PadhAI: From Convolution Operation to Neural Network

One Fourth Labs

The convolution operation and neural networks

Part 2

How did we arrive here?

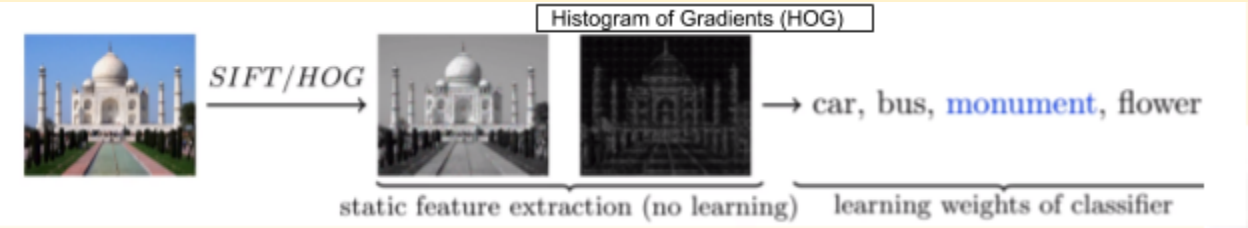
1. Let's look at the image classification task as it would've been performed with Machine Learning.

   a. Here, we flatten a 30x30x3 image into a 2700 raw pixels and feed them as input to a classifier such as a Support Vector Machine or Naive Bayes etc.
   b. There isn't much intelligence applied on the input side, we just pass the raw pixel data.

2. Now, let's look at the image classification done with some input preprocessing

   a. Here, we realise that there are certain aspects of the image (outlines/edges) that are much more critical to the classification task than other aspects
   b. So we perform feature engineering, whereby we apply some transformation to the input pixels before passing them into the classifier.

3. Let's look at the use of feature engineering with a 0 Hidden Layer NN to classify the images



   a. Here, using a deterministic algorithm like HOG or SIFT, we get a better representation of the input by cancelling out useless information.
   b. We now use these new inputs as features for our Neural Network and learn the weights for the classifier.
   c. However, in step (a), the transformation performed on the input image was static, without any learning per se, making it a hand-crafted set of features. The only learning that happens is in the classifier.

4. However, in a deep Neural Network, the input features are not directly fed to the classification/output layer, instead they are passed through hidden/representation layers, where they are distilled down to more relevant features, before being passed into the classification layer. This is why Deep Learning is also called Deep Representation Learning.
5. In the above case, we allow the DNN to learn the representation weights and apply it to the features in steps, before finally passing it onto the output layer.