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Developing an Out-of-Distribution Generalization Model Selection Framework through Impurity and Randomness Measurements and a Bias Index

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Abstract : Out-of-distribution (OOD) detection is receiving increasing amounts of attention in the machine learning research community, boosted by recent technologies, such as autonomous driving and image processing. This newly-burgeoning field has called for the need for more effective and efficient methods for out-of-distribution generalization methods. Without accessing the label information, deploying machine learning models to out-of-distribution domains becomes extremely challenging since it is impossible to evaluate model performance on unseen domains. To tackle this out-of-distribution detection difficulty, we designed a model selection pipeline algorithm and developed a model selection framework with different impurity and randomness measurements to evaluate and choose the best-performing models for out-of-distribution data. By exploring different randomness scores based on predicted probabilities, we adopted the out-of-distribution entropy and developed a custom-designed score, ”CombinedScore,” as the evaluation criterion. This proposed score was created by adding labeled source information into the judging space of the uncertainty entropy score using harmonic mean. Furthermore, the prediction bias was explored through the equality of opportunity violation measurement. We also improved machine learning model performance through model calibration. The effectiveness of the framework with the proposed evaluation criteria was validated on the Folktables American Community Survey (ACS) datasets.

Keywords : model selection, domain generalization, model fairness, randomness measurements, bias index
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