In order to achieve carbon neutrality by 2050, Japan needs to rapidly deploy many renewable-energy facilities. Because of its location, surrounded by the sea, Japan has many suitable areas for the development of offshore wind farms. Offshore power generation is expected to play a major role in Japan's future electricity supply. As offshore environmental impact assessment surveys are far more difficult to conduct than those onshore, the development of a methodology suitable for potential offshore wind farms is both urgent and essential.

Our aim was to develop an image analysis system capable of identifying the flight patterns of birds and bats based on echo information obtained from a radar capable of capturing signals from objects over a wide area of open water. Such a system (without using visual observations) offers a new survey technique and will establish a method for evaluating environmental impact using flight trajectories of flying animals.

As a first step, rangefinders were used to acquire multiple flight trajectories of various bird and bat species. This information provided the training data for the development of an AI discrimination system. Then, as a second step, a tracking program (BbTracker) was developed to extract motion trajectories by applying special image-processing techniques to radar images acquired at radar survey sites. Two further programs (BbTrainer and BbClassfier) were developed to discriminate and identify the flight patterns of birds and bats. These programs used AI learning, based on the training data obtained from the first step, to recognise the echo trails drawn by BbTracker. Using these three programs, we attempted to identify the species of flying animals in radar images taken off the coast of Noshiro, Akita Prefecture.

The discrimination rates for various species groups were: 70.7% for waterfowl, 57.4% for seabirds, 50% for raptors, and 79.3% for bats. At the family level discrimination rates were 61.7% for Laridae, 66.9% for Anatidae, 51.1% for Accipitridae, and 79.3% for Vespertilionidae. The results indicate that

species groups can be identified relatively accurately.

As a final step, the annual number of collisions between flying organisms and potential wind farm turbines was predicted (based on the trajectory lengths determined for the various species groups in the second step) in order to attempt a hypothetical environmental impact assessment using automated radar data.

The radar-image-analysis system developed in this study offers an effective tool for environmental impact assessment for offshore wind farms.

[References]

Kamata T, Sato T, Sekijima T (under review) 'Field validation of avian radar surveys: effects of differences in species and flock sizes on echoes' Scientific reports

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