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Machine learning for ecosystem services

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Abstract

Recent developments in machine learning have expanded data-driven modelling (DDM) capabilities, allowing artificial intelligence to infer the behaviour of a system by computing and exploiting correlations between observed variables within it. Machine learning algorithms may enable the use of increasingly available big data and assist applying ecosystem service models across scales, analysing and predicting the flows of these services to disaggregated beneficiaries. We use the Weka and ARIES software to produce two examples of DDM: firewood use in South Africa and biodiversity value in Sicily, respectively. Our South African example demonstrates that DDM (6491% accuracy) can identify the areas where firewood use is within the top quartile with comparable accuracy as conventional modelling techniques (5477% accuracy). The Sicilian example highlights how DDM can be made more accessible to decision makers, who show both capacity and willingness to engage with uncertainty information. Uncertainty estimates, produced as part of the DDM process, allow decision makers to determine what level of uncertainty is acceptable to them and to use their own expertise for potentially contentious decisions. We conclude that DDM has a clear role to play when modelling ecosystem services, helping produce interdisciplinary models and holistic solutions to complex socio-ecological issues.

Keywords: machine learning, data-driven modeling, firewood use, biodiversity values, uncertainty estimation, d

Full text

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