Final Project Proposal

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Topic: Recognition of Handwritten Mathematical Symbols

1.Motivation

We plan to concentrate on recognition of handwritten mathematical symbols and transfer them to corresponding latex versions. The motivation comes from our daily life when struggling typing mathematical symbols on latex for hours while it only takes half the time writing on the paper. Our project aims at saving time by transferring handwritten mathematical symbols into print versions. In terms of machine learning language, our project is under the category of computer vision problems like facial recognition and style transfer.

2. Dataset and Pre-processing

We find the data from Kaggle.com where each symbol matches with one folders containing handwritten picture files (.jpg format) of size 45*45 (pixels). By now we have obtained 82 folders and 350,000 pictures in total. Since our raw data are pictures, we will transfer pictures into numerical data using pytorch. We will regard every picture as valid data and split the data into a training set, validation set and testing set for each symbol.

3. Machine Learning Algorithms

The main algorithm we will implement in the project is Convolutional Neural Network. In the experiments, we will try different network structures like DenseNet, ResNet or construct and train the network from scratch. We will attempt different models and choose the one with best performance, which will be included in the final presentation.

We will also try out different algorithms and use multiple loss functions to evaluate the results. For example, we will try algorithms like SGD, Adam and L-BFGS with different parameters for

comparison and selection. Finally, we will evaluate the selected model based on prediction accuracy.

Main packages we plan to use for the project: Pytorch, fastai, numpy, pandas and Matplotlib.

4. Expectation of Project

The ultimate goal of this project is to develop an algorithm which would identify individual hand-written mathematical symbols or letters with high accuracy and convert them into typed texts, with some tolerance on some small errors, such as some severely twisted handwritten letters. And if time permits, we would try to identify a word or a sentence, or letters connected with symbols or apostrophes, which would make converting handwritten texts into typed texts really valid.

5. Potential Questions

In real practice, the actual data pre-process can be a problem due to the large amount of raw data set with uneven data quality, so it would take some time to modify raw data. Besides, the training time can also be long.