Aerophotogrammetry and artificial intelligence to quantify trees and palms in Amazon native Rainforests

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The Amazon rainforest is composed by dense and large vegetation, this implies arduous data collection to study forest dynamics. To collaborate with the study, remotely piloted aircrafts (RPA) can be used to collect images of the forest to acquire characteristics such as the height of the forest, used for biomass and carbon calculations. This technology with machine learning can help the processing of extensive data, however, it has not yet been applied to Amazon forests and is an opportunity to improve the accuracy of carbon estimates. The aim of this study was to investigate the performance of the artificial intelligence (AI) YOLOv5 in a Google Colab environment to count palms and trees in aerophotogrammetric images captured with the DJI Phantom 4 Pro and a camera. The AI training, validation and testing phases were applied with 1229 images to generate six models to detect and quantify palms and trees in three sites in the state of Amazonas in Brazil. The models were evaluated using the AI metrics precision, recall and mean average precision (mAP) and the remote sensing metrics omission errors, commission errors and accuracy. The models Palms400 and Trees600 obtained the best performances in mAP with 76% in both, nevertheless, accuracy was highest in Trees200 and Palms200 models, with 53% and 38% respectively. In all models, the omission was higher than the commission, where the models did not detect all the objects, while commission errors did not exceed 20%. Thus, it is possible to say that the models performed well and is recommended to use more different images of the objects in the AI phases, such as different shapes and colors to improve AI for forestry applications, in order to satisfy remote sensing metrics as well as AI metrics.