Applications of Neural Networks with Handwriting Samples

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Introduction

Statement of what you are proposing and how the proposal is organized.

The following proposal will demonstrate clearly how we intend to teach a computer how to write convincingly from simulating human handwriting. This project will effectively train the computer on various handwriting and use long term short term neural networks to develop an effective algorithm to simulate the training.

The proposal is organized in the following manner. First, the purpose of the project and the minimum product is outlined in more detail. This describes the minimum requirements for our software program. The crux of the outline is the project plan or timeline. Here, we carefully lay out our schedule for the next five months. This includes phases and tasks for each phase. Next, the project costs are outlined. As of right now, this is a tentative sketch considering unseen costs. We expect this cost to be minimal. Finally, we conclude with our qualifications for the project.

Purpose / Minimum Viable Product

Concise summary of what you are proposing, benefits of the proposed work, how it will be accomplished and what it will cost.

Our project's purpose is to develop a program using recurrent neural networks, specifically long-short term memory models to effectively predict and train a computer to synthesize handwriting. The benefits of such a model are applications of creating more realistic handwriting computationally, as well as expediting the predictions. This project is extensive and requires the knowledge of several topics such as recurrent neural networks, specifically long short term memory networks. It also requires new software such as the TensorFlow package. Pending permission of a tablet that can track penstrokes, the cost of the project will be relatively small. As of right now, we are estimating our costs to be $100 in the case where the tablet does not have extractable data.

Project Plan / Timeline

Here you discuss in detail how you will accomplish the project goals in a logical progression. Divide project into phases and list tasks for each phase. Explain how you will accomplish each task.

Please see below.

Deadline: Middle of March

Time left: Roughly 20 weeks (including 4 weeks of winter break)

Task	*Activity*	*Order*	*Duration (weeks)*	*Week Number*	*Status*
A	Download TensorFlow and succesfully complete “Hello World” tutorial	Starting Activity	1	0-1	Complete
B	Download IAM-OnDB Data	Starting Activity	1	0-1	In progress
C	Read through paper - annotate fully	Starting Activity	1	0-1	Complete
D	Complete Draft Proposal	Starting Activity	1	0-1	Complete
D	**Understand theory of RNN and LSTM**	**After A-C**	**5**	**0-5**	**In progress**
E	Understand TensorFlow package completely	After A-C	5	0-5	In progress
Winter Break					
F	**Implement a small RNN on a small input size**	**After D-E**	**1**	**5-6**	**To be completed**
G	Email Alex Graves and talk to him about the	After D-E	1	5-6	To be completed
H	**Build the network for handwriting synthesis**	**After F-G**	**3**	**6-9**	**To be completed**
I	Experimenting and testing with our RNN	After H	2	9-11	To be completed
J	Introducing sampling as a parameter to affect accuracy	After I	2	11-13	To be completed
K	**Summarize and write full report**	**After J**	**3**	**13-16**	**To be completed**

* The bolded events above are milestones in our project. We will be able to have evidence of our understanding and / or progress.

Project Cost

Determine the costs by the task. Manpower includes wages and time.

Please see above. This is still being determined.

Project Qualifications

You discuss your qualifications and convince the reader that you should be the one to complete the project successfully. Discuss yourself, your facilities, and any other important resources. Detail manpower.

Technical Discussion

Description of the background material necessary to begin the project. Here you convince the reader that you have done your research and that you fully understand the project requirements. You may also have to explain the relevance of the project and convince the reader that it deserves sponsorship. This section and the project plan are the heart of the proposal.

The completion of the project requires various softwares to be incorporated to generate effective analysis.

Background of TensorFlow Software:

Initial Steps for Downloading TensorFlow:

Initially, we tried to install TensorFlow using anaconda. However, this proved to be increasingly difficult.

The following code was tried from the TensorFlow documentation.

```
$ source activate tensorflow
(tensorflow)$  # Your prompt should change

# Linux/Mac OS X, Python 2.7/3.4/3.5, CPU only:
(tensorflow)$ conda install -c conda-forge tensorflow
```

Then according to the set-up documentation, we should have been able to use TensorFlow if we were in that specific environment which would be triggered by:
`$ source activate tensorflow`
However, for some reason, this was not working. Instead, the method of implementation with pip install. After perusing and trying both documentation from the TensorFlow website as well as StackOverflow, the following excerpt was found:

```
sudo easy_install --upgrade six

sudo pip install
https://storage.googleapis.com/tensorflow/mac/tensorflow-0.5.0-py2-none-any.whl
```

With this code complete, we were able to successfully run the “Hello World!” for TensorFlow. Here is the code that was succesfully performed, taken from the TensorFlow testing section.

```
$ python
...
>>> import tensorflow as tf
>>> hello = tf.constant('Hello, TensorFlow!')
>>> sess = tf.Session()
>>> print(sess.run(hello))
Hello, TensorFlow!
>>> a = tf.constant(10)
>>> b = tf.constant(32)
>>> print(sess.run(a + b))
42
>>>
```

Data Sources:

Note on the structure of the data:
http://www.fki.inf.unibe.ch/DBs/iamOnDB/data.html

TODO:

- **Do analysis of tensorflow software**
  - **What can you do?**
  - **What are tensors?**
  - **Show some examples**
- **Find out why tensorflow wasn't able to be imported naturally through anaconda and just creating that anaconda environment**
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Paper Analysis

Date Report Due:
Report No. - number sequentially
Project Objective - one or two sentences
Accomplishments to the time of previous - add to this weekly
Accomplishments not reported in last report
Plans for Next Week
Major Problems Anticipated
Initial and Current Timeline - see if you can get this on one timeline

Initial Budgeted Time Projection and Actual Time Completed by week - make this a graph