LAB 4B: Convolutional Neural Networks in Space

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Task 1: Do not report

Task 2: One paragraph with observations

We can certainly see some differences between the 3 convolutional filters. Regarding the 1st filter, which averages pixels we can observe the contrast in colors as well as differences in the curvature and the blur, because of the averaging filter and it is less sharp. Furthermore, the second filter emphasizes the horizontal parts of the digit. This makes sense because it is an x-direction filter.. We can also notice differences in the blur, as it is less blurry compared to filter 1. Finally, the third filter highlights the changes in pixel intensity in the vertical direction, as we can confirm from the matrices with the "-1"s, emphasizing the edges, thus enhancing the images. This makes sense because it is a y-direction filter.

Task 3: Do not report

Task 4: Do not report

Task 5: Report training loss

```
Epoch: 4     Loss: 0.307      Acc: 90.87
```

Report test loss

```
Epoch: 9     Loss: 0.299      Acc: 90.76
```

Report relative classification error

During training there is a relative classification error of about 10%.
Similarly, there is a relative classification error of about 10% in the test set.

Note: A better classification error (about 4-5%) is achieved by using 2 layers, 1 tap for both filters, 1,**3**,8 filter dimensions and 28,14,7 pooling dimensions.
(`model = SpatialCNN(2, [1,1], [1,3,8], [28,14,7])`)
In the first layer, the filters were initialized to the values specified in Task 2.

We get the following results:
Training:

```
Epoch: 4     Loss: 0.169      Acc: 95.21
```

Test:

```
Epoch: 9     Loss: 0.147       Acc: 95.88
```