Welcome to TTIC!

Avrim Blum
Chief Academic Officer
What is TTIC?

A COMPUTER SCIENCE GRADUATE INSTITUTE

Affiliated with the University of Chicago

Supported by an endowment provided by TTI-Japan and Toyota
A COMPUTER SCIENCE GRADUATE INSTITUTE

What does that mean?

- We are a single-department university with one program: a PhD in Computer Science (with a Master’s within the PhD). Currently 42 PhD students.
- Tenure-track faculty who conduct research, advise students, teach classes. Research focused on Machine Learning, Theoretical Computer Science, NLP, Speech, Computer Vision, Robotics, and Computational Biology.
- Closely affiliated with the University of Chicago. Students can (and do) take classes across and can be co-advised across.
- Also have 3-year Research Assistant Professors (RAPs) who add to the research environment.

A research-focused mini-university of Machine Learning, AI, Theory, and applications, closely affiliated with the University of Chicago.
Where are we?
Chicago
Campus of the University of Chicago
Our building
What makes TTIC great (for students)?

- Top faculty, comparable to the best universities in computer science in the world.
- Well-funded. Every student gets a competitive stipend, funded by internal TTIC funds or faculty research grants. Plus equipment funds, travel funds. Students only TA one or two quarters out of their entire PhD.
- Personal attention. 4:1 student-to-faculty ratio. Plus mechanisms to ensure every student has the best shot possible and no student “falls through the cracks”.
- Caring, engaged staff with TTIC’s goals of excellence in mind.
- Highly active research environment: colloquium speakers, reading groups, workshops, Research Assistant Professors, visiting/adjoint faculty, postdocs, and more.
What makes TTIC great (for faculty)?

• Fantastic faculty colleagues and a friendly atmosphere, plus excellent folks nearby at UChicago, Northwestern, UIC, and more. [See RAP testimonials]

• Strong TTIC PhD students, with the ability to also seamlessly work with UChicago PhD, Masters, and Undergraduate students.

• Teaching load is only 1 course/year (tenure-track faculty) or 0 courses/year (RAPs)

• Well-funded, with significant internal research funds in addition to external grants

• Caring, engaged staff with TTIC’s goals of excellence in mind.

• Highly active research environment: colloquium speakers, reading groups, workshops, Research Assistant Professors, visiting/adjoint faculty, postdocs, and more
TTIC Alumni

- Faculty at Cornell, UIUC, Peking University, Edinburgh
- Postdocs at top universities/labs (MIT, IAS, ETH, Brown, Caltech, Columbia, IBM)
- Researchers at top labs and startups (Google, Microsoft, Amazon, Tesla, Genentech, Toyota, Zendar, Adobe, Waymo)
- Two graduates named Sloan Research Fellows. 2020 International Society of Computational Biology (ISCB) Overton Prize.
Recent Student Awards

- Best Paper Award at the 34th Annual Conference on Learning Theory (COLT 2021) and both Best Student Paper awards at COLT 2019.
- Best Short Paper award at the 4th Workshop on Computational Models of Reference, Anaphora, and Coreference, 2021.
- 2019, 2020, 2021 Google PhD Fellowships
- 2017, 2019, 2021 NSF Fellowships
- 1st Place at Max Planck Institute for Intelligent Systems Real Robot Challenge. EUR 3500 cash prize 😊
TTIC Tenure-Track Faculty

Avrim Blum  Julia Chuzhoy  Kevin Gimpel
Zhiyuan Li (joining Fall 2023)  Karen Livescu  Yury Makarychev  David McAllester

Greg Shakhnarovich  Nathan Srebro  Madhur Tulsiani  Matthew Turk  Matthew Walter  Jinbo Xu
TTIC Research Assistant Professors

Sam Buchanan  Lee Cohen  Kartik Goyal  Hongyuan Mei
Saeed Sharifi-Malvajerdi  Ohad Trabelsi  Ali Vakilian  Lingxiao Wang
Derek Reiman  Siddharth Bhandari (joining Jan 2023)
Avrim Blum

- Mathematical analysis of machine learning (Machine Learning Theory)
- Privacy, fairness
- Game-theoretic / incentive-aware algorithms
Julia Chuzhoy

• Approximation algorithms for combinatorial optimization problems

• Network design and routing, graph drawing and partitioning, scheduling, geometric problems

• Limits of approximation
Kevin Gimpel

- Machine translation
- Automatically recognizing paraphrases, understanding narratives – systems that can understand text the way people do and answer questions about it
- Methods for representing commonsense knowledge
Zhiyuan Li
(joining Fall 2023)

- Machine Learning Theory
- Analysis of Deep Learning
- Computational and sample efficiency of optimization methods
• Speech and language processing, speech recognition, acoustic+semantic representations of words and text.

• Statistical modeling techniques that can take advantage of both data and prior knowledge.

• Use of deep learning and connections with computer vision, including sign language recognition, semantic speech retrieval.
Yury Makarychev

- Combinatorial optimization
- Non-worst-case analysis of algorithms
- Metric embeddings and dimensionality reduction
- Algorithms for clustering, community detection in networks
David McAllester

- AI: automated reasoning and knowledge representation
- Machine learning
- Natural language processing
- Deep networks and big questions
Greg Shakhnarovich

- Computer vision and machine learning
- Automatic understanding of visual scenes (and what does it mean to understand a visual scene)
- Recovery of 3-d structure from 2-d images
- Similarity-based, supervised and semi-supervised machine learning methods. Self-supervision.
• Statistical machine learning algorithms
• Optimization
• ML algorithms that satisfy fairness, non-discrimination
• Scalable / distributed / multi-task learning
• Error-correcting codes. E.g., locally-decodable error-correcting codes for high noise rates

• Algorithms for constraint satisfaction problems & understanding of their solvability

• Analysis of semidefinite programming techniques
Matthew Turk

- Computer vision and machine learning
- Augmented and mixed reality
- Human-computer interaction
- TTIC president
• Developing intelligent, perceptually aware robots that are able to work effectively with and alongside people in unstructured environments
• Robot-human interaction
  - Advanced perception algorithms
  - Algorithms that utilize multi-modal observations of a robot's surround (incl user's natural language speech)
  - Robot Summarization: Deciding What to Talk About & How
Jinbo Xu

- Machine learning and data-driven methods for computational biology
- First successful deep learning algorithm for protein folding / protein structure prediction
- RaptorX system for protein structure prediction
- Convex optimization for protein-protein interaction network alignment
Courses (all PhD-level)

**Autumn 2022 [September – December]**
- TTIC 31020 - Introduction to Machine Learning - Instructor: Greg Shakhnarovich
- TTIC 31230 - Fundamentals of Deep Learning (CMSC 31230) - Instructor: David McAllester
- TTIC 31200 - Information and Coding Theory (CMSC 37220) - Instructor: Madhur Tulsiani

**Winter 2023 [January – March]**
- TTIC 31010 Algorithms (CMSC 37000) - Instructor: Julia Chuzhoy
- TTIC 31120 - Statistical and Computational Learning Theory - Instructor: Nati Srebro

**Spring 2023 [March – June]**
- TTIC 31100 Computational and Metric Geometry (CMSC 39010) - Instructor: Yury Makarychev
- TTIC 31150 - Mathematical Toolkit (CMSC 31150) - Instructor: Avrim Blum
- TTIC 31220 - Unsupervised Learning and Data Analysis - Instructor: Karen Livescu
- TTIC 31170 - Planning, Learning, and Estimation for Robotics and AI - Instructor: Matt Walter
Activities

• External talks, including colloquium and distinguished lecture series

• Internal Research@TTIC talk + lunch every Friday

• Reading groups

• Daily tea time

• Workshops and more
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More information at http://www.ttic.edu