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Deep convolution neural networks based classification of drone-borne and ground based hyper spectral imagery

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Drones have been of vital importance in fields of surveillance, mapping and infrastructure inspection. With recent growth of computation power and development of algorithms for robust learning, neural learning based techniques have re-gained the prominence in contemporary research domain such as classification of common 2D and 3D images, object detection, etc. Drones have played a vital role for acquiring high resolution images and with present need for precision farming; drones have helped in crop classification and monitoring crop patterns. Here we propose deep convolution architecture for classification of aerial images captured by drones and high resolution Terrestrial Hyperspectral (THS) containing six layers with weights optimized including the input layer, the convolution layer, the max pooling layer, the fully connected layer, softmax probability classifier and the output layer. We have acquired THS (Cubert data) and drone agricultural data comprising seasonal crops sowed from month of March till June for year 2017. Crop patterns include cabbage, eggplant and tomato with varying nitrogen concentration for the region of Bangalore. To study the influence and impact of CNN, ResNets model has been applied. ResNets model and architecture is combined with deep learning network followed with Recurrent Neural learning Network model (RCNN). The HSI input layer with corresponding ground truth data of the region is fed into the ResNets model with a spectral and spatial residual network of $7\times7\times139$ input HSI volume. The network includes two spectral and two spatial residual blocks. An average pooling layer and a fully connected layer transforms a $5\times5\times24$ spectral-spatial feature volume into a single output feature vector. Furthermore, we are working upon using different optimization techniques including RMSProp, AdaBoost, Stochastic Gradient Descent (SGD) and Adam on every convolution layer to regularize the learning process and improve the classification performance of trained models. At present using RMSProp optimizer for error loss minimization when applied on drone dataset, we were able to achieve overall accuracy of 97.16%. Similarly, for cabbage, eggplant and tomato acquired ground based we achieved 87.619%, 89.25% and 80.566%, respectively with comparison to ground truth. Drones and ground based dataset equipped with computational techniques have become promising tools for improving the quality and efficiency for precision agriculture today.

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