Google Summer of Code Proposal

About me

Hello, my name is Imed Eddine TIBERMACINE and I am a student in Master 1 Artificial Intelligence in University of Biskra and a competitive programmer , Algeria. I'm a youth researcher affiliated with the LINFI laboratory in our university (artificial intelligence) and also a SKAILAB member (first algerian center for AI).

My email : imadtiber4@gmail.com

Github : https://github.com/tiber10

Codeforces Handle: imadKAGE

Area of research and Skills

I'm a motivated computer sciences student , I've been interested in AI, parallel programming, optimization since 2018 and i was able to develop my skills in the following technics:

- **Controlled Technologies**
  - Machine Learning: Tensorflow, Keras, Therano, PyTorch
  - Languages: C, C++, Java, Python, Ruby, C#, JS, PHP, Fortran, Bash, Lex, Assembly, Prolog
  - Internet of Things: Arduino, Raspberry pi, STM32, sensor's network
  - Security: Certified Ethical Hacker equivalent
  - Mobile Development: Android Studio
  - Desktop Development: JavaFX
  - Parallel Programming: MPI. MP

- **Area of expertise**
  - ▪ Problem Solving and Algorithms: Graphs, Dynamic Programming, Complexity Optimisation
  - ▪ Deep Learning: CNN, LSTM,
  - ▪ Classification: SVM, Random Forest Trees, Naïve Bayes, Neural Networks, KNN
  - ▪ Reinforcement Learning: DQN, DDPG, Q-Learning, A3C
  - ▪ Dimensionality Reduction: PCA, LDA
  - ▪ Regression: Linear, Logistic
  - ▪ Clustering: K-Means
  - ▪ Transfer Learning
  - ▪ Active Learning
  - ▪ Internet of Things: Raspberry pi applications
  - ▪ Paradigms: Branch and Bound, Divide and Conquer

Achievements

Since 2018, i started participating in national and international competitions and during those 3 years i achieved:

- International Master in problem solving (codeforces)
- First place in Nasa Space Apps Challenge Algeria 2019 (Team gaia)
- First Place “Best Technical Advance” Hackathon Hack Algeria Post Covid-19 2020
- Second Place in the Algerian Collegiate Programming Contest 2020
- Team Coach of the 3rd team in the Algerian Collegiate Programming Contest 2020
- Arab & African Collegiate Programming Contest Finalist
- Participation in the Algerian Collegiate Programming Contest 2018

- Participation in the Algerian Inter-Universities Competition in aeronautics " Rocketry ", Second edition in 2019 at the University of Saad Dahlab Blida 1, Blida, Algeria.
- Team Coach of International Olympiad in Informatics Team
- Top 1 Problem Solver and competitive programmer in Maghreb Area “Codeforces”
- Top 5 Problem Solver and competitive programmer in Africa “Codeforces”
- Top 10 Problem Solver and competitive programmer in Arabs “Codeforces”

Projects

- Bionic Arms with CRTI (Industrial Technology Research Center)
- UAV Applications and structures with CRTI (Industrial Technology Research Center)
- Cov-Fight project to detect social distancing and alerting authorities using public cameras
- DROIELD: Drones Network to detect and fight forest fires(Pending Article) ▪
- GAIA: Using satellite images to detect organic garbage in oceans
- Drones in cadastral and topographic mapping (Pending Article)
- Decoding EEG waves for drugs addicting (Pending Article)
- Decoding EEG for motor imagery ▪ Face expression recognition using deep learning
- Matrix multiplication speedUp using MPI and OpenMP

Conferences and Patens

- International conference "connective cities" for innovative projects to fight covid-19 by Aachen University Germany
- Two submitted patents (pending)

Deep Regression Techniques for Decoding Dark Matter with Strong Gravitational Lensing

I would love to work in the project to develop the DeepLense pipeline that combines state-of-the art of deep learning models with strong lensing simulations initially based on PyAutoLens for strong gravitational lens modeling (i've already implemented a lot of deep regression algorithms).

From the past expertise, i can suggest to use one of the following deep regression based machine learning algorithms:

- Robust linear regression (RLR)
- Cforest,
- Non-convex penalized quantile regression (NCPQR)
- Neural network with feature extraction (NNFE)
- Monotone multilayer perceptron neural network (MMLPNN),
- Ridge regression (RR)
- Boosting generalized linear model (BGLM)
- Negative binomial generalized linear model (NBGLM)
- Boosting generalized additive model (BGAM)
- Spline generalized additive model (SGAM)
- Spike and slab regression (SSR)
- Stochastic gradient boosting (SGB)
- support vector machine (SVM)
- Relevance vector machine (RVM)
- Lasso Regression

In this project, i will use one of the above algorithms to train a deep regression to learn mapping and extracting features, the main object of this algorithm is to estimate dark matter properties and extract dark matter particle candidates such as : as axions, sterile neutrinos, weakly interacting massive particles (WIMPs), gravitationally-interacting massive particles (GIMPs), supersymmetric particles, geons...etc and decoding dark matter

In a previous research, I found that the best algorithms for this purpose are : MMLPNN, SGAM, Cforest, BGAM which i'm already preparing a detailed implementation in pytorch.

Timeline

I would like to notify that i'm a hard worker, i can work up to 18 hours per day and I have a quick response to learn new topics.

Using this skills i can ensure the following timeline:

17 may - 30 may : Deep understanding and conception for the project

31 may - 30 June : Implementing the first viable model

01 july - 30 july : Finalizing the model with the highest accuracy

01 august - 07 august : Preparing the research paper

10 august : Research paper and the Model ready

11 august - 15 august : Extra features/adds..etc to the model

15 august - 30 august : Safety zone