Gebze Technical University
Department of Computer Engineering
CSE 241/505
Object-Oriented Programming
Fall 2019
Winter Homework
Android Programming and Deep Learning
Due date
The second week of Spring 2020

Summary;

We want you to develop an android application for playing and solving `Infamous N-Puzzle` on Android systems. This time we will employ machine(deep) learning techniques for real intelligence.

1.) Download and install Android Studio and Android SDK Tools from https://developer.android.com/studio
2.) Download and Install PythonV3 NumPy from respective sites or a package manager like Pip
3.) Download and Install TensorFlow 2.0 (or TensorFlow 2.0 GPU if you have GPU capabilities) from https://www.tensorflow.org/. Please follow the installation instructions very carefully.

HW Instructions for Android N-Puzzle

1.) Develop an Android Application that will allow users to play the N-Puzzle app. The application should allow users to select different board sizes from 3x3 to 9x9. Note that the board does not have to be square.
2.) The Application should only create initial board configurations that are solvable. (There is no limit on the number of moves required to solve the puzzle.)
3.) The Application should show the number of moves performed during the game. The application should present a hint button that will help users a step toward the solution.

Bonus Deep Learning Instructions.

1.) Study PythonV3 and Numpy
2.) Study Neural Networks and LSTM`s using TensorFlow and python https://adventuresinmachinelearning.com/recurrent-neural-networks-lstm-tutorial-tensorflow/,https://towardsdatascience.com/lstm-by-example-using-tensorflow-feb0c1968537

Training Data Generation

We teach statistical learning models by giving many examples of the problem. This is called ***training.*** Machine learning models learn patterns by inspecting an immense amount of training data. In order to make our N-Puzzle app clever, we need to generate lots of real-game playing data.

Hints on data generation process,

1.) Create a Game Scenario
    a. Start from a final board positon and randomly move the empty tile for at least 200 steps (Do not perform the move that will put the board into the previous state.)
    b. Record every movement in a data structure.
2.) Generate at least 1000 different game scenarios for each board size(3x3,3x4,3x5..9x8,9x9)
3.) Split your training data into training and validation datasets.
4.) Train an LSTM based Neural Network and measure the accuracy of the model. Make improvements either by increasing the number of game scenarios or changing the neural model. (Please study on how to train neural networks and LSTM`s)
5.) Using TensorFlow-Lite convert and deploy your model with your mobile app.