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Machine learning classification of stratified wakes using dynamic mode decomposition and decision trees¹ JONATHAN H. TU, NSWC Carderock, CHAN-YE OHH, GEOFFREY SPEDDING, USC — Previous work has shown that stratified wakes can be sorted into known regimes based on numerical criteria derived from the results of dynamic mode decomposition (DMD) [Ohh Spedding, APS DFD 2019; OS19]. Here, we extend that work by applying methods from machine learning. As before, we compute features for each candidate wake using DMD: a dominant DMD mode is identified and characteristics of that mode, such as its symmetry in each cross-stream direction, are computed. Those features are then used to train a decision tree classifier, which labels candidate wakes using a series of if-then statements. This mirrors the general structure of the model developed previously in OS19, except that here, the criterion used for each if-then statement is determined automatically by the decision tree training algorithm, rather than using human expertise. We find that our model is able to achieve high accuracy while maintaining interpretability, a common challenge in machine learning. Furthermore, the decision tree utilizes many of the same features that were chosen in OS19.

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