Automated spillway surveillance for risk assessment at FishPass

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Jesse Eickholt[1], Daniel P. Zielinski[2]

[1]Department of Computer Science, Central Michigan University, Mount Pleasant, MI 48859
[2]Great Lakes Fishery Commission, Ann Arbor, MI 48105

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ABSTRACT:

Selective passage systems allow passage of desirable fish while blocking movement of undesirable fish. Replacement of fixed, riverine barriers with effective intelligent migratory barriers will increase connectivity of waterways and aid species specific fisheries management and restoration efforts. The overall effectiveness of a selective passage systems will depend on both the selection mechanism and channel as well other components at the selection site designed to prevent passage (e.g., low-head weir). A hazard analysis for unintended escapement and video surveillance for unintended passage provide a more complete characterization of selective passage systems. To these ends, the launch angle and speed of steelhead (*Oncorhynchus mykiss*) present in the Laurentian Great Lakes were characterized through annotated images collected during spring 2022 and 2023 migratory runs. Analysis of 173 total leaps yielded a mean normalized launch speed of 8.6 body lengths per second and mean launch angles of 58.73 and 68.2 degrees in 2022 and 2023, respectively. To detect unintended passage over barriers, object detection methods based in machine learning were developed and evaluated. The developed models were trained to locate jumping fish and designed for incorporation with deployable network video recorders. With regards to the selection mechanism for image-based sorting for selective passage, key operational characteristics such as machine learning architecture, number of species, and presentation of fish (i.e., watered or dewatered) were identified from an extensive review of the literature.