Model Testing

AI Model Development

Time: 60 mins

Introduction

In this class, the student/s will save and load the fittest genome model to create a neural network and run the driverless car simulation on different tracks.

New Commands Introduced

● with open(file_name, 'wb') as f:	Opens file to write in binary mode named as f
● pickle.dump(winner, f)	Dumps the winner data in the file f with pickle extension pkl
● with open(file_name, 'rb') as f:	Opens file to read in binary mode named as f
● pickle.load(f)	Reads pickled objects from a file
● pickle.dump(winner, f)	Dumps the winner data in the file f with pickle extension pkl
● with open(file_name, 'rb') as f:	Opens file to read in binary mode named as f

Vocabulary

- **Neuroevolution** of Augmenting topologies(NEAT) is a method in machine learning which generates neural networks with minimal input parameters to give effective outputs.
- A **genome** in ML contains all the information needed to develop and mutate.
- **Pickle** can be used to serialize Python object structures, which refers to the process of converting an object in the memory to a byte stream that can be stored as a binary file on disk. When we load it back to a Python program, this binary file can be deserialized back to a Python object.

Learning Objectives

Student/s should be able to:

- ***Recall*** how to configure a configuration file for a neural network.
- ***Explain*** how to open a pickle file, save and load the genome with highest fitness.
- ***Demonstrate*** how the trained model works for a different track.

.

Activities

1. **Class Narrative:** *(2 mins)*

    - Brief the student/s that the genome model with the highest fitness we can use in a neural network to simulate the driverless car.

2. **Concept Introduction Activity:** *(5 mins)*

    - Let the student/s play the explore-activity to observe the car simulation on different tracks.
    - Explain the need of an optimized neural network and introduce Neuroevolution and its method NEAT.
    - Using the slides, explain that the student/s will learn:
        - to save the genome model
        - to load the genome model
        - to test the genome model

3. **Activity 1: Save the Genome Model** *(14 mins)*

    Teacher Activity: *(7 mins)*

    - Explain how we simulated the car to train and find the fittest genome and next we need to save it.
    - Explain how to open a pickle file and save the genome model by writing in binary mode in the pickle file only when fitness is more than the highest value(We used 1000).

    Student Activity: *(7 mins)*

    - Guide the student/s to save the genome model with the highest fitness in the pickle file extension.

4. **Activity 2: Load the Genome Model** *(12 mins)*

    Teacher Activity: *(3 mins)* .

    - Explain how to load the saved genome model to further use it in the neural network NEAT method for car simulation.
    - Explain how to open a pickle file and read the genome model using read in binary mode in the pickle file.
    - Explain the need of cleaning the code to stop evolution of new genomes and their fitness values.

Student Activity: *(9 mins)*

- Guide the student/s to load the pickle file to be used for further neural network model of car simulation.

5. **Activity 3: Test the Genome Model** *(12 mins)*

   Teacher Activity: *(6 mins)*

   - Explain that the genome with highest fitness is ready and now we need to test our model with different tracks.

   Student Activity: *(6 mins)*

   - Guide the students to test the genome model with different tracks.

6. **Introduce the Post class project:** *(2 min)*

   - Load the Model and use the NEAT method to control the bird in the game.

7. **Test and Summarize the class learnings:** *(5 mins)*

   - Check for understanding through quizzes and summarize learning after respective missions.
   - Summarize the overall class learning towards the end of the class.

8. **Additional activities:**

   - Encourage the student/s to remove the green sensor markings from the car simulation output.
   - Encourage the student/s to load the trained model to automate the Trex runner game.

9. **State the Next Class Objective:** *(1 min)*

   - In the next class, student/s will learn to use the blockchain technology to verify and trace the transactions.

U.S. Standards:

CSTA: 2-AP-11, 2-AP-12, 2-AP-13, 2-AP-14, 2-AP-19

Links Table		
Activity	**Activity Name**	**Link**

Class Presentation	Model Testing	https://s3-whjr-curriculum-uploads.whjr.online/c260305f-ced2-494a-aafd-619d0594572e.html
Explore Activity	Model Testing	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-SAS-BP
Teacher Activity 1	Save the Genome Model	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-TAS-BP
Teacher Reference: Teacher Activity 1 Solution	Save the Genome Model	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-TAS
Student Activity 1	Save the Genome Model	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-SAS-BP
Teacher Reference: Student Activity 1 Solution	Save the Genome Model	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-SAS
Teacher Activity 2	Load the Genome Model	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-TAS-BP
Teacher Reference: Teacher Activity 2 Solution	Load the Genome Model	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-TAS
Student Activity 2	Load the Genome Model	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-SAS-BP
Teacher Reference: Student Activity 2 Solution	Load the Genome Model	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-SAS
Student Activity 3	Test the Genome Model	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-SAS-BP
Teacher Reference: Student Activity 3 Solution	Test the Genome Model	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-SAS
Student's Additional Activity 1	Remove the Sensor Markings	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-SAS-BP
Teacher Reference: Student's Additional Activity 1 Solution	Remove the Sensor Markings	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-SAS
Student's Additional Activity 2	Automate the TREX Runner Game	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-SAS-BP
Teacher Reference: Student's Additional Activity 2 Solution	Automate the TREX Runner Game	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-SAS
Post Class Project	Automate the Bird Movement	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-PCP-BP
Teacher Reference: Post Class Project Solution	Automate the Bird Movement	https://github.com/Tynker-Computer-Vision/TNK-M10-PRO-C80-PCP