**University of Maryland Global Campus**

DATA 640 – Advanced Predictive Modeling

**Assignment №4 – Deep Learning**

**Deadline:** Last day of week 8 (or as modified by faculty), 11:59 pm Eastern Time

Submission via LEO.

*This is an* ***individual*** *assignment. Each student will complete the assignment outlined below and post his/her written results to the appropriate assignment. Please note that only 1 document is allowed to be submitted.*

**Grading criteria**

Submitted assignments will be graded for (a) content, (b) document quality (i.e. formatting, following guidelines, pleasant to read, etc.), and timeliness of submission. Assignments submitted late will be deducted 5 points for each day it is late.

# **Deep Learning Assignment Overview**

You’ll learn to build a deep learning neural network, focusing on image recognition, sometimes called computer vision. This is one of the primary applications of deep learning neural networks. **To do this you’ll do four steps.**

1. Read the background material on deep learning and on deep learning in Python.
2. Set up your system to be compatible with the required software.
3. Run through the example script with the example data.
4. Complete the “starter” scripts and write a paper summarizing your results.

**NOTE: There is a fair amount of background, and running the scripts to build the networks can take a long time. Be sure to allow appropriate time for the assignment.**

## **Background on Deep Learning**

Read the suggested sources in the classroom to gain familiarity with the subject matter.

## **Set up your system**

You will be using Python 3 and several libraries (notably TensorFlow and Keras) to do this – review the course documents for instructions on downloading Python and setting up your environment:

Once your system is set up, download the example code and data files, which use the MNIST digits data to create and train a dense neural network and a convolutional neural network. Along with the data, there’s a Word document, a Jupyter Notebook and a .py file which you can use to walk through the example.

***NOTE:*** These are BIG datasets and will take a little time to download.

**Develop alternate models from the template**

Once you’ve played with the example, select one of the data sets provided in the course classroom (CIFAR-10 or SVHN) on which to build your own deep learning network. Note that for each dataset, you can download a program that imports the data and structures it ready to go into a neural network. All you need to do is build and test your network.

**Submission**

Each student will submit a single document conforming to the guidelines and standards outlined below.

**Document format**:

* limited to 7 pages (**excluding** *title page*, *references*, and *appendix*),
* **Double-spaced**, 12 point Times New Roman font, 1” margins, Bottom-right page numbering.

**Note:** Submitted report must be either in MS Word or PDF format and titled: “*Assignmen4\_LastName*”.

Only one document will be allowed to be submitted.

**Content** (note that the document must have at ***clearly marked sections*** at least for the items listed below)

1. **Title page** (*1 page limit*): course number and term, assignment number and project title, student name and contact information, instructor’s name. *Format it so it looks pleasant and presentable.* Follow formatting guidelines above.
2. **Introduction.** Describe the problem being addressed. Provide a clear description of the purpose of the model being developed. What would be the value of developing a model for this problem type?
3. **Dataset.** Provide a brief outline of the dataset(s) you are using for this assignment. Briefly explain the content of the data to include a description of the variables in the data sets, the number of cases, etc. Include a screenshot of the data (not all, but partial as far as all relevant variables are visible).
4. **Deep learning model/s developed.** Clearly present, compare, and explain the models. Experiment with the template provided and develop **at least four additional CNN models**. Vary the architecture (e.g., number of layers, types of layers, etc.) or the parameters associated with a layer (e.g., kernel or filter size, number of neurons, etc.) to create new and unique CNN models.
5. **Results.** Include appropriate results for the models. Interpret the results for meaning. Discern which parameter variations impacted the results---explain. Be sure to compare the training set results with the test set results.
6. **Conclusions and takeaways**. Glean any insights from the results as to which parameters were important in improving the outcome results. Provide clear and concise conclusions about the project to include lessons learned and any suggested improvements for future development.
7. **References** (*1 page limit*): List all references in APA format used in preparing this report. It is strongly recommended to use outside knowledge in setting-up the analysis or discussing the results where possible.
8. **Appendix** (6 page limit): Include any appropriate workbooks, screenshots (figures, tables, diagrams) used in this assignment. ***Make sure all tables or figures or diagrams are easily readable and visually presentable.***

**University of Maryland University College**

DATA 640 – Predictive Modeling

**Student Name**: **Assignment №5: Deep Learning** Total points: 100

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| --- | --- | --- | --- | --- |
| **Content** | **Explanation** | **Points** | | **Comment** |
| **Total** | **Earned** |
| **Written Report** |  |  |  |  |
| * 1. Introduction | **How well is the problem described and outlined?** Is the intent of the analysis provided in appropriate detail? | 10 |  |  |
| * 1. Dataset | **Describe and summarize the dataset you chose.** | 10 |  |  |
| * 1. Deep learning model development and discussion | **Run the example scripts**. Briefly describe the steps in the script using your own words.  **Discuss the additional variations and excursions you attempted.**  Explain the logic used to develop additional models (i.e., which parameters did you change and what rationale did you have for changing them). | 35 |  |  |
| * 1. Accuracy measures and results | **Present the results in a readable and coherent table,** including the accuracy and other important aspects. | 25 |  |  |
| * + - 1. Conclusions | **Include insightful and meaningful conclusions, suggestions, and insights.**  **Are** **recommendations** provided for improving or modifying the analysis? | 10 |  |  |
| * + - 1. Appendix | Is there an **appropriate appendix** with necessary supporting materials? | 5 |  |  |
| * + - 1. Mechanics (spelling, grammar) | Is the **paper free of grammatical errors and spelling and punctuation?** Is the paper properly formatted? Does the paper flow well? How well does the paper “tell the story”? | 3 |  |  |
| * + - 1. Citations and References | Are all references and citations correctly written and presented? | 2 |  |  |
| **Total** |  | **100** |  |  |
|  |  |  |  |  |
| * + - 1. **Less** |  |  |  |  |
| Page limit | Is the submission written within specified page limits? 2.5 points will be deducted for submissions substantially over the page limits | - 2.5 |  |  |
| Late submission (less) | 2.5 points will be deducted for each day the assignment is late. | -2.5 each day |  |  |
| **Final Grade for Assignment 5** |  |  |  |  |