Dr. Han Liang Wee, Eric

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To: **School of Computing**   Tuesday 7th May, 2024
Search Committee Chair
Associate Professor Prateek Saxena
School of Computing
National University of Singapore

Dear Associate Professor Prateek Saxena,

I am writing to express my interest in the Educator Track Faculty Position in the Department Of Computer Science (NUS Portal Requisition ID: 24619). With a passion for Computer Science, a dedication to excellent teaching and many years benefitting as an undergraduate and graduate student in SoC, I am excited about the opportunity to contribute back to NUS and SoC.

Throughout my doctorate journey, I have been teaching undergraduate Computer Science classes spanning across AI/ML and Software Engineering as a 'Graduate Tutor' and 'Teaching Assistant'. I am currently 'Teaching Assistant', with more than 5 years of experience (with more than 500 teaching/contact hours) in teaching lectures, tutorials, and consultations. This role has not only allowed me to refine my communication skills but also to play a pivotal part in educating and inspiring the next generation of computer scientists. My responsibilities extended beyond classroom instruction to include the management and mentorship of undergraduate tutors, developing grading rubrics, exam questions, and module tools. In recognition of my dedication to teaching excellence and my ability to effectively convey complex concepts, I was honored with the Full-Time Teaching Assistant Award in 2023. I am committed to teaching excellence and possess the necessary teaching experience for this position.

My doctoral research is primarily in the areas of Artificial Intelligence (AI), and Machine Learning (ML), specifically focusing on developing advanced techniques to mitigate the challenges inherent in Bayesian Optimization - including high-dimensionality, large datasets, and enhancing robustness. I presented my research and have first-author publications in premier conferences, such as AAAI and ICML. I have more than 5 years of formal research experience in Computer Science.

Enclosed is my curriculum vitae, teaching statement, research statement which provides additional details about my background and qualifications. I am grateful for your consideration of my application.

Warm regards,
Eric Han

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Teaching Philosophy / Statement

My philosophy of education is that students who are inquisitive about the subject are effective learners. I believe effective learning is primarily driven by an innate desire to learn the subject rather than a need to learn (secondary). Hence, I am very focused on creating an environment that fosters each student's desire to learn. Specifically, I believe three elements foster a learning-positive environment: (1) Creating a relaxed and safe environment. (2) Engaging students to facilitate learning in and after class. (3) Creating equal opportunities for all students to learn. Here, we discuss each of the elements.

(1) Creating a relaxed and safe environment

Creating a relaxed and safe environment is important to students as it primarily relieves stress from learning. In other words, the primary driver for learning is not "needs" but "wants" - not primarily exams/grades driven in their learning. This allows students to make mistakes during learning without worrying about their grades, focusing more on understanding the material rather than on avoidance of mistakes. I am casual in my teaching communication, for example, sharing my personal struggles (successes/failures) in learning the topic and discussing my thinking processes and approaches to understanding the topic. These approaches are reflected clearly in the student feedback: "Eric keeps the sessions informal and casual, an environment where the best learning takes place in my opinion. By keeping the knowledge–sharing lighthearted, he is able to retain the attention of students well while keeping it entertaining and engaging. Very few TAs have been able to do that in my experience and it makes him stand apart as an educator.". I am encouraged by students who observed my effort and have benefitted greatly from that. I am especially encouraged by a student Undergraduate Teaching Assistant (UGTA) who enjoyed this relaxed and safe learning environment and plans to create such an atmosphere in his class. I plan to continue on this path, especially now that Safe Management measures are lifted, I plan to increase student interaction during my tutorials to further support this relaxed and safe environment.

(2) Engaging students to facilitate learning in and after class

Students benefit the most from timely feedback - engaging students in the class via in-class participation and giving students appropriate and timely feedback is important for their learning. It is important to students as they get to know whether they are on the right track or not and not spend too much time going in circles. Participation helps clear up misunderstandings of the subject; Students can benefit directly from in-class feedback. Over the years, I have been growing more in this aspect - getting students to participate in buddy discussion and live Q&A in class, getting students to recap a concept in class, improving access via the use of telegram DMs and groups as a more accessible platform for students, and also getting to know the students personally via small-talk before or after class. Such efforts have been noticed by the students over the years - "Very engaging.", "Engaging, takes time to explain to students some concepts". From my reflections over the years, I am convinced that engagement is important to building effective learners and reflects not only in the student feedback but also in their academic performance. I plan on continually improving my engagement; I will focus on face-to-face engagement, such as in-class discussions to engage students.

(3) Creating equal opportunities for all students to learn

Even though modules have prerequisites, students come to my class with varied backgrounds and levels of understanding of prior knowledge. Weaker students need more help, and some-

times they do not ask for help. These students need to be able to catch up, or else they can run the risk of giving up or being left behind in terms of understanding. I would pay close attention to students who regularly do poorly in their weekly assignments and those who frequently fail to be engaged in class. I would go out of my way to help these students, personally reaching out to them and offering them help. I would also challenge stronger students to solve harder problems, to encourage and inspire them to learn beyond what is required. This is reflected in the student feedback - "Excellent tutor. Goes out of his way to help students. Incredibly easy to approach.", "Going the extra mile by putting in extra effort to ensure that we understand certain concepts, and ensuring that we can all attend classes", and "He shows knowledge and passion in what he teach, even to the extend of implementing his own wordle bot. It does helps to inspire students in addition to the strengths already mentioned". More importantly, after my intervention, I have observed an improvement in the weaker student's grades and engagement. Reflecting on their feedback, I will continue to ensure that students of all levels can have opportunities to learn and, importantly, for weaker students to catch up. An area that I have yet to try would be to get the stronger students to help the weaker students and that is where I plan to improve further.

Teaching Excellence

I have been improving my teaching quality as a *Teaching Assistant/Graduate Tutor* as discussed from the three elements and the impact narratives from the Student Feedback comments and observations on student performance. Here, I discuss a more macro view of my consistent and sustained performance over the years. The macro picture as seen in Table 1 supports the micro evidence as discussed above in the 3 elements; I consistently received high nominations for teaching awards (> 15%) and high/very high Student Feedback (SF) ratings. I note that the score for CS3217 should be taken in the context where I am teaching CS3217 for the first time and am also teaching another module at the same time. In addition, I have taught a variety of undergraduate modules (5 in total) - CS2109s (x2), CS3217 (x1), CS3243 (x2), CS3203 (x5), and CS2030 (x1); which is a larger variety than required for *Graduate Tutor* who are expected to be kept in 2-3 modules while pursuing a PhD. These modules span across Artificial Intelligence (AI) / Machine Learning (ML) and Software Engineering (SE). In recognition of my dedication to teaching excellence and effective communication, I was honored with the Full-Time Teaching Assistant Award (FTTA) in 2023.

Summary

In summary, I have successfully refined and applied my teaching philosophy to the student's benefit primarily in tutorial teaching. A learning-positive environment is important for effective learning, especially for difficult content. Though not required, I have volunteered to take on other tasks such as designing exam questions (finals/midterms), running tools lectures, working with the module lecturer to improve grading rubrics, and more, where I apply my teaching philosophy wherever I contribute. Aside from the micro and macro evidence, my dedication to exceptional teaching has been formally acknowledged via award of FTTA.

> *"The best TA i have ever met in my 3 years in NUS. He go above and beyond what is expected of him by the students. He is concern about our wellbeing and often encourage us to do better."*
>
> - CS3203 Student, *AY2018/19 S2*

Warm regards,
Eric Han

Table 1: Summary of Student Feedback (SF) ratings (/5.0) and Nominations over the years.

Yr.	Code	Module Name	SF	Nominations	Type
23/24 S2	CS2109s	Introduction to AI and ML	-	-	Tutorial
23/24 S1	CS2109s	Introduction to AI and ML	4.6	4/13 (30%)	Tutorial
22/23 S1	CS3243	Introduction to AI	4.8	8/25 (32%)	Tutorial
21/22 S2	CS3243	Introduction to AI	4.5	12/39 (31%)	Tutorial
21/22 S2	CS3217	SE on Modern App. Platforms	3.8	0/6 (0%)	Tutorial
21/22 S1	CS3203	Software Engineering Project	3.7	5/161 (3%)	Lecture
19/20 S2	CS3203	Software Engineering Project	4.6	8/13 (61%)	Recitation
18/19 S2	CS3203	Software Engineering Project	4.4	5/16 (31%)	Tutorial
18/19 S2	CS3203	Software Engineering Project	4.8	11/18 (61%)	Recitation
18/19 S1	CS3203	Software Engineering Project	4.1	2/20 (10%)	Tutorial
18/19 S1	CS3203	Software Engineering Project	3.3	1/3 (33%)	Recitation

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Research Statement

My primary research interest lies in scaling Machine Learning (ML) models to accommodate higher dimensions and large datasets, with a particular focus on scaling Bayesian Optimization (BO). Many optimization problems of interest are high-dimensional, and scaling BO to such settings remains an critical challenge. In addition, I am also interested in addressing robustness in ML systems, exploring how these models can remain effective and reliable under various operational conditions and adversarial scenarios.

Introduction

At the core of my PhD research interest is BO, which is an effective method of optimizing black-box functions that are expensive to evaluate. This optimization framework is important and effective for applications such as hyperparameter tuning, for example:

1. (Yang, 2024)[1] found that BO can effectively hyperparameter tune feature selection method and has the potential to considerably benefit downstream tasks.

2. (Chen, 2018)[2] used BO to automatically tune AlphaGo's hyperparameter, resulting in an improved win-rate from 50% to 66.5% in self-play games.

High-profile applications like AlphaGo highlight the growing significance of BO as ML models become more complex and require larger datasets.

PhD Work

I studied and addressed scalability and robustness issues surrounding BO:

1. **(AAAI 2021)** Scaled BO to higher-dimensionality via decomposition and learning of its tree-structured dependency graphs, presenting a hybrid graph learning algorithm and a novel zooming-based method allowing optimization on continuous spaces. Model complexity is traded-off to enhance model efficiency and retain sample efficiency. It has birthed follow-up work that instead uses random tree decompositions.

2. **(ICML 2022)** Investigates adversarial attacks on BO by proposing various attack methods based on the attacker's knowledge and strength, and demonstrates that these attacks can effectively manipulate the algorithm's output with a limited budget.

3. **(Ongoing Work)** Used BO for adversarial attacks on Convolutional Neural Networks (CNNs) in a black-box hard-label setting, utilizing domain knowledge for dimensionality reduction and introducing query-efficient hyperparameter selection.

Future Directions

(Xu, 2024)[3] challenges the prevailing belief that BO is ineffective in high-dimensionality, showcasing the cost (performance) of introducing strong additional assumptions. I would like to examine and explore applying alternate scaling techniques such as borrowing the idea of dropout[4], having different stages of BO on sampled data. With different trade-off characteristic, it can encourage wider applicability of BO.

Warm regards,
Eric Han

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1. https://www.nature.com/articles/s41598-024-54515-w
2. https://arxiv.org/abs/1812.06855
3. https://arxiv.org/abs/2402.02746
4. https://www.ijcai.org/proceedings/2017/0291.pdf

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Experience

National University of Singapore

8 Aug 23 - 30 Jun 24 | *Teaching Assistant*
Continues from previous: Teach lectures, tutorials and consultations; Grading; Manage tutors; Mentor new tutors; Develop grading rubrics, exam questions and module tools; Taught 2 Sophomore-level, 8 Junior-level modules with more than 500 teaching/contact hours.

8 Aug 18 - 7 Aug 23 | *Graduate Tutor*

Jul 17 | *Tutor for Intro to Programming Workshop*
Teach freshmen on computational thinking, programming.

Scanteak

Dec 17 - Apr 18 | *Quality Control IT Project*
Studied Scanteak's supply chain, proposed automation to improve QC in procurement.

Agency for Science, Technology and Research

Dec 15 | *Research Intern – A Cloud-based Collaborative Model Building Platform*
Continues from previous: Design, implement & deploy dockerized, distributed ML platform.

May 15 - Jun 15 | *Research Intern – Autonomous Machine Learning using HPC Approaches*

Jan 13 - Jul 13 | *Research Intern – Route My Day (Recommendation System)*
Design, implement & deploy visualization website, distributed web crawler & MongoDB cluster.

Education

Doctor of Philosophy (PhD) in Computer Science, National University of Singapore

Aug 18 - Jan 24 | *Focus is in AI / Machine Learning / Optimization - High-Dimensionality and Robustness.*

Bachelor of Computing (Computer Science), National University of Singapore

Aug 13 - Jan 18 | *Graduated With Honours (Highest Distinction) in Computer Science, with Turing Programme*

Student Exchange, USC Viterbi School of Engineering

Jan - May 16 | *Grade Point Average (4.0/4.0); Best student in CSCI 420.*

Achievement

Awards

21 Apr 23 | *Full-Time Teaching Assistant Award, National University of Singapore*
Recognition of the high level of commitment to, and achievement of good teaching.

1 Feb 22 | *Certificate of Accomplishment, National University of Singapore*
Long Service Award; In appreciation of the 5 years of service as a Graduate Tutor.

21 Jun 18 | *Outstanding Undergraduate Researcher Prize 2017/18, National University of Singapore*
Individual prize; Final Year Project - Feature Subset Selection using Reinforcement Learning.

29 Jan 18 | *Certificate of Merit in Algo. & Theory Focus Area, National University of Singapore*
Awarded for meritorious performance in the focus area.

15 Jan 18 | *Dean's List Recipient, National University of Singapore*
Named to Dean's List for meritorious performance in S1 AY17/18.

Scholarships

25 Jul 12 | *A*STAR Undergraduate Scholarship, Agency for Science, Technology and Research*
Prestigious scholarship awarded to budding scientists.

Research

Peer-Reviewed Conference Publications

Jul 22	*Adversarial Attacks on Gaussian Process Bandits* *Eric Han*, Jonathan Scarlett Proceedings of the 39th International Conference on Machine Learning
Feb 21	*High-Dimensional Bayesian Optimization via Tree-Structured Additive Models* *Eric Han*, Ishank Arora, Jonathan Scarlett Proceedings of the 35th AAAI Conference on Artificial Intelligence

Service — Service to Research Community

23 Feb 23	*Student Volunteer for 34th International Conference on Algorithmic Learning Theory.*
20 Jan 23	*Session Chair for Workshop on Information Theory and Data Science Workshop.*
11 Apr 22	*Reviewer for 39th International Conference on Machine Learning.*

Service to National University of Singapore

8 Apr 22	*Admission reviewer for Master of Computing applicants (Aug 2022).*
29 Sept 21	*Featured in a PhD programme marketing video.*
3 - 5 Aug 21	*Program Committee for NUS Computing Research Week 2021.* Moderator of the technical panel discussion titled 'Heterogeneity in Federated Learning'.
26 Apr 21	*Admission reviewer for Master of Computing applicants (August 2021).*
18 Oct 20	*Admission reviewer for Master of Computing applicants (Jan 2021).*

Service to Agency for Science, Technology and Research

Jun 19	*Guidance to junior scholar – sharing of experiences.*
4 Dec 15	*Invited Speaker for A*STAR Scholarships Seminar for Undergraduate Studies.*
14 Mar 15	*Volunteer at A*STAR booth at NUS Open Day 2015 – Outreach and promotion.*

Service to Pioneer Junior College

May - Jun 15	*Teaching and sharing on 'Computational Thinking' to junior college students.*

Service to Impact Life Church

Mar 18 - Dec 23	*Head Of Information Technology – Lead a team of >15 volunteers.* Responsible for IT infra., purchasing, software development of Church applications, etc.

Teaching — CS2109s – Introduction to AI and Machine Learning (Undergrad. 4 credits)

AY23/24 S2	*Teach tutorials; Ongoing Semester.*
AY23/24 S1	*Teach tutorials, grading, designing exam questions.*

CS3243 – Introduction to Artificial Intelligence (Undergrad. 4 credits)

AY22/23 S1	*Teach tutorials, review of learning materials, designing exam questions.*
AY21/22 S2	*Teach tutorials, grading, organize tutors for assignment grading, designing assignment grading rubrics, designing exam questions.*

CS3217 – Software Engineering on Modern App. Platforms (Undergrad. 4 credits)

AY21/22 S2	*Teach tutorials.*

CS3203 – Software Engineering Project (Undergrad. 8 credits)

AY21/22 S1	*Support lectures, teach consultations, organize tutors, grading, improve grading rubrics and improve testing tools.*
AY20/21 S2	*Support lectures, teach consultations, organize tutors, grading, maintain testing tools.*
AY19/20 S2	*Support lectures, teach consultations and develop testing tools.*
AY18/19 S2	*Teach tutorials, consultations and support lectures.*
AY18/19 S1	*Teach tutorials and consultations.*

CS2030/CS2030S – Programming Methodology II (Undergrad. 4 credits)

AY20/21 S1	*Support labs and develop sub-flavor of Fedora Linux for virtual exam needs due to COVID-19.*

Competency Computing Platforms

> *Programming Languages*
Python, C++, Java, HTML/CSS, Java/Typescript, Bash.

> *Numerical Computing*
NumPy, SciPy, PyTorch, GPy, etc…

> *Databases*
Firebase, SQL, MongoDB.

> *Typesetting / Presentation Tools*
LaTex, Markdown, Microsoft Office, Google Workspace.

> *Tools / Platforms*
Git, Mlflow, Plotly, Matplotlib, Slurm, Jira, Google Cloud Platform.

> *Operating Systems*
Linux (Fedora; daily driver), *nix administration, Windows, macOS.

Language Proficiency

> *English (Native) and Chinese (Intermediate).*