CW2 Character Recognition

# Fourier Space Analysis

In order to select features that would form the basis of my classifiers, I began by visually inspecting the log of the Fourier space of some of the different characters individually. This allowed me to get an overview of how the different shapes in each of the letters related to the output of the Fourier transform.

In an attempt to get more definitive output, I decided to try using Sobel edge detection. When viewed as the raw image output, this appeared to be very effective, and very clearly showed the defining lines of each character. However, when passed through the Fourier transform and viewed in the Fourier domain, the pixelated nature of the output produced very strong horizontal and vertical lines through the origin. Therefore, I decided against using the Sobel operator.

In order to quickly get an idea of how the different variations of each character produced similar patterns in the Fourier domain, I decided to average all the images of each symbol. To achieve this, I read in all images into a 3 dimensional matrix, then averaged this back down to a 2 dimensional image. I then performed the 2D FFT on these averaged S, V, and T inputs. This made it much easier to compare the three different classes side-by-side, incorporating all the variations.

# Spectral Feature Extraction

Looking at the three Fourier domains, I saw the three patterns created by the characters were as follows:

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| --- | --- | --- |
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| **S:** A concentric square rotated 45 degrees, with a fairly regular spread of intensity. | **T:** Two very strong areas of magnitude along the horizontal and vertical axes. | **V:** Similar to T, albeit with the intense regions rotated and more diffused . |

From looking at these, I chose to use a selection of box classifiers, where I would extract features by taking the summation of frequency magnitudes in that area of the Fourier domain.