Tony Xiaochen Xiao

Northeastern University
Department of Mathematics
360 Huntington Ave
Boston, MA 02215

xiao.xiaoc@northeastern.edu

Phone: +1 (408)508-9689
Website: https://tonyxiaochenxiao.github.io/

EDUCATION

Northeastern University, Department of Mathematics
Ph.D. in Mathematics, 2021 - 2026(Expected). GPA: 4.00
Advisor: Jose A. Perea

Northeastern University, Department of Mathematics
M.S. in Mathematics, 2019 - 2021. GPA: 3.95

Beijing University of Technology, College of Metropolitan Transportation
B.S. in Transportation Equipment and Control Engineering, 2015 - 2019. GPA: 3.67

INTERESTS

My research interest lies in topological data analysis (TDA), specifically in generalizing circular coordinates to Eilenberg-MacLane spaces K(G,n) and coordinizations for data with nontrivial persistent cohomology.

GRANTS

Outstanding Students 'Qihang' Plan
Scholarship granted by the university, 04/2018

Scholarship for Excellent Academic Records
Scholarship granted by the university, 10/2017

Scholarship for Excellent Academic Records
Scholarship granted by the university, 10/2016

AWARDS

Beijing Competition of Transportation Science and Technology of Undergrads
Second Prize, Beijing, 11/2018

National College Students Mathematical Contest in Modeling
Second Prize in Beijing venue, 04/2018

'Dingxin Cup' Students' Extracurricular Academic Science and Technology Works Competition
Third Prize at the university, Beijing, 10/2017

The 14th Awarding Program for Future Scientists
National Third Prize, Beijing, 11/2014
Thesis: *Research on traffic problems and solutions in Wudaokou section*
Advisor: Zhenxiang Ye, Tsinghua University

The 34th Beijing Adolescents Science and Technology Innovation Contest
Second Prize in Beijing venue, 10/2014

TEACHING **Instructor:** Introduction to Math Reasoning (MATH 1365), Spring 2022

Teaching Assistant:

Calculus 1 (MATH 1341), Summer 2025, with George Prasanth

Optimization and Complexity (MATH 7234), Spring 2025, with Oana Veliche

Calculus 3 (MATH 2321), Summer I 2024, with John Lindhe

Number Theory 1 (MATH 3527), Spring 2024, with Evan Dummit

Calculus and Differential Equations in Biology, Fall 2023, with Carlos Curley

Applied Linear Algebra (MATH 5110), Fall 2021
Machine Learning and Statistical Learning Theory (MATH 7243), Fall 2021
with He Wang

Introduction to Math Reasoning (MATH 1365), Fall 2020, with Peter Crooks

Introduction to Math Reasoning (MATH 1365), Spring 2020, with Lee-peng Lee

RESEARCH *Extracting Sparse Eilenberg-MacLane Coordinates via Principal Bundles*, 01/2023-Now
Advisor: Jose Perea
Abstract: Let X be a finite data set sampled from an unknown metric space ($\mathbb{X}$,d). The problem this project seeks to address is to develop methods for generating "Eilenberg-MacLane Coordinates", i.e. functions $f : X \to K(G, n)$ characterizing the non-trivial persistent cohomology classes in $PH^n(R(X); G)$. Using the theory of principal bundles, soft sheaves, and Cech Cohomology, we aim to explicit formulas, a stability theory, and algorithms to generate such "Eilenberg-MacLane Coordinates" for any discrete Abelian group G. A complete proof chain of a one-to-one correspondence connecting $PH^n(R(X); G)$ and $f : X \to K(G, n)$ is presented, with an explicit formula for computing these coordinates, and as the following work, an explicit algorithm is being extracted from this proof chain in ongoing research.

Survey of Homology and Cohomology Theory, 05/2020-08/2020
Advisor: Ben Knudsen
During Summer 2020, despite logistic restrictions due to COVID-19, I reviewed Hatcher's *Algebraic Topology* under the supervision of Dr. Knudsen. We had weekly meetings and it helped me with my study of Homology/Cohomology theory.

Vehicle Detection of Aerial Images based on Sparse Representation, 10/2016-10/2018
Advisor: Shaofan Wang
I spent two years with Dr. Wang in researching the vehicle recognition in images photographed by UAV. Based on the sparse representation model, we constructed a Matlab program that can be used to identify vehicles in a given aerial image.

TALKS

Young Topologists Meeting 2025
KTH Royal Institute of Technology, Stockholm, Sweden, 06/2025.

Spires 2024 - 4th Annual Centre for Topological Data Analysis Conference
University of Oxford, Oxford, UK, 08/2024. (Poster Presentation)

Montreal Summer School - Applications of Representation Theory in TDA & GIT
Université du Québec à Montréal (UQAM), Montreal, Canada, 06/2024.

Mid-Atlantic Topology Conference 2024
Northeastern University, Boston, USA, 03/2024. (Poster Presentation)

Graduate Student Seminar at Northeastern
Northeastern University, Boston, USA, 01/2024.

Brandeis Graduate Student Seminar
Brandeis University, Boston, USA, 10/2023.

EXPERIENCES

AMS Graduate Student Chapter at Northeastern University
Vice President
01/2024 - Now

REFERENCES

Ben Knudsen
(Algebraic Topologist)
Department of Mathematics
Northeastern University
b.knudsen@northeastern.edu

Lee-peng Lee
(Teaching Professor)
Department of Mathematics
Northeastern University
lp.lee@northeastern.edu

Shaofan Wang
(Computer Vision Researcher)
Faculty of Information Technology
Beijing University of Technology
wangshaofan@bjut.edu.cn

Xiaohua Zhao
(Data Scientist in Transportation)
College of Metropolitan Transportation
Beijing University of Technology
zhaoxiaohua@bjut.edu.cn

Graduate courses I have taken and am taking at Northeastern:

Courses	Instructors	Grade/GPA	Term
MATH 5111 - Algebra I	Ben Knudsen	A/4.0	Fall 2019
MATH 5101 - Analysis I	Petar Topalov	A/4.0	Fall 2019
MATH 7233 - Graph Theory	Gabor Lippner	A/Audited	Fall 2019
MATH 8450 - Research Seminars in Mathematics	Jonathan Weitsman	A/4.0	Fall 2019
MATH 7301 - Functional Analysis	Petar Topalov	A-/3.67	Spring 2020
MATH 5121 - Topology I	Ben Knudsen	A/4.0	Spring 2020
MATH 7221 - Topology II	Ben Knudsen	A/4.0	Fall 2020
MATH 7303 - Complex Manifold	Alina Marian	Audited	Fall 2020
MATH 5102 - Analysis II	Hsiang Chang	A/4.0	Spring 2021
MATH 5112 - Algebra II	Milen Yakimov	A/4.0	Spring 2021
MATH 7320 - Modern Algebraic Geometry	Peter Crooks	Audited	Spring 2021
MATH 7241 - Probability I	Christopher King	A/4.0	Fall 2021
MATH 7243 - Machine Learning and Statistical Learning Theory	He Wang	A/4.0	Fall 2021
CS 7430 - Formal Specification, Verification and Synthesis	Stavros Tripakis	A/4.0	Fall 2021
MATH 7243 - Modern Representation Theory (Tensor Categories)	Milen Yakimov	A/4.0	Spring 2022
MATH 7234 - Optimization and Complexity	Oana Veliche	A/4.0	Spring 2022
MATH 7721 - Readings in Topology (K-theory)	Ben Knudsen	A/4.0	Spring 2022
MATH 7721 - Readings in Topology (Homotopy Theory)	Ben Knudsen	A/4.0	Fall 2022
MATH 7721 - Readings in Topology (Persistence Homology)	Jose Perea	A/4.0	Fall 2022
MATH 7721 - Readings in Probability and Statistics	Paul Hand	A/4.0	Fall 2022
MATH 7375 - Topics in Topology (Topological Data Analysis)	Jose Perea	A/4.0	Spring 2023
MATH 7223 - Riemannian Optimization	David Rosen	A/4.0	Spring 2023
MATH 5122 - Geometry I	Xuwen Zhu	Audited	Spring 2023
MATH 7359 - Elliptic Curves and Modular Forms	Evan Dummit	A/4.0	Fall 2023
MATH 7362 - Topics in Algebra (Homological Algebra)	Oana Veliche	A/4.0	Fall 2023
PhD Candidacy Achieved			Fall 2023