Capstone Project 1 Final Report Clothing Categorization

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Springboard Data Science Career Track

Goal

- Correctly categorize clothing images

Benefits/Customers

- Online sellers of clothing
- Eventually clothing folding/sorting

Datasets

- Fashion.mnist
- A Kaggle clothing dataset was the dataset I used to train and compare the classifiers

- https://www.kaggle.com/zalando-research/fashionmnist/data

Data Wrangling

- Average images and histograms of each of the image classes are shown
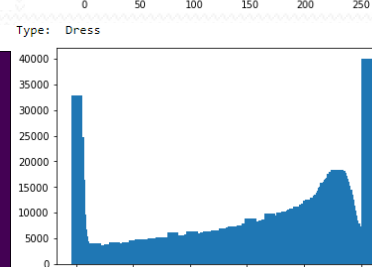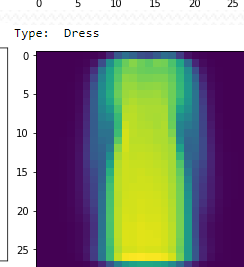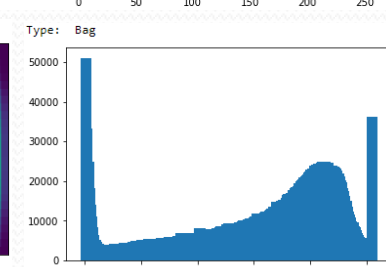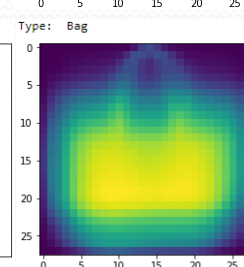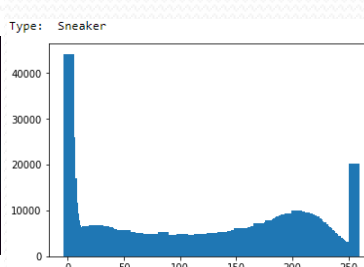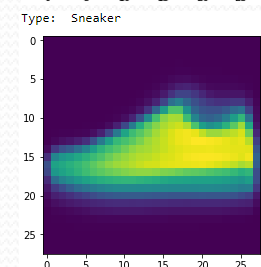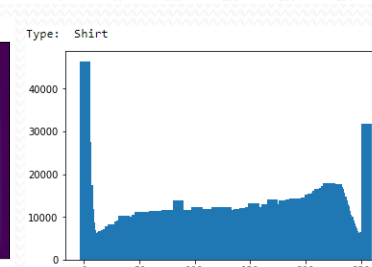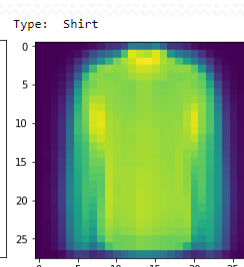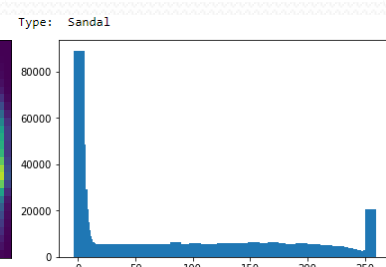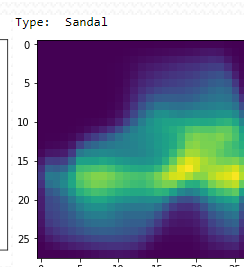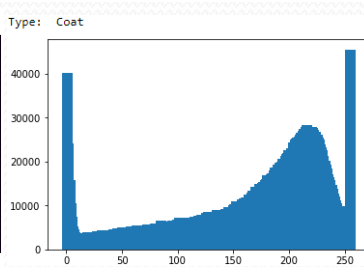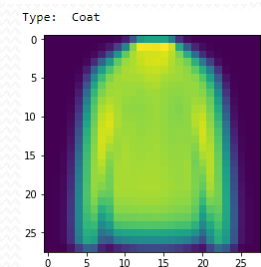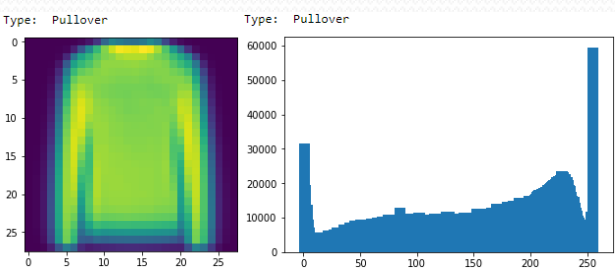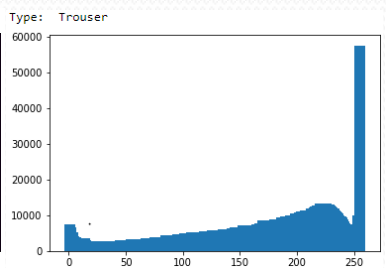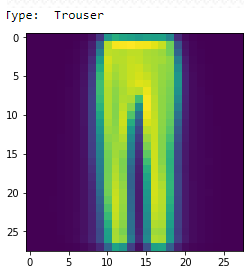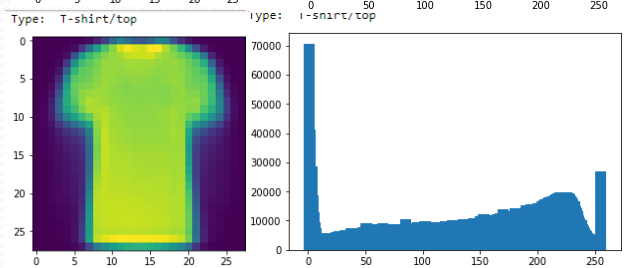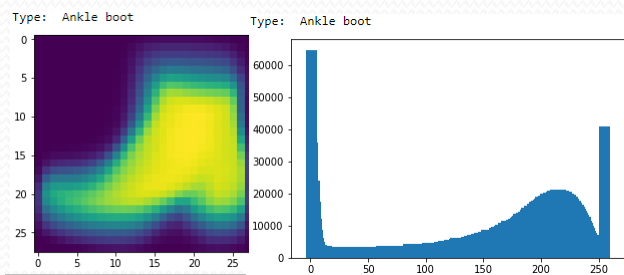
Statistical Analysis

- Compared the order means to see if any of them were statistically similar using a paired z-test
- If the means could be the same the p-score would be about .05

```
p-score 0-1(Z):  0.0
p-score 1-2(Z):  0.0
p-score 2-3(Z):  0.0
p-score 3-4(Z):  0.0
p-score 4-5(Z):  0.0
p-score 5-6(Z):  0.0001
p-score 6-7(Z):  0.0
p-score 7-8(Z):  0.0
p-score 8-9(Z):  0.0
```

Preprocessing

- Normalization (with a range of 0-1)
  - Make the range of values fill and be between 0-1
- Standardization
  - Spread out the data more evenly by scaling it using the standard deviation and mean
  - (Data –mean(Data))/standard deviation

Analysis

- MLP (size of hidden layers 784-100-100):
  - With no preprocessing – 87.65% accuracy
  - Normalized(0-1) – 90.37% accuracy
  - Standardized(0-1) – 90.09% accuracy
- SVC:
  - With no preprocessing – 70.67% accuracy
  - Normalized(0-1) – 85.57% accuracy
  - Standardized(0-1) – 81.87%
- Logistic Regression:
  - With no preprocessing – supposed to be normalized
  - Normalized(0-1) – 84.45% accuracy
  - Standardized(0-1) – 85.19% accuracy
- CNN:
  - Normalized(0-255) – 92.25% accuracy
  - Standardized – **92.32% accuracy**
- Ensemble the above models (Random Forest with 20 trees):
  - 90.56% accuracy
- Ensemble the above models (Random Forest with 20 trees):
  - 91.25% accuracy
- Use VGG19 as a feature extractor before a neural net:
  - 85.71% accuracy

Analysis- Precision/Recall

MLP

	precision	recall	f1-score	support
T-shirt/top	0.81	0.89	0.84	1000
Trouser	0.98	0.99	0.98	1000
Pullover	0.85	0.78	0.82	1000
Dress	0.91	0.91	0.91	1000
Coat	0.82	0.89	0.85	1000
Sandal	0.98	0.94	0.96	1000
Shirt	0.78	0.69	0.73	1000
Sneaker	0.94	0.95	0.94	1000
Bag	0.98	0.98	0.98	1000
Ankle boot	0.94	0.96	0.95	1000
avg / total	0.90	0.90	0.90	10000

SVC

	precision	recall	f1-score	support
T-shirt/top	0.78	0.81	0.80	1000
Trouser	0.96	0.97	0.96	1000
Pullover	0.77	0.77	0.77	1000
Dress	0.84	0.88	0.86	1000
Coat	0.77	0.80	0.79	1000
Sandal	0.93	0.90	0.91	1000
Shirt	0.66	0.55	0.60	1000
Sneaker	0.90	0.92	0.91	1000
Bag	0.92	0.93	0.92	1000
Ankle boot	0.93	0.94	0.93	1000
avg / total	0.84	0.85	0.85	10000

Logistic Regression

	precision	recall	f1-score	support
T-shirt/top	0.78	0.81	0.80	1000
Trouser	0.95	0.97	0.96	1000
Pullover	0.78	0.77	0.78	1000
Dress	0.84	0.88	0.86	1000
Coat	0.77	0.80	0.78	1000
Sandal	0.95	0.92	0.93	1000
Shirt	0.66	0.56	0.60	1000
Sneaker	0.90	0.92	0.91	1000
Bag	0.93	0.94	0.94	1000
Ankle boot	0.93	0.95	0.94	1000
avg / total	0.85	0.85	0.85	10000

CNN

|	precision	recall	f1-score	support
T-shirt/top	0.90	0.86	0.88	1000
Trouser	0.99	0.99	0.99	1000
Pullover	0.94	0.85	0.89	1000
Dress	0.93	0.94	0.93	1000
Coat	0.89	0.90	0.89	1000
Sandal	0.99	0.98	0.98	1000
Shirt	0.76	0.85	0.80	1000
Sneaker	0.97	0.96	0.96	1000
Bag	0.99	0.98	0.98	1000
Ankle boot	0.96	0.98	0.97	1000
avg / total	0.93	0.93	0.93	10000

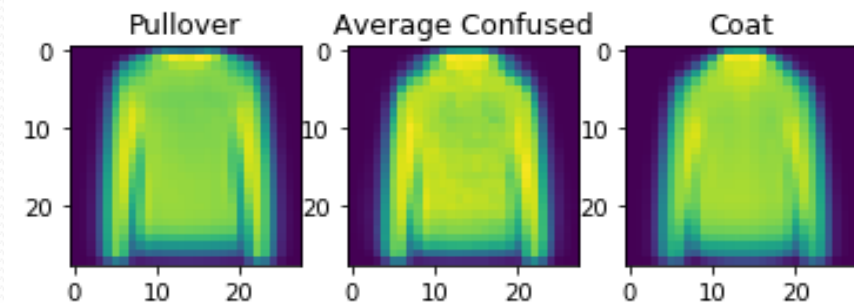# Analysis – Confusion Matrices

Combined
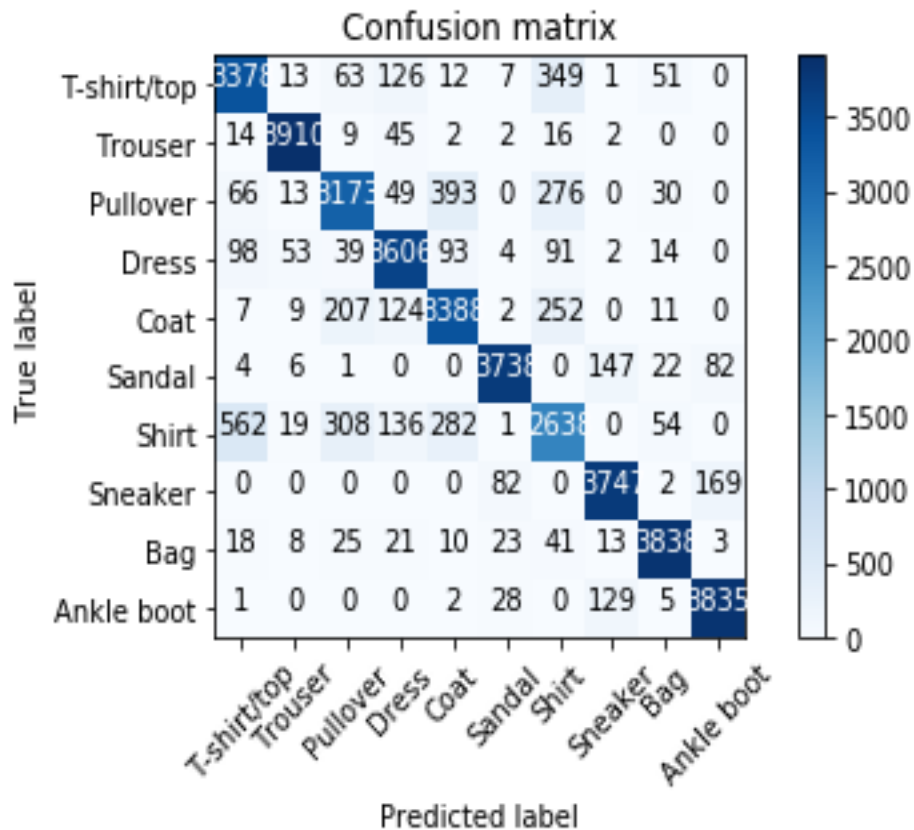
CNN*4
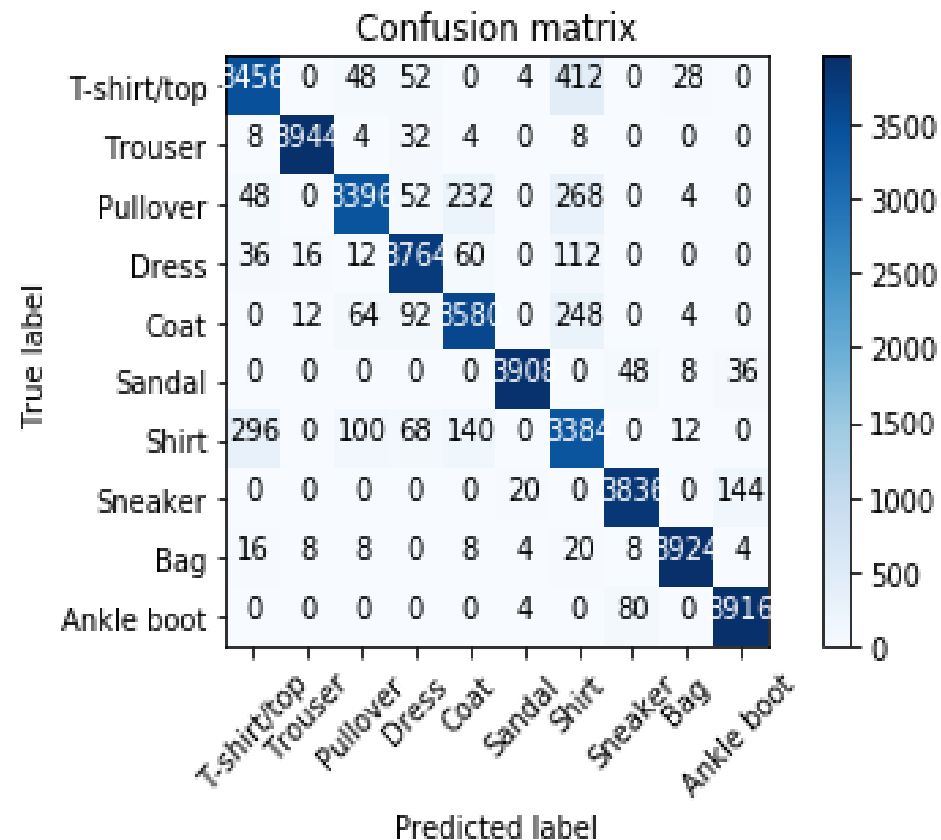
Visualizations

- The commonly confused categories (above 95 percentile) are show with an average of the correct class on the right the average of all the confused images in the middle and the average image of the class it was classified as
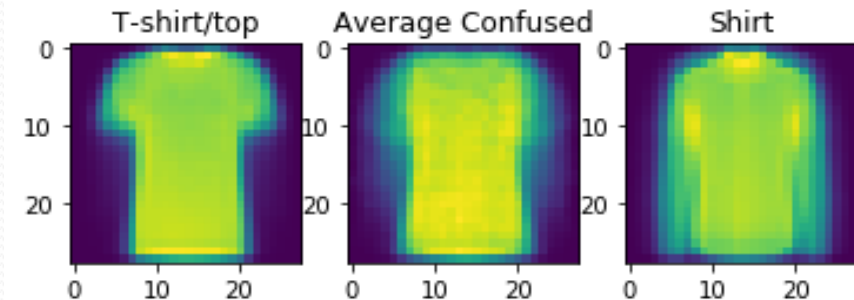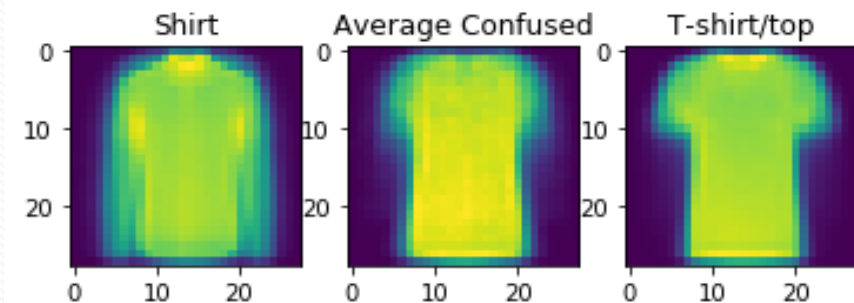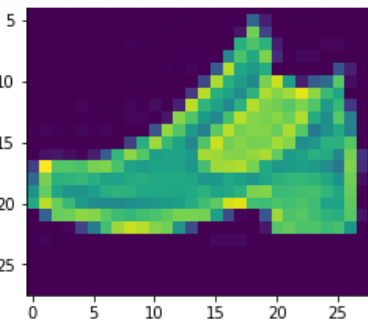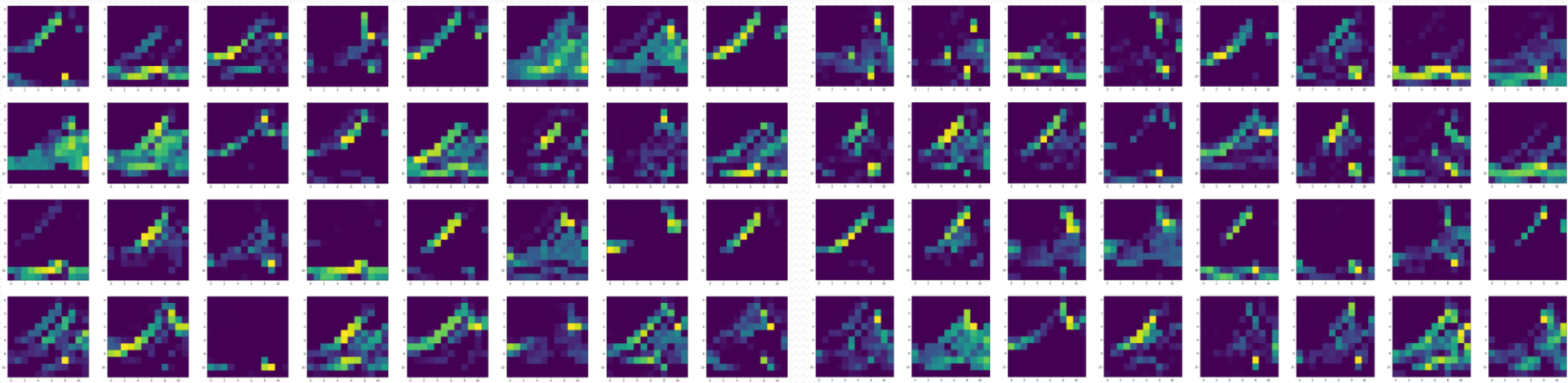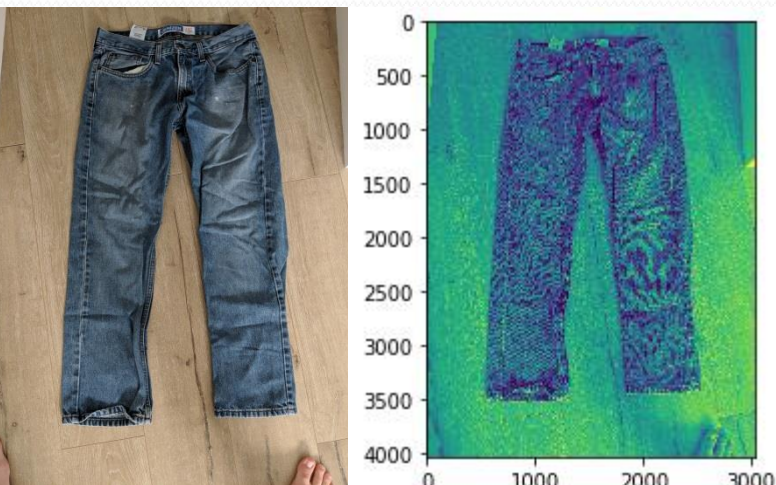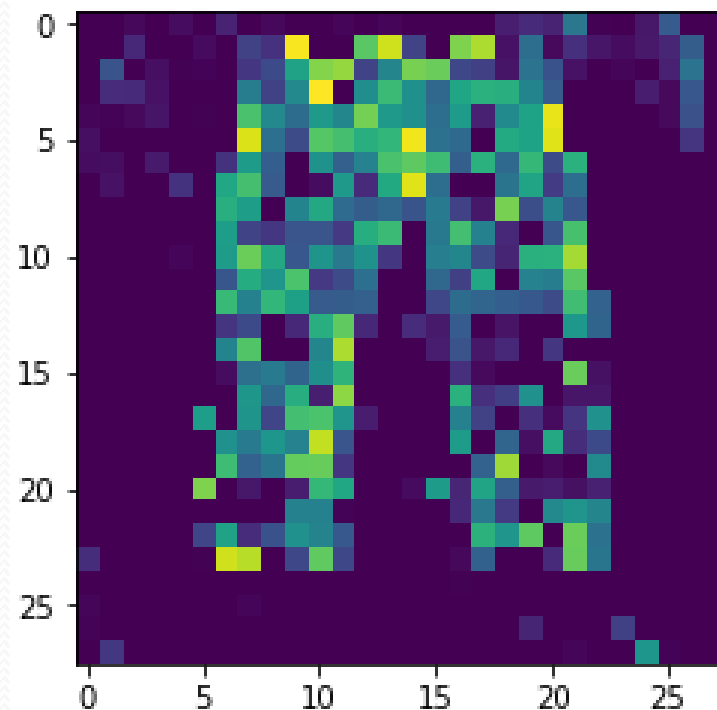
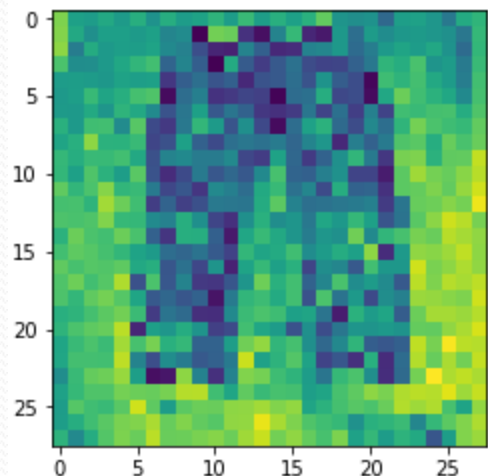# Visualizations – CNN in progress

PHASE 1
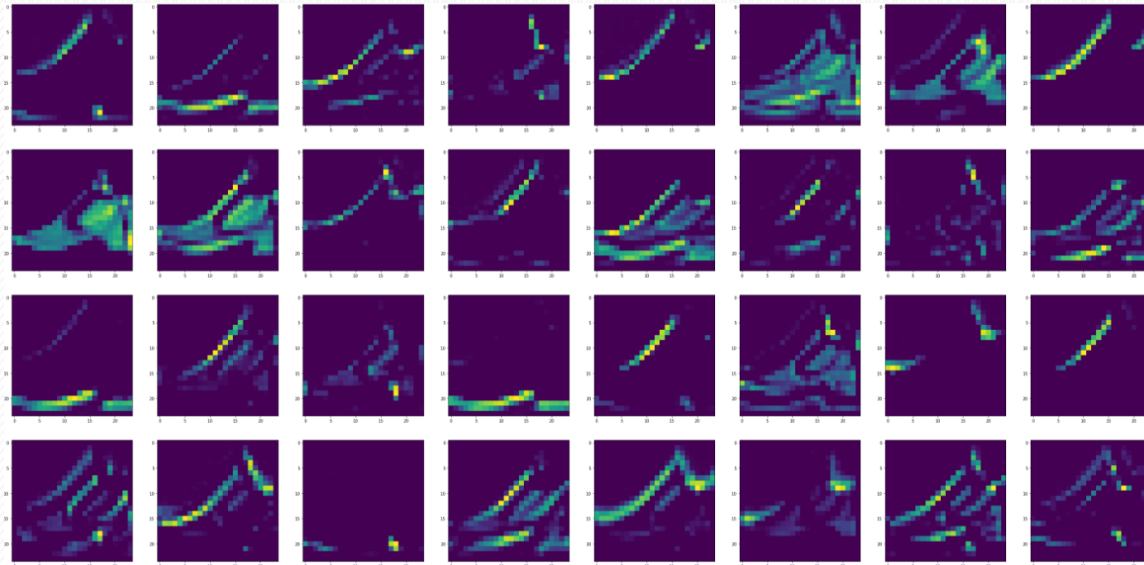
Original image

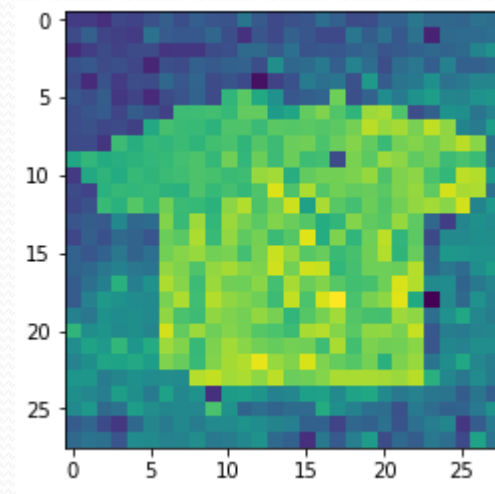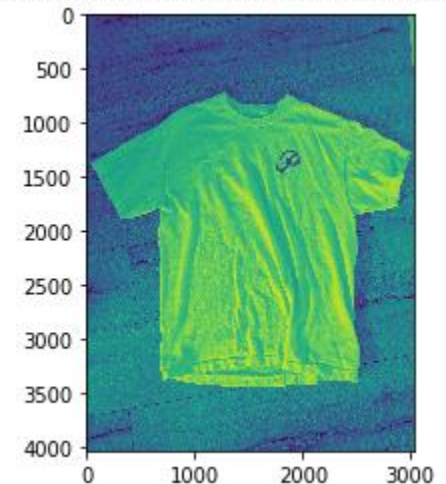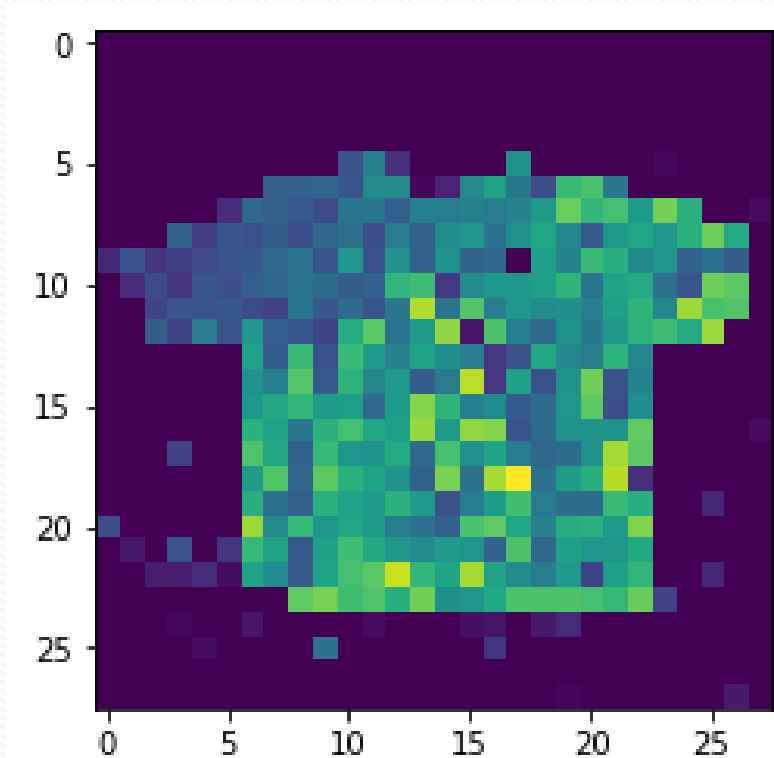PHASE 2

Testing with my Photos

- MLP classified it as a coat, SVM and LogReg both correctly said trousers and CNN said shirt

Testing with my Photos

- MLP classified it as a bag, whereas SVM, LogReg and CNN classified it as a shirt

Testing with my Photos

- Either make sure to train on images filtered in the same way or look out for overfitting with MLP and CNN (MLP is the main classifier that seems it could be overfitting)
- If training on slightly different images, SVM and LogReg may have more robust results