Programming through Python: Deep Learning

Presented by AcademiaEdge

Lead Teacher: Nalin Nagar (9th)
Assistant Teacher: Raghav Sriram (10th)

Date and Timings: 2/21-6/6, Sunday from 5-6 PM EST
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Requirements: Any student ages 11 or above may join if interested. This class is, however, highly recommended for students with a decent math background, preferably knowing upto Precalculus but you don't need to know advanced math, just basic arithmetic for this course, students should have a strong background in python and should at least know basic data processing and computation libraries such as numpy and pandas(though very basic versions will be taught in class). Additionally, participating or previous enrollment in Introduction to Python or Programming through Python: Machine Learning courses is recommended but not required.

About Us:

We are a group of sophomores from Carmel High School who want to help people begin their journey into programming by introducing and teaching students Deep Learning, one of the worlds most in demand fields. Nalin, the teacher of this course, is an experienced professional in python and deep learning and has built and developed projects of their own. He is excited to help people begin their journey into machine learning and deep learning and can't wait to spread his knowledge.

Class Description:

Introduction to Deep Learning with Python is a course offered by AcademiaEdge, a nonprofit organization created by high school programmers. There are 15 classes in total, each class is an hour long. A detailed description of the class syllabus can be found below. All classes are virtual and will be held through Zoom. In addition to hosting our classes through Zoom we will be using google classroom to submit assignments and google calendar for parents and students to keep track of classes and assignments. Each class lecture will be recorded and put in a google drive along with the class slides for all students to reference too when doing their assignments.

Students can ask questions at any time during the class and the assistant or teacher will answer them. Additionally, students may message teachers via google classroom or by email and

our teachers will respond as soon as possible. In order to give this individualized experience filled with fun projects and assignments guided towards young children, classes will be limited to 10-15 students so that teachers can give high-quality attention to each student. Sign up is first come first serve and a waitlist may be created if there is excessive student participation. This course will be guided towards students of ages 11 and up, but any student may join if interested. We are excited to introduce the world of Deep Learning to your child!

Syllabus:

First Class Schedule:

15 minutes	Introduction to Class Syllabus
15 minutes	Learning how to use Google Classroom and Google Colab
30 minutes	Go over what deep learning is and some of the uses in the industry and build a neural network from scratch.

General Class Schedule:

10 minutes	Review coding assignment from last class
30 minutes	Go over the lesson in a collaborative notebook.
10 minutes	Application of the concepts learned today
10 minutes	A reflection and summary of what was learned that day, go over and questions and assign homework

Course Content

1. What are Artificial Neural Networks
    a. Introduction to Artificial Neural Networks
    b. What are Weights and Layers?
    c. Activation Function
    d. Feedforward and Backpropagation
    e. Training Neural Network using Python

2. Intro to TensorFlow
    a. What is a tensor?
    b. Tensor Operations
    c. What can we use tensors for?

3. Start writing low-level TensorFlow code
    a. Intro to TensorFlow Variables
    b. More Tensor Operations
    c. Start Implementing Linear Regression
    d. Go through the notebook for homework
    e. Finish linear regression from scratch

4. Intro to Data and creating Datasets in TensorFlow
    a. Learn how to use tf.data to read data from memory
    b. Learn how to use tf.data in a training loop
    c. Learn how to use tf.data to read data from disk
    d. Learn how to write production input pipelines with feature engineering (batching, shuffling, etc.)

5. Intro to tf.keras.layers and tf.models.Sequential
    a. Build a DNN model using the TensorFlow Sequential API
    b. Learn how to use feature columns in a TensorFlow model
    c. Learn how to train a model with TensorFlow
    d. Learn how to save/load, and deploy a TensorFlow model on GCP
    e. Learn how to make predictions with a TensorFlow model

6. Understand Keras Functional API and Embeddings for text data
    a. Understand embeddings and how to create them with the feature column API
    b. Understand Deep and Wide models and when to use them
    c. Understand the Keras functional API and how to build a deep and wide model with it

7. Intro to PyTorch
    a. Learn about tensor operations in PyTorch
    b. Understand Computation Graphs and Automatic Differentiation

8. Neural Networks in PyTorch
    a. Understand softmax activation
    b. Optimization and Losses
    c. Defining a model in PyTorch

9. PyTorch autograd(automatic differentiation)
    a. Understand Gradients
    b. Understand .backward(), .step(), and .detach()

10. Text Classification in PyTorch
    a. Using TorchText to load data
    b. Defining Models
    c. Defining and running train functions

11. Convolutional Layers in TensorFlow
    a. Get Data
    b. Define model
    c. Define train function
    d. Evaluate model

12. Convolutional Layers in PyTorch
    a. Get Data
    b. Define model
    c. Define train function
    d. Evaluate model

13. Vanilla GAN Interactive Lesson
    a. Code up a Vanilla GAN
    b. Get Ready for final project

14. Final Project: Implementing a DC-GAN
    a. Learn architecture of a GAN
    b. What it does, uses
    c. Understand hyperparameters of GAN Training
15. Continue with building a DC-GAN
    a. Learn architecture of a GAN
    b. What it does, uses
    c. Understand hyperparameters of GAN Training
    d. What do I do next?

Rules and Expectations

Classroom Procedures:

Students are to stay muted at all times except if they have a question or when asked to be unmuted. The student may temporarily unmute himself to ask his/her question. Alternatively, if the student would not like to speak in front of the class, then the student may ask his/her question in the Zoom chat. We encourage students to ask questions and regularly participate in class. Also, we would like students to be respectful to their classmates and teachers.

Students, please do not:

- Eat or drink with your microphone turned on
- Be disrespectful to teachers or other students
- Put inappropriate pictures on your webcam
- Send inappropriate messages in the class chat

Please do:

- Ask questions
- Be attentive
- Be engaged and active throughout the class
- Make sure to have your camera on throughout the class
- Do assignments thoroughly
- Submit assignments before deadline
- Have Fun!

Google Classroom Layout:

Each lesson's recording will be found on google classroom along with the class's slides and notes. Homework assignments will be assigned and submitted via google classroom as well. Students can ask questions through the messaging system in google classroom or via email.

Homework procedures:

Students will be given homework in google classroom via google docs, which will consist of inserting screenshots or short-answer/multiple-choice questions, or google forms. The google forms will mainly be used for knowledge checks, while the google docs will be used for general homework assignments. Each assignment is due 24 hours before the next class to give ample time for teachers to grade students' assignments. Students should send a message or an email if they are unable to turn in their homework by then with a valid explanation of why they will not be able to turn in their homework by the deadline, and the teachers will come up with a possible solution. This also applies to missing a class. Course projects will also be assigned and submitted through Google Classroom. If a student misses an assignment deadline repeatedly an email will be sent to his/her parents.