HAMLET How to Apply Machine Learning to Experimental & Theoretical PHYSICS
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[Remote] Delineation of peatland areas based on drone-borne radiometric surveys and unsupervised machine learning

Peatlands are carbon-rich landscapes that contain one-third of the global soil carbon (C) pool. Their capability to either sequester or release C into the atmosphere depending on the management practice, renders them important for climate action. Climate change mitigation efforts such as the rewetting of drained peatland areas are among key strategies to reduce CO2 emissions globally. In Denmark, there is a national goal to reduce the Danish CO2 emissions by 70% in 2030; this includes rewetting 100,000 ha of the peatlands drained earlier for agricultural production. However, accurate knowledge of the location and extent of peatland areas is necessary to accomplish this. Delineating peatland boundaries based on conventional mapping is not only laborious and time-consuming but may lead to inaccuracies due to lesser sample size. Optical sensors might perform well in some scenarios, but they fail especially in those peatlands which are covered by non-peat forming vegetation due to commercial crop production. Here, UAV-borne gamma-ray radiometric surveys may be useful for rapid, cost-effective, and accurate delineation of peatland areas due to the unique attenuation behavior of peat. In this study, we present results where we assessed the seasonal suitability of performing such surveys along with the influence of different survey heights and flight speeds. The radiometric data were clustered separately using the Density-based spatial clustering of applications with noise (DBSCAN) and the clustering results were validated with ground truth measurements of peat thickness. We show that accurate delineation of the peatland boundaries is possible at various flight altitudes with different line spacing and is more importantly season unspecific. The results have implication for proper C accounting and effective planning of peatland rewetting activities.

Broad physics domain

Geophysics

AI/ML technique(s) to be presented

Density-based spatial clustering of applications with noise (DBSCAN)

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