Using Convolutional Network to Identify Tree Species Related to Forest Disturbance in a Neotropical Forest with very high resolution multispectral images

Wagner, F. H.; **Sanchez, A.**; **Tarabalka, Y.**; **Lotte, R. G.**; **Ferreira, M. P.**; **Aidar, M. P.**; **Gloor, M.**; **Phillips, O. L.**; **Aragão, L. E.**

Mapping tree species at landscape scale to provide information for ecologists and forest managers is a new challenge for the remote sensing community. Here, we tested the potential of a recent deep learning algorithm to identify and segment tree species associated with forest disturbance in very high-resolution multispectral images (0.3 m) from WorldView-3 satellite.

The study was conducted in a region of the critically endangered Brazilian Atlantic Rainforest, which is a global priority for biodiversity conservation due to its abundance of species of flora and fauna occurring across an extremely fragmented and degraded landscape. The convolutional network generated in this study for identifying trees from different species was trained with about 1500 high-resolution true colour synthetic optical images and their labelled masks for each species. Additionally, we created a new framework for measuring disturbance levels within forest fragments based on the spatial distribution of individual disturbance-related trees.

Our deep learning network segmented tree species with overall accuracies of above 95% and Dice coefficients of above 0.85. Then, the segmentation of tree species was produced over a region >1000 km² using WorldView-3 Red, Green and Blue bands pan-sharpened at 0.3 m. We found that the crowns of disturbance-related species covered between 1 and 5 % of the natural forest canopies. Our results based on the trees distribution shown that disturbance tends to increase with fragment size and revealed information that were not accessible from classical landscape fragmentation analysis, which is mainly based on size and connection of the forest fragments.

We are still far from recognizing all the species, however, species that are indicator of disturbance and early successional stage of forests can be accurately mapped. Our work shows how deep learning algorithm can support

applications such as mapping tree species and forest disturbance at the landscape scale from space.

Publication:
American Geophysical Union, Fall Meeting 2018, abstract #B33N-2861

Pub Date:
December 2018

Bibcode:
2018AGUFM.B33N2861W

Keywords:
0439 Ecosystems; structure and dynamics;
BIOGEOSCIENCESDE: 0466 Modeling;
BIOGEOSCIENCESDE: 0480 Remote sensing;
BIOGEOSCIENCESDE: 1630 Impacts of global change;
GLOBAL CHANGE