Background

I am currently a fourth year Ph.D. student supervised by Professor Joemon Jose in school of Computing Science at the University of Glasgow. My research spans many interesting topics, including recommender system, machine learning and information retrieval. In 2017 I was awarded £4200 by the Jim Gatheral Travel Scholarship to fund a two month visit to National University of Singapore (NUS).

Reasons for applying for the scholarship

My research focus is to develop fast and effective machine learning (ML) algorithms for the optimization of embedding models from positive-only data. The application scenario occurs in numerous domains, such as natural language processing (NLP), computer vision (CV), and recommender systems (RS). The main challenges of this research lie in two aspects: (1) the number of positive and missing examples are highly imbalanced in real-world datasets. However, most machine learning algorithms fail to deal with imbalanced data. (2) The number of missing examples can scale to billion or even trillion level, which typically leads to very expensive computation costs. As a result, my research focuses on both efficiency and effectiveness of a learning algorithm.
During my PhD studies, I have achieved good theoretical backgrounds and practical skills in the field of traditional ML. Also, I have published many research works in prestigious conferences, such as CIKM, WSDM and AAAI etc. However, it is well known that computing science, or AI more exactly, is a fast developing field. In recent two years, deep learning (DL) has attracted more attention and become the dominant technique in almost all application fields of ML. It is the same in my area, some newly proposed algorithms that are based on DL have been proven to obtain significant improvements by contrast with traditional shallow models. I have also noticed that applying traditional ML techniques to optimize shallow models is well established. As a result, I believe I should adjust my research direction from traditional shallow ML algorithms to more deep models for future work. Before applying the Jim Gatheral scholarship, I have spent several months surveying related DL literature. I noticed that Dr He at NUS is one of best researchers in this area. Some of his papers have got more than one hundred citations since they were published last year. In particular, I am very interested in his new SIGIR paper that introduced a deep Factorization Machine (FM) model and it was very close to my previous work LambdaFM.

On the other side, we hope to strengthen collaboration between institutions, for example, building connections with the multimedia information retrieval group led by Prof Chua Tat-Seng at NUS. Prof Chua is active in the international research community. He is also the conference co-chair of ACM Multimedia 2005, ACM CIVR 2005, and ACM SIGIR 2008. By the collaboration, we hope to strengthen cooperation and exchange students with NUS in the future.

**Details of my visit**

I spent about two months from the beginning of February to the end of March 2018 in Singapore. During the time, I have done a lot of research work with the multimedia IR group at NUS. I submitted two research papers in the top conferences, including using deep learning for sequential recommendation, and using full sampling technique for word embedding and recommendation tasks. I was also invited to attend the weekly seminar to discuss recent research progress and give talks about my PhD work.
NUS has many good researchers and powerful computing resources. To make full use of the computing resources, I completed a lot of deep learning experiments. For example, during my stay there, I built a deep generative model for recommender systems. Unlike previous work, we propose using an efficient convolutional network to model sequential data rather than relying on the popular recurrent neural networks (RNNs). We have also successfully adapted many optimization techniques that were previously used in computer vision for collaborative filtering. By evaluation, I find our model outperforms most state-of-the-art learning algorithm in this field. The other work is about how to apply batch gradient method for learning from positive and unlabelled data. To the best of my knowledge, our proposed method is the first successful work that is optimized by batch gradient method, considering both effectiveness and efficiency.

At NUS, I met a lot of new friends with different backgrounds. Regular discussions and group meetings with Dr He, Prof Chua and some other researchers were incredibly helpful. With so many help, I find my research progress is much faster than before. Although catching conference deadlines is exhausting, I feel my life at that time is still wonderful because I have achieved many new skills and done many good works. On weekends, we usually went to a proper Chinese restaurant to try some tasty food and drank beers. What an amazing life!

Singapore has not only great food but also very beautiful natural views both in the downtown area and outside the downtown. On weekends, I have explored almost all well-known tourist attractions in Singapore, including the famous Sentosa island, Palawan Beach, Marina pier, Gardens by the Bay, Chinatown, Bukit Timah Mountain, Sungei Buloh Wetland Reserve and two great islands- Saint John and Kusu Island. Taking the boat and fishing on the sea is a wonderful experience!

**Impact of the Travel Scholarship**

The opportunity provided by the Jim Gatheral Travel Scholarship is valuable. It gave me the chance to cooperate with the best researchers in my field and visit the best university in Asia. Besides the submitted papers, we have also created a new idea and intend to co-write another research paper if the results are satisfactory. When I came back to Glasgow,
I am still keeping in contact with many NUS people and will strengthen the collaboration further in my future work.

The experience of staying in Singapore is an unforgettable memory. The weather, views, culture and customs are totally different in UK. I appreciate that I have the opportunity to stay in two of the most beautiful countries in the world. Making new friends, enjoying local food, beautiful views, and doing excellent research are what I gained in Singapore.

I would like to express my sincere gratitude to the University of Glasgow, Jim Gatheral Travel Scholarship and National University of Singapore. Thanks to my PhD supervisor Prof Joemon Jose for recommending me as the candidate for the Jim Gatheral Travel Scholarship, and thanks to Prof Chua and Dr He for the invitation to NUS.