Statement of Purpose
Makkunda Sharma

I want to pursue a masters in Advanced Computer Science at Oxford as it will help me pursue my long term goal of getting a PhD in computer science .

My Research Experience
AI for Social Good

I currently work at Wadhwani AI, a non profit working on AI for social impact in India . My current project is our pest management solution where we are working on early pest detection for cotton farmers and the app we have deployed is being used by around 10,000 farmers . The deep learning part of the app has two parts - first we classify whether the image uploaded is valid or not, and if it is a valid image we count the pests present in the image using object detection, and based on the counts of the types of pests present, we suggest to the farmer, whether to spray pesticide or not. It has been an intense learning experience,because when you deploy models into the real world, you are faced with questions which you would generally never consider, such as impact of your models output on future usage, leading to decisions on should you hedge your prediction bets, choosing worse performing models if they have lower false positive rates and so on, and because we are working in the global south, we also have to keep in mind bounds on both size and memory consumption, leading to interesting design challenges.

My previous project was on diagnosing covid from cough sounds where we used a CNN on the mel spectrogram representation of the cough sound to diagnose covid. We wanted to deploy this model in the field but we were not able to because in every forward testing step(where we simulated deployment by testing on new incoming data), we saw that the model performance fell drastically compared to our test and validation splits. This led us to question the quality of our splits , and then when we looked in the relevant literature we found that while multiple papers were available on covid diagnosis, nobody was doing it on clinically relevant splits . This led to a workshop paper in ICLR 2021 , where we showed that although the model was able to generalize when split in time, or split across multiple sites, performance significantly varied and both were noticeably worse than the random split used in literature .

Applied Deep Learning

Apart from my work at Wadhwani AI, I worked with Prof. Mausam for an independent study on Open IE-Based Science question answering where we built a memory network based architecture to answer multiple choice science questions using external knowledge.The project explored various various ideas in the NLP space.Initially we were using LSTMs to encode the statements but with the emergence of transformer based architectures we replaced it with a BERT encoder.It was a very good learning experience in trying to incorporate the latest research in your work.

The summer before I interned at the Big Data Experience Lab, Adobe Research with Dr. Vishwa Vinay where we worked on Query Reformulation for Image Search where we built a multi-task model for query reformulation and result-ranking using search session data . The work was accepted in ECIR,2020.

Before that I was a member of the computer vision group at IIT Delhi and worked with Prof. Subhashis Banerjee in a project on "monitoring development using high resolution satellite images" where we developed a deep learning based tool for accurate prediction of development and socio economic indicators from high resolution day time satellite imagery. We did end-to-end training for a deep convolutional neural network based on VGG to build a model for regression of asset indicators from satellite images.

My Academic and Programming Background

I feel I am academically suited for the program as I have always been a strong student in a rigorous undergraduate computer science program at IIT Delhi and was awarded a certificate of merit for being in the top 7% of academic performers in 5 semesters during that time. For the practical part of the course, I am a competent programmer with significant experience in c++ and python, and I qualified for the regionals of ACM-ICPC for three consecutive years. I also have significant experience in training and deploying deep learning models which I have acquired during my research fellowship at Wadhwani AI.

My Research Plans

I would like to do research in either applied or theoretical machine learning. While I do not have any actual experience of research in theoretical machine learning, I have extensive applied experience where we use neural networks in various use cases, and I want to gain a deeper understanding of when and why the models work or do not work. In preparation for that I have also done rigorous courses in probability, linear algebra, numerical methods, as well as proof based courses such as discrete math, algorithms with very good grades.

Future Plans

My short term goal is to pursue a PhD after the masters. After doing my PhD, I want to stay in academia and work as a professor, as along with research I have also had positive experience in teaching during my undergrad when I TA-ed varied courses from NLP to Operating Systems, and mentoring interns during my research fellowship.I found that interaction with students brought a clarity on the topic which was not present before.

Why Oxford

I feel the masters program here at Oxford will set me up for the future by giving me an opportunity to do rigorous research and write a thesis, and also firm up my fundamentals by allowing me to attend courses which are rigorous as well as being at the cutting edge in material.