**Final Project**

**Image Processing on Handwritten Alphabets and Numbers**

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**Abstract**

The goal of this deep learning image processing project is to make a deep learning that can read most of the handwritten English’s alphabets and numbers using Convolutional Neural Network. The dataset that we used to train and test the model is EMNIST ‘byClass’ dataset which contains 814,255 characters and 62 unbalanced classes. By using hill climbing methods to fine tune the hyperparameters. we were able to reach the highest accuracy at <accur> with this specific model which is <model>.

1. **Introduction**

Every person has their own handwriting style. Some of them are easy to read while other are hard to read. These are the result of their individual learning environment when they were learning how to write. The starting of this project is that we were having a hard time reading our math professor’ handwriting and thinking that we should make a deep learning to solve this problem since there are also many other people also having the same problem either in studying or working. However, to make a deep learning that can read sentences it requires a complex model. Therefore, we are starting with simpler deep learning model that can read a handwritten alphabet or number from an image using convolutional neural network. The dataset that we used are EMNIST dataset which contains handwritten alphabets and numbers. After we train and fine tune the model, we will test it with our math professor’s handwriting.

1. **Background**
   1. **Image Processing**
   2. **3 Layers CNN Model**

Convolutional Neural Network or CNN is a version of multilayer perceptron or MLP. The multilayer perceptron is a fully connected neural network which makes it weak against overfitting. While the CNN will work in a more efficient way by using the kernel layers to analyze the relations and patterns including the dropout which will drop some connection to prevent the neural network to be fully connected. As a result, CNN is harder to be overfitted compared to MLP.

1. **Methods**

Describe your approach to solving the problem. This should contain your key contributions.

1. **Experiments**
   1. **2 Layers CNN Model**
   2. **3 Layers CNN Model**
      1. **Hidden Size Comparison**
      2. **Kernel Size Comparison**
      3. **Learning Rate Comparison**
      4. **Activation Function Comparison**

In this model we increase the layer of the model from 2 layers to 3 layers.

1. **Conclusion**

Summarize your contributions and discuss future work (50-500 words).

1. **References**

Cohen, G., Afshar, S., Tapson, J., & van Schaik, A. (2017). EMNIST: an extension of MNIST to handwritten letters. Retrieved from <http://arxiv.org/abs/1702.05373>.