Sasha Rubin
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Hiring Committee
Department of Computer Science, NUS
Tenure-Track Faculty Position in Artificial Intelligence.

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Background and Esteem. I am a computer scientist with an interest in Artificial Intelligence, especially knowledge representation, logic, multi-agent systems, and automated planning.

My PhD thesis, mentored by Bakhadyr Khoussainov, won the best-doctoral thesis in the faculty of computer science at the University of Auckland (one of seven awardees). I then won a prestigious New Zealand Science and Technology Postdoctoral Fellowship (NZ$224532) on the same topic. I then held various postdoctoral positions, including a teaching position at Cornell University (2008-2009). Since 2012 I've been working in Formal Methods for Distributed Systems, and since 2014 in Formal Methods for Artificial Intelligence. In 2015-2016 I held another individual fellowship, a Marie Curie fellowship (€107000) jointly funded by the European Research Commission and the Institute for Higher Mathematics (INdAM "F. Severi") in Italy, on the topic of Formal Methods for lightweight mobile multi-agent systems, which led to a best-paper award.

Since 2013, I am chair or organiser of 5 events (workshops and conferences). In 2017 I co-founded and co-organised the First Workshop on Formal Methods in Artificial Intelligence (FMAI'17). I serve as a PC member for top AI/MAS conferences including AAAI, IJCAI, and AAMAS. I co-organised the Young Scientists Symposium at IST Austria on the topic "Understanding Shape: in silico and in vivo". I am guest editor of two special issues of International workshops and Italian conferences. In 2017 I served as an external reviewer for the Icelandic Research Fund and the IRISA Master Research Internship (France).

Research. My vision is to bring Formal Methods and Artificial Intelligence closer together. This is motivated by the need to ensure that the systems being built using, e.g., machine learning, can explain their decisions and actions to human users, so-called "explainable AI" (for instance, in healthcare, a diagnostic and prescription system without such features will likely go unused and untrusted). I bring personal expertise on logics and formal methods for temporal, strategic and epistemic reasoning.

The quality of my research can be quickly but roughly gauged from the venues in which I publish (that said, I strongly maintain that the only way to gauge the strength of a paper is for an expert to read it). These include 16 papers [C2-C11, C17, C22, C26, C27, C29, C30] in conferences ranked A* by the CORE ranking (`portal.core.edu.au/conf-ranks/`), 10 of which were published since 2016, as well as a book on verification of distributed systems [B1] (references of the form [X#] are in the attached CV).

Teaching and Supervision. I work hard at finding angles on the material that will engage my students; this often involves finding questions that are fun for students to solve, or engaging students in big ideas. I seek out, formally and informally, talented teachers and educators from who I can learn best practices as well as some pedagogy theory. If I have the opportunity to statistically evaluate teaching strategies and student outcomes then you can expect that I will make an effort to do so.

As evidence of this effort I make some remarks about my teaching at Cornell University 2008-2009. I sought a number of teaching mentors, including Maria Terrell (Department of Mathematics) and

David Way (Centre for Teaching Excellence) to discuss successful teaching strategies, both philosophical and concrete. As an example of innovativeness in teaching, I remark that I noticed that students who had read the relevant chapter of the textbook before coming to class would ask much deeper questions in class. As a result I instituted a "pre-class test" that was administered online and tested whether or not the student had basic knowledge of the contents of the chapter to be covered in class. Although the tests took time to set up and administer, the payoff was enormous to them and me.

Here is a sample of written student responses to my teaching, the first from my teaching at The University of Cape Town, the rest from Cornell University:

- "*I have enjoyed your maths course the most of all the maths courses I've taken so far. Even more than the content, your delivery was excellent. I made the decision during one of your lectures to do honours in mathematics and computer science.*"
- "*Sasha was a wonderful lecturer – very organized, clear, and willing to help anyone with difficulties (proactively, as well – he sought out people who were doing poorly and offered assistance, which was extremely beneficial).*"
- "*The class was interesting, fun, and easier. Professor was very well prepared and made us really understand what we were learning by having us write mathematical formulas in words. Instead of memorizing formulas, he helped us understand what we were learning, why we were learning it and why it was useful.*"

I am open to teaching theory and programming courses at all levels.

I have supervised 8 undergraduate students in research, and have mentored three PhD students of Aniello Murano in Italy. All completed projects and collaborations with students resulted in publications in, e.g., IJCAI, AAMAS.

My usual approach to undergraduate supervision is to discuss possible problems with students and let them pick one to work on. If the student lacks confidence or is unsure about how to proceed, I create a mini-proposal and timeline for them to follow. I meet with students once a week to discuss progress and troubleshoot. I consider undergraduate research successful if the student a) has fun, b) is challenged, and c) produces and publishes novel research.

Integration in the Department of Computer Science at the NUS. My recent breakthrough work [C2,C3] on verification of a very broad class of multi-agent systems (in which agents communicate by *broadcast*), as well as previous work on verification of *probabilistic* systems [C26] and verification of *quantitative* properties [C12, C7, C6, J2], has applications to formal methods for analysis of: social networks like twitter; collusions in e-auctions and e-voting; distributed secret sharing and data-dispersal; games with public moves and bids such as poker, etc. This work aligns with the research interests of **Roland Yap** (constraint programming languages and social networks), **Lee Wee Sun** and **David Hsu** (planning under uncertainty), and **Bryan Low** (multi-robot systems). My recent work in logic in computer science, specifically games on graphs [J5], aligns with the stunning breakthrough result on parity games of **Frank Stephan** and **Sanjay Jain**.

I look forward to hearing from you,

Sasha Rubin