1. What compiler optimization tasks do you want to tackle and why?

   I am most interested in the phase ordering problem. Different orderings of applying optimization phases by a compiler can result in different code generated, with potentially significant performance differences for many applications or even functions within applications.

   I believe that it's relatively easy to optimize specific tasks and that's what most handwritten compilers are really good at. It's really difficult to identify the order of such hand-tuned optimization that will give the best results because it can change with the piece of code that's provided. It is very well known that using a universal scheme will not produce optimal results. This high variance makes it almost impossible to come up with one general scheme. Many optimization phases have shared resources and their applicability is highly dependent on the target code thus they can interact with each other in an unknown fashion and produce non-optimal results. This makes phase ordering a really difficult task in terms of predicting the correct order as well as keeping track of what's happening. Thus choosing a good order is an NP-hard problem.

   The huge search space of all possible orderings of optimization phases and the intractability of solutions to unknown interactions provides us with the perfect opportunity to use machine learning techniques specifically reinforcement learning to create intelligent compilers that can change their behavior depending on the code, the hardware, etc.

2. Links to past coding project in Python or C++.

- GSoC 2021 with ML4Sci | Equivariant Neural Networks for Classification of Dark Matter Substructure | by Apoorva Vikram Singh | Medium: Link to Code
- DynG2G: An Efficient Stochastic Graph Embedding Method for Temporal Graphs: Link to the research paper
- Movie Recommendation System
- Patient Case Similarity, Smart India Hackathon
- Text classification using LDA and GCN: Link to the research paper
- UNIX Command Line Prediction: Link to the research paper