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Optimizing Neural Networks for Cloud Detection

Neural networks are used extensively for image classification, and consist of an input layer, several hidden layers, and an output layer. The network works iteratively, progressing through each hidden layer, transforming its input, and outputting the input for the next layer. When the network reaches the final output layer, it makes a predictive classification: it then compares its prediction to the expected classification and 'learns' by altering the weights of the network accordingly. For our research, we attempt to classify an input image as either an image that contains a cloud or an image that does not contain a cloud. This classification serves as a tool to segment a larger overhead image into cloud regions and no-cloud regions. The segmentation process is done by dividing the larger overhead image into smaller, overlapping tiles, classifying each tile (and its corresponding pixels), and then averaging the values for each pixel to find each pixel's probability of being part of a cloud region. Traditionally, similar projects have split the larger image into tiles with dimensions 227 pixels by 227 pixels. The objective of our research is to determine the optimal input size for classification. We are measuring the peak classification accuracies of different neural networks over a range of seven tile sizes (60x60, 120x120, 180x180, 210x210, 227x227, 240x240, and 300x300). We discovered that in the case of one network, a modified version of LeNET, that tile size is significant: for this system, classification accuracy increases as tile size increases. The largest tile size has a maximum classification accuracy nearly 20% higher than the smallest tile's maximum classification accuracy. However, in the case of two other networks, AlexNet and an altered model of SegNet, we found no clearly optimal tile size.