# Institute Mission

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Achieving international impact through world-class research and education in fundamental computer science and information technology.

The Research Mission

TTIC aims to achieve international impact through world-class research in fundamental computer science and information technology. Here we clarify the intended meaning of the terms in this statement.

**Impact.** The mission statement focuses on academic impact. A number of criteria may serve to evaluate such impact. These include volumes of peer-reviewed publications; reputation of venues in which publications appear; visibility of work in the community, as expressed in citations by others; number and reputation of co-authors, in particular in other institutions; recognition by the research community, including awards, prizes, invited talks, and invitation or election to serve in senior service positions in professional organizations; reports by external advisory bodies comprised of reputable senior researchers, etc. Precise objective measures of academic impact are controversial and elusive, and no one of the criteria above is alone a solid measure in itself. However, the combined evaluation of these and similar criteria helps assess the academic impact achieved by TTIC researchers.

Note that the number of patents filed, or the amount of extramural research funding, are not considered measures of academic impact. Although funding is clearly an important tool in achieving impact, it is only a tool and not an end in itself.

**Fundamental.** The mission statement is intended to focus on scientifically fundamental research. A scientific result is fundamental to the extent that it has open-ended implications. It is important to distinguish being fundamental from being economically important. A calendar program can be economically successful, and hence important, without adding to fundamental knowledge. The concept of NP-completeness adds greatly to the fundamental understanding of computation without having clear economic significance.

**Computer Science and Information Technology.** Computer science and information technology encompass many sub-disciplines. In the selection of sub-disciplines for study at TTIC, there should be some consideration of relevance to society as a whole. The interpretation of “computer science” and “information technology” should be such that TTIC remains relevant to the societal impact of computation and information.

The Education Mission

The education mission of TTIC is to achieve international impact through the accomplishments of its graduates as productive scientists and citizens. The notion of “impact” in the education mission is broader than in the research mission. Graduates of TTIC may achieve impact by starting successful companies, managing successful products, or influencing government directions in research funding. Of course, TTIC also strives to produce PhDs who achieve academic impact throughout their careers.
The institute strives to produce graduates who contribute to society through their intellectual leadership in computer science and information technology. Success in the education mission requires appropriate selection of curriculum, effective teaching to enable learning, effective assessment and mentorship of students, and effective marketing of students in the job market. TTIC strives to place its PhD graduates at high-quality research institutions.

TTIC also strives to make its PhD students visible to the academic community before graduation. This can be done most effectively through publications prior to graduation.

**Diversity, Inclusion and Equity**

TTIC is committed to effective and compliant policies that foster and expand a supportive and inclusive environment to encourage success for students, staff, and faculty. The institute should exploit the intellectual abilities and talents of all segments of society. TTIC’s collective success in its research and education missions depends on the robust exchange of ideas, as well as on collaboration, innovation, creativity, and broad participation. This requires a dedication to promoting diversity, equity and inclusion in its faculty, staff, student body, and educational programs.

**Vision and Values**

The 21st century will see enormous progress in automation. Automated systems may drive cars, do housekeeping, and translate between spoken languages. But technological progress raises social concerns. Technology must not extinguish our right to privacy, make people unemployable, or destroy cultural diversity. While technology presents important challenges, it also holds great promise. Language translation can reduce misunderstanding. Information management can improve medical care. Communication systems can bring people together. If we can reap the benefits while avoiding the pitfalls, technology may create and sustain harmony and prosperity for mankind. TTIC’s vision is to discover and explore fundamental principles of computation and to improve our world through the technologies those principles enable. At the same time, TTIC is committed to the values of human freedom, dignity, prosperity, and diversity. The institute’s mission and its work have been formulated and are carried out consistent with this vision and these values.

**People**

The strength of TTIC lies in its people. Whether directly involved in research and education, such as faculty and students, or providing the infrastructure and support needed for these activities to take place, all of our people are important to the success of TTIC’s mission. TTIC acknowledges the value provided by each member of its community and aims to provide all its members with the tools and support they need to do their part in advancing the institute’s mission.
The 2021-2022 academic year brought a sense of renewal and enthusiasm to TTIC due to increased in-person activities, including talks and seminars, visiting researchers, reading groups, research meetings, workshops, board meetings, and even our regular afternoon tea times. It has been wonderful to have more face-to-face interaction with one another than was possible in the prior year; additionally, hybrid (both in-person and online) participation in various talks, meetings, and other events has been effective and beneficial. We continue to emphasize safety and caution with respect to the COVID-19 pandemic, but it has not stopped us from doing great research, teaching challenging courses, and continuing to make important and meaningful progress in TTIC’s mission.

As usual, TTIC students and faculty had many research accomplishments, important publications, and completed dissertations in 2021-2022. We held many interesting and enlightening seminars and distinguished lectures, had several successful qualifying exams, and hosted many visitors – some remotely, but many in person. Among the year’s honors and awards, Professor Avrim Blum and his colleagues received the prestigious Paris Kanellakis Theory and Practice Award from the ACM for fundamental contributions to the development of differential privacy. Faculty and students also received several new grants and fellowships from government and industry sources, totaling over $3.2M.

TTIC continues to have a stellar academic reputation due to the accomplishments of our faculty, students, and alumni.

The new group of TTIC Ph.D. students who started in Autumn 2021 quickly adapted to their new circumstances at TTIC and have significantly added to our academic and intellectual community this year. Similarly, new Research Assistant Professors have been great colleagues and have interacted with both students and faculty in research, teaching, grant writing, and more. We welcomed three new administrative staff members (Celeste Ki, Brandie Jones, and Brandi Watson), who have been very important in their roles in support of academic and administrative matters. We were also delighted to welcome a new member to our External Advisory Committee (EAC), Professor Shafi Goldwasser, the director of the Simons Institute for the Theory of Computing at UC Berkeley. We greatly thank Professor Richard Karp, who stepped down from the EAC, for his many years of service to TTIC!

We were very saddened by the passing of former TTIC President and Chair of the Board of Trustees, Dr. Sadaoki Furui. Dr. Furui meant a lot to TTIC, and he cared for the institute deeply. We will miss him.
Although the pandemic still limited opportunities for international travel in 2021-2022, TTIC continued its strong partnerships with TTI in Nagoya, Japan, with three TTI students spending an academic quarter with us in Chicago and our faculty teaching a remote machine learning course for TTI students in the spring, led by Professor Greg Shakhnarovich. A group of TTIC faculty and students visited TTI in Nagoya this summer to participate in a joint workshop, and we have recently had two short visits to TTIC from TTI faculty. Our interactions with the University of Chicago continued strong this academic year, including a new joint funding initiative and discussions with the new President, Paul Alivisatos, about TTIC and collaborative opportunities going forward.

Congratulations are in order to Professor Matthew Walter, who received a promotion to Associate Professor with tenure this year. Matt is a highly-regarded researcher in Human-Centered Robotics, with interests and accomplishments in natural language processing, computer vision, machine learning, and more, focusing on developing intelligent, perceptually aware robots that can work effectively with people in unstructured environments. Matt contributes greatly to TTIC through his research, teaching, mentoring, and much more, and his tenure was very well deserved!

TTIC continues to be a special place for students, faculty, and staff to learn, collaborate, discover, and work, and its reputation reflects this – when I meet people who know about TTIC, they hold it in high regard. I feel privileged to interact daily with colleagues who are current and future leaders in some of the most important and impactful areas of computing.

This has been a successful year for TTIC, and I look forward to the new opportunities and accomplishments in the coming year.

Matthew Turk
President
Message from the Chief Academic Officer

It’s great to be back in person at TTIC. This year we transitioned from almost fully remote operations in 2020-2021 to a hybrid/in-person mix, including reinstituting our tradition of an all-institute lunch every Friday before our Research@TTIC talks. We also had three in-person Distinguished Lectures, both in-person and remote colloquium talks, and even an ultimate frisbee game on the midway to celebrate the end of spring quarter. And we have interns and workshops planned for this coming summer. I must say that it’s fantastic seeing our community in person again, and to again see research discussions going on in our many different collaboration spaces.

Congratulations to Karen Livescu for being selected Program Co-Chair for Interspeech 2022, to Matthew Turk for being appointed to the CRA’s Computing Community Consortium Council, and to incoming student Melissa Dutz for her NSF CSGrad4US Award. Special congratulations to Matthew Walter for his promotion to Associate Professor with Tenure.

As you will see in this report, TTIC students and faculty were highly productive in their research this past year, publishing in major research venues including AAAI, ACL, AISTATS, Bioinformatics, COLT, CVPR, EC, FAccT, Field Robotics, FOCS, FORC, ICASSP, ICLR, ICML, ICRA, ITCS, NAACL, NeurIPS, PLoS Computational Biology, RSS, SICOMP, SODA, and STOC.

We hired five new Research Assistant Professors (RAPs): Sam Buchanan (PhD Columbia), Lee Cohen (PhD Tel-Aviv University), Saeed Sharifi-Malvajerdi (PhD University of Pennsylvania), Ohad Trabelsi (PhD Weizmann), and Siddharth Bhandari (PhD Tata Institute; joining Jan 2023). We also said farewell to six RAPs going on to new positions: Brian Bullins and Raymond Yeh joining Purdue as Assistant Professors, Audrey Sedal joining McGill as an Assistant Professor, Bradly Stadie joining Northwestern as an Assistant Professor, Saeed Seddighin joining Jump Trading, and Mike Yu joining Amazon as a Senior Applied Scientist.

Congratulations to TTIC’s 2022 PhD graduates Mingda Chen (advised by Kevin Gimpel, and joining Meta AI as a Research Scientist), Chip Schaff (advised by Matthew Walter, and joining Tesla as an Autopilot Engineer), Shubham Toshniwal (advised by Kevin Gimpel and Karen Livescu, and joining FAIR as a Research Scientist) and Igor Vasiljevic (advised by Greg Shakhnarovich, and joining TRI as a Machine Learning Research Scientist). Congratulations also to Chip for his thesis being named a Thesis of Distinction. I look forward to seeing your continued accomplishments. You are all always welcome to come back for visits anytime!

Finally, we welcome new students Chung-Ming Chien, Melissa Dutz, Ron Mosenzon, Donya Saless, and Marcelo Sandoval-Castañeda who will be starting this Fall. I hope you enjoy TTIC as much as I do and have a wonderful and productive PhD experience.

Avrim Blum
Chief Academic Officer
Honoring Dr. Sadaoki Furui

TTIC is deeply saddened to share the news of the passing of Dr. Sadaoki Furui, TTIC’s former President (2013-2019) and Chair of the Board of Trustees (2019-2021), who passed on July 31, 2022 at the age of 77. President Furui was the institute’s second president since its founding in 2003, beginning his appointment in April 2013 and stepping down in June 2019. He was then appointed the Chair of TTIC’s Board of Trustees and served until 2021.

Dr. Furui was a leader in the field of speech processing, playing an important role in improving natural communication between humans and machines. He authored and co-authored more than 1,000 papers and books in the fields of speech recognition, artificial intelligence, and natural language processing, and he received numerous awards and honors for his outstanding contributions, including a Person of Cultural Merit (Bunka Korosha), one of the two highest prizes given by the Japanese Government, as well as the Okawa Prize for his pioneering contributions to and leadership in the field of computer-based speech recognition and understanding.

Dr. Furui’s tenure as President involved overseeing 50% growth in the size of TTIC’s faculty, staff and student body, doubling of TTIC’s endowment, and strengthening ties and partnerships with renowned academic and research institutions around the globe.

Dr. Furui shared his love of music, including performing flute concerts for the TTIC community. And he could often be found on the campus tennis courts playing TTIC’s PhD students. We are grateful to Dr. Furui for his professional and academic leadership, and also for sharing his love of life with our community in many ways. Dr. Furui’s warmth and kindness enriched us all.

Our hearts go out to his wife Hikaru, his family, and all of his colleagues, friends, and former students around the world whose lives were enriched by knowing Dr. Furui.
The COVID-19 global pandemic led TTIC and institutions around the globe to operate entirely remotely starting in March 2020 and evolve program delivery, constituent engagement, and infection mitigation measures as the health landscape changed week by week through 2020, 2021, and 2022. 2021-22 was a year in which TTIC acknowledged the challenges that remained, yet made triumphant strides to return to the practices, places, and people that we value the most.

TTIC had planned through the summer of 2021 to aim for a return to in-person operation as much as possible for Autumn 2021. TTIC and its campus host, the University of Chicago, both had a full vaccination requirement for autumn, with exemptions granted in limited circumstances. The autumn quarter remained somewhat hybrid to allow for distancing and caution with so many people returning to campus from every corner of the globe, and some campus community members getting their initial vaccinations, sometimes coming from areas with limited access to COVID-19 vaccines. TTIC was able to have all admitted students begin in autumn, including those that had deferred matriculation due to global travel restrictions and embassy closures. TTIC and TTIJ could also resume exchange student programs.

TTIC once more held an in-person diploma and award ceremony in September 2021. This was the first all-institute event held since the holiday party in December 2019. After 18 months of mostly viewing each other on laptop screens, it was a pleasure to celebrate PhD graduates and Master’s diploma recipients in-person. We acknowledged the perseverance required to obtain a degree during a global pandemic and then have employment opportunities secured. We cheered on award recipients who managed to excel in their work under ongoing, challenging circumstances.
In May 2022, the Board of Trustees was able to hold its first on-site meeting in a year, and its first since the institute’s full renovation and acquisition of part of the building’s third floor. It felt triumphant to be able to hold a meeting of governance in-person once again. It still included an optional remote conferencing format to allow Trustees who could not travel to Chicago, a method to participate.

Once vaccine boosters became widely available, TTIC and University of Chicago required those in order to continue to be in-person on campus. (With some specific exemptions, which required frequent testing to come to campus.) TTIC students maintained 100% compliance with all mitigation and vaccination requirements throughout their evolution.

The remainder of 2021-22 involved a hybrid mixture of operations, courses, internal support and administration, academic collaborations, admissions, and even faculty recruitment. The TTIC community was thoughtful and considerate in managing the ongoing twists, turns, and professional and personal challenges of the year. We learned from it, grew from it, and we are optimistic that we can achieve more as a result of our new proof of adaptability. We can do very hard things, together.
# Faculty and Staff

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Count</th>
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<tbody>
<tr>
<td>Professors</td>
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<tr>
<td>Associate Professors</td>
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</tr>
<tr>
<td>Assistant Professors</td>
<td>2</td>
</tr>
<tr>
<td>Research Assistant Professors</td>
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<tr>
<td>Adjoint Faculty</td>
<td>9</td>
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<tr>
<td>Administrative staff and IT</td>
<td>12</td>
</tr>
<tr>
<td>Postdocs</td>
<td>5</td>
</tr>
</tbody>
</table>

# PhD Program

<table>
<thead>
<tr>
<th>Program</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students enrolled 2021-22</td>
<td>41</td>
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<tr>
<td>New matriculants for 21-22</td>
<td>5</td>
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<tr>
<td>Master’s degrees awarded</td>
<td>9</td>
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<tr>
<td>(in September 2021)</td>
<td></td>
</tr>
<tr>
<td>PhD degrees awarded</td>
<td>4</td>
</tr>
<tr>
<td>(in September 2021)</td>
<td></td>
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<tr>
<td>Applicants for 2021-22 Academic Year</td>
<td>205</td>
</tr>
<tr>
<td>Anticipated Enrolling 2022-23</td>
<td>5</td>
</tr>
</tbody>
</table>
Awards and Honors

June 2022 - Matthew Turk
President Matthew Turk was appointed as a new member of the Computing Community Consortium (CCC) Council by the Computing Research Association (CRA), in consultation with the National Science Foundation (NSF). The CCC Council has 20 members who have expertise in diverse areas of computing, and six new members will begin their three-year terms starting July 1, 2022.

May 2022 - Avrim Blum
The Association for Computing Machinery (ACM) announced TTIC’s Chief Academic Officer, Professor Avrim Blum, as a recipient of the ACM Paris Kanellakis Theory and Practice Award for fundamental contributions to the development of differential privacy. This award is shared with Irit Dinur, Weizmann Institute; Cynthia Dwork, Harvard University; Frank McSherry, Materialize Inc.; Kobbi Nissim, Georgetown University; and Adam Davison Smith, Boston University. These researchers’ separate but related key papers formed a definition of differential privacy which captures the kind of privacy needed in statistical settings, where individual information must be protected while still allowing for discovery of common trends. These fundamental works created a vibrant and multidisciplinary area of research, leading to practical deployments of Differential Privacy in industry and by the U.S. Census Bureau, among other applications.

December 2021 - Freda Shi
Fourth-year PhD candidate Freda Shi was awarded a 2021 Google PhD Fellowship in Natural Language Processing. Her proposal centered around research that will be reflected in her PhD thesis, which will discuss learning language structures through grounding signals. The fellowship is a two-year award, but has the potential to be extended to three years.

December 2021 - Adam Bohlander
The 2021 Latrice Richards Outstanding Administrator Award was given to Director of Information Technology Adam Bohlander, who has been an integral part of the administrative team at TTIC since 2006. The recipient is chosen based on nominations from the TTIC community, including faculty, students, and administrative staff to award an exemplary member of the administrative staff is recognized for their hard work and dedication to the Institute.

November 2021 - Shubham Toshwinal, Kevin Gimpel, and Karen Livescu
PhD Candidate Shubham Toshwinal, Professor Kevin Gimpel, Professor Karen Livescu, and collaborators Patrick Xia from Johns Hopkins and (former TTIC RAP) Professor Sam Wiseman from Duke received a Best Short Paper award at the 4th Workshop on Computational Models of Reference, Anaphora, and Coreference, for their paper “On Generalization in Coreference Resolution.”

August 2021 - Blake Woodworth, Brian Bullins, and Nati Srebro
At the 34th Annual Conference on Learning Theory, PhD Candidate Blake Woodworth, Professor Brian Bullins, Professor Nati Srebro, and coauthors, won a Best Paper award for their paper titled “The Min-Max Complexity of Distributed Stochastic Convex Optimization with Intermittent Communication.” The paper was written in collaboration with Weizmann Institute of Science Professor Ohad Shamir.
New Faculty

Derek Reiman | PhD, University of Illinois at Chicago
Hongyuan Mei | PhD, Johns Hopkins University
Kartik Goyal | PhD, Carnegie Mellon University
Lingxiao Wang | PhD, University of California, Los Angeles
Raymond Yeh | PhD, University of Illinois, Urbana-Champaign

Faculty Promotion and Tenure

At the May 2022 meeting of the Board of Trustees, Matthew Walter’s promotion to Associate Professor with Tenure was approved.

Dr. Walter received his B.S. from the University of Illinois at Urbana-Champaign in 2000 and his Ph.D. in Mechanical and Ocean Engineering from the Massachusetts Institute of Technology (MIT) and the Woods Hole Oceanographic Institution. Prior to joining TTIC, Dr. Walter was a research scientist in the Computer Science and Artificial Intelligence Laboratory at MIT.

Dr. Walter is currently also the director of the Robot Intelligence through Perception Laboratory (RIPL) at TTIC as well as a part-time assistant professor in the Department of Computer Science at the University of Chicago.

Dr. Walter is interested in developing robots that understand their surroundings and that operate effectively with and alongside people. His research focuses on probabilistic approaches to perception and natural language understanding that enable robots to learn rich models of the objects, places, people, and events within their environment, and that allow people to interact with robots in ways that are intuitive and safe. His work is motivated by broad applications that include assistive technology, healthcare, logistics, and manufacturing.
Faculty by Area

Algorithms and Complexity
Avrim Blum
Julia Chuzhoy
Yury Makarychev
Saeed Seddighin
Madhu Tulsiani

Machine Learning
Brian Bullins
David McAllester
Hongyuan Mei
Nati Srebro
Lingxiao Wang

Computational Biology
Derek Reiman
Jinbo Xu
Michael Yu

Robotics
Bradly Stadie
Matthew Walter
Audrey Sedal

Computer Vision and Computational Photography
Greg Shakhnarovich
Matthew Turk
Raymond Yeh

Speech and Language Technologies
Kevin Gimpel
Kartik Goyal
Karen Livescu

Post-Docs

Saba Ahmadi | PhD, University of Maryland College Park
Ali Vakilian | PhD, Massachusetts Institute of Technology
Xiaoyang Jing | PhD, Fudan University
Marks of Progress

Sponsored Research

In FY 21-22, TTIC faculty were awarded 5 grants totalling $3.3M, which is a 220% increase from last year (FY 20-21). The current grants portfolio includes:

- 8 National Science Foundation basic and collaborative research awards
- 3 National Institutes of Health awards
- 2 Department of Defense awards
- 2 Simons Foundation awards
- 3 National Science Foundation Graduate Research Fellowship awards
- 2 Google PhD Fellowships
- Recent corporate awards from Open Philanthropy and Microsoft

Providing a Financial Safety Net for Students

A key source of information for the institute is from the Annual Student Surveys. Students anonymously complete this survey, providing feedback on matters such as the academic program, student and campus services, support, well-being, and more. Often survey results bring into focus where additional support is needed, what parts of the PhD program students value most, when institute or program policy may need to be adjusted, or when strategies need revision and modernization.

Feedback related to financial and health emergencies (often related) began to make a more regular appearance in recent survey results. The pandemic, isolation and illness made this a more urgent matter to consider. The combination of financial emergency, often coupled with a health emergency, under stress, can evolve to then include a mental health emergency as well. In March 2022, TTIC announced the Student Emergency Fund. The fund can award financial support to a degree-seeking student experiencing an emergency situation or an urgent/unexpected circumstance that may require assistance. A student may apply and submit supporting documentation about their emergency to be eligible to be awarded funds. The fund has been awarded a few times already, and those students have reported experiencing relief with the addition of this support.
Expanding Equity in Admissions

TTIC has been examining the role graduate program admissions plays in determining access for those who will become PhD students and create the future of computer science, make technological advances, and indeed shape the world we will all share in the future. We must examine how students come to us, and attempt to remove unnecessary or outdated barriers to entry.

TTIC’s mission document describes its aim for diversity: TTIC’s collective success in its research and education missions depends on the robust exchange of ideas, as well as on collaboration, innovation, creativity, and broad participation. This requires a dedication to promoting diversity, equity and inclusion in its faculty, staff, student body, and educational programs.

TTIC must evolve to reach this goal and continue to evolve, just as society does. The COVID-19 pandemic forced society to evolve, and we identified ways to further remove barriers for program applicants. For several years, TTIC has not required PhD program applicants to provide GRE scores as part of their application. In 2021, TTIC permitted applicants to submit digital transcripts and we created internal procedures for credential verification and digital record management. This is highly impactful in global recruitment in particular. The Admissions Office expanded recruitment strategy to attempt to reach those with the talent to obtain a PhD in computer science but who may not be aware of the opportunities that exist for them at TTIC. The English Language Requirements for Admissions was reviewed to ensure test reporting was only required for necessary countries and territories, and it was updated to include a new exception for applicants coming from specific schools that operate in an English medium. The 2021 admission season saw the start of accepting IELTS and TOEFL ‘at-home testing’ results: necessary when global testing centers could not operate due to the pandemic. And in 2022, TTIC’s admissions application (https://www.ttic.edu/studentapplication) includes more text describing what Diversity means at TTIC, our efforts and programs, and how everyone at TTIC is invited to play a role in this at the institute.

These are small steps that aim to make some difference, and we will monitor how this plays out. In the first year, we are seeing applicants respond to the changes we’ve made. Our applicant pool was diversified from the prior years: in citizenship, gender, gender identification, race and ethnicity. This led to a more diversified acceptance profile, and the incoming class of Autumn 2022 is one of the most diverse TTIC has been privileged to welcome.

Observing Juneteenth

In honor and in celebration of Juneteenth, TTIC administrative offices were closed on Monday, June 20, 2022 to observe the holiday. This holiday has been added to the institute’s official holiday calendar.
Institute Research

Research Philosophy

Research is the heart and soul of activity at the Toyota Technological Institute at Chicago. The institute has an energetic and determined team of professors, visiting professors, assistant professors, research assistant professors, adjoin professors, and post-docs encompassing many areas of research interests, and from many countries and backgrounds, each bringing their own specialty to the Institute.

With a generous budget, distinguished professors, and an environment that promotes learning and sharing, there are ample opportunities for collaborative research. Being on the campus of the University of Chicago, there is opportunity for close and cooperative research with not only the Computer Science Department, but with the departments of Mathematics, Statistics, and the Booth Graduate School of Business. There are also many guests and visitors who come to TTIC to give talks, participate in workshops, and share their research findings, all heightening the feeling of enthusiasm that pulses through the Institute.

The mission of TTIC includes “…achieving international impact through world-class research and education in fundamental computer science and information technology.” The research component of the mission is implemented through high quality research in high impact areas. Currently, there are active research programs in six areas: machine learning, algorithms and complexity, computer vision and computational photography, speech and language technologies, computational biology, and robotics. The areas are introduced below, and in some, TTIC’s strategy for achieving impact is also described. A key part of the strategy for achieving impact in all areas is to foster collaboration and communication between these areas.

Algorithms and Complexity

One of the central tasks in all areas of computer science is the writing of efficient software to perform required computation. In order to write such software, one must first design an efficient algorithm for the computational task at hand. The area of algorithms focuses on designing algorithms, and more generally developing powerful algorithmic tools, for solving fundamental computational problems that frequently occur in different areas of computer science. Complexity theory is the study of the power and limits of efficient computation. The central problem studied by complexity theorists is “Which computational problems can, and which cannot, be solved efficiently?” The study of algorithms and complexity is a part of a broader area called “theory of computer science,” or just “theory.” The area of theory works on developing theoretical foundations for computer science, which lead to a deeper understanding of computation in general, and specific computational tasks in particular, which include better algorithms and faster software. Below is a list of the work done at TTIC this year in the area of Algorithms and Complexity.
Avrim Blum
Professor and Chief Academic Officer
ttc.edu/blum

PUBLISHED/SUBMITTED PAPERS

TALKS

IN卷VOLVEMENT
Editorial board: Journal of the ACM.
Co-Chair: Scientific Advisory Board, Simons Institute for the Theory of Computing
Advisory Board: TheoretCS journal.
External Advisory Board, TILOS (The Institute for Learning-enabled Optimization at Scale).
Reviewer, Transactions on Economics and Computation.
HONORS/AWARDS
2021 ACM Paris Kanellakis Theory and Practice Award.

RESEARCH FUNDING AWARDS

CLASSES/SEMINARS

MISCELLANEOUS
PhD Advisor for: Kevin Stangl, Han Shao, Keziah Naggita (co-advised with Matt Walter), Naren Manoj (co-advised with Yury Makarychev), and Kavya Ravichandran (co-advised with Nati Srebro).
PhD Thesis Committee: Paul Golz (CMU), Falcon Dai (TTIC), Omar Montasser (TTIC).
Hosted summer interns: Mariana Knittel (jointly with Saeed Saddighin), Kunhe Yang, and Princewill Okoroafor.
Internal service: TTIC Chief Academic Officer.

Julia Chuzhoy
Professor
ttic.edu/chuzhoy

PUBLISHED/SUBMITTED PAPERS

TALKS
A survey talk on Graph Crossing Number at “Highlights of Algorithms.” June 2022.

INVolvEMENT
Steering committee: SODA and ITCS.
Reviewer: STOC 2022.
Served on NSF panel.

RESEARCH FUNDING AWARDS

CLASSES/SEMINARS
TTIC 31080/CMSC 37503: Approximation Algorithms.

MISCELLANEOUS
Internal service: Faculty representative at management meetings, Website Committee member, Outstanding TA Committee member, Faculty Liaison to Curriculum.
Advisor: Rachit Nimavat (TTIC), Zihan Tan (University of Chicago).
Yury Makarychev
Professor
ttic.edu/makarychev

PUBLISHED/SUBMITTED PAPERS

INVolVEMENT
Executive Committee: IDEAL (Institute for Data, Econometrics, Algorithms, and Learning, a collaborative institute organized by researchers from Northwestern University, University of Chicago, and TTIC).
Organizer: High-Dimensional Data Analysis at IDEAL (jointly with K. Makarychev).

RESEArCH FUNDING AWARDS
NSF Medium Award CCF-1955173, jointly with K. Makarychev (Northwestern University). TTIC’s share is $475,645 (2020-2024).
NSF HDR TRIPODS Award CCF-1934843, jointly with N. Srebro and our colleagues at Northwestern University and the University of Chicago. TTIC’s share is $511,610 (2019–2022).

CLASSES/SEMINARS
TTIC 31010/CMSC 37000-1: Algorithms.

MISCeLLANEous
Internal service: Co-chair of faculty hiring committee.
Advisor: Naren Manoj (TTIC, jointly with Avrim Blum), Max Ovsiankin (TTIC), and Jafar Jafarov (University of Chicago).
Mentored: Ali Vakilian (TTIC postdoctoral researcher), visiting student Ainesh Bakshi (jointly with Madhur Tulsiani).

Saeed Seddighin
Research Assistant Professor
ttic.edu/seddighin

PUBLISHED/SUBMITTED PAPERS
MohammadTaghi Hajaghayi, Masoud Seddighin, Saeed Seddighin, Xiaorui Sun. “Approximating LCS in linear time: Beating the sqrt(n) Barrier.” SiComp.

TALKS
“Playing the election game; Solving Blotto and Beyond.” University of California San Diego.
“Modern Fine-grained Algorithms for Classic Problems.” TTIC, University of Pennsylvania, Boston University, and University of Maryland.
“3 Approximation of Tree Edit Distance in Truly Subquadratic Time.” ITCS 2022.

INvolvement
Reviewer: SODA, STOC, FOCS.
Program Committee: AAAI.

Research Funding Awards
Google Research Award ($30,000).

Miscellaneous
Hosted summer interns: Hamed Saleh and Marina Knittel.

Madhur Tulsiani
Associate Professor and Director of Graduate Studies
ttic.edu/tulsiani

Published/Submitted Papers

Talks
“Splittable regularity, CSPs, and Codes”, IISc theory seminar, June 2022.
“Splittable regularity, CSPs, and Codes”, STOC workshop on advances in Algorithmic Coding Theory, July 2022.

Involvement
Reviewer: FOCS, ICALP, CCC, APPROX, RANDOM, JACM.
Managing Editor: Theory of Computing journal.

Classes/Seminars
TTIC 31150/CMSC 31150 - Mathematical Toolkit.

Outreach/Diversity
Co-organizer: “New Horizons in TCS,” summer school aimed at increasing participation from under-represented groups.

Miscellaneous
Advisor: Mrinalkanti Ghosh (TTIC), Shashank Srivastava (TTIC), Tushant Mittal (University of Chicago), June Wu (University of Chicago), Goutham Rajendran (University of Chicago).
The thesis committee: Christopher Jones (University of Chicago).
Internal service: Director of Graduate Studies.
Computational biology studies biological systems (e.g., cell, protein, DNA and RNA) through mathematical modeling and optimization. Machine learning methods (e.g., probabilistic graphical model and deep learning) and optimization techniques (e.g., linear programming and convex optimization) have significant applications in this field. Algorithm design and complexity analysis also play an important role, especially when we want to know if there is an efficient algorithm that can find an exact or approximate solution to a specific biological problem. Below is a list of the work done at TTIC this year in the area of Computational Biology.

### Jinbo Xu

**Professor**
ttic.edu/xu

**PUBLISHED/SUBMITTED PAPERS**


**TALKS**

“Protein structure prediction by deep learning.” 2022.

### INVOLVEMENT

Associate Editor: Journal of Bioinformatics.
PC member: RECOMB, ISMB.

### RESEARCH FUNDING AWARDS


### CLASSES/SEMINARS

TTIC31150: Introduction to Bioinformatics and Computational Biology.
Michael Yu  
Research Assistant Professor  
ttic.edu/yu

PUBLISHED/SUBMITTED PAPERS

TALKS
“The Genetic and Ecological Landscape of Plasmids in the Human Gut.” University of Toronto, Department of Molecular Genetics, April 2022.
“The Genetic and Ecological Landscape of Plasmids in the Human Gut.” University of California, Riverside, Department of Computer Science, March 2022.
Computer vision involves getting computers to extract useful information from pictures and videos. It has applications in robotics, surveillance, autonomous vehicles, and automobile collision avoidance.

Historically, this is a central research area of computer science. Below is a list of the work done at TTIC this year in the area of Computer Vision and Computational Photography.

**Greg Shakharovich**
Professor and Director of Admissions
ttic.edu/gregory

**PUBLISHED/SUBMITTED PAPERS**
B. Shi, D. Brentari, G. Shakharovich, K. Livescu, Searching for fingerspelled content in American Sign Language, ACL 2022 (poster).
M Haris, G Shakharovich, N Ukita, Task-driven super resolution: Object detection in low-resolution images, ICONIP 2022 (poster).
A Blum, O Montasser, G Shakharovich, H Zhang, Boosting Barely Robust Learners: A New Perspective on Adversarial Robustness, arXiv 2022 (in submission).

**IN VolvEMENT**
Associate Editor, IEEE Transactions on Pattern Analysis and Machine Intelligence (IEEE TPAMI).
Co-organizer, Workshop on Frontiers of Monocular Depth Estimation, ECCV 2022
Area Chair: ICCV 2021, ICLR 2022, ECCV 2022.

**RESEARCH FUNDING AWARDS**
Adobe corporate gift, $10,000.

**CLASSES/SEMINARS**
Organized instruction for Machine Learning class at TTI (Nagoya).
Independent Reading, University of Chicago: two students in Spring 2022.
Faculty mentor for student-organized Computer Vision reading group at TTIC/University of Chicago.
OUTREACH & DIVERSITY
Co-Chair of Diversity, Equity and Inclusion (DEI) committee.
Coordinator of TTIC involvement in the Leadership Alliance program.

MISCELLANEOUS
Advisor: Haochen Wang (TTIC), Jiahao Li (TTIC), Xiaodan Du (TTIC), Igor Vasiljevic (TTIC).
Undergraduate advisor: Avery Zhou (University of Chicago), Josh Ahn (University of Chicago).
Thesis committees: Andrea Daniele (PhD, TTIC); Zhisheng Xiao (PhD, University of Chicago).
Internal service: Director of Admissions for TTIC PhD program; Faculty Liaison to the Director of IT.

Matthew Turk
President
ttic.edu/turk

PUBLISHED/SUBMITTED PAPERS

TALKS
Keynote speaker, International Conference on 4th Industrial Revolution and Beyond (IC4IR), December 2021.

INVolVEMENT
Editorial board: ACM Transactions on Interactive Intelligent Systems (TiiS)
Area Chair: Conference on Computer Vision and Pattern Recognition (CVPR) 2022.
CVPR 2022 Paper Awards Committee.
General Chair: International Conference on Informatics, Electronics & Vision.
External Review Committee member: John Hopkins University Department of Computer Science.
Internal Advisory Board member: IDIAP (Switzerland).
TTIJ Board of Councilors member.

MISCELLANEOUS
Advisor: Pushkar Shukla (TTIC).
Committee member: Igor Vasiljevic (TTIC), Nick Kolkin (TTIC), Ekta Prashnani (UCSB), Yi Ding (UCSB), Wei Peng (University of Oulu, Finland).
Raymond Yeh
Research Assistant Professor
ttic.edu/yeh

PUBLISHED/Submitted Papers

Talks

Involvement
Conference reviewer: CVPR, ECCV, ICML, NeurIPS, AISTATS, and SIGGRAPH.

Outreach/Diversity
“Machine Learning—Making computers see and talk,” presentation at McClellan Elementary for Girls Who Code program (TTIC community partnership), March 2022.

Machine Learning

Machine Learning generally refers to an engineering or design paradigm where systems are built based on automatic training from examples rather than detailed expert knowledge, much in the same way humans learn how to perform tasks and interact with the world. Most of modern Machine Learning is statistical in nature, and builds on statistical and probabilistic tools, as well as on algorithmic and computational developments. Especially in recent years, as training data is becoming plentiful, and massive computational and storage resources needed for handling the data are also becoming available, Machine Learning is playing a key role in many application areas. This includes classic artificial intelligence problems, such as computer vision, robotics, machine translation, question answering and dialogue systems. There are also a variety of “non-human” problems such as information retrieval, search, bioinformatics, and stock market prediction to be considered. Below is a list of the work done at TTIC this year in the area of Machine Learning.

Brian Bullins
Research Assistant Professor
ttic.edu/bullins

Published/Submitted Papers

TALKS
UNC-Chapel Hill, Department of Statistics and Operations Research, 2022.
Purdue University, CS Colloquium, 2022.
Midwest Optimization & Statistical Learning Meeting, 2022.

INVolVEMENT
Reviewer: JMLR, Mathematical Programming.

HONORS
Best Paper Award, COLT 2021.

David McAllester
Professor
ttic.edu/mcallester

INVolVEMENT
Area chair: NeurIPS, ICLR.

RESEARCH FUNDING AWARDS
“Tracking Misinterpretation Risk.” Open Philanthropy, $700,000 (for 2 years).

CLASSES/SEMINARS

MISCELLANEOUS
Advisor: Pedro Savarese (TTIC).

Hongyuan Mei
Research Assistant Professor
ttic.edu/mei/

PUBLISHED/SUBMITTED PAPERS

TALKS

INVolvEMENT
Area Chair: EMNLP 2022.
Reviewer: NeurIPS 2022, COLING 2022, Trans of Machine Learning Research, ACL Annual Rolling Review.

RESEARCH FUNDING AWARDS
Adobe Research Gift, $20,000.

MISCELLANEOUS
Advisor: Hongyu Zhao (University of Chicago master's student), Shuo Xie (University of Chicago master's student).

Nati Srebro
Professor
ttic.edu/srebro

PUBLISHED/SUBMITTED PAPERS


TALKS
“Can Uniform Convergence Explain Interpolation Learning?” Weizmann Institute, May 2022.
Research at TTIC, November 2021.
“Understanding Deep Learning through Optimization Bias.” Hausdorff Research Institute for Mathematics, Bonn Germany, April 2022.
“Learning Without Discrimination.” Computational Social Science Workshop, University of Chicago, April 2022.
“Understanding Deep Learning through Optimization Bias.” Harvard University Department of Computer Science, April 2022.
“Can Uniform Convergence Explain Interpolation Learning?” Summer Research Institute, EPFL, June 2022.

INVOLVEMENT
Steering Committee: FAaCT, Midwest Machine Learning Symposium.
Editorial Board: Journal of Machine Learning.
Senior Area Chair: NeurIPS 2021, NeurIPS 2022.

HONORS/AWARDS
COLT 2021 Best Paper Award.

CLASSES/SEMINARS
Reading Group on Machine Learning and Optimization.
Princeton Machine Learning Summer School, series of three lectures on deep learning theory.
Les Houches Summer School on Statistical Physics and Machine Learning, series of six lectures on optimization and machine learning.

MISCELLANEOUS
Advisor: Blake Woodworth (TTIC), Gene Li (TTIC), Omar Motasser (TTIC), Gal Vardi (TTIC post-doc), Lijia Zhou (University of Chicago), Zhen Dai (CAM, joint), Owen Melia (CS, joint).
Interim advisees: Anmol Kabra (TTIC), Kavya Ravichandran (TTIC), Kshitij Kumar (TTIC).
Mentored RAPs: Brian Bullins, Lingxiao Wang.

Lingxiao Wang
Research Assistant Professor
ttic.edu/wang

PUBLISHED/SUBMITTED PAPERS

TALKS

ININVOLVEMENT
Senior Program Committee member for AAI 22 and AAAI 23.

CLASSES/SEMINARS
Guest lecturer: Introduction to Machine Learning, TTI Nagoya (2 guest lectures).

MISCELLANEOUS
Internal service: Organizer: Joint TTIC/University of Chicago CS Machine Learning Seminar.
Robotics

Robotics can generally be defined as a field concerned with the development and realization of intelligent, physical agents that are able to perceive, plan, and act intentionally in an uncertain world. Robotics is a broad field that includes mechanical design, planning and control, perception, estimation, and human-robot interaction among others. At TTIC, robotics research currently focuses on developing advanced perception algorithms that endow robots with a rich awareness of, and the ability to act deliberately, within their surroundings. Researchers are particularly interested in algorithms that take multi-modal observations of a robot’s surroundings as input, notably image streams and natural language speech, and infer rich properties of the people, places, objects, and actions that comprise a robot’s environment. Integral to these technologies is their reliance on techniques from machine learning in developing probabilistic and statistical methods that are able to overcome the challenge of mitigating the uncertainty inherent in performing tasks effectively in real-world environments. These tasks include assistive technology for people living with physical and cognitive impairments, healthcare, logistics, manufacturing, and exploration. Below is a list of the work done at TTIC this year in the area of Robotics.

Bradly Stadie
Research Assistant Professor
ttic.edu/faculty/stadie

PUBLISHED/SUBMITTED PAPERS

TALKS
“Hindsight Divergence Minimization.” University of Arkansas Workshop on Data Science, 2022.

MISCELLANEOUS
Mentor: Takuma Yoneda (TTIC).
Internal service: Website Committee member.

Matthew Walter
Professor
ttic.edu/walter

PUBLISHED/SUBMITTED PAPERS


INVolVEMENT
Area chair: ICLR, NeurIPS, ICML.
Steering Committee: Northeast Robotics Colloquium.
Board Member: Duckietown Foundation.
Co-Organizer: IROS 2021 Workshop on Evaluating the Broader Impacts of Self-Driving Cars.
Senior member: IEEE.

CLASSes/SEMINARS
TTIC 31180: Probabilistic Graphical Models (TTIC/University of Chicago).
Self-Driving Cars with Duckietown, edX MOOC (with Andrea Censi, Liam Paull, and Jacopo Tani) involving approximately 7,000 students from across the world.
Robotics Reading Group.

OUTReacht/DIVERSITY
Committee member: Diversity, Equity, and Inclusion (DEI) Committee.
ChiS&E instructor, Advanced Robotics High School Course (TTIC community partnership).
Duckietown MOOC instructor.

MiScELLaneous
Thesis Committee Member: Jacob Arkin (University of Rochester), Igor Vasilijevic (TTIC).
Thesis Committee Chair: Andrea F. Daniele (TTIC), Zhongtian “Falcon” Dai (TTIC), Charles “Chip” Schaff (TTIC).
Co-Advisor (w/ Yali Amit), Ben Picker, “The Hips as a Four-Bar Linkage System: Using Reinforcement Learning to Explore Compensation Patterns in Patients with Leg Length Discrepancies,” MS, University of Chicago, May 2022.
Qualifying exam committee chair: Xiaodan Du (TTIC).
Internal service: TTIC Young Researcher Seminar Series faculty liaison, TTIC Visiting Student Program faculty liaison, TTIC Industrial Affiliates Program faculty liaison.
Speech and Language Technologies

This area is concerned with getting computers to analyze and extract information from spoken language, as well as to generate spoken audio. At TTIC, current speech research focuses mainly on the analysis side. For example, speech recognition is the problem of transcribing the words being spoken in an audio signal, such as that recorded from a microphone. Speech processing heavily relies on techniques from machine learning and statistics, as well as ideas from linguistics and speech science, and shares algorithms with computer vision and computational biology. This area has applications such as automated telephone information centers, dictation systems, machine translation, archiving and search of spoken documents, assistance for the visually or hearing-impaired, and other human-computer interface systems. Below is a list of the work done at TTIC this year in the area of Speech and Language Technologies.

Kevin Gimpel
Assistant Professor
ttic.edu/gimpel

PUBLISHED/SUBMITTED PAPERS

IN INVOLVEMENT
Reviewer: TACL.
Conference reviewer: ICLR 2022.

HONORS/AWARDS
Best Short Paper Award at the Fourth Workshop on Computational Models of Reference, Anaphora, and Coreference for "On Generalization in Coreference Resolution."

MISCELLANEOUS
Advisor: Mingda Chen (TTIC), Lingyu Gao (TTIC), Freda Shi (TTIC, co-advised with K. Livescu), Shubham Toshniwal (TTIC, co-advised with K. Livescu), David Yoshida (TTIC), Xiaolan Ding (University of Chicago).
Dissertation committee: Qingming Tang (TTIC), Shane Settle (TTIC), Ruotian Luo (TTIC).
Chair/co-chair of dissertation committee: Mingda Chen (TTIC), Xiaoan Ding (University of Chicago), Shubham Toshniwal (TTIC).
Internal service: Website Committee member, faculty coordinator of Visiting Student Program, hiring committee.

Kevin Gimpel
Assistant Professor
ttic.edu/gimpel

PUBLISHED/SUBMITTED PAPERS

TALKS

INVOLEVMENT

CLASSES/SEMINARS
TTIC 31210: Advanced Natural Language Processing, Spring 2022.

OUTREACH/DIVERSITY
Girls Who Code facilitator (TTIC community partnership).

MISCELLANEOUS
Internal service: Co-organizer for Speech and Natural Language Processing weekly reading group (TTIC and University of Chicago).

Karen Livescu
Professor
ttic.edu/livescu

PUBLISHED/SUBMITTED PAPERS

TALKS
"Spoken language understanding, with and without pre-training." U. Cambridge Language Technology Lab seminar, March 2022.

IN VolVEMENT
Co-organizer, AAAI Workshop on Self-Supervised Learning for Audio and Speech Processing 2022.
NSF panelist, Robust Intelligence program.
Technical program co-chair, Interspeech 2022.
Associate editor: IEEE Trans. Pattern Analysis and Machine Intelligence (TPAMI), IEEE Open Journal of Signal Processing (OJSP), Transactions of the ACL.
Guest editor: IEEE JSTSP Special Issue on Self-Supervised Learning for Speech and Audio Processing, 2022.

HONORS/AWARDS

CLASSES/SEMINARS
TTIC 31110/CMSC 35110: Speech Technologies.

MISCELLANEOUS
Advisor: Qinging Tang (TTIC), Shubham Toshniwal (TTIC), Shane Settle (TTIC), Bowen Shi (TTIC), Ankita Pasad (TTIC), Freda Shi (TTIC), David Yonis (TTIC), Ju-Chieh Chou (GSAL).
Visiting student: Yushi Hu (University of Chicago undergrad; now PhD student at U. Washington).
Thesis committees: Lasse Boorgholt (University of Copenhagen), Mingda Chen (TTIC).
Internal service: Faculty Hiring Committee co-chair, Colloquium Coordinator, Student Support Coordinator.
University of Chicago service: Research Advisory Committee for University of Chicago Data Science Institute.
# Visiting and Adjoint Faculty

## Visiting Professors

**Eden Chlamtac**  
Assistant Professor, Ben Gurion University  
PhD - Princeton University

## Adjoint Professors

<table>
<thead>
<tr>
<th>Name</th>
<th>Institutions</th>
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</thead>
</table>
| David Forsyth         | Professor, University of Illinois at Urbana-Champaign  
                        | PhD - Balliol College, Oxford                |
| Alexander Razborov    | Professor, University of Chicago                  | PhD - Steklov Mathematical Institute          |
| Sanjeev Khanna        | Professor, University of Pennsylvania              | PhD - Stanford University                    |
| Yutaka Sasaki         | Professor, TTI-Japan                              | PhD - University of Tsukuba                   |
| Svetlana Lazebnik     | Professor, University of Illinois at Urbana-Champaign  
                        | PhD - University of Illinois at Urbana-Champaign  |
| Norimichi Urita       | Professor, TTI-Japan                              | PhD - Kyoto University                        |
| Richard Lipton        | Professor and Frederick G. Storey Chair (emeritus), Georgia Institute of Technology  
                        | PhD - Carnegie Mellon University               |
| Stephen Wright        | Professor, University of Wisconsin-Madison         | PhD - University of Queensland                 |
| Robert Nowak          | Professor, University of Wisconsin-Madison         | PhD - University of Wisconsin-Madison          |
László Babai  
George and Elizabeth Yovovich Professor, University of Chicago  
PhD - Hungarian Academy of Sciences, Budapest

Allyson Ettinger  
Assistant Professor, University of Chicago  
PhD - University of Maryland, College Park

Michael Franklin  
Liew Family Chair of Computer Science, University of Chicago  
PhD - University of Wisconsin

Rana Hanocka  
Assistant Professor, University of Chicago  
PhD - Tel Aviv University

Mladen Kolar  
Associate Professor of Econometrics and Statistics, University of Chicago  
PhD - Carnegie Mellon University

Risi Kondor  
Assistant Professor, University of Chicago  
PhD - Columbia University

Michael Maire  
Assistant Professor, University of Chicago  
PhD - University of California, Berkeley

Rad Niazhdeh  
Assistant Professor of Operations Management, University of Chicago  
PhD - Cornell University

Aaron Potechin  
Assistant Professor, University of Chicago  
PhD - Massachusetts Institute of Technology

Janos Simon  
Professor and Director of Graduate Studies, University of Chicago  
PhD - Cornell University

Chenhao Tan  
Assistant Professor, University of Chicago  
PhD - Cornell University

Rebecca Willett  
Professor, University of Chicago  
PhD - Rice University
Collaboration and Cooperation

Professor Matthew Walter is teaching a MOOC (Massive Online Open Course) on Duckietown, a project teaching fundamental lessons in robotics and AI. He is teaching the course along with his colleagues Liam Paull (University of Montreal Professor), Andrea Censi (Senior Researcher at ETH Zurich), Jacopo Tani (Senior Researcher at ETH Zurich), Stefanie Tellex (Brown University Professor), Nick Wang (National Chiao Tung University, Taiwan Professor), and Kirill Krinkin (Head of The Department of Software Engineering and Computer Applications at St. Petersburg Electrotechnical University). The MOOC that ended in fall 2021 had approximately 7,000 students in the class, 2,000 of whom implemented their code on their own physical Duckiebots (it was the first-ever hardware-based robotics MOOC). TTIC, and especially PhD candidate Andrea Daniele, were instrumental in revamping the software for the DuckieSky Drone course, a high school course that was taught in Rhode Island in summer 2022 with about 300 students who took the course.

Professor Avrim Blum, Professor Julia Chuzhoy, Professor Yury Makarychev, and Professor Nati Srebro are collaborating with researchers from University of Illinois at Chicago, Northwestern University, the University of Chicago, and the Illinois Institute of Technology, and in partnership with researchers at Google NYC, together forming the Institute for Data, Econometrics, Algorithms, and Learning (IDEAL), which was awarded a TRIPODS Phase II award by the National Science Foundation. IDEAL will involve more than 50 researchers working on key aspects of the foundations of data science across multiple disciplines. The research will center around the foundations of machine learning, high-dimensional data analysis and inference, and data science and society.

President Matthew Turk collaborated with Professor E. R. (Roy) Davies (University of London) on a book titled “Advanced Methods and Deep Learning in Computer Vision,” which was published on November 1, 2021.

PhD candidate Keziah Nagita collaborated with Christopher Nsimbe (NextBillion Software Developer) to create CA², an online platform that helps researchers find peer-to-peer collaborators.

PhD candidate Blake Woodworth collaborated with Professor Brian Bullins (TTIC), Professor Nati Srebro (TTIC), and Professor Ohad Shamir (Weizmann Institute of Science) on the paper, “The Min-Max Complexity of Distributed Stochastic Convex Optimization with Intermittent Communication,” which won a Best Paper Award at the 34th Annual Conference on Learning Theory.
Talks and seminars are an important part of any academic institution. They are both a way for researchers to promote their research, and to keep abreast of recent developments. They allow students to be exposed to ideas and researchers that may play a role in shaping their academic views, research direction, or even career. Talks and seminars play an important role in establishing the level of intellectual activity and influx of innovative ideas at an institution: research is more likely to be productive in an active environment with significant interaction between researchers.

The table below lists seminars given at TTIC, many of which are given by speakers from other universities and research institutions, as part of the TTIC Colloquium: a forum for talks by invited speakers on work of current relevance and broad interest to the computer science community. Other talks may be a part of the Research at TTIC series: a weekly seminar series presenting research currently underway at the Institute. Every week a different TTIC faculty member will present their research. The lectures are intended both for students seeking research topics and advisers, and for the general TTIC and University of Chicago communities interested in hearing what their colleagues are currently involved in. The Young Researcher Seminar Series features talks by PhD students and postdocs whose research is of broad interest to the computer science community. The series provides an opportunity for early-career researchers to present their recent and promising work and to meet with students and faculty at TTIC and nearby universities. Some speakers may be part of research Reading Groups: people presenting papers that are of interest to a particular group, such as the theory group or the programming languages group. Most seminars are advertised outside of TTIC and are intended to be for a broad audience in computer science. In the spring quarter there are a large number of recruiting seminars which are talks given by candidates for faculty positions.

The TTIC Event Calendar can be accessed from the main website: www.ttic.edu

<table>
<thead>
<tr>
<th>Year</th>
<th>Speakers</th>
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<tbody>
<tr>
<td>2021-2022</td>
<td>87 speakers</td>
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<tr>
<td>2020-2021</td>
<td>90 speakers</td>
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<tr>
<td>2019-2020</td>
<td>123 speakers</td>
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<tr>
<td>2018-2019</td>
<td>123 speakers</td>
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<td>2017-2018</td>
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<td>2016-2017</td>
<td>79 speakers</td>
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<td>Speaker</td>
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<tr>
<td>Nicholas Kolkin</td>
<td>Toyota Technological Institute at Chicago</td>
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<td>Sanjeev Koppal</td>
<td>University of Florida</td>
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<td>Ruotian Luo</td>
<td>Toyota Technological Institute at Chicago</td>
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<td>Sarah Sebo</td>
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<td>Greg Shakhrarovich</td>
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<td>David McAllester</td>
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<td>Kristina Toutanova</td>
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<td>Zhimei Ren</td>
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<td>Hongyuan Mei</td>
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<td>Frederic Koehler</td>
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<td>Name</td>
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<tr>
<td>Nati Srebro</td>
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<td>Michael Auli</td>
<td>Facebook AI Research</td>
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<td>Mladen Kolar</td>
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<td>Northeastern University</td>
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<td>Deeksha Adil</td>
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<td>Ray Li</td>
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<td>Mitali Bafna</td>
<td>Harvard University</td>
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<td>Kush Bhatia</td>
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<td>University of Pennsylvania</td>
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<td>Jason Altschuler</td>
<td>Massachusetts Institute of Technology</td>
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<td>Saeed Seddighin</td>
<td>Toyota Technological Institute at Chicago</td>
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<tr>
<td>Daniel Bruder</td>
<td>Harvard University</td>
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<td>Surbhi Goel</td>
<td>Microsoft Research NYC</td>
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<td>Ainesh Bakshi</td>
<td>Carnegie Mellon University</td>
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<td>Elena Sizikova</td>
<td>New York University</td>
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<td>Rowan Zellers</td>
<td>University of Washington</td>
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<td>Xiang Lorraine Li</td>
<td>University of Massachusetts, Amherst</td>
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<td>Qi Lei</td>
<td>Princeton University</td>
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<tr>
<td>Chara Podimata</td>
<td>Harvard University</td>
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<tr>
<td>Soumyadip Sengupta</td>
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<tr>
<td>Michael Yu</td>
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<td>Daphne Ippolito</td>
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<td>Nakul Gopalan</td>
<td>Georgia Institute of Technology</td>
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<tr>
<td>Sai Zhang</td>
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<td>Stella Yu</td>
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<tr>
<td>Eric Wong</td>
<td>Massachusetts Institute of Technology</td>
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<tr>
<td>Zhiyuan Li</td>
<td>Princeton University</td>
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<tr>
<td>Priya Donti</td>
<td>Carnegie Mellon</td>
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<td>Kuikui Liu</td>
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<td>Alexander Razborov</td>
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<tr>
<td>Alane Suhr</td>
<td>Cornell University</td>
</tr>
<tr>
<td>Name</td>
<td>Affiliation</td>
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<tr>
<td>Hao Peng</td>
<td>University of Washington</td>
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<td>Mladen Kolar</td>
<td>University of Chicago</td>
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<td>Guodong Zhang</td>
<td>University of Toronto</td>
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<td>SouYoung Jin</td>
<td>Massachusetts Institute of Technology</td>
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<tr>
<td>Derek Reiman</td>
<td>Toyota Technological Institute at Chicago</td>
</tr>
<tr>
<td>Professor Raymond Mooney</td>
<td>University of Texas, Austin</td>
</tr>
<tr>
<td>Arman Cohan</td>
<td>University of Washington</td>
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<tr>
<td>Matthew Turk</td>
<td>Toyota Technological Institute at Chicago</td>
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<tr>
<td>Mher Safaryan</td>
<td>King Abdullah University of Science and Technology</td>
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<td>Yun William Yu</td>
<td>University of Toronto</td>
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<td>Karen Livescu</td>
<td>Toyota Technological Institute at Chicago</td>
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<td>Sam Buchanan</td>
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<td>Rana Hanocka</td>
<td>University of Chicago</td>
</tr>
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<td>Bradley Stadie</td>
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<tr>
<td>Max Hopkins</td>
<td>University of California San Diego</td>
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<tr>
<td>Alyosha (Alexei) Efros</td>
<td>University of California, Berkeley</td>
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<tr>
<td>Yury Makarychev</td>
<td>Toyota Technological Institute at Chicago</td>
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<tr>
<td>Manuela M. Veloso</td>
<td>J.P. Morgan AI and CMU</td>
</tr>
<tr>
<td>Ali Vakilian</td>
<td>Toyota Technological Institute at Chicago</td>
</tr>
<tr>
<td>Name</td>
<td>Institution</td>
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<tr>
<td>Annie Marsden</td>
<td>Stanford University</td>
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<tr>
<td>Julia Chuzhoy</td>
<td>Toyota Technological Institute at Chicago</td>
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<tr>
<td>Hendrik Hamann</td>
<td>University of Chicago</td>
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<tr>
<td>Madhur Tulsiani</td>
<td>Toyota Technological Institute at Chicago</td>
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<tr>
<td>Chenhao Tan</td>
<td>University of Chicago</td>
</tr>
<tr>
<td>Jamie Morgenstern</td>
<td>University of Washington</td>
</tr>
<tr>
<td>Gaurav Mahajan</td>
<td>University of California San Diego</td>
</tr>
<tr>
<td>Elad Hazan</td>
<td>Princeton University and Google Research</td>
</tr>
<tr>
<td>Igor Vasiljevic</td>
<td>Toyota Technological Institute at Chicago</td>
</tr>
</tbody>
</table>
Workshops

MADLab 2022 Summer Workshop

[June 14-15, 2022] TTIC co-sponsored and co-hosted a workshop focused on machine learning theory, algorithms and applications, organized by the Air Force Research Laboratory-sponsored Center of Excellence on Machine, Algorithms and Data (MADLab) in which faculty from TTIC, the University of Chicago and the University of Wisconsin Madison participated.

This event included talks, poster sessions, research meetings and panels. On June 14, 2022, the workshop took place at the John Crerar Library, home of the University of Chicago’s Department of Computer Science. On June 15, 2022, the workshop took place at TTIC.

New Horizons in Theoretical Computer Science

[June 6-10, 2022] TTIC co-sponsored and co-hosted a workshop focused on machine learning theory, algorithms and applications, organized by the Air Force Research Laboratory-sponsored Center of Excellence on Machine, Algorithms and Data (MADLab) in which faculty from TTIC, the University of Chicago and the University of Wisconsin Madison participated.

This event included talks, poster sessions, research meetings and panels. On June 14, 2022, the workshop took place at the John Crerar Library, home of the University of Chicago’s Department of Computer Science. On June 15, 2022, the workshop took place at TTIC.

IDEAL Workshop on High-Dimensional Geometry and Analysis

[May 7, 2022] This workshop was co-organized by Professor Yury Makarychev with The Institute for Data, Econometrics, Algorithms, and Learning (IDEAL), an NSF-supported collaborative institute across Northwestern University, TTIC, and the University of Chicago, and it was part of the “Special Quarter on High-Dimensional Data Analysis” workshop series.

Held at Northwestern University and remotely, this workshop featured speakers Ainesh Bakshi, Carnegie Mellon University; Arnold Filtser, Bar Ilan University; Weiyun Ma, Stanford University; Assaf Naor, Princeton University; and Erik Waingarten, Stanford University.
Distinguished Lecture Series 2022

Raymond J. Mooney  
*Monday, March 14, 2022*  
Professor, Department of Computer Science and Director of the Artificial Intelligence laboratory, University of Texas at Austin  
Talk Title: "Dialog with Robots: Perceptually Grounded Communication with Lifelong Learning"

Alexei (Alyosha) Efros  
*Friday, April 29, 2022*  
Professor, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley  
Talk Title: "Self-Supervision: Learning from the Bottom Up"

Manuela M. Veloso  
*Thursday, May 12, 2022*  
Managing Director, Head of AI Research, J.P. Morgan  
Talk Title: "AI in Finance: Examples and Discussion"
The PhD Program

The TTIC PhD Program is designed to prepare students for modern academic or research careers in computer science. To complete the program, a student must make an original and significant contribution to the field of computer science, conducting high-level, responsible, and original research that culminates in a doctoral thesis which can be successfully defended in a public forum and published. In addition to the thesis, there are course, experiential, and examination requirements to complete the program. The main component of the program is the process by which the student learns to do quality research and becomes a part of the academic community.

As part of the associated partnership between TTIC and University students of TTIC can take and receive credit for courses through the University, and University of Chicago students can take advantage of classes that TTIC offers as well. Students of both institutions have taken full advantage of this opportunity. TTIC students also have full access to the University of Chicago library system, athletic facilities, the student health center, and transportation on campus. TTIC students enjoy the benefits and great rewards of an intimate learning, study, and research setting, exposure to state-of-the-art research, opportunities in the greater computer science community, and still maintain the traditional shared experiences that come with a large university.

Graduates, Diplomas and Awards

After a very challenging, remote 2020-21 academic year, TTIC enthusiastically celebrated and awarded 4 doctoral diplomas in a return to an in-person diploma ceremony in September 2021 to:

Nick Kolkin, who studied under Professor Greg Shakhnarovich, with research interests in machine learning and computer vision. Kolkin is currently employed by Adobe Creative Intelligence Lab.

R.T. Luo, who studied under Professor Greg Shakhnarovich, with research interests in machine learning and computer vision. R.T. is currently employed at Waymo Perception.
Lifu Tu, who studied under Professor Kevin Gimpel, with research interests in Natural language processing, deep learning and machine learning. Lifu is currently employed by Salesforce Research.

Blake Woodworth, who studied under Professor Nati Srebro, with research interests in machine learning theory and optimization. Blake is now a postdoc at Inria.

TTIC expects four PhD Candidates to be eligible for doctoral degrees in the September 2022 diploma ceremony.

Students Vadim Grinberg, Gene Li, Naren Manoj, Keziah Naggita, Kshitij Patel, Han Shao, Pushkar Shukla, Akilesh Tangella, and David Yunis successfully fulfilled all requirements to complete the Master’s portion of the PhD Program, and received master’s diplomas from the institute at the September 2021 diploma ceremony at the start of the academic year.

Davis Yoshida was awarded the 2021 Outstanding Teaching Assistant Award at the ceremony, for his exceptional dedication to the course TTIC 31190 Natural Language Processing (taught by Professor Kevin Gimpel in Autumn Quarter 2020). The annual award was created in 2019 to recognize outstanding performance of teaching assistants (TAs) of courses at the Toyota Technological Institute at Chicago. Students enrolled in TTIC courses may nominate the course TA(s) for the award throughout the academic year. An award committee reviews nominations and selects a winner. A TA Award plaque displays the names of award recipients.
Quality Curriculum

TTIC instructors serve the TTIC student population in their courses, and under the TTIC-University of Chicago Agreement, University students may enroll in TTIC’s courses and receive credit through the University, and vice-versa. TTIC views this as part of serving the Education Mission of the Institute. The amount of University students who register for TTIC courses remains high.

TTIC instructors are proud to offer a quality, modern curriculum and rigorous courses to institute PhD students and the students from the University who take part.

Enrollment Numbers for TTIC Courses

![Bar chart showing enrollment numbers for TTIC courses from 2017-2018 to 2021-2022, with separate bars for TTIC Students and UChicago Students.]

Academic Adjustments Due to COVID-19

TTIC moved from fully in-person to fully remote operation in March 2020 due to the escalating public health risk inflicted by the COVID-19 global pandemic, and mitigation restrictions from the City of Chicago and State of Illinois. The 2020-21 academic year remained mostly remote, and TTIC was committed to safely resuming more in-person operation beginning in autumn 2021.

Autumn quarter involved hybrid operation, both remote and in-person aspects, and due to a surge in COVID-19 cases, winter quarter began with two weeks of remote-only course delivery. By Spring Quarter 2022, most academic activity was being conducted in-person.
Two of the incoming students in autumn 2021 were accepted for autumn 2020 matriculation but had to defer enrollment due to global travel restrictions, high infection rates and closed embassies around the world. It was encouraging to have them with us finally.

The institute typically matched most pandemic operations and guidance the same as University of Chicago, as we share a campus. TTIC found encouragement in the persistence of students to produce great work, make progress, and move towards degree completion. We are grateful to the faculty and staff who support the institute’s mission and these students.

**Financial Support for Students**

Full financial support is offered to all enrolled students in good academic standing, in residence, and making progress in the program, guaranteed for up to five years.

The tuition for an academic year is $30,000. All students at TTIC may expect to receive financial support that covers tuition, health services, health insurance and student services fees, a new student equipment allowance, and a stipend paid for research assistance, provided they remain full-time and in good academic standing.

**TTI Japan Exchange Students**

This year TTIC welcomed three exchange students from the Toyota Technological Institute located in Nagoya, Japan (TTIJ). The students enrolled in TTIC courses during their one-quarter stays and became full participating members of institute life, both academic and social.

Takuto Fuji and Atsuya Murase arrived in September 2020 and returned to TTIJ in late December. Jun Kasai arrived in January and returned home in March.

TTIC remains pleased with the exchange program with TTIJ, as the experience continues to be a success for all involved. New exchange student plans are underway at the institute for 2022-23.

From left to right: Takuto Fuji, Atsuya Murase.
Student Publications, Posters and Abstracts


**Du, Xiaodan, Raymond Yeh, Nicholas Kolkin, Eli Shechtman, and Greg Shakhnarovich.** “Learning a Natural Language Interface forPretrained Image Generators.” Paper to be presented at the European Conference on Computer Vision (ECCV), Tel Aviv, Israel, to be presented October 2022.


Nacson, Mor Shpigel, Kavya Ravichandran, Nati Srebro, and Daniel Soudry. “Implicit Bias of the Step Size in Linear Diagonal Neural Networks.” Paper to be presented at the Conference on Machine Learning (ICML), Baltimore, Maryland, to be presented July 2022.


Student Admissions and Student Body Growth

In the fall of 2004, TTIC matriculated its first three students. The 2021-22 academic year began with 43 students, 5 who enrolled as first time new students for Autumn 2021.

<table>
<thead>
<tr>
<th>Admissions Year</th>
<th>Total Applicants</th>
<th>Applicants Admitted</th>
<th>Enrolled next Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022</td>
<td>205</td>
<td>17</td>
<td>5 planned</td>
</tr>
<tr>
<td>2021</td>
<td>227</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>2020</td>
<td>229</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>2019</td>
<td>225</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td>2018</td>
<td>207</td>
<td>26</td>
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</tr>
<tr>
<td>2017</td>
<td>135</td>
<td>23</td>
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<td>2016</td>
<td>123</td>
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</tr>
<tr>
<td>2015</td>
<td>90</td>
<td>22</td>
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</tr>
<tr>
<td>2014</td>
<td>83</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>
The fiscal year of 2021-2022 signified a transition from remote operations to in-person activities held once again at TTIC. The excitement of emerging from the global pandemic was coupled with the stress of adapting to a new way of work in a hybrid environment.

Over the course of this fiscal year, the Finance Committee continued to refine TTIC’s asset allocation to ensure our investment return will achieve our operating needs. The Committee also underwent a proposal process for hiring new external auditors.

Uncertainty is the theme for this year’s investment performance given high inflation and market volatility. TTIC’s diversified investment pool is designed to weather challenging economic events.

Also, TTIC operates within its budget, has no liquidity issues, no debt, a significant investment pool, and a substantial amount of unrestricted net assets. Our small size in terms of people and space allows for flexibility and quick reactions to undesirable outcomes.

**Operating Results**

28% of TTIC’s operating revenue is derived from external grants. Except for tuition paid by UChicago, the remainder of TTIC’s operating revenue is the board-approved distribution of investment return, which to date, has not been significantly impacted by COVID-19. Overall, operating revenue was close to budget at approximately $11 million.

Regarding operating expenses, TTIC transitioned to in-person operations and once again hosted in-person talks and workshops. Overall, TTIC ended the fiscal year with an operating surplus of approximately $100,000.

TTIC is fortunate to be in a strong financial position with approximately $67 million in unrestricted financial assets.

In conclusion, I would like to thank the TTIC administrative staff for their hard work, commitment, and teamwork.

Jessica Jacobson  
Chief Financial Officer
## Financial Reports

### Statement of Financial Position

<table>
<thead>
<tr>
<th>ASSETS</th>
<th>2022</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash and cash equivalents</td>
<td>$1,855,617</td>
<td>$1,481,352</td>
</tr>
<tr>
<td>Receivables</td>
<td></td>
<td></td>
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<tr>
<td>Miscellaneous receivable</td>
<td>377,276</td>
<td>526,684</td>
</tr>
<tr>
<td>Grants receivable</td>
<td>804,604</td>
<td>926,273</td>
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<td>Due from TTI (Note 9)</td>
<td>1,332</td>
<td>1,646</td>
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<td>Interest receivable</td>
<td>43,643</td>
<td>43,426</td>
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<td>Investment distribution receivable</td>
<td>6,025,762</td>
<td>5,462,834</td>
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<td>Prepaid expenses and other current assets</td>
<td>86,243</td>
<td>34,898</td>
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<tr>
<td>Investments</td>
<td>260,590,725</td>
<td>287,565,842</td>
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<td>Furniture and equipment, net (Note 4)</td>
<td>5,623,151</td>
<td>6,128,092</td>
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<tr>
<td><strong>Total assets</strong></td>
<td>$275,408,353</td>
<td>$302,171,047</td>
</tr>
</tbody>
</table>

| LIABILITIES AND NET ASSETS                  |              |              |
| Current liabilities                         |              |              |
| Accounts payable                            | $100,474     | $326,826     |
| Accrued expenses                            | 743,081      | 820,480      |
| **Total current liabilities**               | 843,555      | 1,147,306    |
| Accrued lease liability (Note 7)            | 265,415      | 288,057      |
| **Total liabilities**                       | 1,108,970    | 1,435,363    |
| Net assets                                  |              |              |
| Without donor restrictions                  | 67,256,617   | 74,717,884   |
| With donor restrictions                     | 207,042,766  | 226,017,800  |
| **Total net assets**                        | 274,299,383  | 300,735,684  |
| **Total liabilities and net assets**        | $275,408,353 | $302,171,047 |
Statement of Activities and Changes in Net Assets

<table>
<thead>
<tr>
<th></th>
<th>Without Donor Restrictions</th>
<th>With Donor Restrictions</th>
<th>Total</th>
<th>Without Donor Restrictions</th>
<th>With Donor Restrictions</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenues, gains and other support</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student tuition and fees, loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scholarships of $1,207,500 and $1,320,000, in 2022 and 2021, respectively</td>
<td>$21,231</td>
<td>$ -</td>
<td>$21,231</td>
<td>$35,414</td>
<td>$ -</td>
<td>$35,414</td>
</tr>
<tr>
<td>Federal grants and contracts</td>
<td>3,026,997</td>
<td>-</td>
<td>3,026,997</td>
<td>3,625,811</td>
<td>-</td>
<td>3,625,811</td>
</tr>
<tr>
<td>Other interest</td>
<td>10,998</td>
<td>-</td>
<td>10,998</td>
<td>14,213</td>
<td>-</td>
<td>14,213</td>
</tr>
<tr>
<td>Net realized and unrealized (losses) gains on investments</td>
<td>(5,022,930)</td>
<td>(13,798,600)</td>
<td>(18,821,530)</td>
<td>7,822,600</td>
<td>27,931,091</td>
<td>35,753,891</td>
</tr>
<tr>
<td>Investment (loss) income – net of investment fees</td>
<td>(260,071)</td>
<td>1,174,254</td>
<td>914,183</td>
<td>363,713</td>
<td>2,480,314</td>
<td>2,844,027</td>
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<tr>
<td>Net assets released from restrictions</td>
<td>6,350,686</td>
<td>(6,350,686)</td>
<td>-</td>
<td>6,112,350</td>
<td>(6,112,350)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total revenue, gains (losses), and other support</strong></td>
<td>4,126,913</td>
<td>(18,975,034)</td>
<td>(14,848,121)</td>
<td>17,974,301</td>
<td>24,299,055</td>
<td>42,273,356</td>
</tr>
</tbody>
</table>

| **Expenses** |
| Education and research expenses – instruction | 8,643,646 | - | 8,643,646 | 8,863,900 | - | 8,863,900 |
| Management and general expenses – institutional support | - | - | - | - | - | - |
| **Total expenses** | 11,588,186 | - | 11,588,186 | 11,189,353 | - | 11,189,353 |

| **Change in net assets** |
| (7,481,267) | (18,975,034) | (26,456,301) | 6,784,948 | 24,299,055 | 31,084,003 |

| **Net assets – beginning of year** | 74,717,884 | 226,017,800 | 300,735,684 | 67,532,936 | 201,718,745 | 269,251,681 |

| **Net assets – end of year** | $67,256,817 | $207,042,766 | $274,299,383 | $74,717,884 | $226,017,800 | $300,735,684 |
Interns and Visiting Scholars

TTIC runs a robust intern/visiting scholar program, with typically 10-15 students from universities around the world spending an academic quarter or more working with faculty and students. This program creates new research and collaboration opportunities and provides valuable research experience for the participating undergraduate and graduate students.

TTIC maintains a steady number of interns and visiting scholars who engage in study and research on the premises. Summer 2022 had five visiting scholars and one remote visiting scholar from other institutions in the U.S. and abroad who came to the Institute to work on research projects in collaboration with TTIC faculty and students.

Short-term visiting scholars bring interest, energy, and enthusiasm to our academic community, and allow TTIC students access to a broad range of specialties that outside researchers bring with them, along with ideas and culture brought from the visitors’ home institutions.

TTIC provides matching funds for faculty to employ summer interns from underrepresented minority populations, which was new to the program starting this year.

Kunhe Yang
University of California, Berkeley
Faculty Host: Avrim Blum

Princewill Okoroafor
Cornell University
Faculty Host: Avrim Blum

Tushant Mittal
University of Chicago
Faculty Host: Madhur Tulsiani

Sophia Lopez
University of Chicago
Faculty Host: Karen Livescu

Luzhe Sun
University of Chicago
Faculty Host: Matthew Walter

Lorand Cheng
University of Chicago
Faculty Host: Matthew Walter
Constituent & Community Outreach

Institute Donation to Ukraine

On February 24, 2022, Russia invaded Ukraine in a major escalation of the Russo-Ukrainian War. The invasion resulted in tens of thousands of deaths on both sides and caused Europe’s largest refugee crisis since World War II, with an estimated 8 million people being displaced in Ukraine and 7.7 million Ukrainians fleeing the country as of October 2022.

TTIC donated $1,700 to Nova Ukraine, a nonprofit that supports Ukraine and provides humanitarian aid to the country. These donations were a mix of contributions from faculty, students and staff, and matching donations from TTIC. TTIC matched up to $50 of each donation, up to $1,000 total.

Promoting Diversity, Equity and Inclusion

The Diversity, Equity, and Inclusion (DEI) Committee at TTIC was first created in August 2020 to seek out new opportunities to educate students, faculty, and staff and make TTIC a more inclusive and welcoming place. The Committee is composed of students, faculty, and staff members, and welcomes feedback and participation from all members of the TTIC community.

In December 2021, after taking a break and reforming with new members, the Committee received a charge from the President that includes identifying challenges and areas of priority for TTIC in the area of DEI, recommending goals to address these, and proposing initiatives and activity to further progress towards those goals. The Committee has initiated work on the charge by proposing ideas aimed to broaden outreach in order to diversify the student applicant pool, and to promote awareness and open dialogue on topics related to societal impacts of computer science research and to the diversity and equity challenges in the field of computer science.

Committee Members:
- Rose Bradford, Administrator (co-chair)
- Greg Shakhnarovich, Faculty (co-chair)
- Matthew Walter, Faculty
- Derec Kobets, Administrator
- Kavya Ravichandran, Student
Women at TTIC Group

TTIC supports a Women at TTIC group, which is a group of women faculty, research assistant professors, courtesy faculty, and PhD students at TTIC, to provide opportunities for increased interaction and support among women faculty and students. Quarterly meet-ups have been a tradition where the group members have hearty conversations over lunch. This tradition has continued in remote settings during the past year with fun meet-ups including virtual games of Balderdash and Escape-Room. Beyond the usual tradition, the group also occasionally holds joint student events with University of Chicago Grad Women in Computer Science (GWiCS) which enables more interdepartmental interaction.

Community Partnerships

Chicago Pre-College Science and Engineering Program (ChiS&E)

Chicago Pre-College Science and Engineering Program (ChiS&E) is a weekend program for Chicago Public School students underrepresented in STEM fields. TTIC is working with ChiS&E to develop a Duckiebot-based high school robotics course for Chicago-area students starting fall 2022. Many of the students from this group are traditionally underrepresented in robotics and STEM.

Duckietown MOOC

Professor Matthew Walter is teaching a MOOC (Massive Online Open Course) on Duckietown, a project teaching fundamental lessons in robotics and AI. He is teaching the course along with his colleagues Liam Paull (University of Montreal Professor), Andrea Censi (Senior Researcher at ETH Zurich), Jacopo Tani (Senior Researcher at ETH Zurich), Stefanie Tellex (Brown University Professor), Nick Wang (National Chiao Tung University, Taiwan Professor), and Kirill Krinkin (Head of The Department of Software Engineering and Computer Applications at St. Petersburg Electrotechnical University). The MOOC that ended in fall 2021 had approximately 7,000 students in the class, 2,000 of whom implemented their code on their own physical Duckiebots (it was the first-ever hardware-based robotics MOOC). TTIC, and PhD candidate Andrea Daniele, were instrumental in revamping the software for the DuckieSky Drone course, a high school course that was taught in Rhode Island in summer 2022 with about 300 students who took the course.

Girls Who Code

TTIC Manager of Research Administration, Ms. Rose Bradford, has initiated and supports new programs of Girls Who Code, which is an after-school coding program for elementary school girls, by providing or arranging facilitation, lessons, and presentations. TTIC has worked with various area Chicago Public Schools (CPS) and is continuing in its role as Community Partner.
New Horizons in Theoretical Computer Science Workshop

Professor Madhur Tulsiani was an organizer for the workshop, “New Horizons in Theoretical Computer Science,” which took place on June 6-10, 2022, and is an annual, week-long online summer school which aimed to expose under-represented undergraduates in theoretical computer science to exciting research areas in the area of theoretical computer science and its applications. The school contained several mini-courses from top researchers in the field. The course was free of charge, held remotely, and applications from undergraduates majoring in computer science or related fields who are currently under-represented were encouraged to attend.
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Member of Councils, Toyota School Foundation, 2011- current
Member of Japan Techno-Economics Society Board of Trustees, 2017- current
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Fellow, American Physical Society and the American Association for the Advancement of Science
Received the Chaire d’Excellence Award of the French Agence Nationale de Recherche, 2006
Received the Llewellyn John and Harriet Manchester Quantrell Award for Excellence in Undergrad Teaching, 2001
Received the Faculty Award for Excellence in Graduate Teaching, University of Chicago, 2015
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Adjunct Professor in Linguistics and Computer Science and Engineering and served as Associate Dean for Research and Graduate Studies in the College of Engineering, 2009-2012
Scottish Informatics and Computer Science Alliance Distinguished Visiting Fellow
Australia Fulbright Scholar at Macquarie University
Has had 260 publications and recipient of two paper awards, the 2010 IEEE HP Harriett B. Rigas Award, and the 2018 IEEE James L. Flanagan Speech and Audio Processing Award
Served as Editor of IEEE Transactions on Audio, Speech and Language Processing and Computer Speech and Language, as VP Publications on IEEE Signal Processing Society, and served as a member of the IEEE Periodicals Review and Advisory Committee
Fellow of IEEE and ISCA and a 2013-2014 IEEE Signal Processing Society Distinguished Lecturer
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Professor Emeritus in 2007
Appointed as Vice President of Toyota Technological Institute (Nagoya, Japan) in 2007 and promoted to President in 2010
Awarded the National Recognition as a Person of Cultural Merit, Japan Academy Award, Leo Esaki Award, Heinrich Welker Award, Medal of Purple Ribbon from the Emperor of Japan, IEEE David Sarnoff Award, Fujiwara Prize, Japan IBM Science Award, and the Hattori-Hoko Award
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Had primary responsibility for budget, capital and debt structure for second-largest county government and associated health system in the country
Designed and led several transformative projects in financial operations, technology, program-based budgeting and performance metric-driven management
Leads integrated strategic financial planning and oversight for the execution of the University’s work in financial analysis and functions, information technology and human resources
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Special Thanks

Ashlyn Sparrow, Assistant Director of the Weston Game Lab at University of Chicago

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