Semantic segmentation of hyperspectral imaging using convolutional neural networks

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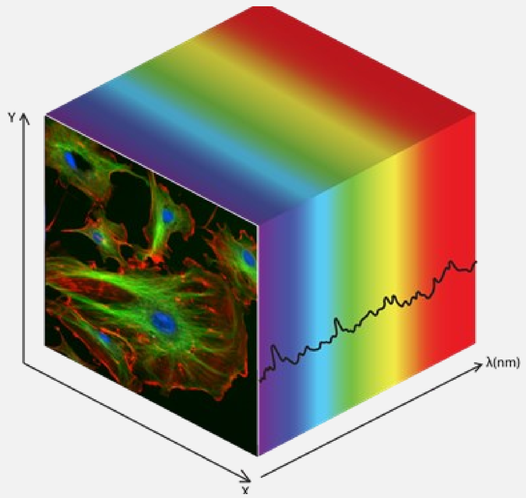
Introduction

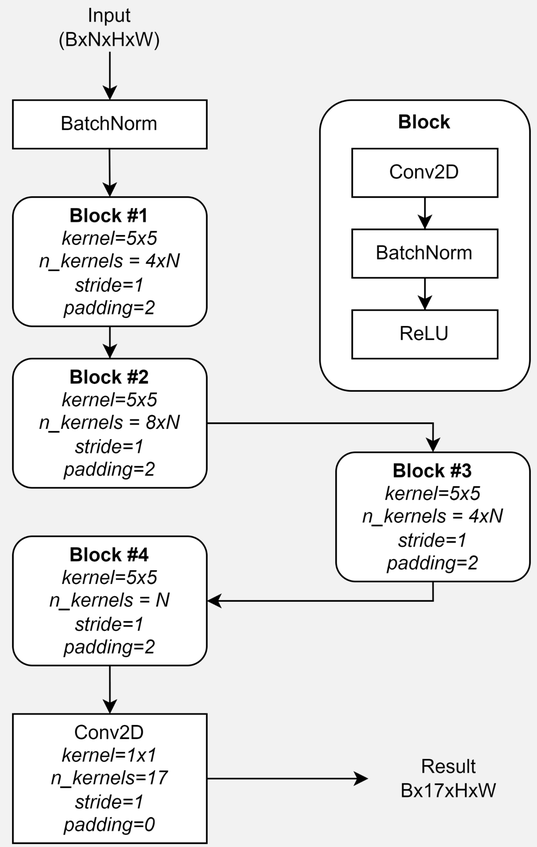
Using neural networks in hyperspectral imaging helps to get through the obstruction to solving data analysis, classification, and segmentation problems. There are problems, such as vegetations analysis in agriculture, which cannot be solved using classic RGB images due to lack of information. Applying neural networks to hyperspectral images is a sophisticated problem. The aim of this study is to examine concerns about using convolutional neural networks for the semantic segmentation of hyperspectral data. The following problems were considered: large spatial resolution, the influence of neural network's input size on accuracy and performance; hyperspectral data preprocessing, the influence of dimensionality reduction and brightness equalization; neural network architecture influence on analyzing hyperspectral imaging.

Hyperspectral image



Proposed architecture

We developed our architecture to achieve two goals. First, we wanted to have a small neural network with a few weights. So, it will allow us to train networks faster and the networks became more robust and generalizing. Also, we wanted to try a completely different architecture. Our architecture has no bottleneck, up sampling and down-sampling paths.



Results

Neural network architecture and classic approaches	
MLR	0.582
RFC	0.589
Unet	0.628
Ours	**0.766**

	Weighted average
Dimensionality reduction	
Original	0.131
PCA	**0.766**
RGB layers	0.584
Equalization	
Original	**0.766**
Histogram eq.	0.352
CLAHE	0.776
Input shape	
1x1	0.765
2x2	0.805
4x4	0.821
8x8	0.814
16x16	0.824
32x32	**0.828**
64x64	0.809
128x128	0.826
256x256	0.803
512x512	0.766

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