Module Name: **Deep Learning**

Module Code: **CT100-3-M-DL**

**Assessments**

1. **Introduction**

The objective of this assessment is to prepare the students to: 1. Explore various Deep learning architectures; 2. Review the application of Deep Learning methods in a chosen domain of interest and 3. Apply a chosen deep learning algorithm to solve a specific problem. **Assignment 1** is focused on the first two objectives. In **Assignment 2**, to achieve the 3rd objective, the student proposes a project that identifies a problem; applies deep learning techniques; presents, analyses and compares the results and finally concludes the project together with suggestions for future work. Both Assignment 1 and Assignment 2 are reported through individual submissions. The learning outcomes of these assignments are as follows:

|  |  |  |
| --- | --- | --- |
| CLO1 | Analyse main variants of deep learning and their typical applications (C4,PLO2) | Assignment 1 (Report – Review/survey of models and background theories) |
| CLO2 | Review and compare the choice of algorithms and hyper-parameters in a similar setting of a chosen domain. (A5, PLO9) | Assignment 2 (Implementation, Validation & Report) |
| CLO3 | Adapt deep learning algorithms to solve real-world problems (P6, PLO3) |

1. **Project Advice**

This section gives some suggestions for various stages of the project.

1. **Choosing a Topic**

The topic may be from any of the areas that is of interest to you. Some examples are:

* Computer Vision
  + Object Recognition/Classification
* Natural Language Processing
  + Sentiment analysis
* Generative Models
  + Image generation
  + Fake image detection
* Time Series
  + Stock market Prediction
  + Weather forecast

From these areas you may select any application areas such as E-commerce, Finance, Healthcare etc.

The topic shall be an application. Here are some suggestions to select a topic:

* You may review any of the suggested areas and select an application problem that interests you. You shall then design a deep learning network or explore the best way of adapting suitable deep learning models to your selected problem.
* You may select a research paper that impresses you and implement the code in that paper. In this choice, you may contribute by selecting a different dataset or tweak the architecture, learning algorithm or tuning procedures.
* You may be working on a specific application for your capstone project. You may want to extend it to include an additional dimension of a deep learning approach to it. If your capstone project currently has a deep learning component, you may work on an alternate deep learning algorithm that is not included in your Capstone Project. In this case you shall get prior approval from your module lecturer to avoid duplication issues.

1. **Literature Review**

You shall conduct a brief overview of the domain and focus your attention on the sub-domain leading to your selected application. You may review existing work on your chosen application problem and any other relevant application. The focus here shall be on methodology and results. Review of methodology shall include deep learning architectures, training approaches, fine tuning methods and evaluation metrics. This review shall assist in choosing your own methodology.

1. **Choosing Network Architecture**

Choice of network and to some extent its architecture may depend on the application problem. Most candidate architectures and learning methods may have been coded and explored. Identify available coded models and you may want to adapt these models to solve your problem. Ensure that all sources used are cited correctly. You may want to **avoid extremely complex architectures** that demand huge processing resources and time. You may look into the possibilities of simplifying the architecture, say, by reducing the number of layers or other alternatives.

1. **Dataset**

You may choose a dataset of reasonable complexity that is suitable for deep learning. Avoid overly complex and extremely large datasets that may be demanding on computing resources and processing time.

1. **Training, Tuning and Analysis**

Choose suitable training algorithm, evaluation metrics and build your basic model.

Fine tune your model and build your final model.

Critically analyse your model performance and compare with peer models.

1. **Deliverables**

**Assignment 1 and Assignment 2 may be submitted in a single report**.

**Assignment 1 ( Weightage 40%)**

This assignment report shall follow the APU thesis guidelines.

The learning objective of Assignment 1 is: Analyse main variants of deep learning and their typical applications. Hence, it should contain *comprehensive coverage of models and background theories related to the project chosen.*

Assignment 1 marking scheme:

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| --- | --- | --- |
| **Component** | **Description** | **Marks** |
| Introduction and Background | The **title** should indicate the learning problem it addresses.  A short 1-paragraph **abstract** that mentions the problem you addressed, two or three sentences on the background to the problem, it’s significance and how your work is positioned in the backdrop of the literature.  Introduction section introduces the domain and the role of deep learning in the domain. It elaborates the key terms in the title. This section shall also include background to the problem addressed. | 4 |
| Description of the domain knowledge and problem chosen | Describe the domain addressed in detail. State your overall aim and objectives as the steps towards achieving your aim.  Significance shall cover the contribution of your work.  (Write this after building models) | 8 |
| Justification of selected deep learning algorithm  Review/Survey existing DL models in the domain  What are the new DL architectures? | Describe how the chosen domain problem is modeled as a data science problem. How is deep learning suitable to address this problem?  The related work section should cover the following:  1. A **detailed** **survey** of relevant deep learning architectures covering some of those recently proposed.  2. Previous works (the papers related to your selected problem/dataset) for your problem and the methods you used in your experiments.  The best related work sections are not just a list of references, but evaluations. You should include references and results related to your choice of dataset. The experiments and results on the same dataset shall later be used for comparing with the results of your work. All references shall be finally summarized in a table form. Include one paragraph referring to this table and this summary shall assist/lead you in selecting a deep learning algorithm to explore in your proposed work together with a justification. This paragraph shall also clearly spell out **what you propose to do in your work in relation to what was done by others** and why.  (Write this after building models) | 16 |
| Discussion on methods and references. | This forms the methodology section of the report. An appropriate deep learning model may be selected or designed and is presented in detail. This section shall include evaluation metrics and the details of the dataset.  All the material in the report shall be supported by references. A list of references shall be included. All referencing shall be in APA format. | 12 |
|  | Total | **40** |

**Assignment 2 (Weightage 60%)**

This report shall be a **word document**. The word document may include code snippets with comments. Original contributions shall be highlighted in the word document. All software shall be presented as ipynb as well as html notebook. It shall have comprehensive comments on the code. The notebook shall also include generated output. Iterative procedures shall have samples of generated output if not the full epochs.

Assignment 2 marking scheme:

|  |  |  |
| --- | --- | --- |
| **Component** | **Description** | **Marks** |
| Model Implementation | Data preprocessing. Basic Model initialization, training and evaluation. Design your model or state any modification you have made in designing the architecture and training method. | 24 |
| Tuning, Validation | The model hyper parameter shall be tuned and validated. Shall include final model building and evaluation. | 18 |
| Visualization and Critical Analysis | Visualize the architecture and performance of your model with a suitable tool. Critically analyse model performance. | 18 |
|  | Total | **60** |

# Academic Integrity

Copying or paraphrasing someone's work (code included), or permitting your own work to be copied or paraphrased, even if only in part, is not allowed, and will result in disciplinary action. Your grade should reflect your own work. Basically, 'plagiarism' means representing someone else's work as if it is your own. This is a very serious academic offence for all students within the University regulations, and is particularly reprehensible for a researcher. Please do not even consider it. Remember that accidental plagiarism (or the appearance of it) may be avoided by referencing your work properly. This gains you credit, not loses it! The simple rule is that you must not represent the ideas of other people (whether they are published works or the work of other students) as your own. The golden rule on plagiarism is **DO NOT DO IT!**

1. **Submission Guidelines**

**List of submissions:**

1. Report as word/pdf document in APU thesis format
2. Code with comments and output as **both**:
   1. ipynb
   2. html
3. url (with permissions) for the data

**Due Date**

Assignment is due in the 11th Week