

# 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 digits<sup>1</sup>. 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
- Calculus<sup>2</sup>
- L<sup>A</sup>T<sub>E</sub>X<sup>3</sup>

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<sup>1</sup>Info for the MNIST Database can be found at: [yann.lecun.com/exdb/mnist/](http://yann.lecun.com/exdb/mnist/)

<sup>2</sup>Maybe not a technology, but first time I've used it writing software.

<sup>3</sup>Not 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 training<sup>4</sup> - 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

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<sup>4</sup>Momentum coupled with the learning rate can speed momentum.