Imperial College London

A UROP perspective by Olivia Cai

- Year 2 in 2021-2022: BSc Earth and planetary science, Department of Earth Science & Engineering
- **UROP: Summer 2022** (undertaken in the Department of Earth Science & Engineering)
- **UROP Title**: Machine learning and physical-informed modelling for efficient and accurate pollution prediction

I came to know about UROP for the first time through an email in the middle of year two from our Department, which encouraged us all to consider the benefits of the UROP scheme. As it happened, I was already thinking about pursuing such opportunities because I had undertook some small-scale research projects before coming to university. Without hesitation, I intensified my search for staff who focused on research topics which I was interested in. I used the College's website to search the background of academic/research staff, and I decided to contact Dr Fang, who was an expert on modelling/predicting air pollution. Luckily, after a short meeting with Dr Fang, she agreed to supervise me for a UROP project. It's exhilarating for me because I have been fascinated by the research behind solving environmental issues since high school. In great probability, I will also work in this field in the future. Although I didn't obtain a bursary because of fierce competition, I was able to support myself for the UROP since in my opinion, this experience was unique and priceless.

When mentioning motivations for doing UROP, especially for this particular research experience, I would say firstly that air pollution, as everyone knows, has become a global concern, and it's necessary to manage and control pollution as early as possible. Predicting the pollution level was undoubtfully an excellent way to achieve that. Secondly, this experience gave me a brief idea of what a master's and PhD life will look like and prepare myself better. Moreover, this experience was one step toward future careers.

Before starting the UROP, I watched some machine learning teaching videos on YouTube. Deep Learning AI was a perfect channel for absolute beginners like me. After gaining theoretical knowledge and doing revisions on my year one python lectures, I learned codes related to machine learning in pollution on GitHub. Then, most importantly, I planned my project in weekly detail and discussed the plan with Dr Fang. So, I practised my planning skills and time management skills.

Following is a list of skills/experiences I gained from this research experience.

- Select and use a range of communication skills and media.
- Process, analyse and interpret the given data using python (I have analysed the influence of variables and the effect of different machine learning models: CNN and LSTM, on the prediction of air pollution (PM2.5)).
- Solve problems and take decisions critically and flexibly.
- Be more sophisticated at coding.
- Build a foundation for future machine learning study.
- Learn Basic machine learning theories and codes (LSTM and CNN specifically)
- Be more confident in self-learning.
- Improve my research skills.
- How to work with seniors and professors.

In the weekly meetings with Dr Fang and one of her PhD students, we not only discussed problems I met during the project but also talked about future careers and plans. Through conversation with Dr Fang's PhD student, I got a clearer picture of PhD life and combining it with the UROP experience (like a mini-PhD), I started to think about whether I would like this kind of life mode. So far, I have enjoyed it a lot, but I remain unsure whether I would prefer to work in a company next few years. Therefore, I am going to apply for an internship next summer. However, I can be sure I will most likely undertake a master's degree because I really enjoy university life, and it will benefit me no matter what I choose. This experience has inspired me a lot about the future and motivated me to work smarter and harder to embrace a better future. If I have spare time next summer, I still want to have another UROP to go further on machine learning in air pollution with Dr Fang. Overall, I appreciate Dr Fang and her team for giving me this chance to prove myself. They taught me things beyond academia and about life in general. I highly recommend UROP to other undergraduate students because you will learn and progress a lot!