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**COP528 AI and Applied Machine Learning Coursework**

In this coursework you will apply what you have learnt in this module to solve the following tasks:

**Task 1:**

You will be provided with a standard dataset to practice your knowledge of machine learning. The provided dataset is an image dataset, where each image contains meaningful objects, e.g., parachute, oil box and truck etc. (**Note. The data can be downloaded at Teams/COP528 module under Main channels/General/Files. When you download the coursework\_task01\_dataset.zip, you can use any unzip tool to get the image data into a folder for processing**). When given a test image, your developed code should be able to classify it into its corresponding class.

(a) You may select appropriate machine learning approach(es) to solve the task. Justify your selection of the approach(es), write code to implement the approach(es), training and test your ML model(s), analyse the results, and discuss your findings. You also need to define your evaluation protocol to assess the performance of your machine learning approach(es).

(b) Design and write code to implement appropriate strategies, e.g., data augmentation and/or model architecture changes, to further improve your model(s) performance, discuss your findings and reflect your work.

**Task 2:**

Gridworld is a tool for building a customised environment for testing reinforcement learning approaches. Please use the following code to create a new environment where an agent starts its journey from top-left corner of the maze, w is the wall that the agent cannot move to, o represents obstacles that penalise the agent behaviours if the agent moves to those locations while g is the final goal to return a big reward to the agent.

import numpy as np

from gridworld import GridWorld

world=\

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env=GridWorld(world,slip=0)

(a) Write code to implement both the Value Iteration and Q-Learning methods to find optimal policies that the agent learns to behave.

(b) Explain how these methods are used to solve the task, compare and analyse the results from the two approaches.

(c) Investigate and explain how discount factor and exploration rate of Q-learning make effects on the performance. Note that discussions should be based on observations from experiments.

**Submission guidelines**

**Submission:** The code, report and reflection must be submitted on 11:00 am Friday [14th March 2024] for full-time students and 11:00 am Monday [28th April 2024] for part-time students.

* Project Report: PDF, 1000 – 1500 words for each task, tables and figures are not included in the word counting.
* Software: Jupyter Notebook. Code needs to be submitted as attachments.
* You may use a software tool to zip the above files into a .zip file to submit both the report and the code.

**Assessment Criteria:** The project will be marked based on the code quality and the report. The marking criteria is given as below.

**Code:**

* **Code Quality (20%):** You need to submit clean, structured and well commented code so that the instructor could run your code and get the evaluation results.

**Report:**

The report for each task will take 40% of your final mark. Try completing all the subtasks, which will be treated equally in the assessment.

**Further Information:**

* You are recommended to use Python scikit-learn, TensorFlow/Pytorch for implementation. You can use data pre-processing code blocks that are available online (to avoid plagiarism, ensure that you provide the source and acknowledge the author of the code you have used. You must add this information in a comment accompanying the code fragment that you borrowed. If you have adapted the code, state “Code adapted from: [provide the source]”. If you have copied the code and have made no changes to it, state “Code copied from: [https://uark.libguides.com/CSCE/CitingCode]”).
* You need to demonstrate your knowledge and effort made to gain a good understanding and practical skills related to machine learning in detail through the project.
* The report structure and contents are indicative. Components which are relevant to your project should be demonstrated. Some questions may be standard for your project and only a brief mention is enough. You do not need to address all of them in full detail.
* You may consult any textbooks, online resources, or publicly available implementations for ideas and code that you may adapt into your strategy or algorithm. You need to clearly cite your sources in your code and your writeup. You should not use another students’ code for the class for your project.
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