Disclaimer: the coding for the project isn't very sophisticated, in case you have better coding knowledge, please try to improve the code. The only merit of the provided code is: It works!!!

Gravitational Waves Workshop: Basic Training

Step 1: To learn about gravitational waves: do the following in sequence

GWOSC (gw-openscience.org)

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After doing both of the courses, you will have known how these waves are formed and PYCBC python package to simulate the waves, you can do the tutorials given below as well

gwastro/PyCBC-Tutorials: Learn how to use PyCBC to analyze gravitational-wave data and do parameter inference. (github.com)

The documentation for the PYCBC package:

PyCBC — PyCBC 1.16.4 documentation (uni-hannover.de)

Step 2: Read the FYP report to get an idea of what we did as our project, you can even find the summary of the project in the team presentation.

Step 3: Try out the code as given in the report, you can find the files in the repository.

The ipynb files are for:

1. Data generation of BBH signal (8s long, 2048 Hz sampling freq)
2. Classification model in TF to run on colab GPU
3. Classification Model Testing Code (Testing on waves simulated by code)
4. Real Time Data Testing of Classification Model (testing on actual gravitational waves captured by LIGO)
5. Data Generation Code for Denoising Model(0.25s long, 2048 Hz sampling freq)

6. Denoising AutoEncoder Model
7. DAE Model Testing

Step 4: Learn deep learning (Tensor flow)
Step 5: make a detailed curriculum for the workshop, like the one our college publishes for each branch, so that you get an idea of what all topics you need to cover

Gravitational Waves Workshop:
Day 1: (10 - 5:30) 7.5 hrs

1. Teach what are gravitational waves, how they are formed, their sources.
2. Using PYCBC, visualize a real time gravitational wave as well as simulate artificial gravitational waves.
3. Data generation of samples of BBH signals (1s long, 2048 Hz)
4. Scope of research in gravitational waves (LIGO-India Education & Public Outreach - YouTube - you will get the necessary information on this channel)

Day 2: (10-5:30) 7.5 hrs

1. Basics of machine learning, deep learning
2. Coding the DL model on TF/ PyTorch
3. Classification of gravitational waves using the same model
4. If time permits, make a denoising model to denoise the signals to get pure gravitational waves as well.