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Springboard Data Science Career Track

Capstone Project 1 – Data Visualization

Image data needs to be broken down by image and category for meaningful analysis. Histograms can show the pixel range used and intermediate images of the CNN models can show important features. I will also look at the mean and median values of each image and how preprocessing changes the image of the biggest difference. Show an example of each category and figure out which categories are the most commonly confused.

Mean and median values start to show some of the differences between categories. Mode wouldn't make sense to examine because it would be zero for every class since the zero is the most common value, because of the background. Although groups definitely mix, it is a decent start to look at their mean and median because categories like 5:Sandels will clearly have a much lower average than others such as 2:Pullovers. Shown below are the median by class in order and two different analysis of medians.

```
mean by type: [ 82.37583333  56.24816667  95.22066667  65.70016667  97.65566667
   34.37516667  84.61316667  42.33666667  89.54033333  76.51516667]
```

|	median of medians		mean of medians
class		class	
0.0	74.5	0.0	80.818917
1.0	0.0	1.0	3.011417
2.0	118.5	2.0	118.118000
3.0	0.0	3.0	9.821583
4.0	120.5	4.0	109.664333
5.0	0.0	5.0	0.549583
6.0	89.5	6.0	95.798250
7.0	0.0	7.0	0.161083
8.0	64.5	8.0	76.247750
9.0	0.0	9.0	17.960833

An example of all 10 classes of images are on the following pages, clearly shirt, t-shirt, pullover and coat categories are a lot more similar than some of the other classes, and their histograms are more similar to match. The histograms all largely have a spike at zero because of the background but then deviate, the shoes are all flat across the range but the rest build to the high value end. The tops seem to have more variation than others, because they have decals or color variation.
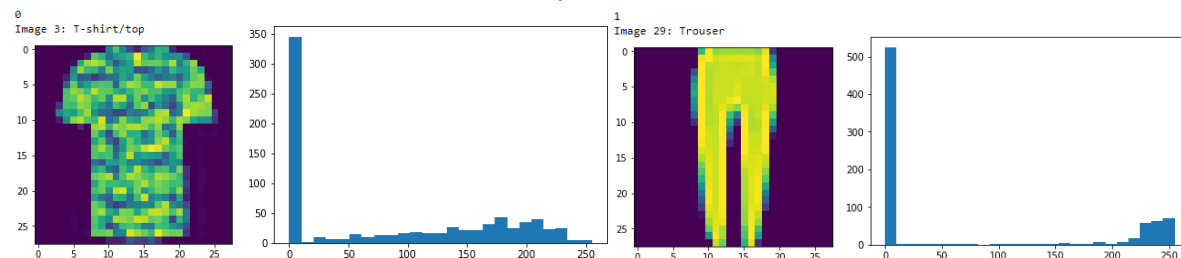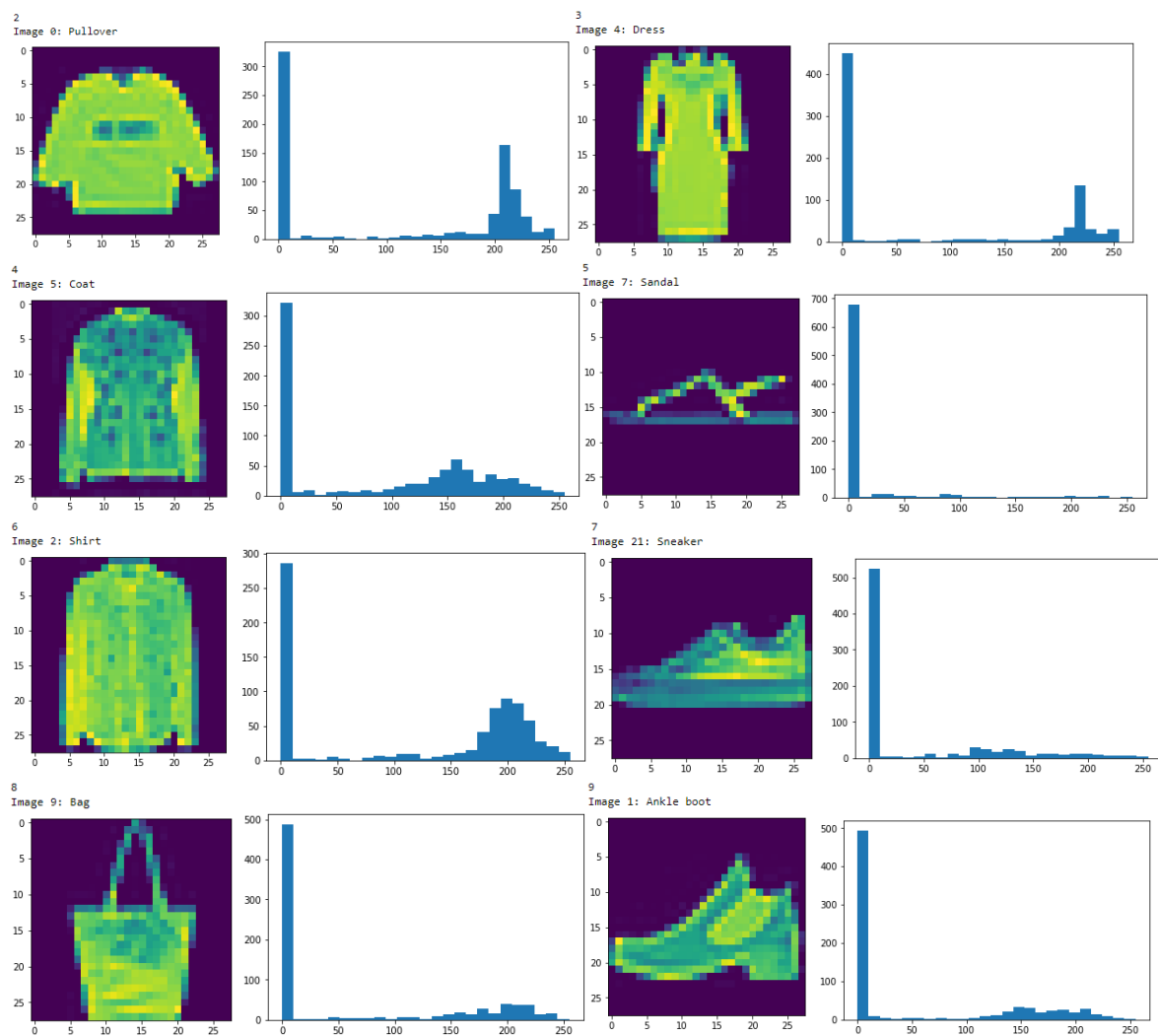
The effects of normalization on one of the images with the larges changes are below. The variation per pixel.



```
index 18712: change 118351.0
sum:    58157.0
```
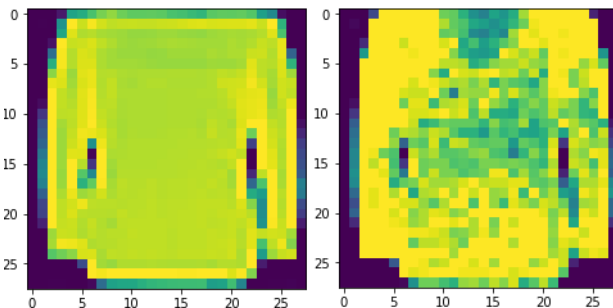
Finally there are visualizations of the convolutional neural network (CNN) intermediate layers. The first layer breaks the image into many different pieces and the second layer abstracts them to focus more on the general form. This is of the first CNN architecture and layout. Results may be improved by changing it, but these results are representative of the filtration and abstraction that the neural network does on every image.
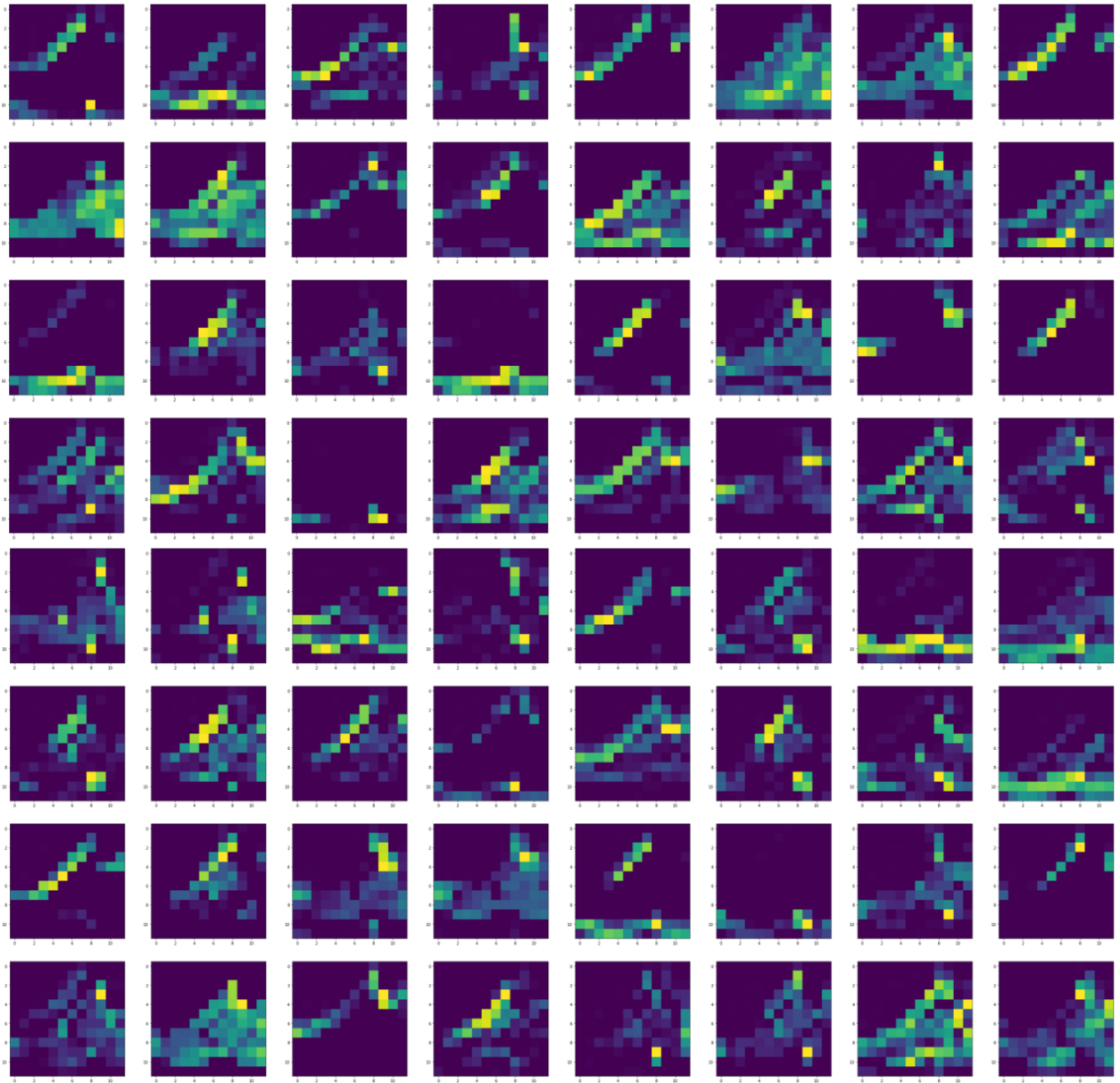
Original image
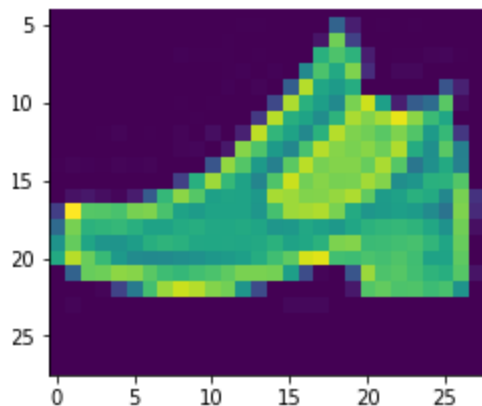
PHASE 1
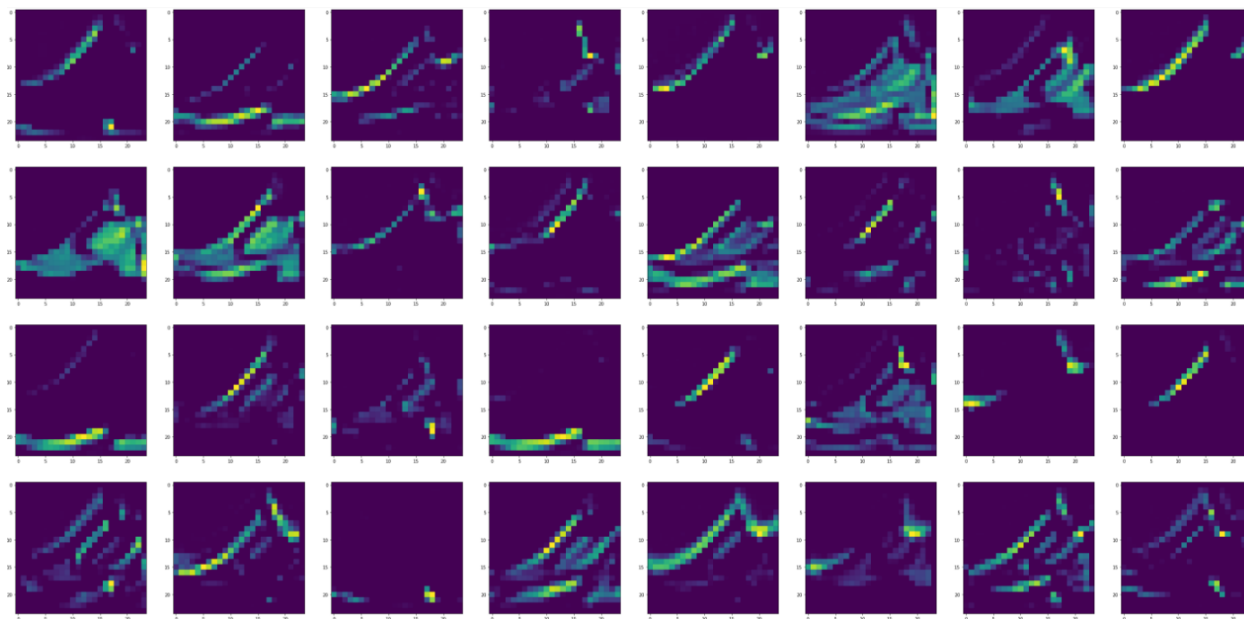
PHASE 2

Further tweaking of the neural network is needed to improve results, but there are many ways that images can be separated and identified through the visual properties show in this document.