Homework 6

This homework is the last homework of the semester and is due in 2 weeks from the date of release (on March 31st (11:59 pm)).

Part 1: Transformers

Task 1 (30 points): In this task you should work with the Facebook BART model (https://huggingface.co/docs/transformers/en/model_doc/bart) to provide **text summarization** of news articles. Text summarization in Natural Language Processing (NLP) is a technique that breaks down long texts into sentences or paragraphs, while retaining the text's meaning and extracting important information. Pick any one dataset of your choice.

You may have to do data cleaning, preprocessing etc. Next, perform the following tasks:

1. Provide a description of the dataset you selected. Split your data into train-test set with a (90-10) split.
2. Load the model from Hugging Face's Transformers library and write its training script.
3. Fine tune the pre-trained model with your data and report results on your test set. You must report the BLEU and ROUGE Scores. (See the code provided in class for more details)
4. Analyze your results and discuss the impact of hyperparameters. Are your results impacted by the choice of the LLM here? How?

Part 2: Reinforcement Learning

Task 2(20 points): We discussed how we can formulate RL problems as an MDP. Describe any real-world application that can be formulated as an MDP. Describe the state space, action space, transition model, and rewards for that problem. You do not need to be precise in the description of the transition model and reward (no formula is needed). Qualitative description is enough.

Task 3(20 points): RL is used in various sectors - Healthcare, recommender systems and trading are a few of those. Pick one of the three areas. Explain one of the problems in any of these domains that can be more effectively solved by reinforcement learning. Find an open-source project (if any) that has addressed this problem. Explain this project in detail.

Task 4 is for 6000 level ONLY

Task 4(100 points): Implement the game of tic-tac-toe (write a class that implements an agent playing Tic Tac Toe and learning its Q function) using the Q-learning technique (see the resources/links provided in class for more details). Clearly describe your evaluation metric and demonstrate a few runs. You might need to use some online resources to proceed with this. Do not forget to cite those.

Part 3: Recommender Systems

Task 5 (30 points): For this task use the MovieLens 100k dataset (https://grouplens.org/datasets/movielens/100k/)

Perform the necessary data cleaning, EDA and conversion to User-item matrix.

Implement any 2 collaborative filtering recommendation systems (RecSys) algorithms covered in class (Matrix Factorization, Alternating Least Squares, NCF etc.) and compare their performance for any 2-evaluation metrics used for RecSys. You may read literature to find out which evaluation metrics are used for RecSys. Cite all your research.