Subsurface targets detection using Faster R-CNN for Unmanned Aerial Vehicle Magnetic Survey

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Unmanned Aerial Vehicle (UAV) has become a viable platform for magnetic surveys, but the interference generated during flight and lack of the interpretation method for survey data limits its application. In this paper, we present a structure of a half-fixed boom for the UAV-magnetometer system. Compared to suspend the magnetometer on a long rope or cable, our new structure reduces interference and positional error meanwhile increases flight stability. The interference field was removed through compensation based on leveling, with root mean square error significantly reduced from 2.7889 nT to 0.2809 nT. The Faster R-CNN network was adapted for the detection of subsurface buried objects (i.e. Unexploded Ordnance) in UAV magnetic surveys, our Faster R-CNN object detection network is composed of a feature extraction network followed by two subnetworks, the feature extraction network we use is a pre-trained CNN called ResNet-50, the first subnetwork is a region proposal network (RPN) and the second subnetwork is trained to predict the actual class of each object proposal. A labeled dataset that contains 740 images was used for training and each image contains one or more labeled instances of mag anomaly, data augmentation is used by randomly flipping the image and associated box labels horizontally to improve network accuracy, the trained object detector was evaluated on both simulated and field test images. All implementations in this work were accomplished through MATLAB Deep Learning Toolbox using a PC with a GPU compute capability 7.5. Preliminary results reveal that the proposed technique can automatically confirm the number of subsurface targets, in the meantime results from different field tests show its robustness. Significant improvements have made compared to traditional computer vision methods and hence become quite promising to be applied in the field of UAV magnetic survey.