

Senior Project Proposal

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What It Is...

The project will be an application to recognize handwritten characters. The focus and functional block of the project is a neural network and I plan to design it for universal use, versus tailored specifically for handwriting recognition.

The network will be continually training on euclid against the MNIST database of handwritten digits¹. I'll have an iOS front end on which to write, that will query a web page on euclid and return the results using the best known weights configuration at the time. It will be constantly improving in the background, the user will always see the best results possible.

This project will focus specifically on digit recognition (0-9) but including letters—or any other symbols—would only require an amended data set on which to train and an appropriately scaled neural network.

Technologies...

- Python
- Python CGI
- Objective C
- iOS
- JSON
- HTTP
- Calculus²
- L^AT_EX³

¹Info for the MNIST Database can be found at: yann.lecun.com/exdb/mnist/

²Maybe not a technology, but first time Ive used it writing software.

³Not necessary, but using it to write these docs. It's kinda cool.

What I Hope to Learn...

This is a venture into machine learning, and I hope to learn just that. All the applications I sent to graduate schools expressed interest in AI and machine learning, but I don't yet know how to write anything of substance in the fields. I'm hoping this is a challenging and meaningful entrance to the subject area.

I will learn some iOS development as well.

Points on Points...

Neural Network - 15 points

- Scalable size for universal use - 5 pts
- Learn and implement a back-propagated training algorithm - 5 pts
- Option for momentum during training⁴ - 2 pts
- Use a smooth, symmetrical sigmoidal function to determine activation (and by extension, its derivative for back-propagation) - 2 pts
- Ability to save/load weights. - 1 pts

Network Training App - 12 points

- Automatically store weights when new best performance is achieved - 3 pts
- Automatically load best known weights on start of training - 2 pts
- Include experimental mode, which will graph performance of various configurations, to help determine optimal settings of production network - 5 pts
- Option for verbose/silent - 1 pts
- Include a log. Important since running unattended - 1 pts

iOS App 8 pts

- 3 pts - Automatically recognize a pause in writing and submit the image for recognition.
- 3 pts - Display percent certainty.
- 1 pts - Graceful notification on loss of network.
- 1 pts - Optionally display grid for visual estimate of what data network receives.

⁴Momentum coupled with the learning rate can reduce time for training.

Web Page 5 pts

- 3 pts Find and load the latest weights after initializing a neural network.
- 2 pts Output JSON feedback including both guesses and associated certainty.

Total - 40 pts**Grading...**

0-20 = Failure

20-24 = D

25-29 = C

30-34 = B

35-40 = A