

An explanation of any relevant background you have in category theory or any of the specific projects areas.

About Category Theory.

I have watched a Category Theory course by Steve Awodey in Oregon Programming Languages Summer School. And with no difficulty when using categorical language in Algebraic Geometry and Algebraic Topology. I have also listened to a short course of Homotopy Type Theory at Peking University by Colin McLarty. Currently, I am doing a research project of Category Theory in my university, it just begins and is looking for interesting topics. But anyway I will read lots of extra materials on Category Theory other than the given background reading and I believe that my understanding of Category Theory will be deeper and deeper.

About specific background of 'Complexity classes, computation, and Turing categories'.

I feel that this topic is rather fit my background. I have studied Software Engineering for about two years, then because of the love of logic, I transferred to Mathematics. So both in Computer Science and Mathematics, I have taken lots of important courses and familiar with these two areas. Especially in logic, which I have put most of the time in, trying to catch every opportunity to learn more about it. The details about the courses I have taken can be found in my CV and personal website. In specific for this project and for this program, I have taken a course of recursion theory in Fudan University Logic Summer School. Which covers most of the contents until Slaman-Woodin Method. And by the way, the Steve Awodey's Category Theory course which I watched was also taught with illustrating the connection between Category Theory and Computer Science.

The date you completed or expect to complete your Ph.D. and a one-sentence summary of its subject matter.

I am currently in MMath Program in School of Mathematics, University of Manchester. The expected date to complete the program is about June 2020. In this program, I need to do a project in the final year but I started one semester earlier, so actually, my project just begins, I am still looking for topics, but the general range is in Category Theory, this has already decided with my supervisor before. Actually, I am very interested in the topic of 'Complexity classes, computation, and Turing categories'. When I was studying Recursion Theory, I felt that some results are in some sense very rely on the special structure of natural numbers, and curious about which property, or to say the structure, is the key point of Recursion theory. I have read part of the first paper in background reading of 'Complexity classes, computation, and Turing categories', I felt in some sense it is exactly discussing what I am concern about. So I am

very willing to do this project and if possible I think maybe I will continue to do around this topic in my next whole final year as my graduation thesis.

Order of project preference

1. *Complexity classes, computation, and Turing categories*, Pieter Hofstra
2. *Toward a mathematical foundation for autopoiesis*, David Spivak

To what extent can you commit to coming to Oxford (availability of funding is uncertain at this time)

If there is no special circumstances happen, I am quite sure that I will go to Oxford, no matter how the availability of funding is.

JINGHUI TAO

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Website: sites.google.com/view/taojinghui
MMath Program of Mathematics
University of Manchester

EDUCATION

University of Manchester <i>MMath Mathematics</i>	Manchester, UK 09/2018 - 06/2020(expect)
Shandong University <i>BSc of Mathematics and Applied Mathematics (then to UoM for Joint-Cultivated Program)</i>	Shandong, China 01/2017 - 06/2018
Shandong University <i>BSc of Software Engineering (transfer to Mathematics and Applied Mathematics)</i>	Shandong, China 09/2015 - 01/2017

EXPERIENCE

Research Project in Category Theory <i>Institution: School of Mathematics, University of Manchester</i> · In progress.	01/2019 - presnt <i>Advisor: Prof. Mike Prest</i>
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Research Internship <i>Institution: Academy for Advanced Interdisciplinary Studies, Peking University</i> · Participate the project of measuring the accurate mature time of Fluorescent Proteins. · Built an improved ODE model which solved the problem of the inconsistency between prediction and experiment. · Built a program with Mathematica® to select the qualified data automatically by Machine learning and generate the statistical result.	07/2017 - 08/2017 <i>Advisor: PI. Yihan Lin</i>
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Undergraduate Research Project <i>Institution: School of Mathematics and System Science, Shandong University</i> · Leader of the undergraduate research group which tried to find a new way to locate the cancer driver gene. · Found a new algorithm which based on topological invariant to abstract the pattern of cancer driver circuit.	06/2017 - 04/2018 <i>Advisor: Prof. Guojun Li</i>
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PARTICIPANT

Fudan University Logic Summer School <i>Department of Philosophy of Science and Logic, Fudan University, Shanghai, China</i>	08/2018
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Attended Courses:

- *Introduction to Recursion Theory*
- *Measure and Category*

Hilbert-Bernays Summer School on Logic and Computation <i>Mathematisches Institut, Georg-August-Universität Göttingen, Göttingen, Germany</i>	07/2018
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Attended Courses:

- *Gödel's Incompleteness Theorems*
- *From abstract mathematics to verified programs*
- *Proof-Theoretic Semantics*
- *Ordinal analysis (with a mini project supervised by Prof. Wolfram Pohlers)*

North American Summer School on Logic, Language, and Information <i>Department of Philosophy, Carnegie Mellon University, Pittsburgh, US</i>	06/2018
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Attended Courses:

- *New type-theoretic tools in natural language semantics*
- *Proof interpretations: a modern perspective*
- *Proof theory: logical and philosophical aspects*
- *Logic and probability*
- *Topology, Logic, and Epistemology*
- *Hybrid Logic*

Fudan University Top-notch Talent Training Program Summer School on Mathematics

08/2017

School of Mathematics, Fudan University, Shanghai, China

Attended Courses:

- Seminar on ZFC Set Theory
- Commutative Algebra
- Advanced Topics in Mathematical Analysis

Peking University Summer School of Quantitative Biology

07/2017

Academy for Advanced Interdisciplinary Studies, Peking University, Beijing, China

Attended Lectures:

- Introduction to Systems Biology
- Computational Genomics and Epigenomics
- Introduction to Computational Biophysics
- Biomolecular design
- The Application of Physical Concepts in Quantitative Biology
- The Next Generation of Industrial Biotechnology
- Biological Signal Transduction Networks and Synthetic Biology
- A new bridge between physics and biology: DNA curtains

ACTIVITIES

Reading & Discussing Group in University of Manchester

12/2018 - present

- Organizer of the Group.
- Topics lie in general area of mathematics, major in those advanced/interesting books which haven't be taught in university.
- The purpose is to enhance the discussions between students and cultivate the ability of independent thinking and self-study.

Algebraic Topology and Category Theory Study Group in Shandong University

04/2018-09/2018

- Organizer of the Group.
- Reading books by ourselves, and get together every week.
- One of us do summary and others give some supplement and new ideas or questions. Then discuss together.

INTERESTS

- Foundation of Mathematics
- Category Theory
- Algebraic Geometry

RELEVANT COURSES

Introduction to Recursion Theory

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Model Theory

Discrete Mathematics

Principles of Computer Organization

Gödel's Incompleteness Theorems

Advanced Logic

Seminar of Algebraic Geometry

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Advanced Programming Language

Data Structures and Algorithms

SKILLS

Java, C++, Mathematica, Matlab

AWARD & MEMBERSHIP

Honorable Mention in American Mathematical Contest in Modeling (MCM)

2018

Student Member of China Society for Industrial and Applied Mathematics

2017

OTHER

Corrected some errors for the textbook 'Methods of algebra: Volume 1' and be listed into the acknowledgments.

2018

Statement

I have interested in Category Theory for a long time. Category Theory shows a great philosophical fundamental transformation of the viewpoint of mathematics from the Set Theory. In set theory, we always think mathematical objects in an intensional way, it is reasonable but always cause some additional troubles. For example, there are many different ways to define natural numbers in set theory, but the Set Theory does not give any extra reasons for us to decide why should we should one instead of any others. What we say 'same structure' is actually a bit vague in set theory. But what category theory do, is clarify what is called 'structure'. 'up to isomorphism' gives us a sufficient dealing about what should not care about. Category theory has already shown its advantage in many branches of mathematics, but in most of the courses I have taken, it was taught with the language of set theory. So I am eager to see how Category Theory could perform in these areas. For example in recursion theory, most of the things treated in it are about natural numbers. I can know from it that natural numbers are really special for example cause incompleteness theorem. But what I do really more care about is why it is so special? or to say what is the requirement of the structure to cause similar results in category theory. We can feel that the natural numbers are too basic, i.e. it looks like be generated in anywhere, for example in Chern–Gauss–Bonnet theorem in Differential Geometry, from closed even-dimensional Riemannian manifold we can get integers to classify different manifolds. In Pieter Hofstra's project, I think I could see a different version of Recursion Theory in the viewpoint of Category Theory. In this pure structural view, I believe we could get more clear results about those questions which I concern about. And because I have begun my graduation project one-semester in advance, if in ACT2019 I find some interesting questions, I would like to use a whole year to concentrate on one question and do some interesting trials. Also, as a fan of Category Theory, I believe Category Theory will also change some of practical sciences. I will very glad to learn, how is category theory be used and how will these area going after influenced by Category Theory.

And, I am also considering my Ph.D., I would like to study pure math in the future. I love pure math, it is so beautiful and nothing could be more fantastic than it. But on the other hand, sometimes how I wish if only I could do something for others. Especially two years ago, one of my classmates left us forever because of cancer. That's why I have taken some Biological summer school and research internship, which you can find in my CV. So, I think in ACT2019, it is also a good chance to find some scientists who want to use mathematical thoughts in their area. I will always glad to try my best to help them with their mathematical problems if I could able to solve it.



reference for Jinghui Tao

1 message

Mike Prest <mike.prest@manchester.ac.uk>

Tue, Jan 29, 2019 at 5:55 AM

To: "act2019school@gmail.com" <act2019school@gmail.com>

This is a reference for Jinghui Tao, who has applied to the Applied Category Theory School 2019.

I am Mike Prest, academic adviser to Jinghui Tao and a professor of Pure Mathematics in the School of Mathematics at the University of Manchester.

Jinghui joined us in September 2019, having spent his earlier undergraduate years at the University of Shandong in Jinan (that university is highly ranked within China). We have a 2+2 arrangement with the Mathematics department there, and the students who have come to us through that arrangement, whereby they enter our Second year and graduate after two years in Manchester, have all been very good to outstanding. We have noticed, in particular, that their background in pure mathematics is very strong. Even among those students, Jinghui is exceptional and, after discussion, we have placed him directly at level 3 of our programme (so he will do the 3rd and 4th years of our MMath degree).

Jinghui is remarkably proactive mathematically. From talking to him it is clear that he does a lot(!) of independent reading (and using online materials) and he is keen to make good use of short courses and the like, as can be seen from his CV. He is certainly thinking like a graduate student. He seems to have identified and brought together a small group of very keen undergraduates with the reading group he mentions in his CV. There is no doubting his passion and interest in mathematics and its relations with other areas. We don't have any formal marks for him yet but I had very positive comments about his work from the lecturers of Mathematical Logic and Galois Theory and I have just seen his raw mark (a strong first class mark) in the (level 4) Model Theory exam, so I am confident that his enthusiasm translates to results.

I will be supervising Jinghui on a 1-semester Category Theory project this semester (next year he must do a 2-semester project but, this year, projects are optional) and I think his main purpose there is to study the topic more systematically than he has hitherto done, so as to have a very solid foundation in the subject (though he already knows and understands a lot).

I am confident that Jinghui will gain an immense amount from participating in this School and that he will be an enthusiastic, interesting and sociable participant.

Yours,

(Prof.) Mike Prest

School of Mathematics

1/30/2019

Gmail - reference for Jinghui Tao

University of Manchester