



## President



## Leadership Profile

**WITT / KIEFFER**  
*Leaders Connecting Leaders*

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This Leadership Profile is intended to provide information about the TTIC and the position of President. It is designed to assist qualified individuals in assessing their interest.

## The Opportunity

Toyota Technological Institute at Chicago (TTIC or the Institute) is an independent, philanthropically-endowed academic computer science institute, dedicated to basic research and graduate education located in the Hyde Park neighborhood of Chicago on the University of Chicago campus. Its mission is to achieve international impact through world-class research and education in fundamental computer science and information technology. The Institute is distinctive to the American educational scene in its unique combination of graduate education and endowed research.

To progress and enhance its contributions to computer science and higher education, TTIC seeks a president to lead its operations and community.

TTIC was founded by the Toyota Motor Corporation (TMC) and the Toyota Technological Institute (TTI) in Japan, in collaboration with the University of Chicago. TTIC officially opened for operation in September 2003. It has degree granting authority in the State of Illinois and is accredited by the Higher Learning Commission of the North Central Association of Colleges and Schools. TTIC offers a graduate program leading to a doctorate in computer science, and is currently focusing primarily on theoretical computer science (algorithms and complexity); machine learning and its applications (computational biology, computer vision, natural language processing, robotics and speech); and scientific computing, including numerical analysis and numerical optimization. The Institute is supported by the earnings on an endowment of approximately \$255 million and approximately \$7 million available for spending from both federal and corporate grant awards.

Reporting to TTIC's Board of Trustees, the president is the Institute's chief executive officer and bears responsibility and accountability for the entirety of its operations. Leading a tenure-track faculty of 11, 8 research assistant professors conducting post-doctoral research, a highly motivated staff of 10 and a student body of 30, the president will be charged with growing the Institute both in size and in reputation, enhancing the quality and number of its key partnerships (especially with TTI and the University of Chicago), maintaining and enhancing its fiscal well-being and nurturing an optimal environment for scholarship and teaching. Accomplishing these ends will require a leader with a Ph.D. in computer science or related field, a history of successful management and leadership within a complex, highly-productive university environment, the willingness and ability to serve as the Institute's principal public representative and advocate and an entrepreneurial spirit.

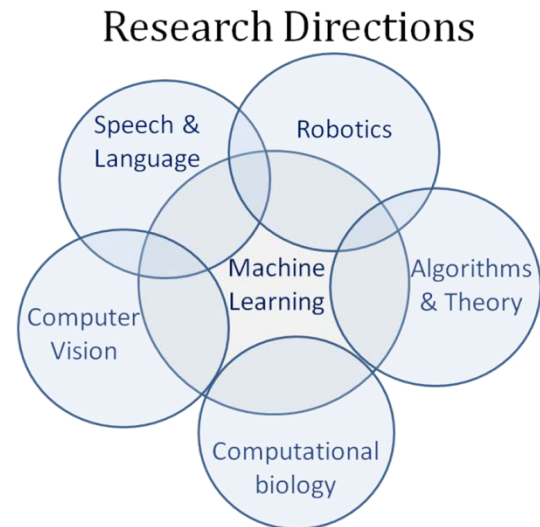
The Toyota Technological Institute at Chicago is doing cutting-edge work in a discipline very much "of the moment" to all of society. Its president will have the opportunity to expand on this important work both in capacity and in impact.

Recruitment will continue until the position is filled. Information about how to nominate someone or to apply for this opportunity may be found near the end of this document in the section entitled "Procedure for Candidacy."

# Toyota Technological Institute at Chicago: An Overview

## Research

Research is the heart and soul of activity at the Toyota Technological Institute at Chicago. Currently, there are active research programs in six areas: algorithms and complexity, computational biology, computer vision and computational photography, machine learning and robotics, and speech and language technologies. Each of these areas, described below, achieves greater impact as a result of the close, collaborative interactions and communication between them.



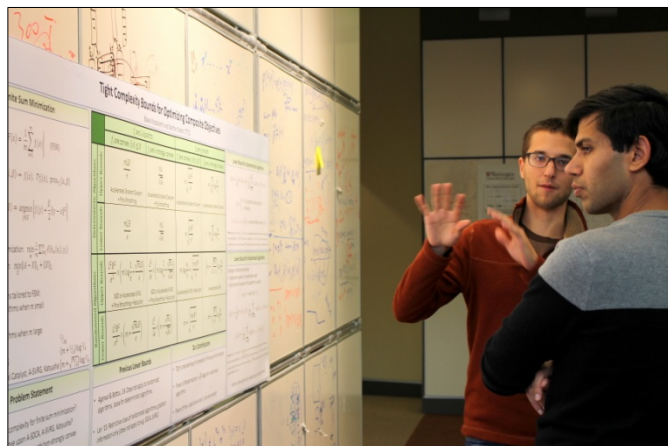
- Algorithms and Complexity – The area of algorithms focuses on designing algorithms, and more generally developing powerful algorithmic tools, for solving fundamental computational problems that frequently occur in different areas of computer science. Complexity theory is the study of the power and the 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 develops 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.
- Computational Biology – 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 seeking an efficient algorithm that can find an exact or approximate solution to a specific biological problem.
- Computer Vision and Computational Photography – Computer vision involves utilizing 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.
- 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. Machine learning plays a key role in classic artificial intelligence problems, such as computer vision, robotics, machine translation, question answering and dialogue systems, as well as a

variety of “non-human” problems such as information retrieval, search, bioinformatics and stock market prediction.

- 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. 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 surrounds 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.
- Speech and Language Technologies – This area is concerned with utilizing 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, in speech recognition. 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. Current NLP research at TTIC includes problems such as determining similarity between phrases and sentences, finding meaningful representations of sentences and of words in context and combining linguistic representation with knowledge outside of language. These technologies will, in turn, enable computers to better understand and summarize free text, and more broadly, will enable them to better aid and interact with their users.

## Faculty

TTIC currently has 11 tenure-track faculty of which eight have tenure. Tenure-track faculty conduct research, advise Ph.D. students, apply for grants and teach one course per year. The faculty also includes eight research assistant professors (RAPs). RAPs are appointed on a non-renewable three-year contract and typically join TTIC immediately after their Ph.D. RAPs work on research, work with students, may write grants and/or teach if they wish.





## Students and Education

TTIC's educational mission is achieved mostly through its Ph.D. program, which currently enrolls 30 students, and to date, has graduated 14. With its increasing visibility, TTIC has seen an increase in the number and quality of applicants; there were 123 applicants in 2015-2016, 135 applicants in 2016-2017 and 207 applicants in 2017-2018.



Full financial support is offered to all enrolled students in good standing, making progress towards their degree, guaranteed for five years. This includes tuition, health services, health insurance and student life fees and a stipend paid for research assistance. Currently, up to 13 students can be supported directly by TTIC's endowment. Each quarter, three to four students are also supported as teaching

assistants, roughly one per class taught by a TTIC tenure-track faculty member. The remaining students are supported through external funding, including faculty research grants, training grants and fellowships.

Courses taught by TTIC faculty satisfy all requirements of the Ph.D. program. In addition, TTIC students have access to courses offered at the University of Chicago (UofC), and UofC students have similar access to TTIC courses. Due to the popularity of TTIC's focus areas, an increasing number of UofC students exercise that option, and last year 211 UofC students took TTIC classes. Currently, TTIC has an informal agreement with the UofC Physical Sciences Division to provide teaching assistants for TTIC classes with large numbers of UofC students.

## Affiliated Partners

TTIC faculty engage with the University of Chicago faculty in a number of areas and also serve as advisors to several UofC Ph.D. students. Collaboration is particularly strong in the area of theoretical computer science. TTIC and the UofC computer science theory group attend shared seminars and events. There are also significant interactions with the statistics department and the Booth School of Business in the areas of machine learning and optimization. Relationships also exist in biochemistry (structural molecular biology), sociology (big data analysis) and linguistics.

Building on its relationship with TTI in Japan, TTIC offers a course at TTI, has organized joint workshops and research and also maintains a strong scholar exchange program.

## Events

TTIC hosts a number of events that make it a “destination” for colleagues in the national computer science community. These include a distinguished lecture series, a young researcher seminar series, a student career preparation workshop, the Midwest Machine Learning Symposium, the Midwest Robotics Workshop, Midwest Speech and Language Days and summer internship programs. In addition, a new program offering four week-long summer workshops will be launched this summer.

## Finances

TTIC’s current budget is \$9 million and is primarily supported through income from its \$255-million endowment. Another \$1.8 million in grant funding came from NSF (CISE), NIH, ONR, ARO, AFOSR and DARPA. Small grants from Google, Adobe, Intel, JTEKT and IBM also have been received. A summary of long-term budget projections reflecting anticipated growth over the next several years may be found in the appendix of this document.

## Governance and Administration

TTIC is governed by a diverse board of trustees whose 15 members serve renewable five-year terms. They meet two times a year. An executive committee, finance committee and search committee convenes more frequently. TTIC’s president sits on the board in an ex-officio capacity. A full list of board members may be found online at the following link:

<http://www.ttic.edu/board/>

TTIC currently employs a staff of 10. Reporting directly to the president are the chief academic officer, the chief financial officer and director of operations, the secretary of the institute and administrative director of graduate studies and publications and the director of information technology. An organization chart may be found in the appendix of this document.

## Facilities

TTIC occupies the top two floors of a building leased from the University of Chicago on its Hyde Park campus in Chicago. The space includes classrooms, labs, offices, conference rooms and commons areas. TTIC’s computing capacity, as might be expected, is extremely robust and includes cutting-edge, high performance computing systems with state-of-the-art graphic processing units.



## Opportunities and Expectations for Leadership

The following represent some of the immediate opportunities that the president will address during the first two to three years in office. They are presented here in no particular order of priority.

### **First, accelerate the momentum**

TTIC is on an upward trajectory and poised to take a significant step. The faculty is engaged with cutting-edge issues of great moment and global interest. The Institute's admissions profile and the quality of the student body are steadily improving; TTIC's current acceptance rate is approximately the same as that of Carnegie Mellon University. Its courses have drawn a 250 percent student registration increase over the last couple years and are drawing more and more students from its partner and host, the University of Chicago. The Institute is solidly endowed and fiscally sound. Its key partnerships — the University of Chicago, the Toyota Technological Institute, and their mutual benefactor, the Toyota Motor Corporation — are strong and symbiotic. TTIC is on mission and focused. Its new president will work with the Board, sponsors and the faculty from the outset to determine the niche for TTIC in the computer science ecosystem and develop a plan to garner the resources to get there. It is essential for the new president to maintain the Institute's trajectory and to enhance the pace of its progress.



### **Execute the strategic plan**

TTIC's current strategic plan was developed in the winter and spring of 2018 and was discussed by the TTIC board at its April 2018 meeting. The plan may be found in its entirety in the appendix of this document. The major elements of the plan are as follows.

- Grow the faculty – Faculty recruitment is critical to TTIC and its future, and the market is extremely competitive. TTIC plans to grow the tenure-track faculty from 11 to 16 and the total faculty body — including research assistant professors — from 20 to 30 over five years ending in 2023. The president will play a central and visible role in this effort and will ensure that women and underrepresented groups are enfranchised in these efforts.



- Ensure robust student demand – Applications for admission to TTIC’s Ph.D. program have increased substantially over recent years, and the quality of the student body has paralleled this substantial uptick in demand. The new president will ensure that this trend continues and accelerates as it anticipates growing from 30 to 45 or more students over the next five years, including especially by encouraging women and people from underrepresented groups to pursue computer science.
- Maintain and enhance key relationships – TTIC’s partnerships with the Toyota Technological Institute in Japan and the University of Chicago are critical both to its academic program and its business enterprise. The president will work from the outset to ensure that those partnerships remain strong and grow closer and more productive over time.
- Provide adequate and appropriate space for TTIC’s work – TTIC’s current home on the University of Chicago campus has worked well for several years. As the Institute grows, however, space will soon become a delimiter. A committee has been formed to look carefully and prospectively at TTIC’s space needs; the president will play an active role in planning and executing on that committee’s findings.

### **Raise the visibility of the Institute**

While TTIC is doing remarkable work in an area of exceptional public interest, its name recognition can be substantially enhanced. Particularly as it anticipates competing for faculty in a highly competitive discipline, the Institute would likely benefit, perhaps quite considerably, from a more robust public profile. In addition to providing increased leverage for the Institute’s efforts, raising the Institute’s visibility could have the collateral benefit of furthering the profile of the Chicago area and the Midwest as an incubator of innovation.



To that end, the president will seize the opportunity to identify and engage with additional corporate partners. Given TTIC’s focus on machine learning and the associated sub-disciplines, there would appear to be several avenues to enhance collaboration, including research laboratories, corporations, academic institutions or even local or regional governments. Such partnerships could have significant intellectual and/or financial benefits.

### **Ensure financial stability and health**

Thanks to the generosity of its donors, the Toyota Motor Corporation (TMC), and TTI, TTIC’s operations are supported by an endowment currently totaling over \$255 million. The corpus of the endowment reached this level thanks to a gift of \$85 million from TMC that was paid over three installments ending in 2017. When that gift was made, the board made the decision to



invest a portion of it with the University of Chicago by purchasing units within its investment pool. The remainder of the gift and the rest of the endowment are invested in long-term, fixed assets such as U.S. Treasury bonds. This extremely conservative approach to endowment investment is matched by a very modest spending policy.

As a result of this history and approach, the endowment corpus is safe and adequate for the time being, but it does not provide much room for growth. It is therefore anticipated that TTIC's next president will need to expand support for the Institute beyond the founding donors. TTIC's alumni body is small and its alumni are early in their careers. The president, then, will both begin to cultivate the Institute's alumni for current and, especially, future giving, and will at the same time, seek philanthropic investment from currently unaligned prospects with a deep interest in the Institute's work. The president should explore and pursue other means to increase the income, such as commercialization of IP, cooperative research arrangements with industry and support from relevant foundations.

### **Professionalize the institutional infrastructure and build a sense of community**

TTIC as an organization is still in many ways, a work in progress. There is, for example, no formal process for developing and articulating institutional policy. As a result, fundamental policies covering issues like investments and endowment spending are just now being formulated. There are fewer of the sorts of checks and balances on administrative functions than would be found in a more mature environment. While this provides an environment that is short on bureaucracy, far too many business decisions are made on an ad hoc basis, which of course risks unintended consequences, some of which could be dire.

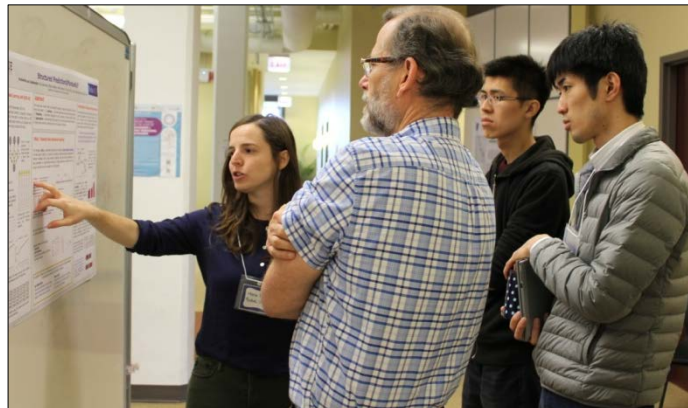
TTIC's academic initiatives thrive on collaboration. At the same time, the Institute is not immune to the typical infrastructural pressures and stresses that attend most higher education institutions, including a perceived division between faculty and staff. While these stresses, and the friction that accompanies them, are not remotely unusual, they are particularly acutely felt in such intimate environs. The president will work across the institution to ensure that the work environment is optimal for all and is typified by respect and collegiality, and that faculty and staff are engaged effectively in institutional decision-making.



# Qualities and Qualifications of the Ideal Candidate

## Academic

- Ph.D. in computer science or related field and a history of scholarship and teaching that has been rewarded with a tenured appointment at the rank of full professor; expertise in machine learning is highly desirable
- A deep and abiding commitment to academic freedom
- Ability to provide meaningful leadership in the development, improvement and enhancement of the Ph.D. program and curriculum
- Ability to serve as an advocate for the faculty on matters related to faculty compensation, hiring and program development, encouraging excellence in teaching, scholarship and service, fostering participation in faculty governance and ensuring best practices for the principles and procedures of appointment, rank and the tenure system
- Student-centered commitment and an understanding of recruitment, retention, persistence and assessment
- The skills, passion and commitment necessary to advance and champion a diverse community of students, faculty and staff



## Leadership and Management

- High level of integrity
- Demonstrated extensive organizational experience with leading, developing and building a world-class higher education team in a complex and competitive environment
- Experience as a natural and collaborative leader with business acumen that favors a policy of fiscal conservatism and can aid TTIC in matching aspirations with finite resources while thinking creatively about growth opportunities and encouraging new educational ventures and programs
- Substantial skills to engage in an essential and strong shared governance process
- A willingness to make strategic choices, timely decisions and responsive actions
- Possess the traits of great leadership, including emotional intelligence and maturity, honesty, intelligence, optimism, prodigious energy, a commitment to excellence,

outstanding judgment, energy, creativity, decisiveness, courage of convictions, diplomacy, tolerance for ambiguity and a sense of humor

### **Planning**

- Ability and willingness to provide and articulate a vision of TTIC's future, demonstrating leadership and ambitious long-range strategic planning skills to grow and develop an outstanding academic enterprise, including development of facilities and personnel
- Proven ability to articulate a clear and coherent plan, implement the plan and unify constituents behind it
- Deep knowledge of sound strategic planning and clear decision making based upon regional, national and global trends concerning the challenges of higher education, Ph.D. curricula and accreditation procedures

### **Community Relations**

- Demonstrated record of partnership and a spirit of entrepreneurship
- Robust history of personal interaction with campus and its constituent groups — faculty, students and staff — and the willingness to serve as the Institute's most visible and passionate ambassador
- Capacity to engender trust through excellent internal and external communication skills
- Track record for modeling and encouraging transparent decision making to promote trust and to nourish the spirit of mutual respect that is fundamental to TTIC's identity
- Familiarity and comfort with Japanese corporate culture is preferred
- Experience and acumen in dealing with the media is highly desirable

### **Resource Development and Guardianship**

- Demonstrated knowledge of fundraising and resource acquisition
- An ongoing commitment to building the endowment through donations, strategic investment management and disciplined spending

### **Board Relations**

- Ability and willingness to maintain an engaged and productive working relationship with the chairperson of the TTIC Board of Trustees in order to advance the business of the Board and its committees
- Ability to lead the administrative staff in the work of the Institute and in coordination with the direction of the Board of Trustees

## Procedure for Candidacy

Inquiries, nominations and applications are invited. For fullest consideration, applicant materials should be received by August 31, 2018. Candidates should provide a resume or *curriculum vitae*, a letter of application that addresses the responsibilities and requirements described in this leadership profile and the names and contact information of five references. Candidate confidentiality will be respected and references will not be contacted without prior knowledge and approval of candidates. Inquiries and application materials should be sent via email to the University's consultants, Dennis M. Barden and Elizabeth K. Bohan of Witt/Kieffer, at [TTICPresident@wittkieffer.com](mailto:TTICPresident@wittkieffer.com). Questions also may be directed to the consultants through the office of Laurie Adams at 630-575-6152.

### ***EEOC STATEMENT FROM TTIC***

TTIC is committed to providing equal employment opportunity to all employees and applicants. All employment-related decisions and personnel actions will be made and carried out without regard to race, color, religion, national origin, ancestry, citizenship, age, sex, marital status, pregnancy, sexual orientation, veteran status, disability or any other legally protected status. TTIC will endeavor to provide reasonable accommodations to qualified employees with disabilities, and of employees' religious beliefs, in accordance with applicable law.

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The material presented in this leadership profile should be relied on for informational purposes only. This material has been copied, compiled or quoted in part from Toyota Technological Institute at Chicago documents and personal interviews and is believed to be reliable. While every effort has been made to ensure the accuracy of this information, the original source documents and factual situations govern.

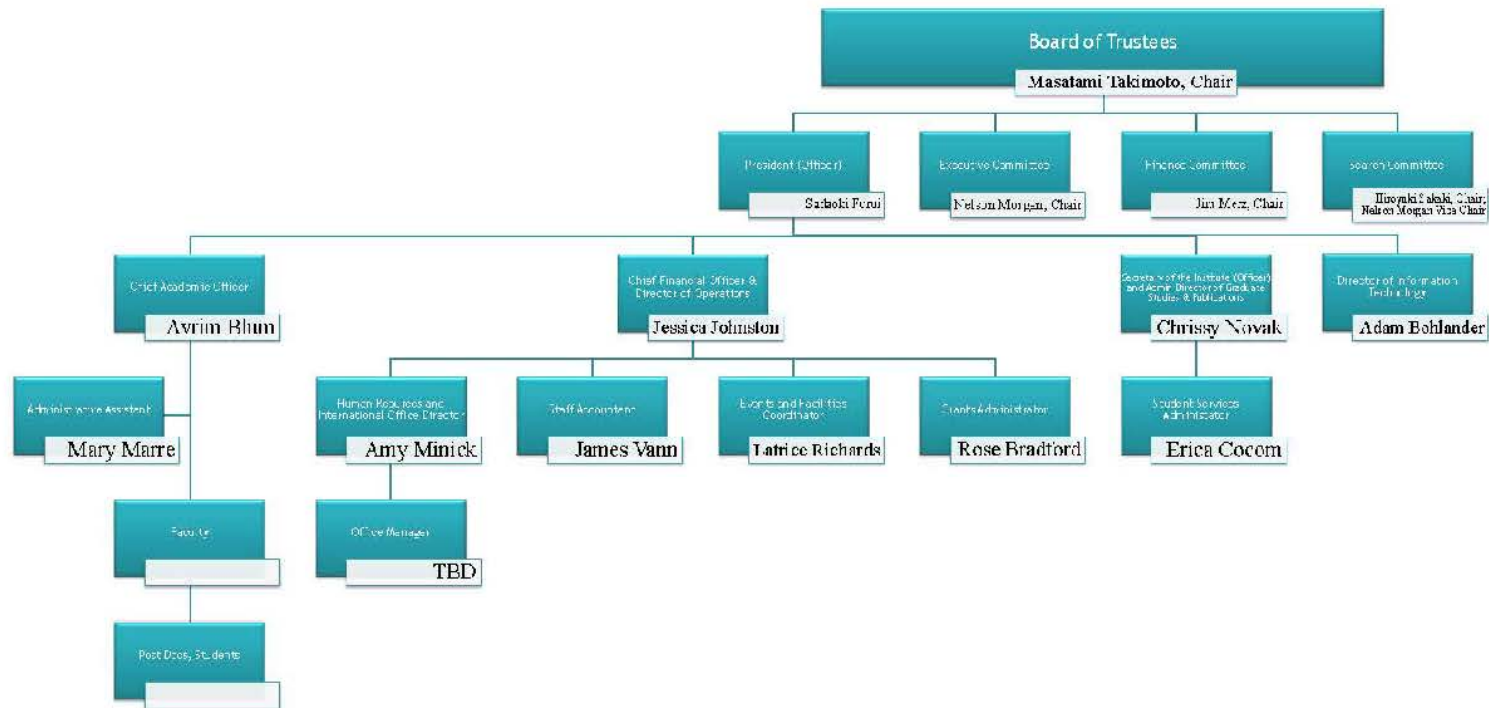
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# Appendix I: Organizational Chart



## Organizational Chart



## Appendix II: Budget

### Toyota Technological Institute at Chicago Long Term Budget - Revised November 2016

	Actual Operating Results 15-16	1 16-17	2 17-18	3 18-19	4 19-20	5 20-21	6 21-22	7 22-23	8 23-24	9 24-25	10 25-26
<b>Revenue</b>											
Grants and contracts	1,966,643	1,750,000	1,850,000	2,000,000	2,150,000	2,300,000	2,450,000	2,600,000	2,750,000	2,900,000	3,050,000
Interest income - bonds	1,662,159	1,481,489	1,520,533	1,520,533	1,520,533	1,518,182	1,509,157	1,492,970	1,469,206	1,442,044	1,410,694
TRIP distribution	2,120,670	2,420,059	2,993,448	3,025,559	3,120,561	3,218,547	3,319,609	3,423,845	3,531,354	3,642,238	3,756,604
Other income	20,463	20,000	20,353	20,712	21,077	21,449	21,827	22,212	22,604	23,002	23,408
<b>Total Revenue</b>	<b>8,369,935</b>	<b>8,671,547</b>	<b>9,324,334</b>	<b>9,566,804</b>	<b>9,812,171</b>	<b>10,058,178</b>	<b>10,300,593</b>	<b>10,539,027</b>	<b>10,773,163</b>	<b>11,007,285</b>	<b>11,240,706</b>
<b>Expense</b>											
Management and general	2,761,355	2,590,919	2,637,341	2,684,968	2,733,833	2,781,337	2,833,893	2,887,816	3,010,212	3,160,810	3,219,220
Education - Nongrant	4,496,269	4,931,503	5,244,049	5,574,086	5,948,980	6,334,883	6,732,100	7,140,945	7,306,135	7,475,416	7,648,895
Education - Grant	975,867	997,500	1,054,500	1,140,000	1,225,500	1,311,000	1,396,500	1,482,000	1,567,500	1,653,000	1,738,500
<b>Total Expense</b>	<b>7,933,491</b>	<b>8,519,922</b>	<b>8,935,890</b>	<b>9,399,053</b>	<b>9,908,313</b>	<b>10,427,220</b>	<b>10,962,493</b>	<b>11,510,791</b>	<b>11,883,816</b>	<b>12,289,256</b>	<b>12,606,614</b>
<b>Net Operating Surplus / (Deficit)</b>	<b>436,444</b>	<b>151,626</b>	<b>388,444</b>	<b>167,750</b>	<b>(96,142)</b>	<b>(369,042)</b>	<b>(661,900)</b>	<b>(971,764)</b>	<b>(1,110,688)</b>	<b>(1,281,971)</b>	<b>(1,365,909)</b>
Cash/Investment balance	204,584,194	226,916,579	254,022,138	256,194,421	258,434,604	260,648,988	262,663,021	264,459,026	266,022,344	267,526,345	268,941,159

# Appendix III: Strategic Plan

## TTI-Chicago Strategic Plan

Avrim Blum and Sadaoki Furui

April 12, 2018

The mission of the Toyota Technological Institute at Chicago (TTIC) is to achieve international impact through world-class research and education in fundamental computer science and information technology. As a small institution, TTIC's strategic plan has been to develop an intellectually coherent culture that fosters collaboration, so that the whole is greater than the sum of its parts. More specifically, TTIC has followed a hub and spoke model. The hub areas are theoretical computer science and machine learning, and the spokes are application areas with close intellectual connections to the hubs: computer vision, robotics, speech technologies, natural language processing, and computational biology. The choice of areas reflects a desire for intellectual coherence in which each faculty member can appreciate the technical content of the work of most other faculty members, as well as an environment that supports collaboration. In many ways, we are like a "department of AI and Theory".

Shortly after opening in 2003, TTIC developed a focus on machine learning. Over the twelve years of TTIC's formal operation, machine learning and "big data" have become more prominent and central to research and education in computer science and to the use of computer science in industry. In the last five years there has been a tremendous resurgence of neural network methods with empirical successes in computer vision, speech recognition, and natural language processing. TTIC is well-positioned, due to its focus areas, to make substantial impact in these directions. This is both an exciting opportunity and a challenge, as the competition in these areas is intense. TTIC must continue to grow, and to do so strategically, in order to fulfill its mission, to remain attractive to top students, and to take its place among world-class institutions.

### 1 Faculty

TTIC currently has five full professors, three associate professors, and three assistant professors, for a total of eleven tenure-track faculty of which eight have tenure (promotion to associate professor includes a conferral of tenure; the term "tenure track" refers to both tenured and untenured faculty). TTIC is currently approved by its board to grow to 16 tenure-track faculty with no additional restriction on how many may be tenured. Tenure-track faculty conduct research, advise PhD students, apply for grants, and teach one class per year.

TTIC's faculty also includes research assistant professors (RAPs). RAPs are appointed on a non-renewable three-year contract and are typically young researchers immediately after their PhD. The RAP program provides a constant stream of energetic talented young faculty to TTIC and has helped many researchers launch successful careers. TTIC remains committed to maintaining the high quality of RAPs, attracting strong researchers who will have a positive impact on TTIC and the computer science community more generally. TTIC currently has 8 RAPs with room to grow to a total of 14. Some RAP budget slots may be used for visiting faculty — more senior faculty spending a year or two at TTIC. The RAP program allows TTIC to be nimble and to quickly move into new areas.

TTIC aims to hire roughly 5 more tenure-track faculty over the next 5-8 years. The primary criterion for new hires is always excellence, but in terms of areas it roughly might include one or two in the hub areas (theoretical computer science and machine learning), two or three in applications, and one aimed towards an opportunistic, big-name, or out-of-the-box hire. TTIC also aims to hire high-quality RAPs in a range of areas. One of TTIC's competitive advantages is its collaborative and friendly atmosphere. It is crucial that

this atmosphere be maintained throughout TTIC's growth. In addition, it is crucial to maintain TTIC's culture of excellence.

## 2 Students and Education

The educational mission of TTIC is to train next-generation scientists and engineers, and achieve international impact through the accomplishments of its students. TTIC's recent graduates have taken both academic positions in top-ten universities and industrial research positions in leading companies. No matter what path a student takes, the educational foundation and training that TTIC provides in conducting cutting-edge research is of central importance to the later success of its students.

TTIC's educational mission is achieved mostly through its PhD program. The PhD program currently has 30 enrolled students, a ratio of roughly 3:1 to tenure-track faculty. We expect to maintain roughly this ratio (between 2:1 and 4:1) as we grow the ranks of tenure-track faculty to 16. TTIC has been able to attract a good number of high-quality students due to the reputation of its faculty. Maintaining the high quality of TTIC's PhD students is important both for its long-term educational impact and for the positive effect that such students have on the research environment. Current trends are positive in this regard: there were 123 applicants in 2015-2016, 135 applicants in 2016-2017, and 207 applicants in 2017-2018.

Currently, up to thirteen students can be supported directly by TTIC's endowment (this includes a special scholarship for female graduate students). Each quarter, 3-4 students are also supported as teaching assistants, roughly one per class taught by a TTIC tenure-track faculty member. The remaining students are supported by external funding, including faculty research grants, training grants and fellowships.

TTIC ensures that the courses taught by its own faculty are sufficient to satisfy the requirements of its PhD program. However, TTIC students are also free to take courses offered at UChicago, and UChicago students are free to take courses taught by TTIC faculty. Due to the popularity of TTIC's topics, currently many more UChicago students take TTIC courses than vice-versa. For example, last year, 211 UChicago students took TTIC classes and 6 TTIC students took UChicago classes.

Large classes require more support in terms of TAs and grading support compared to small classes. Currently, TTIC has an informal agreement with the UChicago Physical Sciences Division (PSD) to provide TAs for TTIC classes with large numbers of UChicago students. This appears to be working fairly well. However, it may make sense to have more formal agreements in place, and there are near-term plans to explore this direction. TTIC always reserves the right to limit UChicago enrollment in its classes if necessary.

Another part of TTIC's educational strategic plan is to develop and implement mechanisms for increasing the visibility of its students, to help them become well-positioned in the job market. This can carry many long-term benefits to TTIC and its mission.

## 3 Relationships with Other Institutions

TTIC will continue to maintain and invest in relationships with other institutions. This includes, but is not limited to, the University of Chicago and TTI in Nagoya. TTIC will seek additional relationships as productive opportunities arise.

TTIC's relationship with the University of Chicago is an important asset. Collaboration is particularly strong in the area of theoretical computer science. There are also significant interactions with the statistics department and the Booth School of Business in the areas of machine learning and optimization. Relationships also exist in biochemistry (structural molecular biology), sociology (big data analysis), and linguistics.



Looking to the future, TTIC hopes to further strengthen its relationship with the University of Chicago and has just recently implemented a notion of courtesy faculty to foster and acknowledge collaboration.

TTIC is also committed to its relationship with TTI in Nagoya (TTI-J). TTIC offers a course at TTI-J and hosts students visiting from TTI-J, and has a scholar exchange program with TTI-J under which faculty from each institution can spend time at the other. These activities are expected to continue as we also seek other meaningful interactions with TTI-J. Furthermore, TTIC sees its commitment to TTI-J and its mission as also encompassing impact on Computer Science in Japan more broadly, e.g. through visits and interactions with other institutes in Japan, and possibly creating special programs and opportunities for Japanese students and scholars.

## 4 Space and Activities

TTIC has created a space committee to look into and discuss options for space that will accommodate its medium-term and longer-term planned growth. We are currently examining possibilities for improved classroom and event space, as well as additional offices, research, and meeting space. In broad terms, our goals are for space that fosters collaboration, that provides a comfortable working and research environment, that is inviting and pleasing, and that accommodates growth in faculty, students, administration, and class sizes.

In terms of activities, in addition to research and teaching, TTIC aims to increase visibility through a range of other research-related and teaching-related programs. These include its visiting student program, summer workshops, and its distinguished lecture series. Workshops include those organized by TTIC faculty as well as a new *TTI-Chicago Summer Workshop Program* consisting of workshops organized by others but held at TTIC. This year we accepted 4 proposals submitted by groups in NLP, Machine Learning, and Algorithms. If these are successful, we aim to secure funding to allow us to continue and extend these workshops, ideally in collaboration with other nearby institutions. The high-level goal is to make TTIC a destination location, to spark collaborations, and to provide a rich experience for our students.

## 5 Conclusion and final thoughts

This Strategic Plan document purposefully does not aim to push in a specific research direction, or predict where future advances are most likely to lie. Instead, our strategic plan is to provide the best possible environment for faculty and students to conduct research and push boundaries in their areas of interest, and to become leaders of the breakthroughs of the future. Faculty are involved in a range of exciting projects including automatic sign-language reading, machine learning for protein folding, the design of perceptually-aware robots, understanding of fairness in machine learning, paraphrase recognition, the design of fundamental combinatorial algorithms, broad-context language modeling, self-supervised learning for image analysis, and understanding fundamental algorithmic limitations. There are no plans for a top-down push in any specific research direction.

We believe the future of TTIC is bright. Its collaborative nature, research orientation, mix of junior and senior scientists, low teaching load, research freedom, and quality students are all significant strengths. If TTIC's unique advantages can be maintained through its growth, which we believe it can, TTIC's reputation will continue to strengthen as it makes even greater international impact through world-class research and education in fundamental computer science and information technology.

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