DSE 3260 ARTIFICIAL INTELLIGENCE LABORATORY

WEEK 1 Representational Learning using Autoencoders.

1. **Use the Fashion MNIST data set and train a basic autoencoder to reconstruct images.**
   Train the model using x_train as both the input and the target. The encoder should learn to compress the dataset from 784 dimensions to the latent space, and the decoder should learn to reconstruct the original images.
   Let the autoencoder have two Dense layers:
   a. an encoder, which compresses the images into a 64 dimensional latent vector, use reLU as activation function.
   b. and a decoder, that reconstructs the original image from the latent space, use sigmoid as activation function.

   Once the model is trained for at least 10 epochs , with loss function as mean square error, test it by encoding and decoding images from the test set. Display original and reconstructed images.

2. **Train an autoencoder to detect anomalies using the ECG5000 dataset.**
   Plot and observe a normal ECG vs an anomalous ECG.
   Design and Train an autoencoder on the normal rhythms only, then use it to reconstruct all the data.
   The autoencoder is trained using only the normal ECGs, but is evaluated using the full test set. Classify an ECG as anomalous if the reconstruction error is greater than one standard deviation from the normal training examples.

WEEK 2: Simple Agents

1. Take the TF-Agents Environments Tutorial:
   https://colab.research.google.com/github/tensorflow/agents/blob/master/docs/tutorials/2_environments_tutorial.ipynb

2. Use the **CartPole-v0** environment and write a program to
a. Implement the CartPole environment for a certain number of steps
b. Implement the CartPole environment for a certain number of episodes
c. Compare and comment on the rewards earned for both approaches.

WEEK 3: Problem Solving Agents & SEARCH

The Game :

According to the "Six Degrees of Kevin Bacon" game, anyone in the Hollywood film industry can be connected to Kevin Bacon within six steps, where each step consists of finding a film that two actors both starred in. To solve the problem, find the shortest path between any two actors by choosing a sequence of movies that connects them. For example, the shortest path between Jennifer Lawrence and Tom Hanks is **2**:

Jennifer Lawrence is connected to Kevin Bacon by both starring in "X-Men: First Class," and Kevin Bacon is connected to Tom Hanks by both starring in "Apollo 13."

Problem Solving Agent:

Given two actors nodes in the graph we need to find the distance (shortest path) between the nodes.

Write a python program to determine how many "degrees of separation" apart two actors are. Find the distance or the degree of separation., using

a. Breadth first search
b. Depth first search

Distribution Code:

Data & Download the distribution code from:
https://cdn.cs50.net/ai/2020/x/projects/0/degrees.zip

The distribution code contains two sets of CSV data files: one set in the large directory and one set in the small directory. Use the small dataset for ease of testing and experimentation. Each dataset consists of three CSV files.

1. **small/people.csv:** each person has a unique id, corresponding with their id in IMDb's database. They also have a name, and a birth year.
2. **small/movies.csv:** You'll see here that each movie also has a unique id, in addition to a title and the year in which the movie was released.
3. **small/stars.csv:** This file establishes a relationship between the people in people.csv and the movies in movies.csv. Each row is a pair of a person_id value and movie_id value.

For example: The first row (ignoring the header), for example, states that the person with id 102 starred in the movie with id 104257. Checking that against people.csv and movies.csv, you'll find that this line is saying that Kevin Bacon starred in the movie "A Few Good Men."

4. **degrees.py**:

At the top, several data structures are defined to store information from the CSV files. The names dictionary is a way to look up a person by their name: it maps names to a set of corresponding ids (because it's possible that multiple actors have the same name). The people dictionary maps each person's id to another dictionary with values for the person's name, birth year, and the set of all the movies they have starred in.

And the movies dictionary maps each movie's id to another dictionary with values for that movie's title, release year, and the set of all the movie's stars. The load_data function loads data from the CSV files into these data structures.

The main function in this program first loads data into memory (the directory from which the data is loaded can be specified by a command-line argument). Then, the function prompts the user to type in two names. The person_id_for_name function retrieves the id for any person (and handles prompting the user to clarify, in the event that multiple people have the same name). The function then calls the shortest_path function to compute the shortest path between the two people, and prints out the path.

The `shortest_path` function has to be coded using

a. Breadth First Search
b. Depth First Search