Assignment 2 – Research Report on AI Techniques

Due date: 20.01.2023
[This assignment must be completed as a team of 3]
CORE ASSESSMENT
Worth: 3%

Summary

AI research is highly technical and specialized, divided into subfields that often fail to communicate with each other. Subfields have the solution of specific problems, longstanding differences of opinion about how AI should be done and the application of widely differing tools. The central problems of AI include such traits as reasoning, knowledge, planning, learning, communication, perception and the ability to move and manipulate objects. There are four AI subfields are mentioned below for preparing the research report.

Objectives

The main objective of this assignment is to help you understand the concepts and apply AI techniques to a real word problem and prepare a research report. You should be able to answer the below questions on the chosen choices through readings, referred articles, publications and journals for preparing the research report. There are four parts in the assignment. Part 1 is about Neural Network, Part 2 is on Genetic algorithms, Part 3 is on Machine Vision and Part 4 is on Natural Language Processing.

Assignment Task

Choose and decide any ONE topic related to the choices given below

Choice 1

NEURAL NETWORKS

REPORT SHOULD FOCUS ON:

1. Determine and report the network architecture, including the number of input nodes, the number of output nodes and the number of hidden nodes.
2. Describe the rationale of your choice.
3. Determine the learning parameters, including the learning rate, momentum, initial weight ranges, and any other used parameters.
4. Determine the network training termination criteria.
5. Report the results on both the training set and the test set.
6. Analyze the results and make conclusions.
7. Evaluate the any ONE neural network package, the dataset and the obtained results.

There are many artificial neural network software packages developed by different people and they are made available on the internet. Also, the Matlab has a neural network tool box. You are required to apply one of these neural network software packages to a real world problem. The data for your chosen problem should be large enough to demonstrate the usefulness of the selected neural network.

You may consider a problem of pattern recognition, classification, clustering, prediction or estimation. The datasets for these problems may be available on the internet, books, or other resources. You are also required to describe and report your selected neural network, the application area, the dataset for this particular area of application, and the results.

Choice 2

Genetic Algorithms

REPORT SHOULD FOCUS ON:

1. Describe the overview of Genetic algorithm and explain how it works?
2. Describe the rationale of your Choice in GA and Support by providing any two applications in GA.
3. Describe the various components of a genetic algorithm and explain how such an algorithm can be used to maximize a function. Illustrate by considering few examples.
4. Determine the types of Initialization and termination in GA?
5. Determine and report the types of optimization problem and CHOOSE any **ONE** tool for solving the optimization problem. You are required to apply GA tools to a real-world problem. The data for your chosen problem should be large enough to demonstrate the usefulness of the selected problem. You may consider a problem of pattern search, optimization and planning, object localization in complex images & decision making. The datasets for these problems may be available on the internet, books, or other resources. Simulate and test the datasets.
6. Report and analyze the result findings
7. Conclude your report with how performance can be improved in GA.

Choice 3

Machine Vision

REPORT SHOULD FOCUS ON:

1. Describe the potential and limitations of Machine Vision
2. Evaluate the usefulness and performance of Machine Vision methods
3. Determine the relationship between computer vision to computer graphics
4. Evaluate the technical description of Machine Vision System
5. There are several Machine Vision tools including Matlab, OPenCv. Choose any **ONE** of the tool and work out with sample image data and test simple functions from toolbox like loadimage, read image, cropimage, filterimage displayimage etc. Run and test any set of sample image data (JPEG, GIF, BMP). Sample image data's are available on internet; you can use natural scenery images, Car, Boat, Animal images for testing. Analyze and test the result. Report the result with your findings.
6. Report recent advances in Machine vision and put them in context.
7. Conclude the Report with benefits of Machine vision in real world problems.

Choice 4

Natural Language Processing

REPORT SHOULD FOCUS ON:

1. Describe the significance of NLP to academic research and practical industrial applications.
2. Brief the various Levels & different approaches of Natural language Processing?
3. Brief the basic concepts of text processing, part of speech tagging and parsing techniques in NLP.
4. In the last 20 years, the field of NLP is dominated by the data-oriented approach in all sorts of tasks. The construction and use of corpora and treebanks have become critical. This is also an area where linguists' contribution is important. Make a survey a few commonly-used corpora and treebanks such as the Brown corpus, Penn Treebank, Academic Sinica Treebank etc. Draft a report on different design principles and grammatical orientations involved.
5. Semantic processing is arguably one of the most difficult domains in NLP. One commonly used resource is WordNet. Examine how the network represents word-sense relations between words.
6. Evaluate any **ONE** NLP S/ W or Tool for your research findings.
7. Report your findings with conclusions.

REPORT SUBMISSION

Your report should be not more than 15 pages (excluding appendix), typed and single spaced. You are expected to include diagrams as appropriate; the finished report should be well- organized, neatly presented, and visibly divided into sections. Pages should be numbered. The use of computer word processing or text processing facilities to prepare the report is strongly encouraged.

As far as possible, the report should follow the appropriate outline based on the above questions for the chosen topics. You are free to discuss on AI topics and reference sources with one another. Reports that are unduly similar may not be accepted.

REPORT FORMAT

Prepare the report like research article, follow the below requirements

Page 0 – Title of Chosen Section, Student Names, Running Head, Abstract

Page 1 and remainder, in this order - Introduction, Research Questions, Sample Datasets & Results/ Evaluation of S/W package or tools, Discussion, Bibliography, Appendix

Report should be typewritten using 1 inch margins on 8.5 x 11 inch paper. Text should be left-justified using elite print (twelve characters per inch). Report should be single-spaced throughout, including the title and abstract.

Abstract: Times New Roman, Size: 11, BOLD. The abstract should summarize the main conclusions and any new methods or procedures critical to the results of the study. It should be 250 words or fewer

Full Body Text: Times New Roman, Size: 12.

Heading Titles: 12 size
Sub titles: 10 size
Paper Size: A4
Header and Footer: "Title of your research report ", Size 10, Times New Roman.

Bibliography: Times New Roman, Font: 10 points. List several information sources you used or found out about, even if you were not able to obtain them all. Include the software's and toolbox source references.

Appendix: You can include tables, figures, source codes, screenshots, testing and training data's etc.

Assignment Submission

Each Report must submit a single, soft copy and hardcopy of the completed documentation during tutorials by 20/01/2023 **or at office M249**. Students should keep a copy of all assignment work for their OWN use (for example exam revision or job applications).

Marking Guidelines

Report organization and format	**20 Marks**
Clarity and Technical Quality	**20 Marks**
Originality and Research Questions	**20 Marks**
Evaluation of Software Packages/ Tools	**20 Marks**
Discussion and Findings	**20 Marks**
References	**10 Marks**
TOTAL MARKS	**100 Marks (15%)**