Gmail

Applied Category Theory <act2019school@gmail.com>

ACT2019 Application

1 message

Abhishek Shivkumar <ashivkum@berkeley.edu> Wed, Jan 30, 2019 at 9:31 PM
To: act2019school@gmail.com

To Whom it May Concern,

My relevant background in category theory comes largely from self-study out of Riehl's Category Theory in Context and following Lang's Algebra for a graduate course in group theory that I completed in the Fall of 2018. This course used category theory extensively, including, for example, using adjoint functors to prove the Morita Equivalence for matrix algebras, and proving the Frobenius Reciprocity for representations of finite groups in the context of category theory (as well as formalizing the notion that restriction and induction are somehow "dual" to each other, they form a pair of adjoint functors).

I am not a Ph.D student at the moment, though I do plan to pursue higher education in mathematics. I am currently a second year mathematics major.

My order of project preference is as follows:

1. Autopoiesis (Spivak)
2. Partial Evaluations (Fritz)
3. Distributional semantics (Sadrzadeh)
4. Complexity Classes (Hofstra)
5. ZX-Calculus (Backens)
6. Optics (Milewski)

My availability at Oxford for this program depends almost entirely on the level of funding, unfortunately.

To explain my fascination with category theory, I begin with a digression. One fairly well documented example of the linguistic relativity hypothesis is that native Russian speakers are significantly and consistently faster at separating light blues from dark blues than speakers of most other languages; incidentally, Russian is one of few languages that has entirely separate words for light and dark blue. In a very concrete way, the language one has access to determines what one is able to conceptualize (or at least the ease of said conceptualization).

Category theory is a language for mathematics (in the broadest sense) that vastly expands one's mathematical vocabulary, and translates known concepts to disparate domains. The axioms are so sparse, the structure so easily attained. Propositional statements can be formed into a category, with the initial object of the false statement, and the terminal object of the tautology. The categorical product of statements p,q is "p and q," the coproduct is "p or q." This category is symmetric monoidal and dualizable, so implications between statements can be assigned a trace. Results abound from simple assumptions.

This school can help in my career inasmuch as my interests in mathematics thus far have skewed towards algebra, and I would welcome the opportunity to further those interests; in particular, the paper "Behavior Mereology" by Fong et al. recommended for the Autopoiesis project has sparked a deep interest in me. Participation in this school would certainly prepare me better for graduate school, as well as help to solidify my research interests even as I branch out and attempt to build as broad a foundation as I can.

A letter of recommendation for me should be sent to this address shortly, thank you for your consideration.

Abhishek Shivkumar

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Class of 2021

Resume 2019.pdf
105K

Abhishek Shivkumar

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EDUCATION

University of California, Berkeley

August 2017 - May 2021

- Bachelor of Arts, Math and Physics
- Cumulative GPA: 3.8

Relevant Coursework:

- Classical Mechanics
- Discrete Mathematics
- Abstract Algebra
- Real Analysis
- Honors Linear Algebra (with emphasis on Category Theory)
- Complex Analysis
- **Graduate Abstract Algebra**
- **Graduate General Relativity**
- **Graduate Multilinear Algebra/Commutative Algebra**

RESEARCH EXPERIENCE

Lawrence Berkeley National Laboratory — *Research Apprentice*

Sept 2017 - PRESENT

- Working with CERN ROOT toolkit for data analysis
- Writing scripts to parse large data files and produce histograms representing discrepancies between experimental and model data
- Authoring a technical note on sources of error in hadron production and the focusing system for the DUNE particle beam
- Designing and implementing a neural network for classifying proton decay, authoring a technical note and giving a talk to the Particle Data Group at LBNL to present my findings in this area

PAPERS

- Effects of Error in Hadron Production and the Focusing System in the Near Detector of DUNE - 2018, DUNE Internal Technical Note
- Machine learning for proton decay identification and differentiation in DUNE - 2019, DUNE Internal Technical Note

SKILLS

Languages and programs: **python, CERN ROOT**, Tensorflow, Keras, LaTeX, Mathematica, processing.py, pyCairo, FFmpeg

OS: Windows, macOS, Ubuntu, UNIX

AWARDS

Dean's Honors List: Fall 2017

Frank Kraft Award for Freshmen: Fall 2017

Putnam Exam: 2017 - 771st Place, 83rd percentile

PROJECTS

Berkeley Directed Reading Program — *Mentee*

Jan 2018 - May 2018

- Working closely with a graduate student in physics on extensive independent reading in general relativity, mostly using Sean Carroll's Spacetime and Geometry
- Meeting weekly with graduate student mentor in order to discuss the material, solve problems, and explore possible avenues of inquiry
- Attending graduate General Relativity lectures and researching niche topics in gravitation