Assessing Accuracy and Geographical Transferability of Machine Learning Algorithms for Wind Speed Modelling

Fabio Veronesi, Athina Korfiati, René Buffat, Martin Raubal

Abstract Machine learning is very popular in the environmental modelling community and has recently been demonstrated to be a useful tool for wind resource assessment as well. Despite the popularity of wind resource assessment, research in the field of machine learning for this purpose is in its infancy. Only few algorithms have been tested and only for specific areas, making it difficult to draw any conclusions in regards to the best wind estimation method at the global scale. In this study, we compared several machine learning algorithms with validation techniques specifically employed to not only assess their accuracy but also their transferability. In particular, we tested cross-validation techniques designed to test the accuracy of the estimation in the context of autocorrelation. This way we performed a benchmarking experiment that should provide end users with practical rules of application for each algorithm. We tested three families of popular algorithms, namely linear models, decision trees and support vector machines; each was tested using wind mean speed data and several environmental covariates as predictors. The results demonstrated that no single algorithm could consistently be used to estimate wind globally, even though decision-tree based methods seemed to be often the best estimators.

Keywords Machine learning, Geographical cross-validation, Geographic information systems, Wind resource assessment