Program Review Response
Institute of Technology, UW Tacoma

The Institute of Technology (or Institute) at UW Tacoma has undergone major changes since the last review in 2011-12.

- In 2011 the Institute had 341 students, 19 faculty, and 5 staff members. In fall 2017, the Institute has 805 students, 32 faculty (going up to 38 in 2018), and 13 staff members.
- In 2017, the Institute awarded 173 BS Computer Science & Systems (CSS) degrees, 26 BS Computer Engineering & Systems (CES) degrees, 67 BS Information Technology (IT) degrees, 88 MS CSS degrees, and 26 Master of Cybersecurity & Leadership (MCL) degrees.
- The Institute graduates secured industry placements in companies like Infoblox, T-Mobile, Avanade, Microsoft, Nordstrom, Paravida Solutions, West Monroe Partners, Amazon, and Google. Most graduate students secure positions in companies like Google, Facebook, Microsoft, and Apple. Several graduate students were admitted to doctoral programs at Georgia Tech, Virginia Tech, Oregon State University, University of Ottawa, University of Minnesota, and Dartmouth.
- More than 250 Institute students took part in Industry Internships. The Institute had one Fulbright Scholar in 2016 and one student in the Husky 100 in 2016 and one in 2017. Every year, Institute students take part in the ACM International Collegiate Programming Competition, Industry sponsored hackathons, the Pacific Rim Collegiate Cyber Defense Competition, the UW Business Plan Competition and the VIBE (Veterans Incubator for Better Entrepreneurship) Business Plan Competition.
- The Institute has research strengths in machine learning, cybersecurity, GIS, and bioinformatics. Institute faculty published 59 research papers in 2016-17 and obtained research funding from NIH, NSF, and industry (KenSci and Infoblox). Institute faculty served as chairs of conferences, were on conference program committees, and are on editorial boards of journals.
- In fall 2017 the Institute started offering the BS in Electrical Engineering, with an enrollment of 27 in its first class.
- The BS programs in CSS, IT, and CES obtained ABET accreditation in September 2017.
- The Institute also has the Center for Data Science (CDS) which conducts data science research for the social good. The CDS has raised more than $2 million since its inception in 2012.
- A new phase of development began in the Institute of Technology when it became a school in September 2016. The Institute now has three academic programs (or divisions): Computer Science (offering BS CSS and MS CSS degrees), Information Technology (offering BS IT and MCL degrees), and Engineering (offering BS CES, BS EE

degrees). A faculty council was formed in 2017 along with bylaws for the new school. The faculty council is considering the development of policies regarding faculty workload and lecturer promotion. We have plans to develop graduate degrees in IT and ECE (electrical and computer engineering) because developing more graduate degrees would attract and retain excellent faculty and staff.

Below we outline progress made with respect to challenges and areas of concurrences (or lack thereof) outlined in the review committee report. Additional information can be found in the following documents that have been provided separately. ABET self-study reports can be provided upon request.

- Annual Reports of the Institute of Technology for 2014, 2015, and 2016. The annual report for each academic year consists of faculty, student and staff numbers; student achievements; and a summary of teaching, research and service.
- Center for Data Science 5 year report written in summer 2017.
- Proviso report for 2015 and 2016. This is a report submitted to the state legislature on student data and retention rates for the Institute.

Progress on Challenges Outlined in the Review Committee Report:

- *The Institute is a new program that is building rapidly with a number of junior faculty. Faculty leadership is needed to develop operational structures to support the Institute's growth.*
  In the past five years several operational structures have been put into place that support the Institute's growth. In 2016, the Institute became a school with three academic programs (or divisions) each with a program chair elected by faculty. These academic programs are Computer Science (offering BS and MS degrees), Information Technology (offering BS IT and MCL degrees), and Engineering (offering BS CES, BS EE degrees). A faculty council was formed that enables faculty governance of the Institute. The faculty collaborated to write the bylaws of the newly formed school. The new dean of the school has formed a leadership committee (of program chairs and staff leaders) that deals with strategic planning and goal formulation. The staff leaders consist of the academic program administrator, the director for industry relations, and the director of operations.

  Senior faculty also contribute to the proper functioning of programs in the Institute by serving on committees like P&T and curriculum committees. Currently the Institute has 32 fulltime faculty (18 tenure track and 14 lecturers). Of the 18 tenure track faculty members, 6 are full professors, 5 are associate professors, and 7 are assistant professors. Of the 14 lecturers, two are senior lecturers. Full and associate professors exist in all programs in the Institute. The senior faculty perform rigorous 3rd year reviews of junior faculty.

  Junior faculty have mentors that help them succeed in teaching and research. The dean

gives adequate feedback to junior faculty annually regarding progress made towards tenure and promotion.

In 2017-18 the Institute is conducting searches for 6 new faculty members (3 assistant professor positions, 1 associate professor position and 2 lecturer positions).

- *Given the reliance on new junior faculty, there is a need to develop clear expectations about the quality of performance required for promotion and tenure.*
  The Institute does not rely on new junior faculty to do a large portion of service. The junior faculty now have a normal teaching, research and service expectation. In 2016-17, an ad hoc committee of senior faculty worked on formulating lecturer promotion and annual evaluation guidelines. The faculty council will complete this work by spring 2018. Clear expectations for promotion and tenure are delineated in the Promotion and Tenure Guidelines developed by the Institute. The guidelines emphasize quality of teaching and research. The campus also holds a promotion workshop every year in order to clarify procedural and other issues related to promotion.

- *Care must be exercised to ensure that expectations of teaching and new course/curriculum development do not conflict with expectations for research outcomes that may be considered for promotion and tenure.*
  The number of faculty in the Institute has gone from 19 in 2011 to 32 in 2017. The faculty members hired in the past five years are excellent in teaching and research. There are several faculty members who can teach courses in each area thereby ensuring program continuity. Junior faculty are given a lower teaching load (5 courses per year instead of 6) in their first 2 years. They also receive salary for one month in their first two summers. Startup funds of about $15000 are given to each new faculty member. This has led to a reduction in the conflict between teaching and research expectations. All faculty are provided with yearly funds for travel to conferences and for conference registration.

- *Opportunities exist to support career planning and mentoring, and through innovations such as developing joint research programs with the Seattle campus, e.g., through the South Sound Industrial Center for Engineering Education and Practice.*
  The Institute supports career planning and mentoring of faculty in several ways. The Institute holds an annual teaching and curriculum workshop in September. This year's theme of the workshop was active learning. The workshop discussed active learning techniques that work in Institute courses and how to use them. Also, at the annual Institute retreat we had a workshop on writing successful research grants. In the dean's annual evaluation of faculty, he discusses progress made towards tenure and promotion with each faculty member. We encourage each new faculty member to find a faculty mentor. If a new faculty member is not able to self-select a mentor then the program chair or dean assigns a mentor.

The computer science program has course stewards who make sure that faculty teaching

different sections of a course, collaborate by sharing teaching materials.

Faculty form research teams in order to collaborate on research problems. The Center for Data Science has teams of researchers working collaboratively on research problems. Junior faculty can join any of the research teams that exist in the Institute. The Institute faculty have research collaborations with industry/organizations such as Infoblox, Bosch, Microsoft, Costco, KenSci (a company started by an Institute faculty member), and the Tacoma Fire Department. The Institute faculty have filed for several patents with UW CoMotion in the past four years. Lecturers have opportunities in teaching and service in order to further their career.

Opportunities exist for lecturers to participate in curriculum development and in mentoring other faculty. We encourage lecturers to seek promotion to senior lecturer and/or principal lecturer positions.

- *Full-time Lecturers are hired on annual contracts which saves resources but does not create faculty commitment to building a program. The Institute may consider longer term appointments or the appointment of Senior Lecturers.*
  In 2015-16 we started changing all renewing lecturer appointments to 3 year terms. After the first 3 year appointment, lecturers are considered for a 5 year appointment. Initial appointments are 1 to 3 years, depending on experience. Two lecturers were promoted to senior lecturers in September 2017 and two more have applied for promotion to senior lecturer in 2017.

- *The faculty and advisory board recognize that the lack of high technology industries in Tacoma presents a challenge and are working to address it. The Institute may want to explore with the Milgard School of Business development of an entrepreneurship program for IT majors as a way to encourage start-ups, etc.*
  There has been a resurgence in the number of high tech industries in the Tacoma area. Specifically, there are several cybersecurity and information assurance companies in Tacoma (most notable among these are Infoblox, Windtalkers and Topia Technologies). The Institute has a strong relationship with Infoblox in research. Infoblox hires a large number of Institute graduates. The Institute also has a strong relationship with NAVSEA (Naval Undersea Warfare Center). NAVSEA hires Institute graduates, hires interns, and supports senior projects in engineering. Another local company, GeoEngineers, supports Institute programs by sponsoring hackathons. More than 200 Institute students took part in industry internships. The Institute is a member of the Pierce County Economic Development Board.

The Institute offers TINST 475, a course on entrepreneurship and technology. The students in this course learn how to leverage technology to create a competitive advantage in a market. Students have to submit a business plan as a final report in the course. This course has resulted in several companies being started by the students of the Institute. These include Phyzeek.com, Oli Fitness and Handimaps, which took first place in the 7th SVP Fast

Pitch competition in the collegiate category.

Each year many students participate in the VIBE (Veterans Incubator for Better Entrepreneurship) and UW Business plan competitions. Student participation in hackathons (the Institute holds at least three hackathons a year) has also encouraged them to start companies and produce innovative solutions to community and world problems. One Institute faculty member has started a company whose product predicts hospital readmission probabilities using machine learning. This company, called KenSci, has raised more than $10 million in venture capital.

Access to our students and faculty have helped several young regional companies grow dramatically including cloudPWR and Accumula.

A new endowment, the Andrew and Julie Fry Innovation Award, was created to support entrepreneurially inclined students at the Institute of Technology.

- *The Institute's two campus locations interfered with its development. Anticipated growth required consolidation into a single location. The issue was addressed with the Institute's move into one building at the beginning of Autumn Quarter 2012.*
  All Institute faculty and staff are located in two adjacent and connected buildings while classes and labs are located in various buildings on campus.

- *The graduate curriculum has attracted students from the Seattle area. Serving two student populations (local and Seattle) with different curricular needs may present a challenge. The primary student population should be determined so that the curriculum supports students' needs and to realize sufficient enrollment to support its operation.*
  The MSCSS program has a thesis option, a capstone option, and a coursework-only option to cater to the needs of different kinds of students. To accommodate different student interest, the MSCSS program has five tracks in data science, cybersecurity, bioinformatics, GIS, and cyberphysical systems. The program also offers classes at different times of the day (mornings and evenings) that would fit students with different needs. The MSCSS program has had consistent enrollment of about 140 students per year. The MSCSS program received 191 applications in 2016-17 and enrolled 61 new students in fall 2017.

- *The UW Tacoma employs a centralized advising model for undergraduate advising which may not provide the strongest approach for the Institute's undergraduates.*
  The UW Tacoma now employs a centralized advising model only for pre-majors. There are three full-time advisors in the Institute for majors with a search for a fourth advisor underway.

- *Opportunities exist for the Institute as it develops, such as having a core courses that most faculty could teach and clusters of specialized courses for particular programs, or consider the concept of threads used at Georgia Institute of Technology. The Institute faculty should determine a particular structure through a transparent, collegial process.*

The Institute became a school in September 2016 with three academic programs in Computer Science, Information Technology, and Engineering. These academic programs each offer two degrees and are headed by a chair. Extensive course assessment was done in order to write three self-study reports that resulted in the BS CSS, CES, and IT programs receiving ABET accreditation in September 2017. The programs maintain efficiency by sharing courses between programs. Below are some examples of programs sharing courses.

   a. TCSS 325 (Computer Ethics), TCSS 342 (Data Structures), TCSS 321 (Discrete Math), TCSS 142/143 (Intro Programming) are shared by the computer science and computer engineering programs.
   b. TCSS 325, TCSS 142/143 are shared by computer science and electrical engineering programs.
   c. TCSS 325 is shared by the computer science and IT programs.
   d. TCSS 101 (intro to computing) is shared by computer science, information technology, and computer engineering.

Program chairs discuss curricular changes with other program chairs before the curriculum committee in an academic program approves them.

Progress on Areas of Concurrence or lack thereof:

- *Recommendations 1a and 1b. Although the committee understood that a C course was offered in three required courses for both the Computer Science and Computer Engineering degrees, it recommended that the faculty consider offering a C programming course and increase the use of C programming in control and embedded systems, network, and security courses. Student expressed the need for more preparation prior to exposure in later courses. An informal C seminar/workshop is offered to better prepare students for certain CES coursework. The Institute responded that the program, as currently constituted, is adequate to meet students' needs.*
Two C programming courses (TCSS 333 and TCES 203) are now offered for Institute students. Computer Engineering majors use C programming in TCES 372 (Computer Organization and Architecture), TCES 420 (Operating Systems for Engineers), TCES 455 (Devices and Controls), TCES 460 (Embedded Systems Design), and TCES 480, 481, 482 (Senior Design I, II, III). Computer Science majors use C programming in TCSS 371 (Machine Organization), TCSS 372 (Computer Architecture), and TCSS 422 (Computer Operating Systems). The Computer Science curriculum will make TCSS 380 (Programming Languages) a required course starting in fall 2018. TCSS 380 covers the C programming language along with other programming languages.

- *Recommendation 2. The faculty should consider undertaking a comprehensive review to determine whether the pedagogy, course content, and introductory programming sequencing is best supporting student learning outcomes. The Institute responded that since the majority of students transfer from two-year schools in Pierce and King Counties, offering C any*

earlier than at the 300-level is not possible. An increase in C, C++, Python and other language teaching is under discussion. C# is taught in a required course for IT students. Curriculum restructuring is the first priority for the Institute this year.

A comprehensive review of all programs in the Institute has been conducted in the past three years. This resulted in comprehensive assessment of the BS CSS, BS IT, and BS CES programs culminating in ABET accreditation of these programs in September 2017. The MSCSS program changed its curriculum in 2016 to better serve its students. The MSCSS program now has 5 tracks in data science, cybersecurity, bioinformatics, GIS, and cyberphysical systems. The MCL program conducted program assessment in 2016 for accreditation purposes. The BS EE program will go up for ABET accreditation after the first student graduates from the program.

In order to meet accreditation requirements, the IT program added courses in Discrete Math, Ethics, and Technical Writing and reduced the number of required electives from 6 to 4. The BS CSS, CES, and IT programs meet all ABET requirements with respect to curriculum, faculty, and facilities. Curricular and program requirements of ABET can be found at http://www.abet.org/accreditation/accreditation-criteria/ . For example, ABET requires that BS CSS course work must consist of the following:

a. Mathematics: At least one half year that must include discrete mathematics. The additional mathematics might consist of courses in areas such as calculus, linear algebra, numerical methods, probability, statistics, number theory, geometry, or symbolic logic.

b. Science: A science component that develops an understanding of the scientific method and provides students with an opportunity to experience this mode of inquiry in courses for science or engineering majors that provide some exposure to laboratory work.

c. Coverage of the fundamentals of algorithms, data structures, software design, concepts of programming languages and computer organization and architecture.

d. An exposure to a variety of programming languages and systems.

e. Proficiency in at least one higher-level language.

f. Advanced course work that builds on the fundamental course work to provide depth.

- *Recommendation 3. The faculty should consider eliminating the Java programming self-assessment and substitute a more reliable Java programming placement exam. Due to the burden of the grading exam falling on a small number of faculty, the Institute has moved away from the placement exam to a self-assessment protocol. An electronic version of the placement exam will eventually be implemented. A parallel CSO course is currently being piloted to expose students to programming concepts through Python, while the CS1 and CS2 courses continue to be taught in Java.*

Since the elimination of the placement exam many years ago, the Java programming self-assessment test was never the sole determinant of course placement. Grades in courses

taken at UWT and/or community colleges are the main determinant of placement. There are unusual cases, and sometimes the self-assessment exam can help in those cases. Now that TCSS 142 and 143 are requirements for admission into the major, the self-assessment exam plays no role in major declaration. Currently, for pre-majors and those non-majors interested in computing, we offer an AP CS Principles course, a CS 1 course taught in Python (TCSS 142), and a CS 2 course taught in Java (TCSS 143). The first programming course in the major is a programming practicum course (TCSS 305).

- *Recommendation 4. The Institute and UW Tacoma administration should formulate a sustainable plan for continually updating the computing labs. The Institute's Facilities Committee will be meeting with appropriate UWT administrators to develop a sustainable replacement program for lab equipment.*
  All computers and equipment in Institute labs are replaced every 5 years. The budget for new purchases, licensing, consumables, and upgrading equipment is about $70,000 per year. The following computer/engineering labs exist in the Institute of Technology:
  a. CP 206 D,H,I: These three rooms are engineering/computer labs. The computers and equipment (oscilloscopes, logic analyzers, power supplies, signal generators) in these labs were replaced in 2015.
  b. SCI 106, 108, 113: These are computer labs which are scheduled to be upgraded in 2018.
  c. Dougan 110: This is a computer lab with computers replaced in 2016.
  d. TPS 202, 302: These are new electrical engineering labs with equipment purchased in 2017.
  e. JOY 001, 009, 205: Labs used by the Information Technology Program. The Campus IT department maintains equipment in these labs.

- *Recommendation 5. The Institute and UW Tacoma administration should review the factors that are creating constraints on elective course availability and implement corrective action. In the 2011-2012 academic year, the Institute began to address the issue. Changes were made to required and elective course schedules to better utilize faculty resources. Growth of the graduate program in computer science has increased demand for elective courses which created difficulty in sufficient teaching staff.*
  Over the last five years many new faculty members have developed new elective courses in the CS, Engineering, and IT programs. Many electives in the MSCSS program are taught by industry experts. Industry partners help the graduate program cope with emerging industry trends. Electives that are taught by industry experts open doors for collaboration between the Institute and industry. They also increase the opportunities of internships and jobs for our students.

  With the hiring of new faculty in recent years, the Institute is now offering enough electives that match faculty interests and in the variety that meet student needs.

The electives in each of the programs are listed below.

Computer Science Electives
TCSS 333 C for System Programming
TCSS 421 Compiler Construction
TCSS 430 Networking and Distributed Systems
TCSS 431 Network Security
TCSS 435 Artificial Intelligence and Knowledge Acquisition
TCSS 437 Mobile Robotics
TCSS 440 Formal Models in Computer Science
TCSS 445 Database Systems Design
TCSS 450 Mobile Application Programming
TCSS 452 Human-Computer Interaction
TCSS 455 Introduction to Machine Learning
TCSS 456 Introduction to Natural Language Processing
TCSS 458 Computer Graphics
TCSS 460 Client/Server Programming for Internet Applications
TCSS 461 Advanced Software Engineering
TCSS 465 Embedded Real-Time System Programming
TCSS 478 Fundamentals in Bioinformatics
TCSS 481 Computer Security
TCSS 487 Cryptography
TCSS 488 Coding Theory
TCSS 491 Computational Worlds

Computer Engineering Electives
TCES 421 - Digital Integrated Circuit Design
TCES 431 - Essentials of VLSI Circuit Testing and Hardware Security
TCES 460 - Embedded Systems Design
TCES 461 - Hardware for Cryptography
TCES 491 - Digital Signal Processing

Information Technology Electives
TINFO 431 - Server Side Web Applications
TINFO 441 - Network Security
TINFO 442 - Computer Security
TINFO 443 - Digital Forensics
TINFO 444 - Mobile Digital Forensics
TINFO 445 - Mobile Digital Forensics II

TINFO 451 - Routing and Switching

TINFO 452 - System Administration

TINFO 453 - Wireless Networking

TINFO 461 - Organizational Information Assurance

TINFO 462 - Building and Information Risk Management Toolkit

TINFO 463 - Establishing and Managing Information Assurance Strategies

TINFO 470 - Information Technology for Future Leaders

TINFO 476 - Threat Modeling

TINFO 480 - Research Methods

<u>Graduate Electives in Computer Science</u>

TCSS 511 Advanced Enterprise Architecture

TCSS 523 Data Compression

TCSS 531 Cloud and Virtualization Systems Engineering

TCSS 540 Theory of Computing

TCSS 544 Applied Linear Algebra

TCSS 545 Database Systems Design

TCSS 551 Big Data Analytics

TCSS 552 Interaction Design

TCSS 554 Information Retrieval and Web Search

TCSS 555 Machine Learning

TCSS 559 Web Services

TCSS 562 Software Engineering for Cloud Computing

TCSS 564 Database Systems Internals

TCSS 565 Spatial Databases with Applications in Geographic Information Systems

TCSS 569 Introduction to Cyber-Physical Systems

TCSS 573 Internet of Things

TCSS 574 Cyber Electromagnetics

TCSS 575 Control of Cyber-physical Systems

TCSS 580 Information Theory

TCSS 581 Cryptology

TCSS 582 Cryptographic Protocols

TCSS 583 Post-Quantum Cryptosystems

TCSS 584 Testing VLSI Circuits and Hardware Security

TCSS 588 Bioinformatics

- *Recommendation 6. The faculty acted upon the recommendation to use their retreat as an opportunity to examine underlying dynamics that constrain continuous programmatic improvement and a more uniform sense of collegiality. A UW Cares representative who met*

with the faculty provided information on strategies to build a stronger sense of collegiality and resources that are available. It is an Institute priority. The Chancellor articulated and demonstrated, at the retreat, that a positive sense of community within the unit and throughout campus is central to an effective university. The working research and teaching groups will increase the scope and level of interaction among all faculty.

In the last three years the sense of collegiality in the Institute has increased dramatically. Faculty have collaborated to accomplish the following:

a. The Institute became a school in September 2016. The faculty collaborated to write and approve new bylaws for the Institute. The faculty formed a faculty council that will formulate policy for the proper functioning of the new school.

b. The faculty as a group voted to undergo the ABET accreditation process. The faculty performed program assessment in order to write three self-study reports to ABET. The CSS faculty collaborated in changing the CSS curriculum to satisfy ABET requirements. The BS CSS, CES, and IT programs received ABET accreditation in September 2017, while the EE program will apply for ABET accreditation in 2019 after producing the first graduate.

c. The CSS faculty collaborated in order to control the rapidly growing enrollments in the CSS program. The CSS program now admits 90 students in fall and 90 in winter.

d. All faculty collaborate by sharing their course material with other faculty. Faculty have also formed research groups.

Overall, the quality of all programs in the Institute has improved over the past five years.

Appendix A: Annual Report of the Institute of Technology for 2014, 2015, and 2016

The annual report for each academic year consists of the following:

1. Faculty, Student, and Staff Numbers
2. Student Achievements
3. Summary of Teaching, Research, and Service

Annual Report: Institute of Technology 2014-2015

1. Faculty, Student, and Staff Numbers

<u>Student Numbers:</u> In the 2014-15 academic year the Institute of Technology had approximately 686 students enrolled with the following breakdown: Undergraduate – CSS 361, CES 86, IT 123; Graduate – MSCSS 93, MCL 23. The projected enrollment for 2015-16 is 740 students (an 8% increase).

<u>Degrees Awarded:</u> The number of degrees awarded in 2014-15 is shown in the table below.

Degree	Number Awarded
BS CSS	151
BA CSS	3
BS CES	29
BS IT	50
MCL	21
MSCSS	54
Total	308

<u>Faculty Numbers:</u> In 2014-15 the Institute had 14 tenure track faculty members, 9 full-time lecturers, and 17 part-time lecturers. In 2015-16 the Institute will have 16 tenure track and 11 full-time lecturers.

<u>Staff Numbers:</u> There were 12 staff members in 2014-15 and there will be 12 staff members in 2015-16.

The plot below shows approximate trends in these numbers since 2007.
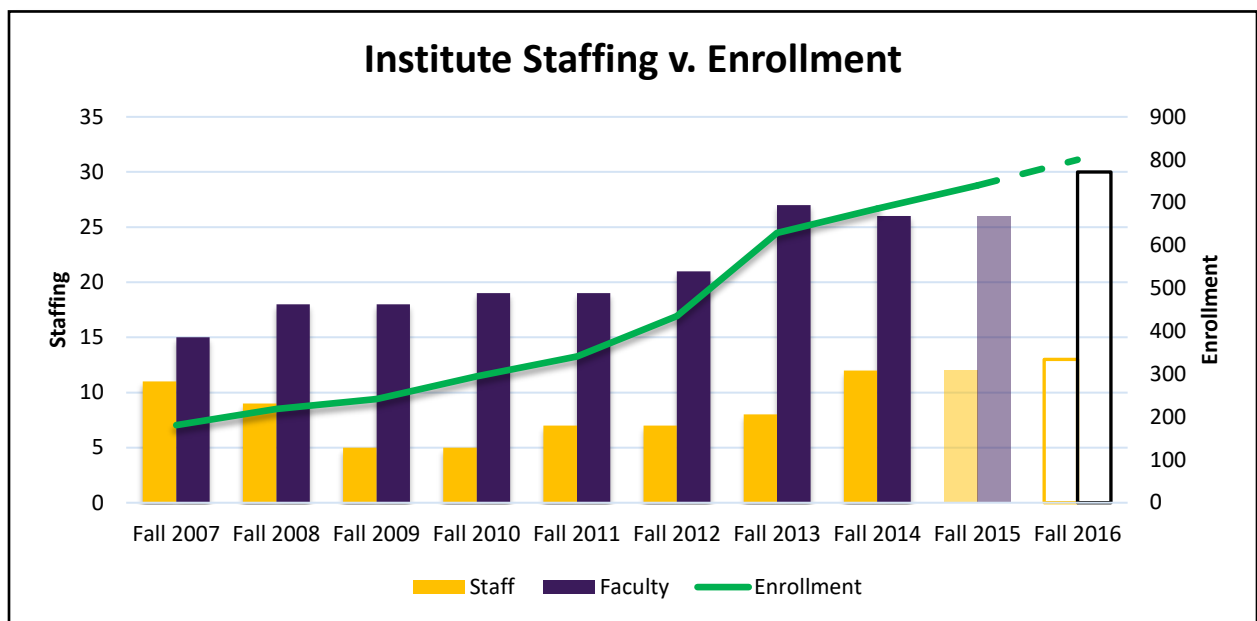
2. Student Achievements

Undergraduate Students:

Nearly all of the graduates of the Institute of Technology received job offers at the time of graduation. Though no exact percentage is available as there is not complete coverage of student employment after graduation, two random samplings of alumni, both recent and from the last decade provided 100% employment in the technology industry.

Below is a partial list of companies that offered employment to the graduates of the Institute of Technology from a sampling of 30 former students representing all programs with varied graduation dates:

	Name	Prog	Year	Position	Company
1	Ainsley Herndon	CS	12	Software Engineer	Slalom Consulting
2	Ben Krack	CE	12	Software Engineer	Slalom Consulting
3	Brenda Mabry	CS	12	Implementation Engineer	Thomas Rueters
4	Chan Curry	IT	12	Project Manager	Boeing
5	Doug Kroll	IT	11	Systems Engineer	Avanade
6	Brian Van	IT	11	Enterprise Architect	Boeing
7	Hannah Craswell	IT	11	Systems Engineer Infrastructure	Avanade
8	Travis Rautman	MCS	12	Software Development Engineer 2	Amazon
9	Amita Lakkad	MCS	11	Software Developer	Nordstrom
10	Jordan Ryan Moore	CS MCS	09	Software Development Engineer 2	Amazon
11	Scott Mutter	CS	09	Senior Software Engineer	Tech Mahindra
12	Mary Jane Kelly	CS	07	Computer Security Consultant	Casaba Security
13	Andrew Becherer	CS	07	Technical Vice President	iSec Partners
14	Justin Raynor	CE	10	USAF Captain, Development Eng	USAF
15	Robert Bunge	MCS	07	Faculty Coordinator for IT	N Seattle College
16	Jennifer Leaf	MCS	07	Senior Program Manager	Microsoft
17	Keith Bloomfield	CS	06	Lead Developer	Dev 9
18	Brett Batie	CS	06	Solutions Engineer/ Dev Man	SmartStreet
19	Ahmad Hajiismael	IT	14	Software Design Engineer	Concur Tech
20	Matt Rigg	IT	14	Cloud Support Engineer	Amazon
21	Kyle Levy	IT	11	IT Field Tech	Google
22	Brent Sargent	IT	12	Security Operations Engineer	Amazon
23	Ashish Bindra	CS MCS	09	Software Design Engineer/Data Eng	White Pages
24	Brian Muckian	IT	14	Oracle Developer	NIKE
25	D.C. Grant	IT	12	Assistant Professor Cyber Security	Columbia Basin
26	Andrew Sorenson	CS	14	Security Consultant	Leviathan Sec Grp
27	Gary Belvin	CE	09	Security Engineer	Google
28	Jordan Gottlieb	CS	09	UI/UX Director	4QTRS LLC
29	Matthew Evans	CS	08	Software Engineer	Aptech Systems
30	Craig Truzzi	CS	09	Software Engineer	Software AG

This sample includes 13 CS alumni, 3 CE alumni and 10 IT alumni with 6 MCS graduates represented.

The companies actively recruiting our students run the full gamut of industry. Local companies and municipal organizations such as Internet Identity, Avue Technology and Pierce County IT actively visit, recruit and intern our students with many hires being made. Larger Fortune 500 technology companies also commonly recruit the students and many such as Boeing, Microsoft, Avanade, Amazon and Google will visit campus or set up company student recruitment activities including presentations and interviews.

Student Outreach

The Institute of Technology incorporates outreach to the community as part of the provided student experience. In the last academic year over two hundred instances of student-community interaction took place, with one hundred and forty two internships, fifty plus students engaged in Managing Technical Teams projects and numerous senior projects within IT, CS and CES.

Over one hundred and fifty students participated in the May 8th Microsoft Hackathon in William Philip Hall. This was the 3rd event hosted by Microsoft over the last two years. Student teams created solutions with embedded software integrated into a cloud based solution and at the end of the event 12 different solutions were presented by student teams.

As part of a school project, students from the University of Washington-Tacoma Institute of Technology developed and implemented an automated system for Joint Base Lewis McChord's Fischer House, whose mission is to help families focus on their loved ones that are going through recovery, surgery or dealing with their medical issues.

The resulting solution caught the attention of Lt. General Stephen R. Lanza, commanding general of I Corps. He came to the campus and presented the students with challenge coins and certificates of appreciation for their hard work.

The Institute students took part in the following competitions: ACM's International Collegiate Programming Competition, the Pacific Rim Collegiate Cyber Defense Competition (the UWT team got 4th place), and the IEEEXtreme 8.0 programming competition.

Student Groups in the Institute are: Women in Computer Science, ACM (Association for Computing Machinery), and IEEE (Institute of Electrical and Electronics Engineers) and the Gray Hat group.

Graduate Students:

The following paper by Mohamed Ali, Abdeltawab Hendawi, Sarah George, Craig Apfelbeck , Yiru Li, "Routing Service with Real World Severe Weather. Demo Paper," got the best demo award at the 2014 ACM SIGSPATIAL GIS Conference.

3. **Summary of Teaching, Research, and Service**
Teaching: The Institute faculty taught 20510 student credit hours (course credits times number of students per course). This number accounts for courses in which faculty were engaged in classroom teaching and does not include courses like TCSS 390, independent study, MS theses, or capstone projects. The 14 tenure track faculty members accounted for 5917 credit hours of teaching while the full-time and part-

time lecturers accounted for 10180 credit hours and 4413 credit hours respectively. The tenure track faculty members mentored many of the 93 MSCSS students.

Research: The Institute faculty published 53 refereed conference papers and 16 journal papers in 2014-15 (this is an average of 3.6 conference papers per tenure-track faculty member and 1 journal paper per tenure-track faculty member). In 2014-15 the Center for Data Science obtained $1.18 million in grants and gifts. In addition to this one NIH sub-grant of $506079 was also funded.

Service:

    a. Tenure-track faculty members were on 26 conference program committees.
    b. Tenure-track faculty members were on the editorial boards of 8 journals.
    c. Leadership roles in conferences by tenure-track faculty: General Chair for the ACM SIGSPATIAL Int'l Conference on Advances in GIS 2015, Information director for ACM SIGKDD 2015, Publicity co-chair for IEEE BigDataService 2015, Ph.D. forum co-chair for the IEEE Int'l conference on Cloud computing technology and science 2015, Advisory co-chair for NAFIPS 2015, and Session organizer for the Biophysical Economics Meeting 2015.
    d. Faculty members were teachers in the MSL program (Math Science Leadership Program) for middle and high school students.

Annual Report: Institute of Technology 2015-2016

Summary:

Student demand for programs in the Institute continues to be very high. The three undergraduate programs offered by the Institute will be up for ABET accreditation in the fall of 2016. Student enrollment went from 686 in fall 2014 to 784 in fall 2015. The number of tenure track faculty members for 2016-17 will remain the same as the number in 2015-16. The number of lecturers will increase from 11 in 2015-16 to 13 in 2016-17. Employer demand for graduates of our programs is very high. Faculty research output increased a little compared to the previous year.

1. Faculty, Student, and Staff Numbers

Student Numbers: In the 2015-16 academic year the Institute of Technology had approximately 784 students enrolled with the following breakdown: Undergraduate – CSS 391, CES 81, IT 132; Graduate – MSCSS 142, MCL 38. The projected enrollment for 2016-17 is 820 students (if we added another cohort in IT and admitted all students eligible for admission in the BS CSS and MS CSS programs the projected enrollment would be 923).

How the projected enrollment is computed: The total number of returning students in the undergraduate programs plus new students admitted as of June 17, 2016 is 540. Based on the number of applicants in each of the undergraduate programs we project 84 more students in BS CSS, 29 more students in BS IT, and 20 more students in BS CES. The projected total number of new students admitted into the undergraduate programs would be: 140 in BS CSS, 70 in BS IT, and 28 in BS CES. The total expected enrollment from undergraduates is 540+84+29+20 = 673.

The total number of graduate students that are expected to enroll is 170 (150 for MS CSS and 20 for MCL). Therefore, the total expected enrollment is 673+170 = 843. It is likely that we turn down about 23 students in the BS CSS program (due to shortage in faculty numbers) to give an estimated enrollment of 820.

It should be noted that 50 more students could be admitted in the MS CSS program and 30 more in the BS IT program for a total possible enrollment of 843 + 80 = 923.

Degrees Awarded: The number of degrees awarded in 2015-16 is shown in the table below.

Degree	Number Awarded
BS CSS	153
BA CSS	8
BS CES	21
BS IT	61
MCL	34
MSCSS	49
Total	334 (17 double majors)

Faculty Numbers: In 2015-16 the Institute had 16 tenure track faculty members, 11 full-time lecturers, and 24 part-time lecturers. In 2016-17 the Institute will have 16 tenure track (one retirement and one faculty member is going to resign but has not done so yet) and 13 full-time lecturers.

Staff Numbers: There were 12 staff members in 2015-16 and there will be 12 staff members in 2016-17.

The plot below shows approximate trends in these numbers since 2007.
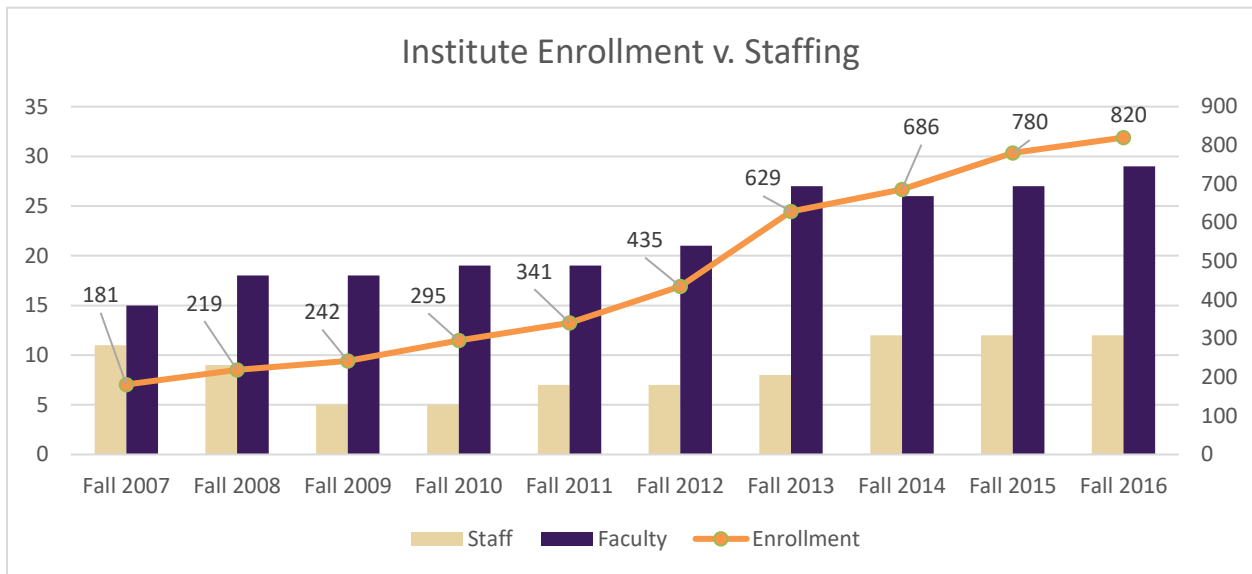
2. Student Achievements
Undergraduate Students:

The Institute of Technology continues to see a very high placement rate for students finding jobs after they have graduated.   Though no exact percentage is available through alumni resources, we have conducted surveys and samplings over the last year to get a sense of the placement rate. In this year's sampling of 125 alumni, representing all programs with varied graduation dates, results were achieved similar to the year before. Using a random method to crawl through LinkedIn, out of the entire sampling only one student was not working in a position that mapped to his/her degree program.

Below is a partial list of companies that offered employment to the graduates of the Institute of Technology in 2015-16.

Name	Major	Year	Employer	Job Title
Timothy Loverin	CES	2015	Garmin	Aviation Software Engineer
Hguyen Khanh	CES	2015	Infoblox	Software Developer
Shruti More	CES	2015	Microsoft	Software Developer
Kebra Thompson	CES	2015	Naval Undersea Warfare Center	
Marilyn Ferguson	CSS	2015	Blue Origin	Software Engineer

Huy Ngo	CSS	2015	Booking.com	Jr. Software Engineer
Ben Cassidy	CSS	2015	Cascade Energy	Software Engineer
Michael Overby	CSS	2015	Continuum	Software Engineer
Andrew Leach	CSS	2015	Costco Travel	Software Engineer
Joshua Moore	CSS	2015	Costco Travel	Software Engineer
Kirsten Grace	CSS	2015	Microsoft	Software Engineer
Robert Enteman	CSS	2015	Parallel Machines	Software Engineer
Loren Milliman	CSS	2015	Pierce County IT	Software Developer
Reagan Middlebrook	CSS	2016	Google	Engineer Resident
Tyler Jarmon	IT	2015	Amazon	Security Operations Analysis
David Kan	IT	2015	Amazon	IT Support Tech
Earl Switzer	IT	2015	Amazon	Tech Support
Nikolay Kravchuk	IT	2015	Avanade	Software Engineer
Daniel Massie	IT	2015	Engility Corp	Applications System Analysis
Iatkit Ho	IT	2015	Envestnet Inc	Software Engineer
Branden Hiatt	IT	2015	Harborstone Credit Union	Information Tech Specialist
Devon Linn	IT	2015	Tata Consulting Services	Software Engineer
Himchan Han	IT	2015	Weyerhauser	BI Analysis
Todd Love	IT	2015	YMCA Pierce & Kitsap County	System Administrator
Larry Chang	IT	2016	Booking.com	Software Dev Engineer Intern
Iyad Alqurabawi	IT	2016	Tacoma Community College	Lead Software Engineer

The companies actively recruiting our students run the full gamut of industry. Local companies and municipal organizations such as Infoblox, Topia Technology, Pierce County IT and Keyport Naval Base actively visit, recruit and intern our students with many hires being made. Larger Fortune 500 technology companies also commonly recruit the students and many such as Boeing, Microsoft, Avanade, Amazon and Google will visit campus or set up company student recruitment activities including presentations and interviews.

Student Outreach

The Institute of Technology incorporates outreach to the community as part of the provided student experience. In the last academic year over two hundred and twenty five instances of student-community interaction took place, with one hundred and sixty six internships (up from one hundred and forty four the previous year), sixty plus students engaged in Managing Technical Teams projects and numerous senior projects within IT, CSS and CES.

65 students participated in the April Hackathon in the Student Activity Center which was sponsored by GeoEngineers, Smartmine, Ezri, Socrata, Pierce County Transit and the City of Tacoma. Three of the

students later presented their solutions to the advisory committee meeting of Pierce Transit for consideration of funding. In the 4th event hosted by Microsoft over the last two years 60 students created solutions from a variety of platforms with several solutions being presented by student teams as well as guests from middle and high schools. CSS student Viveret Steele won first place in the XPRT Women Code-A-Thon held in March 2016.

Students acted as greeters and guides for the South Sound Technology Conference which attracted over 200 members of industry, government and academia to the campus. Students from other academic institutions at the high school and community and technical college level were also invited to showcase their technical projects to the conference.

Of the 100 student teams entering for the Buerke Center for Entrepreneurship Business Plan Competition, 36 were chosen for a showcase including an Institute of Technology team called VESPAR, which implemented voice recognition in the kiosk ordering process.

Student Groups in the Institute are: Women in Computer Science, ACM (Association for Computing Machinery), IEEE (Institute of Electrical and Electronics Engineers) and the Gray Hat group.

Graduate Students:

- Graduate student paper with best demo award: *A Map-Matching Aware Framework for Road Network Compression, the International Conference on Mobile Data Management (MDM), 2015.*
- A provisional patent was filed by CoMotion based on the work of graduate students in the following paper: *Coma: Road Network Compression for Map Matching, the International Conference on Mobile Data Management (MDM), 2015*.
- Graduate students worked on the following industry sponsored research projects: Bosch Research ($150000) and Microsoft ($90000).
- Graduate student Jumana Karwa awarded $60000 by the Amazon Catalyst Program for her project called "FaceCrop" that aims at compressing the size of videos by focusing on moving faces in the video.
- Graduate Student Daniel Kristiyanto in UW Husky100.
- The machine learning/data science group published six conference papers in prestigious conferences.
- The bio-informatics group published one conference paper and two posters in conferences.

3. **Summary of Teaching, Research, and Service**

Teaching: The Institute faculty taught 27,787 student credit hours (course credits times number of students per course) in 2015-16. In 2014-15 the number of student credit hours taught was 20,510. This number accounts for courses in which faculty were engaged in classroom teaching and does not include courses like TCSS 390, independent study, MS theses, or capstone projects. The 16 tenure track faculty members accounted for 8935 credit hours of teaching (compared to 5917 in 2014-15) while the full-time and part-time lecturers accounted for 11940 credit hours (compared to 10180 in 2014-15) and 6912 credit hours (compared to 4413 in 2014-15) respectively. The tenure track faculty members mentored many of the 142 MSCSS students.

<u>Research:</u> The Institute faculty published 36 refereed conference papers and 22 journal papers in 2015-16 (this is an average of 2.2 conference papers per tenure-track faculty member and 1.4 journal papers per tenure-track faculty member). In 2015-16 the Institute faculty received approximately $735,624 in grants and gifts.

<u>Service:</u>

   a. Tenure-track faculty members were on 40 conference program committees.
   b. Tenure-track faculty members were on the editorial boards of 11 journals.
   c. Leadership roles in conferences by tenure-track faculty: Program Chair 2016 ACM International Computing Education Research Workshops, Advisory co-chair of the Annual Conference of the North American Fuzzy Information Processing Society, co-chair 9th International Conference on Information Theoretic Security, co-chair 19th Information Security Conference (2016), Keynote speaker 2015 US-Korea Joint Workshop on Quantum Information, Keynote speaker 2016 Workshop on post-quantum cryptography, and General Chair for the ACM SIGSPATIAL Int'l Conference on Advances in GIS 2016.
   d. Faculty members were teachers in the MSL program (Math Science Leadership Program) for middle and high school students.

Annual Report: Institute of Technology 2016-2017

1. Faculty, Student, and Staff Numbers

Student Numbers: In the 2016-17 academic year the Institute of Technology had approximately 790 students enrolled with the following breakdown: Undergraduate – CSS 402, CES 56, IT 163; Graduate – MSCSS 143, MCL 26. Enrollments in all programs are expected to remain the same in 2017-18 except for CES and EE. We expect 30 new students in BS EE and 15 more students in BS CES. The projected enrollment for 2017-18 is expected to be about 835 students. We will be operating at capacity in all the programs in the Institute of Technology.

Annually, nearly half of the Institute's undergraduate students are Pell eligible and more than half are students of color. This year's demographics: 41.2% Caucasian, 29.8% Asian, 7.1% African American, 6.5% Hispanic, 4.7% two or more races, 3.1% unknown race, 0.5% Hawaiian/Pacific Islander, 0.3% American Indian. Women make up 18% of the student population, which is a demographic the Institute works to attract into high technology fields. Approximately 16% of undergraduate students are underrepresented minorities.

Degrees Awarded: The number of degrees awarded in 2015-16 is shown in the table below.

Degree	Number Awarded
BS CSS	173
BS CES	26
BS IT	67
MCL	26
MSCSS	88
Total	380

Faculty Numbers: In 2016-17 the Institute had 16 tenure track faculty members, 13 full-time lecturers, and 20 part-time lecturers. In 2017-18 the Institute will have 18 tenure track and 14 full-time lecturers.

Staff Numbers: There were 12 staff members in 2016-17 and there will be 14 staff members in 2017-18.

The plot below shows approximate trends in these numbers since 2007.
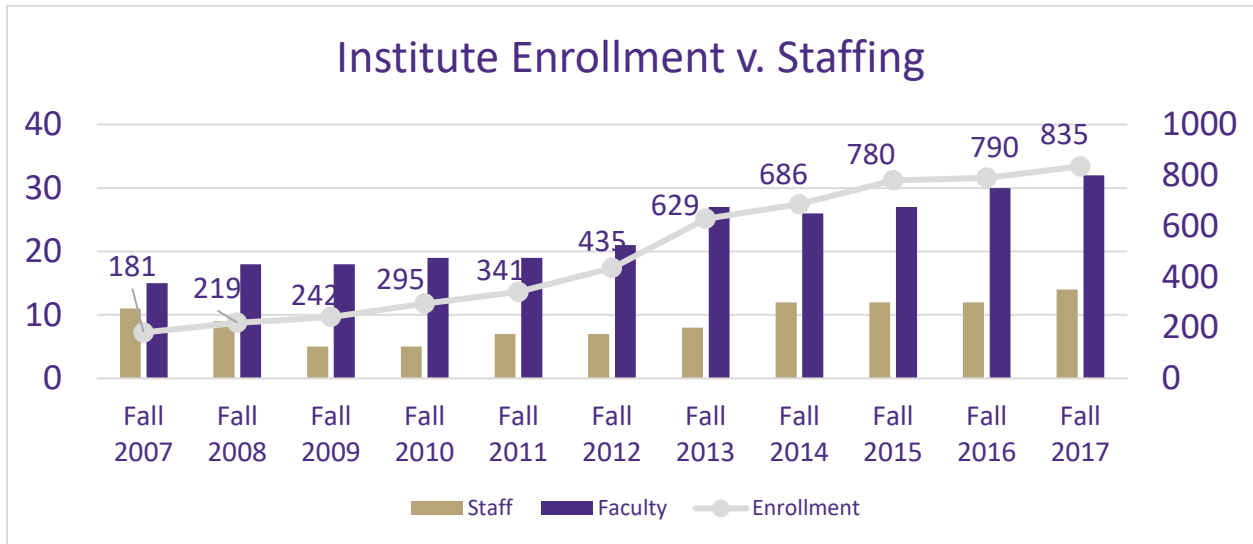
Institute Enrollment v. Staffing

2. Student Achievements

Undergraduate Students:

Nearly all of the graduates of the Institute of Technology received job offers at the time of graduation. Though no exact percentage is available as there is not complete coverage of student employment after graduation, two random samplings of alumni, both recent and from the last decade provided 100% employment in the technology industry.

Below is a partial list of companies that offered employment to the graduates of the Institute of Technology from a sampling of former students representing all programs with varied graduation dates:

Name	Prog	Year	Position	Company
Keith Bloomfield	CS	06	Lead Developer	Dev 9
Brett Batie	CS	06	Solutions Engineer/ Dev Man	SmartStreet
Mary Jane Kelly	CS	07	Computer Security Consultant	Casaba Security
Andrew Becherer	CS	07	Technical Vice President	iSec Partners
Robert Bunge	MCS	07	Faculty Coordinator for IT	N Seattle College
Jennifer Leaf	MCS	07	Senior Program Manager	Microsoft
Matthew Evans	CS	08	Software Engineer	Aptech Systems
Jordan Ryan Moore	CS MCS	09	Software Development Engineer 2	Amazon
Scott Mutter	CS	09	Senior Software Engineer	Tech Mahindra
Ashish Bindra	CS MCS	09	Software Design Engineer/Data Eng	White Pages
Gary Belvin	CE	09	Security Engineer	Google
Jordan Gottlieb	CS	09	UI/UX Director	4QTRS LLC
Craig Truzzi	CS	09	Software Engineer	Software AG
Justin Raynor	CE	10	USAF Captain, Development Eng	USAF
Doug Kroll	IT	11	Systems Engineer	Avanade
Brian Gosch	CS	11	Senior Threat Engineer	InfoBlox

	Brian Van	IT	11	Enterprise Architect	Boeing
	Hannah Craswell	IT	11	Systems Engineer Infrastructure	Avanade
	Amita Lakkad	MCS	11	Software Developer	Nordstrom
	Kyle Levy	IT	11	IT Field Tech	Google
	Ainsley Herndon	CS	12	Software Engineer	Slalom Consulting
	Ben Krack	CE	12	Software Engineer	Slalom Consulting
	Brenda Mabry	CS	12	Implementation Engineer	Thomas Rueters
	Chan Curry	IT	12	Project Manager	Boeing
	Travis Rautman	MCS	12	Software Development Engineer 2	Amazon
	Brent Sargent	IT	12	Security Operations Engineer	Amazon
	D.C. Grant	IT	12	Assistant Professor Cyber Security	Columbia Basin
	Cheolmin Sky Moon	CS MCS	12 14	Software Engineer	Expedia
	Navjot Kamal	CS	13	Software Engineer 2	Boeing
	Ravi Bansal	IT	13	ETL Developer	Microsoft
	Ahmad Hajiismael	IT	14	Software Design Engineer	Concur Tech
	Matt Rigg	IT	14	Cloud Support Engineer	Amazon
	Brian Muckian	IT	14	Oracle Developer	NIKE
	Andrew Sorenson	CS	14	Security Consultant	Leviathan Sec Grp
	Yun Tse Wu	IT	14	DevOps Engineer	Boeing
	Jacob Young	IT	14	Program Manager Cloud Platform	Google
	Roberto Sanchez	IT	14	Info Security Server Controls	Boeing
	Heegun Yang	IT	14	Cyber Threat Intelligence Analyst	F5 Networks
	David Kan	IT MCL	15 17	Technical Risk Reduction	Amazon
	Olivia Corliss	IT	15	System Engineer	Avanade
	Keerthi Swetha Potluri	CS	15	Software Engineer	Microsoft
	David Hunter	IT	15	CAS IT Security	Boeing
	Artem Davtyan	CS	16	Software Engineer	Skyline Properties
	Chris Vishoot	CS, CE	16	Software Engineer	T-Mobile
	Rahul Deshpande	CS MCS	16 17-19	Software Engineer	Microsoft
	Reid Thompson	CS	16	Software Engineering Consultant	Paravida Solutions
	Weiwei Shi	CS	16	Software Engineer	Avanade
	Mark Garces	IT	16	ITS Production Specialist	Avanade
	Karanbir Toor	CS	17	Consultant	West Monroe Partners
	Scott Klauminzer	MCL	17	Critical Infrastructure Protect Lead	TPU
	Samantha Ong	CS	17	Systems Design Engineer Intern	T-Mobile
	Nathanael Toporek	CS	17	Associate Threat Analyst	InfoBlox
	Khanh Nguyen	CS MCS	15 18	Software Developer Engineer	InfoBlox

The companies actively recruiting our students run the full gamut of industry. Local companies and municipal organizations such as cloudPWR, Accumula, Tacoma Public Utilities and Pierce County IT

visit, recruit and intern our students with many hires being made. Larger Fortune 500 technology companies also commonly recruit our students. This academic year, Microsoft, Avanade, Amazon and Nordstrom all came to visit the campus or to set up company student recruitment activities including presentations and interviews. Google rented out the Student Activities Center third floor conference room for two days specifically to attract student interest.

One of the most recent notable partnerships formed with the university, is that with Infoblox. While the business' headquarters in Silicon Valley coordinate its global efforts in providing network service, the Tacoma branch specifically focuses on cyber-security research, threat intelligence, and engineering. This relationship extends to scholarships, research funding for faculty and a steady stream of hires from the Institute.

Student Outreach

The Institute of Technology incorporates outreach to the community as part of the provided student experience. In the last academic year over four hundred instances of targeted student-community interaction took place, with over two hundred and fifty internships, one hundred plus students engaged in Managing Technical Teams projects and numerous senior projects within IT, CS and CES.

Over one hundred and fifty students participated in the Hackathons and Business Plan Competitions promoted and held by the Institute. The first was held at the Student Activities Center and involved 95 participants, and the largest, with over 225 registered participants took place off campus at the Tacoma Parks and Recreation Star Center. This was the 2nd event co-hosted by GeoEngineers, Ezri, Secrata, Urban Studies and Pierce County over the last two years. Student teams created mobile application solutions based on a newly released national parks department platform and at the end of the event sixteen different solutions were presented by student teams.

The business plan competition was put on by VIBE, (the Veterans Incubator for Better Entrepreneurship) with support from the Institute. Two of the semifinalists were teams from the Institute of Technology, one of which came in third place. Oli Fitness, a software program supporting physical fitness training has since formed as an LLC and is continuing development, and HandiMaps, which won funding from the Amazon Catalyst program are continuing to move toward a company launch.

On March 16th the Defending the City event was held and hosted at UW-Tacoma. This event was the final project of the quarter-long Embedded Systems class for the Computer Engineering undergraduates. They built fully autonomous self-navigating robots that roamed a model city built within William Philip Hall on campus. They defended the city using computer vision-based foam dart missile launchers from "invading" radio controlled cars and quad-copters. The public was invited to not only view their robots in action, but also to actively participate by driving the RC cars and quadcopters in an attempt to make it into the city!

Five computer programming teams took part in the 2016-17 ACM International Collegiate Programming Competition regional qualifiers.

There are five Student Groups in the Institute including two new groups. They are: Women in Computer Science, ACM (Association for Computing Machinery), IEEE (Institute of Electrical and Electronics Engineers), HuSCII Coders and the Gray Hat group. The two newest are Student Engineers and the UX

Group. The purpose of Student Engineers is to give students an opportunity to work on large software projects like location services, sensor technology and gaming design/development while employing modern business and software development techniques such as AGILE programming. The UX Group is a diverse collection of designers, programmers, researchers, and problem solvers working to meet the needs of end users.

Graduate Students:

88 MSCSS degrees were awarded in 2016-17. 33 of these students worked on a thesis or capstone project (6 theses and 27 capstone projects). 26 MCL degrees were awarded in 2016-17. The MCL students work on industry projects in groups of two to four students. A list of these projects is also given below.

Table 1. MSCSS Theses/Capstone Projects

Project Title
Predicting prognosis of breast cancer patients
Andorid Record & Replay App
A full stack emergency notification server platform
Traffic sign detection from GPS data.
String Similarity Model
Scalable Propagation Algorithms for Node Labeling in Bipartite Graphs
A Sequence Based Approach for Predicting Clinical Events
Communication and Round Balanced Oblivious FSM Evaluation
Building containerized workflows for big biomedical data
A Frequent Sequence Mining based Approach for Predicting Hospital Readmission
A Neural Network Approach for Sequence Based Prediction of Hospital Readmissions
Predicting Future Aspects of Hospital Readmissions using a Sequence Based Markovian Approach
Risk Prediction Following Surgery Using Machine Learning Algorithms
Enterprise Architecture in Machine Learning
Building Machine Learning Models to Predict Future Frequent Users of Emergency Department
Building a streaming data processing pipeline and Failure prediction model for IoT (sensor) data
Search for the future: A Spatial Predictive Search Engine
HealthSCOPE v2.0: Healthcare Cost and Admission Prediction Framework
Data Pipeline Setup and Predictive Analytics for Streaming Data
Performance Analysis of Large-Scale Distributed Data Stores
Building a streaming Data pipeline and Failure prediction of Bosch ThermoBoilers

Table 2. MCL Capstone Projects

1. Review and recommend modifications to hiring training and performance management practices. Sponsor: Critical Informatics
2. Align NERC Critical Infrastructure Protection and NIST best practices to inform management priorities. Sponsor: Tacoma Public Utilities
3. Develop holistic IT and Cyber Security policies from ad-hoc and undocumented practices. Sponsor: Tacoma Public Utilities
4. Research current and trending web application vulnerabilities to feed F5 research efforts. Sponsor: F5 Networks
5. Research current and trending email related attacks to feed F5 research efforts. Sponsor: F5 Networks
6. Distill actionable intelligence from many diverse data sources and streams. Sponsor: Snohomish Public Utility District

Dr. Martine De Cock and her students took 2nd place in 2016 AMIA KDDM-WG competition (Data Mining Competition for their work titled, "Machine Learning Models for Surgical Site Infection Prediction.")

3. Summary of Teaching, Research, and Service

Teaching: The Institute faculty taught 28,185 (27,787 in the prior year) student credit hours (course credits times number of students per course). This number accounts for courses in which faculty were engaged in classroom teaching and does not include courses like TCSS 390, independent study, MS theses, or capstone projects. The 16 tenure track faculty members accounted for 8,370 (8935 in the prior year) credit hours of teaching while the full-time and part-time lecturers accounted for 13,810 (11,940 in the prior year) credit hours and 6005 (6912 in the prior year) credit hours respectively. The tenure track faculty members mentored many of the 143 MSCSS students.

Research: The Institute faculty published 37 (36 in the prior year) refereed conference papers and 22 (22 in the prior year) journal papers in 2016-17 (this is an average of 2.3 conference papers per tenure-track faculty member and 1.4 journal papers per tenure-track faculty member). In 2016-17 the Center for Data Science research expenditures were $332,109 with several faculty obtaining research grants from NIH ($260,000 2 year grant), Madigan ($75,000 1 year grant), NSF ($174,000 3 year grant), Infoblox ($240,000 2 year gift), and Kensei ($40,000 1 year gift).

Service:

a. Tenure-track faculty members were on 46 conference program committees.
b. Tenure-track faculty members were on the editorial boards of 8 journals.
c. Leadership roles in conferences by tenure-track faculty: General Chair for the ACM SIGSPATIAL Int'l Conference on Advances in GIS 2016, Information director for ACM SIGKDD 2016, Publicity co-chair for IEEE BigDataService 2016, Program co-chair 2017 ACM International Computing Education Research Workshops (hosted in Tacoma), Co-chair 9th International Conference on Information Theoretic Security, and co-chair 19th Information Security Conference 2016.
d. Faculty members were teachers in the MSL program (Math Science Leadership Program) for middle and high school students.

4. Looking Ahead

Since 2013, the Institute of Technology has expanded its faculty research capacity in cybersecurity, machine learning, cloud computing, robotics, and the Internet of Things (IoT) in addition to its strengths in software development, computer engineering and information technology. The Institute's Center for Data Science has recently focused its research on secure machine learning, machine learning for detecting network attacks, bioinformatics, and geographic information systems. In fall of 2017, the Institute will offer a new BS degree program in electrical engineering.

Student demand for programs offered by the Institute of Technology continues to increase. The enrollments in computer science and information technology programs have reached capacity. The projected new student enrollment for the BS CES program in 2017-18 is 71, an increase of 15. The projected new student enrollment for the new BS Electrical Engineering (EE) program in 2017-18 is 30. If the projected enrollments hold true then all programs in the Institute of Technology will be operating at their maximum enrollment capacity in fall 2017. The overall projected enrollment in the Institute of Technology for 2017-18 is about 835 (this includes increase in enrollment in graduate programs). This represents a 5.7% increase from the overall enrollment of 790 in 2016-17. The research areas that will continue to be emphasized by the Institute are cybersecurity, machine learning, cloud computing, and IoT/Robotics.

Center for Data Science

University of Washington | Tacoma

Institute of Technology

5-Year Review (2012-2017)

The Center for Data Science is engaged in societal, mission-driven data science research at the Institute of Technology and the University of Washington Tacoma where it empowers domains and disciplines rich in data, but lacking in tools, to come together with technology faculty to solve deeply challenging problems.

A. **Overview and executive summary**

The Center for Data Science (CDS) began work, in 2012. CDS was founded as a strategic initiative to bring together researchers in various domains across UW Tacoma to engage in *use-inspired research*. With significant evidence of growth of interest from students, as well as industry, the center was formed to explore research in data mining and machine learning, collectively called data science.

CDS is engaged in societal, mission-driven data science research at the Institute of Technology (Institute) and the University of Washington Tacoma (UW Tacoma) where it empowers domains and disciplines rich in data but lacking in tools, to come together with technology faculty to solve deeply challenging problems.

Big Data is changing the way our society makes decisions. At the Center for Data Science we embrace these challenges. We design and develop solutions that enable our partners and sponsors to solve complex problems posed by volume, variety and velocity (3Vs) of data.

The center involves faculty and students, engaged in research, in many disciplines; including bioinformatics, enviromental and geospatial data, and healthcare. We also do intra-disciplinary work in cybersecurity, big data, and systems.

The center embodies the components of the UW Tacoma mission:

Expand access to higher education in an environment where every student has the opportunity to succeed

Students are engaged in the Center of Data Science on a variety of levels. The most visual role is through graduate students in the Master of Science in Computer Science and Systems (MSCSS) who are employed as Research Assistants on various projects in the center. Other students at the graduate and undergraduate level are also hired in hourly student assistant roles to serve in a variety of ways at the center.

Graduate and undergraduate students are also exposed to research in the center through research seminar, independent reading, capstone, and thesis courses by participating with faculty on their projects.

Foster scholarship, research, and creativity to address the challenging problems of our time and place

Research in the CDS comes directly from our community partners and addresses real world problems in data science. The center is community driven, and aligns strongly by engaging students and drawing upon local expertise to solve problems. We measure our impact not only by peer review publications, but through economic impact as measured by employment opportunities, startups, patents; and software toolkits released.

The center deepens this impact by supporting Impact goal #2 of "Charting Our Course: UW Tacoma Strategic Plan 2016-2021." The impact goal focuses on Scholarship by stating "We champion publicly engaged scholarship" using a series of metrics to track progress.

a. *Increase the number of faculty, students and staff involved in publicly engaged scholarship*

   As stated previously, CDS encourages faculty to seek research from community partners that come from a real-world problem. Faculty are also encouraged to engage with students at the undergraduate and graduate levels to move their work forward.

b. *Increase the visibility of scholarship and creative activity across campus and in the community*

   The center hosts a weekly seminar in which a faculty member, student, or community partner presents on work being done in the center or work that impacts the work being done in the center. These seminars are open to anyone and take place on Wednesday afternoons in TLB 307B from 12-1pm.

c. *Increase faculty satisfaction with the support and infrastructure for all types of scholarship, including global/international*

   The MSCSS program consistently has an enrollment of > 60% international students. Many return to their home nations after graduation, taking the skills learned at UW Tacoma and in the Center for Data Science and applying them to their work back home. The MSCSS program has established a strong program with Saudi students, especially women, to study and conduct research at the center.

d. *Continuously improve the infrastructure that connects faculty, community members, students and staff as scholarly partners*

e. *Increase the number, breadth and activity of interdisciplinary, collaborative scholarly centers that address problems of our time and place*

   The Center has improved the fabric of communication by having faculty from multiple units from across campus working together. Projects include collaboration with School of Interdisciplinary Arts and Science, the Milgard School of Business, University of Washington College of the Environment as well as work with OSPI, the Center for Urban Waters, Fred Hutchinson Cancer Research Center, and many others.

f. *Increase the number of students participating in research, scholarship and creative activity, including producing publications, public presentations and creative works*

g. *Assess and increase our research, scholarly and creative impact using evidence-based indicator of publicly engaged scholarship*

   Over 100 students have benefitted from the center's projects with industry. Students have worked as Research Assistants and completed independent studies with faculty. Students

have also contributed as coauthors on publications with faculty in more than 50 cases. Our students regularly find support from center funds to attend conferences and present their work.

Partner and collaborate for common good

Partnering for common good is at the center of the mission for CDS. The earliest projects involved the Washington State Office of the Superintendent for Public Instruction, Multicare, and the Center for Urban Waters.

Catalyze the economic and social vitality of the region

The center's early work with Multicare on predicting the 30-day risk of readmission for Congestive Heart Failure patients helped to reduce costs to regional medical centers related to lost coverage from insurance companies. This work also incubated the first-ever, spin-out corporation from a research center at UW Tacoma (KenSci), which secured $8.5 million in start-up funding in January 2017. KenSci has also employed several alumni from UW Tacoma, and has re-invested in the Center for Data Science to support the continued research of graduate students.

KenSci is building the world's first vertically integrated machine learning platform for healthcare, and its ambition is to make healthcare more proactive, more coordinated and more accountable. KenSci's Machine Learning Platform and Predictive Analytics Apps answer the hard questions about "Who might get sick?", "What can we do about it?", and "How can we serve them better across the continuum of care?" The company is a team of Doctors, Data Scientists and Developers focused on building the first vertically integrated Machine Learning Platform for Healthcare.

Founded: 2015
Headquarters: Seattle, WA
Funding Rounds (1):
- $8.5M; Jan 2017

B. **Organizational structure and space**

The hierarchy of the center has changed over the past 5-years. The current structure, as shown below, consists of a Director of the center under the supervision of the Dean of the Institute of Technology, that works with the Office of Research and Institute of Technology Operations.

The director oversees collaboration of the faculty in a variety of research groups. The director of the center does not have direct supervision of any faculty in the center. Students and employees on various projects are under the direction of their PI.

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                         │  Dean, Institute     │
                         │  of Technology       │
                         └──────────────────────┘
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 ┌──────────────┐   ┌──────────────────┐   ┌──────────────┐
 │  Institute   │   │  Director,       │   │  Office of   │
 │  Operations  │   │  Center for      │   │  Research    │
 │              │   │  Data Science    │   │              │
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Big Data infrastructure	Education	Geospacial Data Management	Health Analytics	Intelligent Systems	Mobile computing	SENSE	Social Computing
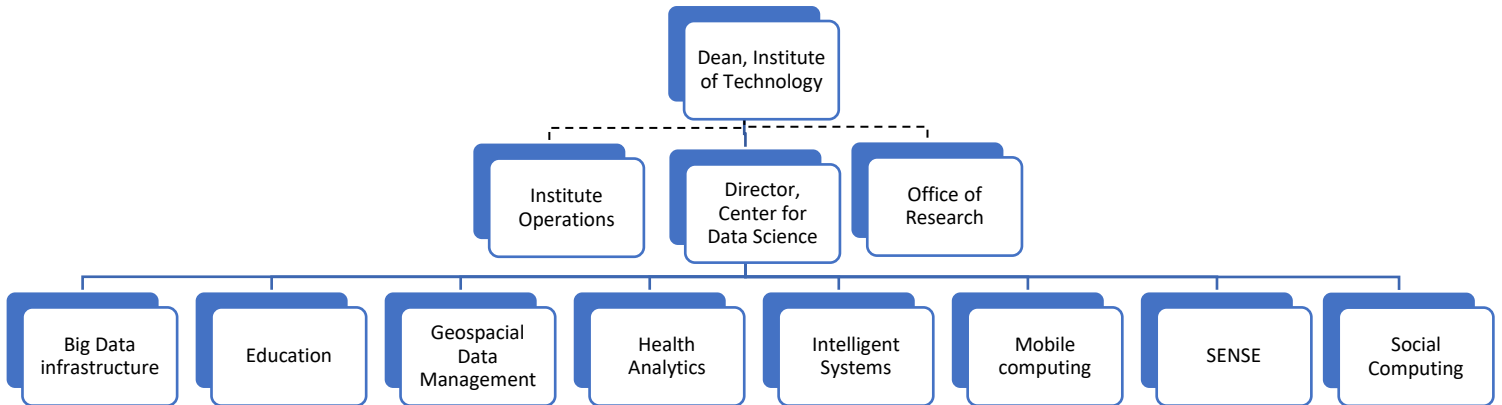
1. The names of faculty members, research staff, and community partners involved in the center's research or administration. Include a brief description of their activities.

Big Data Infrastructure (2012 – Present)

Researchers:
Ankur Teredesai
Martine De Cock
Matt Tolentino
Soumak Ghosh (MSCSS 2016)
Raj Velamur (MSCSS 2015)
Shruti Balabhadruni (MSCSS 2015)
Shanu Sushmita (separated 2017)

Our group focuses on the evolution and utility of various big data platforms and tools and how to evaluate the right set of tools for a particular problem domain. We help industry partners and researchers benchmark Hadoop stacks and leverage an understanding of our expertise in data transformation, parallel and distributed computing and machine learning.

In-Database In-Memory Mining (IDIM2)
With increasing availability of large amounts of main memory and shared nothing architectures, there is an increasing opportunity to design data parallel in-memory operators that blend query processing and map-reduce like constructs. Thus machine learning and data mining can be scaled up significantly if such operators and data structures become available. I like to term such structures in-database in-memory operators. In this project I would like to collaborate with students to port traditional memory bound data mining algorithms to this new paradigm and develop an open source architecture. Programming would likely be in C, R, Java and Scala. Application datasets would range from social graphs to healthcare datasets. Joint project with any interested colleagues from institute and industry.

ACO Risk Stratification
Accountable Care Organizations are a special new thing resulting from what is popularly called Obamacare. One key challenge ACOs face today are identifying patients that are high or low risk to understand the cost of managing various patients. Once cost models are understood, patients can receive quality care improving holistic health rather than just symptoms related treatments. In this project we will engage in a yearlong investigation of ACO's and how they stratify risk. We will build machine learning models to predict risk categories for existing patients and validate our results in partnership with Edifecs, a local claims processing startup. Joint project with industry partners and interested colleagues including post-docs Si-Chi Chin and Archana Ramesh

Education (2012-2016)

Researchers:
David Hazel (MSCSS 2007, separated 2017)
Anika Teppo (BS IT 2014)

The Education Research Group is involved with two major projects: the OSPI Data Dashboard and the Integrity Rubric for RTI Implementation.

OSPI Data Dashboard
The OSPI Data Dashboard project represents a joint venture between the University of Washington-Tacoma (UWT) and the Office of the Superintendent of Public Instruction (OSPI) to support state-needs projects and to meet the needs of students with special needs throughout the state of Washington. The main three objectives of this project are to:
    1. To build a web-based data system to better evaluate OSPI Special Education Department funded state-needs projects

    2. To develop common data collection measures to evaluate state-needs projects and protocols to administer, score, and build capacity to use these measures

    3. To support state-needs project staff to use and interpret valid measurements to continuously improve in the following areas: Effectiveness, Alignment, Evidence-based Practices, Quality of Coaching / Engagement, Data Collection, Cost-Benefit Analysis, Advertising, and State Need.

On the OSPI Data Dashboard site, State Needs Projects can create trainings, add participants, send survey links to attendees, and generate downloadable data reports for future strategic decision making.

Integrity Rubric for RTI Implementation
The Response to Intervention (RTI) Essential Components Integrity Rubric and the RTI Essential Components Integrity Worksheet were developed by the National Center on Response to Intervention and are for use by individuals who are responsible for monitoring school-level fidelity of RTI implementation. UWT has worked with OSPI to develop an evaluation tool for RTI Implementation for either self-assessment by a school team, or by an outside, third-party evaluator.

On the RTI Integrity Rubric Implementation site created by the UWT Education Research Group, users can complete rubrics, manage submissions, explore data visualizations, and access other important information related to the RTI evaluation rubric.

Geospatial Data Management (2014-Present)

Researchers:
Mohamed Ali
Abdeltawab Hendawi (separated 2014)
YiRu Li (MSCSS 2015)
Sarah George (MSCSS 2014)
Craig Apfelbeck (BS CSS 2014)
Soumak Ghosh (MSCSS 2016)

The Geospatial Data Management research group at the University of Washington, Tacoma, focuses on the Big Data challenges related to the enormous amount of spatiotemporal location information that are continuously streamed by mobile devices.

Geospatial Data Management improves our experience with the surrounding world through understanding our relationship to space. The Geospatial Data Management research group at the University of Washington, Tacoma, focuses on the Big Data challenges related to the enormous amount of spatiotemporal location information that are continuously streamed by mobile devices. In the enterprise domain, the "Big Data" wave is moving forward with a pressing need to process and analyze data sizes that currently pose a challenge for existing spatiotemporal database systems.

On the consumer side, the widespread of smart phones, hand-held devices and tablets has added new dimensions that are spatiotemporal and, even, beyond. Every click on a smart phone bears information about the individual's behavior. Every screen touch and every step a person takes with a smart phone in his pocket indicates where he has been and where he is heading, what he has been doing and what he plans to do, where he lives and where he works, which places he visits and which movies he watches, what he likes and what he dislikes, what he does on his own and what he does jointly with friends in his social network. The mission of the Geospatial Data Management group is to connect the dots between the enterprise domain and the consumer domain through innovations in geospatial computing and GIS systems.

Health Analytics (2012-Present)

Researchers:
Ankur Teredesai
Martine De Cock
Senjuti Basu Roy (separated 2016)
David Hazel (MSCSS 2007; separated 2017)
Shanu Sushmita (separated 2017)

Our interdisciplinary research group is known for applying machine learning to address problems arising in healthcare practice. We support clinicians in decision making process. We

mindfully attend to problem understanding, data quality, and data visualization to facilitate cross-disciplinary collaborations. Active projects are:

- Predicting Hospital Readmissions, Mortality and Utilization

- Personalized Recommendation of Clinical Interventions

- Health Information Search Behavior on the Web

In the past we partnered with Nursing and Healthcare Leadership Program (http://www.tacoma.uw.edu/healthcare-leadership/healthcare-leadership), to offer two courses on campus to advance health informatics education -- Health Informatics I: Fundamentals (THLEAD 405) and Health Informatics II: Databases and Data Analysis (THLEAD 406).

30-Day Readmission Risk Management for Congestive Heart Failure

CHF is a leading cause of hospital admission and many of these hospitalizations are readmission within a small window. The Center of Medicare and Medicaid Services have considered 30-day readmission rate as a quality of metric. Many such readmissions could be prevented, if appropriate interventions are designed and administered on time. The objective of this project is to design appropriate statistical analyses or sequence mining techniques to suggest appropriate interventions to reduce 30-day readmission risk for CHF patients. This project would use Multicare Health System dataset for experimentation and validation. The results would be validated using data mining techniques, such as, precision, accuracy, recall, AUC, as well as by conducting case studies involving physicians, care managers, and data consultants.

Intelligent Systems (2014-Present)

Researchers:
Martine De Cock
Shruti Balabhadruni (MSCSS 2015)
Shanu Sushmita (separated 2017)

Inferring Missing User Attributes from User Generated Content
Users of social networks generate a lot of information about themselves in a variety of ways. Users create an account and share structured data such as birth date, gender, geographical location, etc. In addition, users share unstructured data such as textual data (free text description about themselves, blog posts, status updates, comments, etc.) and multimedia data (uploaded photos and video clips). Furthermore, users form relationships with other users, explicitly as e.g. friends or followers, and/or implicitly through interactions such as commenting on each other's content. All this data provides a potentially very rich source of information for business intelligence applications that leverage this content for personalization, such as online marketing. This project focuses on the use of machine learning techniques to derive missing attribute values of users, such as age and gender, from their user generated content and activities in the social network. The project will be carried out in close cooperation with

Golnoosh Farnadi of Ghent University. For more information please contact Martine De Cock (mdecock@u.washington.edu).

Author Name Disambiguation
We present a system called ALIAS, which is designed to search for duplicate authors from Microsoft Academic Search Engine dataset. Author ambiguity is a prevalent problem in this dataset, as many authors publish under several variations of their own name, or different authors share similar or same name. ALIAS takes an author name as an input (who may or may not exist in the corpus), and outputs a set of author names from the database, that are determined as duplicates of the inputted author. It also provides a confidence score, associated with each output. Additionally, ALIAS has the feature of finding a Top-k list of similar authors, given an input author name. The underlying techniques heavily rely on exhaustive feature engineering, supervised learning algorithms, partitioning, clustering, and performing efficient similarity search to enable fast response for near real time user interaction.

Mobile Computing (2013 – Present)

Researchers:
Jie Sheng
Ruiyi Li (MSCSS 2015)

Routing in Mobile Ad-hoc Networks considering Human Attributes
The current explosion of battery-powered mobile devices has driven an immense growth in the amount of computing power and storage ability available on the planet. There are a huge number of applications (e.g., mobile social applications, mobile storage applications) built for these mobile devices that take advantage of these mobile storage and computing resources. The underlying network infrastructures and protocols are one of the keys to the success of these applications. Therefore, it is very critical for us to study the fundamental aspects of such networks (e.g., mobile ad-hoc networks) and build more efficient and intelligent network protocols to onboard more next generation mobile applications.

The main object is to propose efficient strategies for establishing routing paths within such mobile ad-hoc networks. There are two main directions in this proposal: Contact & Packet Dropping Prediction and Routing Protocol Design. Contact prediction is a vital part of routing in mobile ad-hoc networks. Most previous work predicted contact probability only according to contact history. Many human factors and surrounding environments were ignored. We will study what human factors (e.g., interests, job title, current time, and current location) can help to improve prediction accuracy. When their resources are used up and new packets are still coming, some packets will be dropped.

One important issue is raised. Whatis the probability that one packet will be dropped by one device? Both contact probability and packet drop probability will affect routing performance. We will study how to balance these two factors to achieve efficient routing protocols.

'Task' assignment for Tacoma Water

Tacoma water studies water by sampling and testing water quality. There are a set of places where researchers will go to take samples. There are two problems are raised. 1) Given a group of researchers who will go to take samples and a bunch of places of interests, each researcher will be assigned of a place subset. That is, every researcher needs to go to the places in the subset assigned to him/her. We define journey time of one researcher as the total time this researcher needs to visit all the places assigned to him/her. How to assign these places to each researcher to minimize the maximum journey time of all researches? 2) Based on the previous sampling results, is it possible to find the result similarity among sampling places? If we can find the similarity among a group of places, we may go to one instead of all places in this group. Then, which one should be chosen in this group?

SENSE: Sensing the Environment, Network Systems and Energy (2012-Present)

Researchers:

Orlando Baiocchi

Jie Sheng

Don Mclane

Prof Fabricio

Luis Duarte

Dr. C. Shin

Bob Landowski (BS 2015; MSCSS 2019)

Chris Barrett (BS 2015)

Keith Luenberg

Richard Hemingway (BS 2015)

Eric Yee (BS 2015)

Alvin Baldemeca (BS 2014)

Wellyton Rodrigues (Brazilian student)

Adson Filipe (Brazilian student)

Ricardo Meira (Brazilian student)

Thiago Deicke (Brazilian student)

Rodrigo Bacurau (Brazilian student)

Sergio Soares (Brazilian student)

Guilherme Camargo (Brazilian student)

Paulo Filho (Brazilian student)

Renato Pereira (Brazilian student)

This is an R & D group who aims to not only respond to the research questions, but also to develop and deliver the proofs of concept of the proposed solutions. We are committed to enhance the visibility of the research work at the University of Washington Tacoma and of the Institute of Technology in particular. We are also committed to continue and expand our collaborative efforts with the Brazilian universities.

Currently we have 2 active projects and one inactive project. We are working on a Sensor Network in concert with the Center for Data Science and the Center for Urban Waters that is collecting Sensor data from multiple nodes and organizing that data into an Azure Web Server that we are also working on building a web interface to display the collected data in an interactive way. Our second project is a deployable device with different energy harvesters connected to it to determine how much energy can be collected at a specific location so we can determine how many and what kind of sensors we can deploy at that location using those

harvesters. As yet this project is still in the development stage. Our inactive project is a creek sensor project that will be used to determine how much pollution is coming from our creeks to add to the pollution that we see in the Puget Sound. It is inactive because we are trying to determine the best form factor to accomplish the goals that have been set for the project.

Social Computing (2012-Present)

Researchers:
Sergio Davalos
Martine De Cock
Shanu Sushmita (separated 2017)

Our research group is focused on conducting research that combines computing and social media behavior. Research has focused on examining the different dimension of the use of social media such as Facebook and Twitter. The research involves a multidisciplinary approach that involves data science, software development, social sciences, communication theory, and psychology.

Social computing refers to the use of computing systems to support of social interactions and behavior. It has become an important concept for use in business it can involve the analysis of social networks, the design of systems to support and facilitate the intentions and goals of social media users, and to explore the discourse and communication evidenced in social media systems such as Facebook, Twitter, blogs, and forums.

Topics of research include:

- Personalization of advertising of social media
- Personality identification and prediction
- Personalization of social media content for users
- Age and Gender prediction of social media users
- Detection of nostalgia in social media
- Lexicon expansion methodologies
- Distributed topic modeling

The Social Computing Group uses a variety of research approaches:

- Empirical studies of users interacting with social computing.
- Text mining of user generated content such as topic modeling, cluster analysis, sentiment analysis, emotion detection, and personality identification.
- Building adaptive systems to support user intents and goals during the use of social media.
- Examination of phenomenon such as emotion propagation through data mining and text mining.
- Data mining to predict age and gender.

The group often collaborates with researchers at other universities and researchers with a background in such fields as data science, social psychology, economics, design, and communications.

Other Research Projects

- Chronozoom (2012-2014)
- Illionix (2012-2014)

2. The types and numbers of students involved in the center's activities.

In addition to direct involvement through funding the center has supported course work for students in the MSCSS program in the following break down:

Graduate Students

- 42 students did Independent Study
- 14 students did a Thesis
- 65 students did a Capstone

3. A description of the amount of space currently occupied, space challenges, and anticipated space needs over next five years.

The Center for Data Science currently occupies space in Tioga Library Building 307c. In the summer of 2017, the footprint of this space will be reduced from 12 desks and a cubicle to 8 desks. Along with this space, the CDS regularly uses the meeting space in TLB 307b, and the meeting rooms in TLB 307c.

There are few challenges with space for CDS, primary issues have been centered around where students and faculty meet to work on research. With a limited number of employed students and staff directly in the CDS, the reduced footprint should be sufficient for the needs of the center for the future.

Over the next 5 years, space needs are indeterminable. Depending on funding, the staffing of the center is expected to remain minimal. With study/work space in McDonald-Smith (MDS) near to the faculty offices, the space in TLB should suffice.

C. **Financial Data**
    1. A description of current and planned revenue streams, including sponsored research support, service contracts, membership fees, gifts, in-kind donations, etc.

GRANTS and CONTRACTS

Long Title	Fiscal Year	PI	Sponsor Name	Total Requested	Proposal Status
BIGDATA: Small: DA: i-HEX - An Integrated Health Data Explorer	2013	Basu Roy	National Science Foundation (NSF)	$679,044	Denied By Sponsor
DDMP: A System for Automated Collection, Storage, Analysis, and Reporting of Annotated Dietary Data	2013	Teredesai	Illionix, LLC.	$61,680	Awarded
RtI DATA DASHBOARD PROJECT Phase 2	2013	Teredesai	Washington State Office of Superintendent of Public Instruction (OSPI)	$65,473	Awarded
MultiCare Hospital Readmission Project Supplemental Extension	2013	Teredesai	MultiCare Health System	$27,061	Awarded
MultiCare Hospital Readmission Project Phase 2	2014	Teredesai	MultiCare Health System	$368,379	Awarded
ALIAS: Microsoft Academic Search Name Disambiguation Research Initiative	2014	Basu Roy	Microsoft Corporation	$103,155	Approved
Illionix DDMP Internships	2013	Teredesai	Illionix, LLC.	$8,559	Approved
An Energy Efficient Sensor Fusion Scheme for wireless Sensor Networks with Multiple Sampling Rates	2013	Sheng	National Science Foundation (NSF)	$392,966	Approved
Costco Wholesale Explore Merchandising and Member Behavior	2014	Teredesai	Costco Wholesale	$62,329	Awarded
SmartCrowd - a Framework for Intelligent Crowdsourcing	2014	Basu Roy	National Science Foundation (NSF)	$434,528	Denied By Sponsor
Mobile ad hoc cloud considering human behaviors	2014	Ding	National Science Foundation (NSF)	$466,559	Approved
III: Small: Collaborative Research: An Optimization Framework for Collaborative Crowdsourcing	2014	Basu Roy	National Science Foundation (NSF)	$236,940	Approved
Data Coordination and Integration Center for LINCS-BD2K	2014	Yeung-Rhee	Mount Sinai School of Medicine	$686,004	Awarded
Personalized Intervention for Reducing Hospital Readmission for Heart Failure	2014	Chin	National Institutes of Health (NIH)	$173,406	Approved

| Title	Year	PI	Sponsor	Amount	Status
BIGDATA: IA: DKA:DKM:Collaborative Research: Opportunities and Computational Challenges in Combining Structured and Unstructured Data for Heart Failure	2014	Basu Roy	National Science Foundation (NSF)	$916,411	Approved
MultiCare Hospital Readmission Project Phase 2	2015	Basu Roy	MultiCare Health System	$118,932	Awarded
Combining Structured and Unstructured Data for Cohort Retrieval and Clinical Decision Support in Heart Failure	2015	Basu Roy	Northwestern University	$1,482,515	Approved
SCH:INT:Collaborative Research: Augmenting EMR with Medical Literature to Enable Decision Support for Heart Failure	2015	Basu Roy	National Science Foundation (NSF)	$1,027,881	Denied By Sponsor
III:Small:Collaborative Research: KICrowd: A Data Management and Optimization Framework for Knowledge-Intensive Crowdsourcing	2015	Basu Roy	National Science Foundation (NSF)	$249,555	Denied By Sponsor
TWC: Small: Cryptographically Secure Machine Learning for Healthcare Data	2015	Nascimento	National Science Foundation (NSF)	$499,370	Denied By Sponsor
Data Coordination and Integration Center for LINCS-BD2K	2015	Yeung-Rhee	Mount Sinai School of Medicine	$326,564	Awarded
Integration of Mobile Learning and Online Learning Community to Infuse Security into Computer Science Subjects in High Schools	2015	Bai	University of Akron	$100,039	Approved
US-Based Students Support to Attend ACM SIGSPATIAL 2015	2015	Ali	National Science Foundation (NSF)	$29,696	Awarded
HEALTH-NET: a Bayesian Network Explorer of Healthcare Factors from State and Federal Data	2015	De Cock	National Institutes of Health (NIH)	$99,998	Approved
An Optimization Framework for Crowd Data Sourcing through Active Learning	2016	Basu Roy	National Science Foundation (NSF)	$499,426	Approved
Bayesian ensemble methods for integrating multiple data types	2016	Yeung-Rhee	Mount Sinai School of Medicine	$260,000	Awarded
III: Medium: Collaborative Research: KICrowd: A Data Management and Optimization Framework for Knowledge-Intensive Crowdsourcing	2016	Basu Roy	National Science Foundation (NSF)	$321,482	Approved
NW Big Data Analytics for Emergency Management – a West BD Innovation Hub Spoke/PPG Proposal	2016	Ali	National Science Foundation (NSF)	$0	Approved

Development of Vitamin A Deficiency Diagnostic Device and Care Management and Data Analytics Platform	2016	Teredesai	National Institutes of Health (NIH)	$214,835	Approved
BioDepot: a repository of GUIdock workflows for reproducible biomedical research	2016	Yeung-Rhee	National Institutes of Health (NIH)	$1,370,438	Approved
BD Spokes: PLANNING: WEST: Northwest BD Emergency Management Analytics (NWBD/EMA	2016	Ali	National Science Foundation (NSF)	$99,470	Approved
Scholarships for minority and low-income undergraduates in Computer Science, Engineering and Information Technology	2016	Yeung-Rhee	National Science Foundation (NSF)	$649,840	Denied By Sponsor
Prospective validation of a genomic classifier for the early detection of ectopic pregnancy	2017	Yeung-Rhee	Madigan Army Medical Center	$74,929	Approved
Undergraduate Research Education in Bioinformatics and Biostatistics	2017	Yeung-Rhee	National Science Foundation (NSF)	$361,747	Denied By Sponsor
Machine Learning while Preserving Confidentiality of Administrative Data	2017	Nascimento	US Department of Commerce	$286,717	Approved
Re-analyses of RNA-seq data using customized Docker workflows	2017	Hung	National Institutes of Health (NIH)	$155,233	Approved
Data Coordination and Integration Center for LINCS-BD2K	2017	Yeung-Rhee	Icahn School of Medicine at Mount Sinai	$130,000	Awarded
Intelligent deployment of containerized bioinformatics workflows on the cloud	2017	Yeung-Rhee	National Institutes of Health (NIH)	$1,338,109	Approved
EAGER:USBRCCR: Collaborative: Privacy-preserving Outsourced Malware Detection at Scale	2017	Nascimento	National Science Foundation (NSF)	$149,984	Approved
Total Proposals				**$14,529,254**	**39**
Total Awarded				**$2,106,422**	**10**

GIFTS

Donor Name	Date of Record	Legal Amt	Credit Amt
Illionix, LLC	2/19/2013	$4,000.00	$4,000.00
Microsoft Corporation	2/27/2013	$80,000.00	$80,000.00
Microsoft Corporation	8/2/2013	$35,000.00	$35,000.00
Microsoft Corporation	8/2/2013	$33,000.00	$33,000.00
Edifecs	10/17/2013	$83,333.33	$83,333.33
Edifecs	11/25/2013	$41,666.66	$41,666.66
Edifecs	1/13/2014	$20,833.33	$20,833.33
Edifecs	4/8/2014	$20,833.00	$20,833.00
Edifecs	6/5/2014	$20,833.00	$20,833.00
iDataLabs	7/14/2014	$3,500.00	$3,500.00
Edifecs	7/14/2014	$31,250.34	$31,250.34
iDataLabs	8/26/2014	$3,500.00	$3,500.00
Edifecs	9/15/2014	$31,250.34	$31,250.34
Lessontrek	10/3/2014	$0.00	$5,000.00
Journeyscholar, Inc.	10/3/2014	$5,000.00	$5,000.00
iDataLabs	10/23/2014	$3,000.00	$3,000.00
Niara Inc.	12/19/2014	$30,000.00	$30,000.00
Bosch Corporation	12/31/2014	$50,000.00	$50,000.00
Topia Technology, Inc.	3/27/2015	$13,333.00	$13,333.00
Niara Inc.	4/14/2015	$60,000.00	$60,000.00
Topia Technology, Inc.	6/16/2015	$8,889.00	$8,889.00
Microsoft Corporation	6/18/2015	$25,000.00	$25,000.00
Niara Inc.	9/1/2015	$30,000.00	$30,000.00
Bosch Corporation	12/11/2015	$100,000.00	$100,000.00
Microsoft Corporation	9/22/2016	$252.95	$252.95
Microsoft Corporation	9/22/2016	$2,529.05	$2,529.05
Infoblox	10/31/2016	$60,000.00	$60,000.00
KenSci	11/4/2016	$13,333.33	$13,333.33
KenSci	1/5/2017	$13,333.33	$13,333.33
Microsoft Corporation	3/29/2017	$0.00	$20.84
Benevity	3/29/2017	$41.68	$41.68
Mandava, Vani	3/29/2017	$0.00	$41.68
Infoblox	4/28/2017	$30,000.00	$30,000.00
Microsoft Corporation	5/1/2017	$0.00	$31.26
Benevity	5/1/2017	$62.52	$62.52
Mandava, Vani	5/1/2017	$0.00	$62.52
Mandava, Vani	5/22/2017	$0.00	$20.84
Microsoft Corporation	5/22/2017	$0.00	$10.42
Benevity	5/22/2017	$20.84	$20.84
Microsoft Corporation	6/27/2017	$0.00	$31.26
Mandava, Vani	6/27/2017	$0.00	$62.52
Benevity	6/27/2017	$62.52	$62.52
Total Gifts		**$853,858.22**	

2. A detailed list of awards given to the center and expenditures over the last five years.

CDS Operations
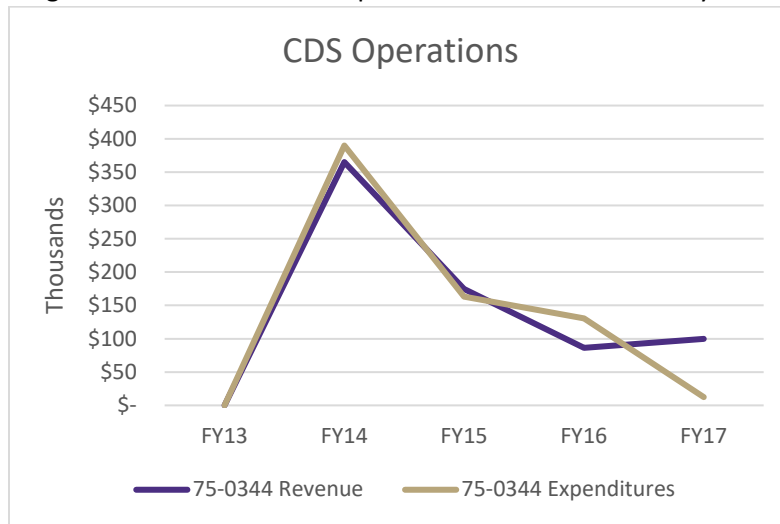
FY	75-0344 Revenue	75-0344 Expenditures
FY13	$ 0	$ 0
FY14	$ 365,153	$ 390,010
FY15	$ 174,595	$ 163,307
FY16	$ 86,430	$ 130,724
FY17	$ 100,000	$ 12,503
Total	**$ 735,038**	**$ 696,544**

CDS Donation
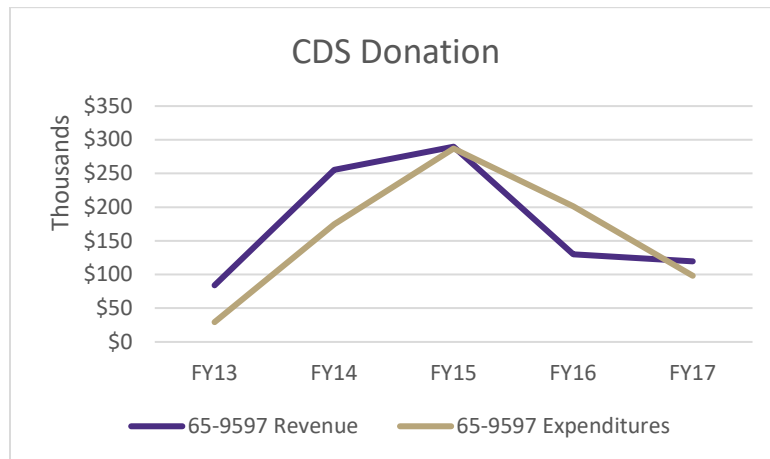
FY	65-9597 Revenue	65-9597 Expenditures
FY13	$ 84,000	$ 29,353
FY14	$ 255,499	$ 174,798
FY15	$ 289,722	$ 286,988
FY16	$ 130,000	$ 201,385
FY17	$ 119,573	$ 98,333
Total	**$ 878,795**	**$ 790,860**

3. A projected budget for the next five years.

There is an outstanding balance in the CDS GOF (75-0344), however there are currently no permanent staff working for the Center at this time. The budget is driven by the research of the faculty that operate under the umbrella, and those grants have their own budgets.

4. A description of anticipated resource challenges over the next five years.

    The largest challenge facing the center is that a large portion of their funding during the 5-years has been centrally funded, or in the form of donations that do not collect overhead fees, and thus contribute to the center through indirect recovery.

Major goals for next five-year performance period

1. Increased external funding that generates indirect cost recovery
2. Increased cross-campus collaboration with other units
3. Focused leadership that build a culture of administrative support to supplement that provided by the Office of Research

APPENDIX A – Faculty Publications

Ankur Teredesai

Title	Cited by	Year
Smart Personalized Routing For Smart Cities AM Hendawi, A Rustum, AA Ahmadain, D Hazel, A Teredesai, D Oliver, … Data Engineering (ICDE), 2017 IEEE 33rd International Conference on, 1295-1306	1	2017
ACM SIGKDD Explorations Newsletter Volume 18 Issue 2 C Aggarwal, H Tong, H Wang, AM Teredesai ACM 18 (2)	-	2017
Kernel based principal axis tree Q Li, J Sheng, A Teredesai Computing and Communication Workshop and Conference (CCWC), 2017 IEEE 7th …	-	2017
Gender prediction on a real life blog data set using LSI and KNN J Chen, T Xiao, J Sheng, A Teredesai Computing and Communication Workshop and Conference (CCWC), 2017 IEEE 7th …	-	2017
Risk Stratification for Hospital Readmission of Heart Failure Patients: A Machine Learning Approach. CP Hon, M Pereira, S Sushmita, A Teredesai, M De Cock BCB, 491-492	2	2016
Dynamic and Personalized Routing in PreGo AM Hendawi, A Rustum, AA Ahmadain, D Oliver, D Hazel, A Teredesai, … Mobile Data Management (MDM), 2016 17th IEEE International Conference on 1 …	4	2016
Predicting 30-Day Risk and Cost of" All-Cause" Hospital Readmissions. S Sushmita, G Khulbe, A Hasan, S Newman, P Ravindra, SB Roy, … AAAI Workshop: Expanding the Boundaries of Health Informatics Using AI	6	2016
'The good old days': An examination of nostalgia in Facebook posts S Davalos, A Merchant, GM Rose, BJ Lessley, AM Teredesai International Journal of Human-Computer Studies 83, 83-93	7	2015
Scalable adaptive label propagation in Grappa G Farnadi, Z Mahdavifar, I Keller, J Nelson, A Teredesai, MF Moens, … Big Data (Big Data), 2015 IEEE International Conference on, 1485-1491	2	2015
Dynamic hierarchical classification for patient risk-of-readmission S Basu Roy, A Teredesai, K Zolfaghar, R Liu, D Hazel, S Newman, … Proceedings of the 21th ACM SIGKDD international conference on knowledge …	8	2015
Fuzzy Rough Set Prototype Selection for Regression	-	2015

S Vluymans, Y Saeys, C Cornelis, A Teredesai, M De Cock
Fuzzy Systems (FUZZ-IEEE), 2015 IEEE International Conference on, 1-8

[A Map-Matching Aware Framework For Road Network Compression](#)
AM Hendawi, A Khot, A Rustum, A Basalamah, A Teredesai, M Ali
Mobile Data Management (MDM), 2015 16th IEEE International Conference on 1 …

[1]   2015

[COMA: Road Network Compression For Map-Matching](#)
AM Hendawi, A Khot, A Rustum, A Basalamah, A Teredesai, M Ali
Mobile Data Management (MDM), 2015 16th IEEE International Conference on 1 …

[3]   2015

[Population cost prediction on public healthcare datasets](#)
S Sushmita, S Newman, J Marquardt, P Ram, V Prasad, MD Cock, …
Proceedings of the 5th International Conference on Digital Health 2015, 87-94

[8]   2015

[Selecting Robust Strategies in RTS Games via Concurrent Plan Augmentation](#)
A Elogeel, A Kolobov, M Alden, A Teredesai
Proceedings of the 2015 International Conference on Autonomous Agents and …

    2015

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The $684,185 per year in funding that UW Tacoma received during the 2013-15 biennium supported enrollment growth of nearly 25 percent, from 629 to 781, an increase of 152 students at the undergraduate and graduate levels combined. During this period, 8.2 FTE faculty were added with proviso funding, along with 4.1 FTE faculty and 4.8 FTE staff from state and tuition dollars. During the 2015-16 academic year, without proviso funding, another 90 students were added, along with 9.5 FTE faculty and one FTE in staff from state, tuition and local funds. For fall 2016, the Institute of Technology has reached capacity and **began turning away qualified students for the first time in its history**. Since 2013, UW Tacoma has invested $1.5 million to expand Institute enrollments, in addition to the $1,368,370 in proviso funding. Please see the expenditures in Table 25 below:

Expenditures

Table 25. UW Tacoma Expenditures, FY14-FY17

UW Tacoma
Institute of Technology Budget and Expenditures

	FY 2013-14			FY 2014-15			FY 2015-16			FY 2016-17
	Budget	Expenditures	FTE*	Budget	Expenditures	FTE*	Budget	Expenditures	FTE*	Proposed Budget
UWT Funding										
State and Tuition										
Faculty Salaries	$ 1,875,934	$ 1,834,022	20.8	$ 2,387,778	$ 2,472,338	24.9	$ 3,213,786	$ 3,261,571	34.4	$ 3,635,791
Staff Salaries	$ 492,488	$ 478,515	7.6	$ 681,143	$ 762,342	12.4	$ 793,041	$ 788,032	12.2	$ 805,964
Operations	$ 379,437	$ 179,775		$ 233,449	$ 142,020		$ 281,507	$ 301,272		$ 180,194
Equipment	$ 18,147	$ 10,367		$ 18,147	$ 10,275		$ 18,147	$ 48,959		$ 18,147
Benefits	$ 631,383	$ 628,723		$ 746,421	$ 790,313		$ 1,086,516	$ 1,107,791		$ 1,193,710
Total State and Tuition	$ 3,397,389	$ 3,131,402		$ 4,066,938	$ 4,177,288		$ 5,392,997	$ 5,507,625		$ 5,833,805
Local Funds										
Faculty Salaries		$ 9,229	0.3		$ 12,084	0.1		$ 86,889	0.8	
Staff Salaries		$ 2,778	0.1		$ 3,709	0.1		$ 3,885	0.1	
Operations	$ 110,030	$ 62,644		$ 169,095	$ 110,406		$ 312,422	$ 98,299		$ 222,285
Equipment		$ 20,382			$ 16,279			$ 25,284		
Benefits		$ 2,513			$ 3,975			$ 22,604		
Total Local Funds	$ 110,030	$ 97,545		$ 169,095	$ 146,452		$ 312,422	$ 236,962		$ 222,285
Total UWT Funding	$ 3,507,419	$ 3,228,948	28.8	$ 4,236,033	$ 4,323,740	37.5	$ 5,705,419	$ 5,744,587	47.5	$ 6,056,090
Proviso										
Faculty Salaries	$ 531,612	$ 531,612	8.1	$ 531,612	$ 540,004	8.2				
Benefits	$ 152,573	$ 152,573		$ 152,573	$ 144,181					
Total Proviso	$ 684,185	$ 684,185	8.1	$ 684,185	$ 684,185	8.2				
Total All	$ 4,191,604	$ 3,913,133	36.9	$ 4,920,218	$ 5,007,925	45.7	$ 5,705,419	$ 5,744,587	47.5	$ 6,056,090
Percentage Increase				17%	28%	24%	16%	15%	4%	6%

*FTE--Full time Equivalent Employees

Student Data

Enrollment

Table 26. Total Enrollment, Undergraduate and Graduate, UW Tacoma, 2013-15

	Aut 2013	Aut 2014	Aut 2015	Change 2013 to 2015
Computer Science and Systems	406	454	530	124
Computer Engineering and Systems	89	86	81	-8
Information Technology	106	123	132	26
MCL	28	23	38	10
				0
Grand Total	**629**	**686**	**781**	**152**

Table 27. Undergraduate Enrollment, UW Tacoma, 2013-15

	Aut 2013	Aut 2014	Aut 2015	Change 2013 to 2015
Computer Science and Systems	316	361	394	78
Computer Engineering and Systems	89	86	81	-8
Information Technology	106	123	132	26
				0
Total	**511**	**570**	**607**	**96**

Table 28. Graduate Enrollment, UW Tacoma, 2013-15

	Aut 2013	Aut 2014	Aut 2015	Change 2013 to 2015
Computer Science and Systems	90	93	136	46
MCL	28	23	38	10
				0
Total	**118**	**116**	**174**	**56**

Degrees Awarded

The Institute graduates about 200 students a year who are working for Boeing, Microsoft, Intel, Amazon, Garmin, Northrop Grumman, Motorola, Nike, Nordstrom, IBM, Thompson Reuters, Avanade, Google and Honeywell, among other employers.

Table 29. Total Degrees, Undergraduate and Graduate, UW Tacoma

	2013-2014	2014-2015	2015-2016	Change 2013-14 to 2015-16
Computer Science and Systems	143	201	207	64
Computer Engineering and Systems	31	29	39	8
Information Technology	46	50	59	13
MCL	26	20	33	7
				0
Total	**246**	**300**	**338**	**92**

Table 30. Total Bachelor's Degrees, UW Tacoma

	2013-2014	2014-2015	2015-2016	Change 2013-14 to 2015-16
Computer Science and Systems	103	146	161	58
Computer Engineering and Systems	31	29	39	8
Information Technology	46	50	59	13
				0
Total	**180**	**225**	**259**	**79**

Table 31. Total Graduate Degrees, UW Tacoma

	2013-2014	2014-2015	2015-2016	Change 2013-14 to 2015-16
Computer Science and Systems	40	55	46	6
MCL	26	20	33	7
				0
Total	**66**	**75**	**79**	**13**

Time to Degree

Table 32. Time to Bachelor's Degree, UW Tacoma - Academic Origin, High School

	2013-2014	2014-2015	2015-2016	3-year totals
2 Years	1	7	7	15
3 Years	5	10	9	24
4 Years	18	17	23	58
5 Years	13	12	16	41
6 Years	2	7	1	10
> 6 Years	2	6	11	19
Total	**41**	**59**	**67**	**167**
Avg Time to Degree	**4.39**	**4.34**	**4.42**	**4.38**

When calculating averages, 7 years is used for all >6 year degree recipients.

Table 33. Time to Bachelor's Degree, UW Tacoma - Academic Origin, WA CC

	2013-2014	2014-2015	2015-2016	3-year totals
2 Years	35	42	73	150
3 Years	46	64	70	180
4 Years	17	14	11	42
5 Years	9	8	3	20
6 Years	1	2	1	4
> 6 Years	2	4	1	7
Total	**110**	**134**	**159**	**403**
Avg Time to Degree	**3.10**	**3.07**	**2.69**	**2.93**

When calculating averages, 7 years is used for all >6 year degree recipients.

Pell Eligibility

Annually, nearly half of the Institute's students are Pell-eligible and more than half are students of color. This year's demographics are: 43.3 percent Caucasian, 27.3 percent Asian, 6.2 percent Hispanic, 6.1 percent two or more races, 5.9 percent African American, 4.4 percent unknown race, 0.8 percent Hawaiian/Pacific Islander, 0.3 percent American Indian. 17 percent are women, which is a demographic the Institute works to attract into high technology fields.

Table 34. Percent Pell Eligible Undergraduate Students, UW Tacoma

	Aut 2013	Aut 2014	Aut 2015
Count of Pell UWT	1697	1852	1919
UW Tacoma % Pell	48.1%	49.7%	50.1%
Count of Pell Institute	213	248	269
Institute Declared % Pell	47.0%	49.5%	48.1%
Difference	**5.3%**	**6.4%**	**3.9%**

Table 35. Undergraduate Pell-Eligible Enrollment, UW Tacoma

	Aut 2013	Aut 2014	Aut 2015	Change 2013 to 2015
Computer Science and Systems	116	134	159	43
Computer Engineering and Systems	45	44	36	-9
Information Technology	52	70	74	22
				0
Total	**213**	**248**	**269**	**56**

Retention Rates and Best Practices

The student retention rate is around 83 percent. Two student advisors help retain students via extensive mentoring. One-credit seminar courses that are attached to lecture courses help students via problem-solving sessions. Other best practices include founding the UW Tacoma Math-Science-Leadership Program (MSL), a youth outreach program that serves groups underrepresented among college graduates and in the STEM workforce. Most MSL students come from public school districts in Pierce and South King counties and may re-enroll in MSL every year through high school. Supported by both institutional dollars and private grants, the program serves 120 youth each summer with a vibrant, three-week, on-campus experience supplemented by monthly school-year events. Instructors include Institute students and alumni, with some involvement by Institute faculty. The great majority of MSL participants (in 2015 more than 90 percent) come from groups defined by National Science Foundation as underrepresented in science, technology, engineering and math: minority, low-income, female, and/or potential first-generation college students.

Direct Freshman Admits:
Institute does not directly admit freshmen

Sophomore Admits:
Institute does not directly admit sophomores

Table 36. Retention Rates for Junior Admits, UW Tacoma

Cohort Year (fall)	Total Head Count	Degrees 4-yrs after declaring major	Retention Rate
2007	31	24	77.4%
2008	39	31	79.5%
2009	53	48	90.6%
2010	52	44	84.6%
2011	64	52	81.3%
5-yr Total	**239**	**199**	**83.3%**

Table 37. Retention Rates for Transfer Admits, UW Tacoma

Cohort Year (fall)	Total Head Count	Degrees 4-yrs after declaring major	Retention Rate
2007	77	56	72.7%
2008	72	59	81.9%
2009	90	80	88.9%
2010	96	86	89.6%
2011	105	77	73.3%
5-yr Total	**440**	**358**	**81.4%**

Looking Ahead

Since 2013, the Institute of Technology has expanded its faculty research capacity into hardware security, distributed computing, and post-quantum cryptography, in addition to its strengths in software development, computer engineering, and information technology. It also established the Center for Data Science, which has recently focused on healthcare informatics in support of leading regional healthcare providers and improving patient outcomes across the South Puget Sound region. In fall of 2017, the Institute will offer a new BS degree program in electrical engineering. The research areas of the two new faculty members starting in fall 2016 are cloud computing and human-computer interaction.

UW Tacoma

Since state and tuition dollars remained at the same level in 2016-17, the enrollments in the Institute of Technology remained at the same level at 790. We did not increase enrollments in the BS and MS Computer Science and Systems (CSS) programs in 2016-17 because these programs have reached their maximum enrollment capacity. The BS Information Technology (IT) enrollment increased by 31 (from 132 to 163) in 2016-17. We experienced a dip in enrollment (from 81 to 56) in the BS Computer Engineering and Systems (CES) program in 2016-17. 9.5 FTE faculty (in 2015-16) and 1.8 FTE faculty (in 2016-17) were added from state and tuition dollars. This increase in faculty numbers has helped us catch up with the dramatic enrollment increases we have experienced over the last five years (the enrollments increased from 460 to 790 in the period 2012-17). In autumn 2016, the BS CSS, BS CES, and BS IT programs had an accreditation visit from ABET. The preliminary results of this visit have been positive. The final results will be known by the end of August.

Expenditures

See Appendix 1 on the last page of the report for "Table 23. UW Tacoma Expenditures, FY14-FY17."

Student Data

Enrollment

Table 24. Total Enrollment, Undergraduate and Graduate, UW-Tacoma, 2014-16

	Aut 2014	Aut 2015	Aut 2016	Change
Computer Science and Systems	454	530	545	**91**
Computer Engineering and Systems	86	81	56	**-30**
Information Technology	123	132	163	**40**
MCL	23	38	26	**3**
Total	**686**	**781**	**790**	**104**

Table 25. Undergraduate Enrollment, UW-Tacoma, 2014-16

	Aut 2014	Aut 2015	Aut 2016	Change
Computer Science and Systems	361	394	402	**41**
Computer Engineering and Systems	86	81	56	**-30**
Information Technology	123	132	163	**40**
Total	**570**	**607**	**621**	**51**

Table 26. Graduate Enrollment, UW-Tacoma, 2014-16

	Aut 2014	Aut 2015	Aut 2016	Change
Computer Science and Systems	93	136	143	**50**
MCL	23	38	26	**3**
Total	**116**	**174**	**169**	**53**

Degrees Awarded

In 2016-17, the Institute awarded 266 bachelor's degrees and 114 master's degrees. Graduates find employment in companies such as Boeing, Microsoft, Intel, Amazon, Garmin, Northrop Grumman, Motorola, Nike, Nordstrom, IBM, Thompson Reuters, Avanade, Google, the Naval Undersea Warfare Center, and Honeywell. Many of these graduates have also gone on to graduate studies (MS or PhD).

Table 27. Total Degrees, Undergraduate and Graduate, UW-Tacoma, 2014-16

	2014-2015	2015-2016	2016-2017	Change
Computer Science and Systems	*201*	*208*	*261*	**60**
Computer Engineering and Systems	*29*	*42*	*16*	**-13**
Information Technology	*50*	*60*	*67*	**17**
MCL	*20*	*33*	*33*	**13**
Total	**300**	**343**	**377**	**77**

Table 28. Bachelor's Degrees, UW-Tacoma, 2014-16

	2014-2015	2015-2016	2016-2017	Change
Computer Science and Systems	146	*162*	*173*	**27**
Computer Engineering and Systems	29	*42*	*26*	**-3**
Information Technology	*50*	*60*	*67*	**17**
Total	**225**	**264**	**266**	**41**

Table 29. Graduate Degrees, UW-Tacoma, 2014-16

	2014-2015	2015-2016	2016-2017	Change
Computer Science and Systems	55	*46*	*88*	**33**
MCL	20	*33*	*26*	**6**
Total	**75**	**79**	**114**	**39**

Time to Degree

Table 30. Time to Bachelor's Degree - Academic Origin, High School

	2014-2015	2015-2016	2016-2017	3-year totals
2 Years	7	7	2	**16**
3 Years	10	9	10	**29**
4 Years	17	23	27	**67**
5 Years	12	16	16	**44**
6 Years	7	1	4	**12**
> 6 Years	6	4	5	**15**
Total	59	60	64	**183**
Avg Time to Degree	**4.34**	**4.12**	**4.39**	**4.28**
When calculating averages, 7 years is used for all >6 year degree recipients.				

Table 31. Time to Bachelor's Degree - Academic Origin, WA CC

	2014-2015	2015-2016	2016-2017	3-year totals
2 Years	42	74	71	**187**
3 Years	64	73	70	**207**
4 Years	14	11	14	**39**
5 Years	8	3	3	**14**
6 Years	2	1	2	**5**
> 6 Years	4		3	**7**
Total	134	162	163	**459**
Avg Time to Degree	**3.07**	**2.67**	**2.80**	**2.83**
When calculating averages, 7 years is used for all >6 year degree recipients.				

Pell Eligibility

Annually, nearly half of the Institute's undergraduate students are Pell eligible and more than half are students of color. This year's demographics: 41.2% Caucasian, 29.8% Asian, 7.1% African American, 6.5% Hispanic, 4.7% two or more races, 3.1% unknown race, 0.5% Hawaiian/Pacific Islander, 0.3% American Indian. Women make up 18% of the student population, which is a demographic the Institute works to attract into high technology fields. Approximately 16% of undergraduate students are underrepresented minorities.

Table 32. Percent Pell Eligible Undergraduate Students

	Aut 2014	Aut 2015	Aut 2016
Count of Pell UWT	1852	1919	1964
UW Tacoma % Pell	49.7%	50.1%	47.2%
Count of Pell Institute	248	269	270
Institute Declared % Pell	49.5%	48.1%	46.2%

Table 33. Undergraduate Pell-Eligible Enrollment

	Aut 2014	Aut 2015	Aut 2016	Change
Computer Science and Systems	134	159	164	**30**
Computer Engineering and Systems	44	36	24	**-20**
Information Technology	70	74	82	**12**
Total	**248**	**269**	**270**	**22**

Retention Rates and Best Practices

The student retention rate is around 83%. Two student advisors help retain students via extensive mentoring. One-credit seminar courses that are attached to lecture courses help students via problem solving sessions. Students participate in hackathons conducted by industry. In 2016-17, over 160 students participated in internships in industry and community organizations. The Institute of Technology has active professional student organizations that include a student IEEE (Institute of Electrical and Electronic Engineers) chapter, an ACM (Association for Computing Machinery) student

group, and a WIC (Women in Computing) group. Other best practices include founding the UW Tacoma Math-Science-Leadership Program (MSL), a youth outreach program that serves groups underrepresented among college graduates and in the STEM workforce. Most MSL students come from public school districts in Pierce and South King counties and may re-enroll in MSL every year through high school. Supported by both institutional dollars and private grants, the program serves 120 youth each summer with a vibrant, three-week, on-campus experience supplemented by monthly school-year events. Instructors include Institute students and alumni, with some involvement by Institute faculty. The great majority of MSL participants come from groups defined by National Science Foundation as underrepresented in science, technology, engineering and math: minority, low-income, female, and/or potential first-generation college students.

Direct Freshman Admits:
Institute does not directly admit freshmen

Sophomore Admits:
Institute does not directly admit sophomores

Table 34. Junior Admits

Cohort Year (fall)	Total Head Count*	Degrees 4-yrs after declaring major**	4-Year Graduation Rate	Graduated	Graduation Rate
2008	39	24	61.5%	34	87.2%
2009	53	19	35.8%	51	96.2%
2010	53	33	62.3%	45	84.9%
2011	65	32	49.2%	57	87.7%
2012	75	41	54.7%	57	76.0%
5-yr Total	285	149	52.3%	244	85.6%

Table 35. Transfer Admits

Cohort Year (fall)	Total Head Count*	Degrees 4-yrs after declaring major**	4-Year Graduation Rate
2008	72	59	81.9%
2009	90	80	88.9%
2010	96	86	89.6%
2011	105	77	73.3%
2012	133	108	81.2%
5-yr Total	496	410	82.7%

*All students with an entry year in 2008-2012 where any degree seeking major, at that time or later, was in the Institute.
** Graduated within four years of their initial entry to UW

Looking Ahead

Since 2013, the Institute of Technology has expanded its faculty research capacity in cybersecurity, machine learning, cloud computing, robotics, and the Internet of Things (IoT) in addition to its strengths in software development, computer engineering and information technology. The Institute's Center for Data Science has recently focused its research on secure machine learning, machine learning for detecting network attacks, bioinformatics, and geographic information systems. In fall of 2017, the Institute will offer a new BS degree program in electrical engineering.

Student demand for programs offered by the Institute of Technology continues to increase. The enrollments in computer science and information technology programs have reached capacity. The projected enrollment for the BS CES program in 2017-18 is 86, an increase of 30. The projected enrollment for the new BS Electrical Engineering (EE) program in 2017-18 is 45. If the projected enrollments hold true then all programs in the Institute of Technology will be operating at their maximum enrollment capacity in fall 2017. The overall projected enrollment in the Institute of Technology for 2017-18 is about 900 (this includes increase in enrollment in graduate programs). This represents a 14% increase from the overall enrollment of 790 in 2016-17. The research areas that will continue to be emphasized by the Institute are cybersecurity, machine learning, cloud computing, and IoT/Robotics.

APPENDIX 1

Table 23. UW Tacoma Expenditures, FY14-FY17

	FY 13-14			FY 14-15			FY 15-16			FY 16-17			FY 17-18 Projected
	Budget	Expenditures	FTE*	Budget	Expenditures	FTE*	Budget	Expenditures	FTE*	Budget	Expenditures	FTE*	Budget
State and Tuition													
Faculty Salaries	$ 1,875,934	$ 1,834,022	20.8	$ 2,387,778	$ 2,472,338	24.9	$ 3,213,786	$ 3,261,571	34.4	$ 3,420,412	$ 3,488,324	36.2	$ 3,682,383
Staff Salaries	$ 492,488	$ 478,515	7.6	$ 631,143	$ 762,342	12.4	$ 696,741	$ 788,032	12.2	$ 777,255	$ 914,868	14.9	$ 777,209
Operations	$ 379,437	$ 179,775		$ 233,449	$ 142,020		$ 281,507	$ 301,272		$ 179,471	$ 340,870		$ (168,598)
Equipment	$ 18,147	$ 10,367		$ 18,147	$ 10,275		$ 18,147	$ 48,959		$ 18,147	$ -		$ 18,147
Benefits	$ 631,383	$ 628,723		$ 746,421	$ 790,313		$ 1,086,516	$ 1,107,791		$ 1,180,752	$ 1,196,181		$ 1,240,130
Total State and Tuition	$ 3,397,389	$ 3,131,402	28.4	$ 4,016,938	$ 4,177,288	37.3	$ 5,296,697	$ 5,507,626	46.6	$ 5,576,037	$ 5,940,243	51.1	$ 5,549,271
Local Funds													
Faculty Salaries		$ 9,229	0.3		$ 12,084	0.1		$ 86,889	0.6		$ 113,184	1.0	
Staff Salaries		$ 2,778	0.1		$ 3,709	0.1		$ 3,885	0.1		$ 19,556	0.2	
Operations	$ 110,030	$ 62,644		$ 169,095	$ 110,406		$ 312,422	$ 98,299		$ 256,951	$ 52,402		$ 418,756
Equipment		$ 20,832			$ 16,279			$ 25,284		$ 50,000	$ -		$ 150,000
Benefits		$ 2,513			$ 3,975			$ 22,604			$ 34,457		
Total Local Funds	$ 110,030	$ 97,996	0.4	$ 169,095	$ 146,453	0.2	$ 312,422	$ 236,962	0.7	$ 306,951	$ 219,598	1.2	$ 568,756
Total UWT Funding	$ 3,507,419	$ 3,229,398	28.8	$ 4,186,033	$ 4,323,741	37.5	$ 5,609,119	$ 5,744,587	47.3	$ 5,882,988	$ 6,159,841	52.3	$ 6,118,027
Proviso													
Faculty Salaries	$ 531,612	$ 531,612	8.1	$ 531,612	$ 540,004	8.2							
Benefits	$ 152,573	$ 152,573		$ 152,573	$ 144,181								
Total Proviso	$ 684,185	$ 684,185	8.1	$ 684,185	$ 684,185	8.2	$ -	$ -	-	$ -	$ -	-	$ -
Total All	$ 4,191,604	$ 3,913,583	36.9	$ 4,870,218	$ 5,007,926	45.7	$ 5,609,119	$ 5,744,587	47.3	$ 5,882,988	$ 6,159,841	52.3	$ 6,118,027
Percent Increase				16.2%	28.0%		15.2%	14.7%		4.9%	7.2%		4.0%

*FTE-Full time Equivalent Employees

FY 17-18 is projected. The deficit in the Operations Budget is due to a negative carryforward in this budget.