GSoC'22 Proposal – Machine Learning 4 Science (ML4SCI)

Project Recommendation System

Personal Details

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Link to Resume / CV

Link to my Tasks

About Me

I am a curious guy, who loves to build things and coding helps me do that. Machine Learning excites me and I love automating stuff. I am particularly interested in the field of Deep Learning and Artificial Intelligence and how that combines with Astronomy. I have a fair knowledge of HTML,CSS, JS, NodeJs , Express , C++, Python and have done two projects involving Deep Learning, Computer Vision and Machine Learning. One was under Dr. Dhiraj from CSIR-CEERI Pilani, and the other one is under Dr. Swati Agarwal, under whom I am doing an undergraduate Study Oriented Project.

Why this project ?

I came across Machine Learning for Science when they conducted the ML4SCI 2021 hackathon and immediately I was intrigued by their choice of projects. Although I found them difficult but extremely knowledgeable, I was not able to make any participation in the same and I was waiting for an opportunity to open up in this organization and GSoC 2022 has provided me with the same.

Commitments

1. **Are you planning any vacations during the GSoC period?** Nope
2. **How many classes are you taking during the GSoC period?** None
3. **Do you have any other employment during the GSoC period?**
   I have a compulsory internship from BITS Placement Unit, as I was selected for same via the Summer Internship Program. But I can assure that that will not interfere with this project.
4. **How many hours per week do you expect to work on the project and what hours do you tend to work?**

I can easily devote over 40+ hours every week.

Problem Statement

Deep Regression Techniques for Decoding Dark Matter with Strong Gravitational Lensing

Approach:

So the general approach that I would go about in this project would be the data cleaning, data extraction followed by model building and inference.

Data Cleaning and Extraction: For this purpose we can use the [lenstronomy](#) library which is a brilliant contribution for the purpose of image acquisition and modelling gravitational lenses. We can also induce the necessary transformations and noisy images to more realistically model the real life data.

Model Building: The first and foremost approach that we can adapt for model building will be that of Convolutional Neural Networks (CNNs) because they are the tried and tested methods for solving the image ML problems. Furthermore we can investigate the path of Continuous Learning as well so as to include new additions to the dataset without the need to retrain the model from scratch. And we can also use the concept of Adversarial networks to inherently test if our results are going along the right track or not.

Inference: Once the major part of the project is done lies the task of inferring from the data. This we can do in the last one month of the project timeline to see and understand how the substructure of the dark matter can be inferred from these computer simulations of huge galaxies!

Additional Information

What to expect from your mentor

What I expect from my mentor
- Should set my approach right if I am going in the wrong direction or wasting too much time in a less time consuming part of the project.
- Should be punctual during meetings, status updates and easy to reach out to.