

Artificial Intelligence Protecting Birds against Collisions with Wind Turbines

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Abstract : The dynamic development of wind energy requires the simultaneous implementation of effective systems minimizing the risk of collisions between birds and wind turbines. Wind turbines are installed in more and more challenging locations, often close to the natural environment of birds. More and more countries and organizations are defining guidelines for the necessary functionality of such systems. The minimum bird detection distance, trajectory tracking, and shutdown time are key factors in eliminating collisions. Since 2020, we have continued the survey on the validation of the subsequent version of the BPS detection and reaction system. Bird protection system (BPS) is a fully automatic camera system which allows one to estimate the distance of the bird to the turbine, classify its size and autonomously undertake various actions depending on the bird's distance and flight path. The BPS was installed and tested in a real environment at a wind turbine in northern Poland and Central Spain. The performed validation showed that at a distance of up to 300 m, the BPS performs at least as well as a skilled ornithologist, and large bird species are successfully detected from over 600 m. In addition, data collected by BPS systems installed in Spain showed that 60% of the detections of all birds of prey were from individuals approaching the turbine, and these detections meet the turbine shutdown criteria. Less than 40% of the detections of birds of prey took place at wind speeds below 2 m/s while the turbines were not working. As shown by the analysis of the data collected by the system over 12 months, the system classified the improved size of birds with a wingspan of more than 1.1 m in 90% and the size of birds with a wingspan of 0.7 - 1 m in 80% of cases. The collected data also allow the conclusion that some species keep a certain distance from the turbines at a wind speed of over 8 m/s (Aquila sp., Buteo sp., Gyps sp.), but Gyps sp. and Milvus sp. remained active at this wind speed on the tested area. The data collected so far indicate that BPS is effective in detecting and stopping wind turbines in response to the presence of birds of prey with a wingspan of more than 1 m.

Keywords : protecting birds, birds monitoring, wind farms, green energy, sustainable development

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