

Dancer in the Wind: Automated Eagle Monitoring and Deterrence

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Abstract

Improving the coexistence of eagles and wind energy is a critical effort for the sustainable expansion of the wind energy sector. Information about eagle activity and interactions with wind turbines enables verification of deterrence methods. This information can be broken into two categories: eagle activity in the airspace around wind turbines, and the number of collisions that occur. Airspace monitoring, collision detection, and deterrence are addressed via three subsystems that are integrated to form an automated solution. Operating holistically, deterrents are deployed when the airspace monitoring system detects an inbound eagle; if a collision occurs, a blade impact detection unit captures the event for later analysis. Visual deterrents take the form of kinetic scarecrows, whose anthropomorphic form and dynamic movements may effectively encourage flight path changes away from turbine structures. Deployment of the deterrent system with wild eagles took place in winter of 2018, where the deterrent was activated in front of 11 wild eagles. Airspace monitoring utilizes a 360-degree camera mounted on the nacelle of the wind turbine. A convolution neural network analyzes the footage for real-time eagle recognition, and currently has demonstrated an accuracy of 87%. Mounting solutions provide low cost and size for affordable and effective up-tower securement of the 360-degree camera. An on-blade unit detects collisions using vibration sensors, and captures the event using an onboard camera for later evaluation. On-blade unit vibration transducers were tested, showing viability for the sensors and a need for higher sampling rates. Overall, the system demonstrates viability as a low-cost solution for removing the need for extensive human activities to determine wind farm effects on protected species.

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