Dear Professor:

Nice to meet you! Firstly, I should appreciate it that you read my e-mail during your busy time.

My name is Qitong Zhao, I finished my undergraduate degree in mathematics at University of California, Santa Barbara and now is a graduate student at Columbia University in applied mathematics. My past learning, research, and intern experience so far were mainly focused on some topics in Numerical Methods and Scientific Computing, Python Data Visualization, Statistics and Probability, Partial Differential Equation, Differential Geometry, and large language model. （后面补充新东方科研）

So I luckily found your information on the website of the Department. Since I have relatively solid background in mathematics, applied mathematics and statistics supported by my graduate GPA level at Columbia University is 3.67/4.00, as well as in the process of publishing a research paper in signal processing（跟付费项目那边再次确认）. I really yearn for joining your research group and am applying for（项目名称）recently, I would like to ask if you have any possible research positions next year 2024 Fall?

Here are my mainly related learning and research experience in numerical methods, statistics, python data visualization and large language models.

In numerical methods and scientific computing experience: I take some advanced courses in numerical methods, for example, I get an A in the graduate course introduction to numerical method, also an A level score in the course of methods in computational science. In the course methods in computational science, I and my classmate finished the course project which is based on the paper, Preconditioning Sparse Matrix with Alternating and Multiplicative Operator Splitting, and wrote a report (as an attachment). Additionally, during my research with Song Zhao who is a researcher in Adobe Research, I read a lot of papers about computational methods. For example, in the paper Fine-Tuning Language Models with Just Forward, there is an introduction of the algorithm of MeZO (Memory-efficient Zeroth-order Optimizer), which could be used to optimize large language models with billions of parameters. Also, I made a slide for this paper for Song Zhao (as an attachment). Another computational-method paper I read is Faster Matrix Multiplication via Asymmetric Hashing. Coppersmith-Winograd algorithm, which generates the relatively small complexity exponent () for matrix multiplication, is cited in this paper and used by researchers to generate a smaller bound.

In probability and statistics, during the 2021 summer at Chinese Southwest University, under the guide of Professor Tingyong Feng, we conducted two research about pupil’s academic procrastination. The first one is Statistical Analysis on Cognitive Factors of Pupil’s Susceptibility to Academic Procrastination and the Developmental Characteristics. We firstly adopted the overall sampling method to collect experimental data and filtered out 4,120 sets of valid data from 5,048 sets of data by using the format of questionnaire survey. Then we performed the independent t-test, correlation analysis and 4 by 3 ANOVA to analyze individual differences in students’ academic procrastination behavior. By applying the regression analysis, correlation analysis and one-way ANOVA, we analyze 4 cognitive susceptibility factors that affect pupil’s academic procrastination behavior such as self-control and emotion regulation. The other research is The Empirical Study of the Mechanism of Cognitive Susceptibility Factors in Decision-making of Academic Procrastination. I still assisted in experimental design, data collection and preprocessing as I did in the first research, and then we carried out hierarchical regression analysis to explore the predictive effect of self-control ability on procrastination decision-making. I also partook in establishing an intermediary model to explore the cognitive mechanism of self-control on delayed decision-making. After employing the multiple linear regression model, we investigated the moderation effect of emotional adjustment difficulties in task utility and procrastination tendency.

In python data visualization, during the 2021 Fall, I took my remote intern with a master supervisor, Yuhang Liu, in Institute of Computing Technology, Chinese Academy of Sciences. During my intern, I realized various data visualization charts using python, modeled and solved linear equations and numerical derivation using NumPy Package in python. Dr. Yuhang Liu also asked me to attend the seminar which is held by Professor Naihua Xiu in Beijing Jiaotong University Mathematics Department. The seminar is about Professor Naihua Xiu’s research on the application and existing problems of the 0/1 optimization model and the research status quo of data science. I also wrote a summary for this seminar (as an attachment).

In large language models, during my research with Zhiqi Cheng, who is a research associate in Language Technologies Institute, Carnegie Mellon University, I read a lot of papers about large language models. Even though I haven’t taken any courses about large language model before, but I really think this is what I want to learn and dive into. Not only because this has been a popular topic recently based on the rise of Chat-GPT, but I think it is an amazing discipline where we aim to make computer act and think like human beings. I have begun to get touch on it. Under the guidance of Zhiqi Cheng, I read Solving Quantitative Reasoning Problems with Language Models, Math Prompter: Mathematics Reasoning Using Large Language Models, GPT-4 Techanical Report, DoReMi: Optimizing Data Mixtures Speeds Up Language Model Pretraining, and Skill-it! A Date-Driven Skills Framework for Understanding and Training Language Models. After reading those papers, I feel like I am more confident to learn this stuff in my future doctoral career.

In related course working, I take some other related undergraduate and graduate level math and statistics courses, for example, I got an A level score in math courses like abstract algebra and intro real analysis, and an A- in partial differential equations. In statistics courses, I also got an A level score in probability theory and probability & statistics, which both become the top in the class.

I will feel very honored and lucky if you can supervise me in person during my future graduate researching period. To introduce me better, herewith I enclose my course projects in applied math and slides I made in my research. I am looking forward to hearing from you soon!

All Best Wishes!

Qitong Zhao