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Article

Hyperspectral Classification of Savanah Tree Species Using k-fold Cross-Validated Non-linear Support Vector Machines

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Abstract: Identifiying savannah species at ecological scale is major mile-stone in measuring biomass, carbon reserves, drought and invasive specie spread predictions. In this paper we perform classification and geo-mapping of tree species from hyperspectral imagery collected using AVRIS airborne sensors and atmospherically corrected using ATCOR. This study classifies four common savannah tree species in Ordway-Swisher Biological Station in north-central Florida, USA. Among predictors we found NDVI, the NIR wavelngths ($0.73\mu m$) and removal of water absorption bands ($1.36\mu m$ - $1.44\mu m$) and ($1.8\mu m$ - $1.96\mu m$) to be most useful. Gaussian filter was used to avoid sensor measurements and calibration errors in reflectance data. We employed various classification techniques out of which Support Vector Machines with a third degree polynomial kernel outperformed others. Our classification scheme produces accurate predictions of 80.02% at pixel level. This research was performed as a pilot study for the National Ecological Observatory Network-Airborne Observation Platform protocols.

Keywords: Specie classification; Hyperspectral; Savannah; Support Vector Machines; Ordway-Swisher Biological Station; High spatial and spectral resolution; Pixel-level classification; National Ecological Observatory Network; Airborne Observation Platform protocols; NEON-AOP

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1. Introduction

National Ecological Observatory Network (NEON) is a long term ecology monitoring project for for discovering, understanding and forecasting the impacts of climate change, land use change, and invasive species at continental-scale. NEON, funded by National Science Foundation (NSF) in the US, will operate for 30 years starting 2016. Local ecological measurements at sites distributed within 20 ecoclimatic domains across the contiguous United States, Alaska, Hawaii, and Puerto Rico will be coordinated with high resolution, regional airborne remote sensing observations [1]. Airborne Observation Platform (AOP) would be the remote sensing platform with equipments of meter/sub-meter resolution for hyperspectral and Light Detection and Ranging (LiDAR) measurements. This work is a pilot study on the pre-mission airborne hyperspectral data collected.

Various studies have dealt with identifying tree species at both pixel level and crown level. State-of-the-art uses both a combination of airborne or satellite hyperspectral/lidar sensors to for various classification purposes such as road/building classification, tree specie classification and mapping.

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2. Data Aquisition

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2.1. Hypercpetral Photometry

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2.1.1. Airborne Setup

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2.1.2. Atmospheric Correction

3. Specie Classification

3.0.3. Support Vector Machines

4. Results and Discussion

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5. Conclusions

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Author Contributions

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