Advith Govindarajan - Application for ACT2019

Background in Category Theory

I've read Categories for the Working Mathematician and Sheaves in Geometry and Logic. Currently I am taking a class in Higher Category Theory and my current research project is on the applications of Automata Categories. I also have some background for the project "Toward a mathematical foundation for autopoiesis" because of personal interest and reading in First- and Second- order cybernetics and in systems biology.

Expected PhD date

Currently I'm making progress towards my Masters degree and expect to complete it May 2020. My thesis is on modelling biological networks (focusing on gene networks) using automata categories. Afterwards, I expect to apply to PhD programs - hopefully in areas close to category theory and its applications to mathematical modelling.

Order of Project Preference

1. Toward a mathematical foundation for autopoiesis
2. Formal and experimental methods to reason about dialogue and discourse using categorical models of vector spaces
3. Simplifying quantum circuits using the ZX-calculus
4. Complexity classes, computation, and Turing categories
5. Traversal optics and profunctors
6. Partial evaluations, the bar construction, and second-order stochastic dominance

Availability of Coming to Oxford

I should be able to make the trip, however, funding may be an issue - especially the cost of lodging.

Statement of Interest

My current career goals align very closely to the ACT - I want to work in applying category theory to real-world problems. My research right now is on applying category theory to biological systems and computation - but I also want to work in the applications of the subject to areas as diverse as philosophy, humanities, logic and the social sciences. The reason category theory interests me is that it reframes how you look at mathematics - it gives you a fundamentally structural view of how mathematics operates. To me, this understanding of structure is really powerful and moreover, useful for thinking about how real-world systems operate. I want to be on the forefront of describing the categorical view of the world, and this is an excellent opportunity to get to that goal, along with meeting others who are like-minded.

Towards my specific research goals, working on any of these projects will provide me with helpful perspectives and experience. Since my current goals are on modelling biological systems using category theory, any experience in applied category theory will be helpful to my research progress - both in the refinement of how I think about category theory and in the process of getting experience writing in

this subject area. Moreover, the conference and the school itself provides tremendous opportunity to talk to people in the field, which will be very useful for knowing how and where I can go to further continue my research goals.

Advith Govindarajan

Present Address
505 S Busey Ave #107
Urbana, IL 51801
(412) 420-0571

Permanent Address
1528 Riva Trigoso Drive
Manteca, CA, 95337
agovind2@illinois.edu

Education	B.S. in Mathematics, Physics	
	: University of Illinois at Urbana-Champaign (QPA 3.73)	Spring 2018
	M.S in Mathematics	
	: University of Illinois at Urbana-Champaign	In Progress
	: Tuition Waiver via Teaching-Assistantship at NetMath	

Research and Experience

TA, Netmath, University of Illinois, Urbana-Champaign — Fall 2018
- Teaching Assistant for Math 285/286 - Differential Equations
- Developed a bank of parameterized test questions in Mathematica-based software
- Graded Exams, Answered student questions

Illinois Geometry Lab: Iterated tent maps and number systems — Spring 2018
- Co-wrote a paper and research poster partially developing the theory between iterated tent maps and continued fraction representations of certain numbers

The Illinois Group on Groups, Geometry, and Other Related Subjects — 2017
- Presented on various topics in Geometric Group Theory, including: Acyllindrically hyperbolic actions, Rips' construction of small cancellation groups, and the Bounded Cohomology of Amenable Groups

Research on the distribution of power sequences — Fall 2017
- Developed theory to explain the local structure of the equidistributed sequences $x^n \mod 1$ for $x \in (0,1)$
- Presented on the topic including visualizations and computations based in Mathematica

Illinois Geometry Lab: Research on games on rings — Summer 2017
- Co-wrote a paper on certain extensions of results in Martin Brandenburg's algebraic game played on rings
- Used MacCaulay2 to write simulations of the algebraic game in order to suggest new results

Research Group in Mathematical Physics — 2016-2017
- Led discussion on papers related to AdS-CFT correspondence and information loss in black holes
- Worked on extending the many interacting worlds formulation of quantum mechanics based in deBroglie-Bohm to quantum field theory

Budapest Semesters in Mathematics: Analysis of metro maps — Summer 2015
- Turned metro maps of different cities into hypergraphs
- Used Octave to analyze and compare different properties of metro maps of different cities via markov chains on the associated bipartite graph

Computer Skills

Python, Java, Mathematica, MacCaulay2, Matlab