This year’s front cover was designed by **WILLIAM DAZEY**, a senior from Canton, Ohio. William’s focus within CSE is application development and programming languages. He plans to graduate in Spring 2013 and hopes to find a position in his area of interest or “an IT position that allows me to think critically and write programs (of some significance) would be a nice starting point.”
REPORT CONTENTS

III LETTER FROM THE CHAIR

1 AWARDS & HIGHLIGHTS

11 RESEARCH

11 Automated Software Verification
14 Isosurface & Fractal Dimensions
15 2011 - 2012 Research funding
15 New Grants Established
17 Grants Established Prior to July 1, 2011
22 Gifts
23 Select Publications
31 Faculty Service
33 Invited Guest Presentations
33 Distinguished Guest Lectures
33 Guest Speakers

35 STUDENTS

35 Statistical Historical View
35 Graduate Program
36 Doctorate Recipients
38 Masters Graduates
40 Undergraduate Program
41 Bachelors Degrees Awarded
47 Participants in the 6th Annual Student Research Poster Exhibition

49 FACULTY & STAFF

49 Tenured & Tenure Track Faculty
56 Emeritus Appointments
57 Clinical Faculty
57 Courtesy Appointments
57 Adjunct Faculty
60 Administrative Staff
60 Computing Services Staff
Dear Colleagues, Alumni, Friends, and Parents,

Welcome to the 2011-2012 Department of Computer Science and Engineering Annual Report. Besides many stories of faculty, students, and alumni accomplishments, the annual report also provides current and historical data charts reflecting the steady growth of the department and its increasingly high contributions of human talents to the society. The department strongly promotes faculty scholarship and leadership in teaching and research and excellence in students. I would like to highlight some of this year’s best achievements.

- The CSE department successfully passed with high marks the National Accreditation Evaluation by the both engineering committee and computing committee. We would particularly like to thank Professor Neelam Soundarajan for his tireless efforts to prepare and host the evaluation.
- Due to rapid growth of the department in both teaching and research, we have been authorized to hire five tenure-track faculty of open ranks next year.
- CSE faculty Paul Sivilotti is a recipient of 2012 Alumni Award for Distinguished Teaching. This is the highest teaching award for Ohio State Professors.
- Ph.D. student Joshua Eckroth is a recipient of 2012 Graduate Associate Teaching Award, which is the highest recognition to a graduate student teaching at Ohio State.
- Marc Khoury, a CSE undergraduate of class 2012 is a recipient of a 2012 Churchill Scholar Fellowship and a National Science Foundation Graduate Fellowship. Both awards are highly competitive and prestigious.
- The number of grants received by CSE faculty last year is a record high, a total amount about $11 millions. This is 25% more than the previous year.
- I would like to congratulate Raghu Machiraju and Han-Wei Shen for their promotions to the rank of full professor.

Please keep us informed about your progress and accomplishments. We look forward to another exciting report next year.

Cordially yours,

Xiaodong Zhang
SIVILOTTI RECEIVES TEACHING AWARD

In a surprise classroom visit, OSU President E. Gordon Gee awarded CSE Associate Professor Paul Sivilotti, a 2012 Alumni Award for Distinguished Teaching. This award is given annually to a highly selective professor group at Ohio State for their teaching excellence. Only five professors were selected after rigorous reviews and evaluation this year.

CSE has long known and appreciated the teaching talents of Dr. Sivilotti. He is a three time winner of the Department Outstanding Teaching Award. He participated in the 2010 Frontiers of Education Symposium where he presented a collection of learning activities designed around kinesthetic learning.

Paul joined CSE in 1998 after receiving his Ph.D. in Computer Science from the California Institute of Technology where he also attained a Master’s of Science. Originally from Canada, he earned his B.Sc.H. in Computing Science, Mathematics and Biochemistry at the Queen’s University in Ontario. His research area is Software Engineering with foci in Distributed Systems and Tool-based Support for Testing Component Implementations.

Sivilotti is the second CSE faculty member to achieve this award. Dr. Tim Long was given it in 1990. In 2004, Dr. Scott Pike, a mentee of Paul’s, received the Distinguished Graduate Student award.

ECKROTH RECEIVES OSU HIGHEST GRAD TEACHING AWARD

Also receiving University recognition for teaching, Joshua Eckroth, Ph.D. candidate, was given a Graduate Associate Teaching Award (GATA). This award is the highest recognition The Ohio State University bestows on graduate students. This very selective award is given to only ten students a year out of potentially over 10,000 students.

Joshua began his career at Humboldt State University where, in 2008, he was named Computing Sciences Department Student of the Year. At OSU-CSE, he works in Artificial Intelligence with Dr. John R. Josephson, advisor, and Prof. B. Chandrasekaran. He is minoring in Cognitive Science and Mathematical Logic under the tutelage of Prof. Neil Tennant (Cognitive Science) and Prof. Harvey Friedman (Mathematical Logic). His research aims to develop strategies that improve the ability of an intelligent agent (such as a robot) to perform challenging reasoning tasks even when the agent’s knowledge about the world is significantly limited or the sensors that provide information about its domain (e.g., video cameras, and microphones) are sometimes inaccurate, misreporting, or otherwise malfunctioning.

UGRAD WINS PRESTIGIOUS FELLOWSHIP

New CSE graduate Marc Khoury was awarded a 2012 Churchill Scholar Fellowship from the Winston Churchill Foundation. Annually only fourteen scholarships are given to graduating
seniors and recent graduates demonstrating exceptional academic talent, outstanding personal qualities, and a capacity to contribute to the advancement of knowledge in the sciences, engineering, or mathematics. The scholarship supports one year of graduate study in a relevant field at the University of Cambridge in the United Kingdom. Marc is only the third OSU student to attain this recognition and the first from CSE.

Marc was an exceptional student with a drive to achieve an outstanding career in academia. He was a member of the Honors Collegium and began conducting research as a freshman under the guidance of Dr. Rephael Wenger, studying isosurface meshes, a tool for data visualization. During his sophomore year, this work resulted in his first publication and a national presentation at the leading conference in computer visualization. Marc has also gained experience with mathematics research, studying topology through a National Science Foundation Research Experiences for Undergraduates (NSF REU) at Ohio Wesleyan University in 2010. In summer 2011, Marc undertook a high profile internship in New Jersey with AT&T Labs in their information visualization group, working on new techniques for generating large graph layouts. Following this, he spent the fall quarter with Amazon. com in Seattle as a software development engineering intern in their fraud department. All of these research and industry experiences combine to give Marc a diverse tool set to use in approaching complex topics in computational geometry.

Marc will pursue an M.Phil. in Advanced Computer Science at Cambridge, where he will conduct research in geometric modeling under Dr. Neil Dodgson. Upon completion of his degree, he plans to return to the United States to begin a Ph.D. program in Computer Science at University of California, Berkeley or Stanford. Marc’s ultimate goal is to become a professor at a major university, teaching students and developing provably good meshing techniques to provide researchers in computational science with an array of high quality meshing tools so that they can easily pursue their research.

Mvapich Supporting Stampede

Software developed by Dr. D. K. Panda and his team, MVAPICH, will be used in the National Science Foundation’s powerful new supercomputer, “Stampede,” being built at the Texas Advanced Computing Center at The University of Texas at Austin. Upon completion in 2013, Stampede will be one of the world’s most powerful supercomputers. At its initial peak performance, it will process at 10 petaflops, contain 272 terabytes (272,000 gigabytes) of total memory, and handle 14 petabytes (14 million gigabytes) of disk storage. Eventually, Intel will be adding new generations of MIC processors which will then allow Stampede to clock at 15 petaflops.

MVAPICH/MVAPICH2 (pronounced em-va-pich) software delivers best performance, scalability and fault tolerance for high-end computing systems and servers using InfiniBand, 10GigE/iWARP and RoCE networking technologies. All components of Stampede will be integrated with InfiniBand FDR 56G/bs network. MVAPICH improves the processing by connecting traditional supercomputing software with innovative networking technologies and protocols, thus increasing the data flow speed in a significant manner.

CSE Researchers Update Real World “Big Data” Systems

Dr. Xiaodong Zhang and his research team, working with Facebook engineers, have developed a data placement structure, called RCFile (Record Columnar File), to efficiently store
increasingly big data sets using a large and distributed data warehouse in a scalable way. This data placement problem is challenging to big data management and users, such as social networks, Web service providers, and online stores. RCFile and its open source implementation were documented in a paper presented in the 27th International Conference on Data Engineering (ICDE 2011). RCFile has been widely used in real-world systems. For example, it has become the default data placement structure in Facebook’s production data warehouse, which is so far the largest Hadoop data warehouse in the world. RCFile is also adopted in two open source data analytic systems, Apache Hive and Apache Pig, which are being used in major Internet services, including Facebook, LinkedIn, Taobao, Twitter, and Yahoo.

Another big data related project of Dr. Zhang’s team is to address the low efficiency of automatic translating SQL to MapReduce programs in existing big data processing systems, such as Hadoop and Hive. They have developed YSmart, a correlation-aware SQL-to-MapReduce translator that applies a set of rigorous rules to generate a minimum number of MapReduce jobs to execute multiple correlated operations in a complex query. YSmart has significantly reduce redundant computations, unnecessary I/O operations and network transfers compared to existing translators in Hive developed by Facebook and in Pig Latin developed by Yahoo!. This work received the Best Paper Award in the International Conference of Distributed Computing Systems (ICDCS 2011). After collaborative efforts of one year with Facebook engineers, YSmart has been merged into the Hive data warehouse, a production system in Facebook, and in many other large organizations. An independent and open source version of YSmart (http://ysmart.cse.ohio-state.edu) has been widely used in the academic and research community.

Besides Dr. Zhang, the big data research team includes Research Scientist Rubao Lee, and CSE Ph.D. students Yin Hua, Tian Luo, and Yuan Yuan.

**Emeritus Faculty Receives Lifetime Achievement Recognition**

**Charles Csuri**, CSE Professor Emeritus and a founder of the Advanced Center for Computing Art and Design, received the Award for Lifetime Achievement in Digital Art from ACM SIGGRAPH, the Association for Computing Machinery’s Special Interest Group on Computer Graphics and Interactive Techniques, for his “visionary and creative merging of art and technology.” This highly prestigious award is presented annually to an artist who has created a substantial and important body of work that significantly advances aesthetic content in the field of digital art.

Often called the Father of Digital Art, ‘Chuck’ Csuri is internationally recognized and admired. He began his career as a painter, but in 1964 he began using keystrokes to translate his brush strokes. Very soon, he was winning awards and notoriety as he also began working with animation in the cyber realm. Owing to his heightened aesthetic, he was uniquely qualified to open doors and introduce the worlds of art and computers to one another and find an exciting new field.

While a professor in the Arts at The Ohio State University, he proposed the creation of a new and very special group, the Computer Graphics Research Group (CGRG). This group would include faculty and graduate students from Art, Industrial Design, Photography and Cinema, Computer and Information Science (now CSE), and Mathematics and would teach and research practical applications of computer animation. This group evolved into the Advanced Computing Center for the Arts and Design (ACCAD).

Csuri is one of the rare non-science oriented researchers to receive grants from the National Science Foundation. Indeed, with support from NSF, the US Navy and the Air Force Office of
Scientific Research, Csuri directed research on computer graphics for over 22 years at CGRG and then later ACCAD. The results of these studies have been applied to flight simulators, computer-aided design, architecture, magnetic resonance imaging, visualization of scientific phenomena and special effects for TV and film. Charles Csuri is also an OSU alumnus having received both a BA and an MFA.

**College of Engineering Recognizes Two for Research**

Drs. James W. Davis and Raghu Machiraju were each awarded Lumley Research Awards from the Ohio State College of Engineering. These awards are given in recognition of research contributions.

James Davis works in the area of Computer Vision specifically developing advanced video surveillance systems that use computers equipped with video cameras to not only detect the presence of people and track them, but also to identify their activities.

With primary interests are in imaging and visualization, Raghu Machiraju searches for the ways to apply them to topics in biology, medicine and engineering.

**Promotions**

Beginning in the 2012-2013 academic year, CSE will have two more Full Professors: Drs. Raghu Machiraju and Han-Wei Shen. Both gentlemen work in the graphics area.

**Graphics Best Paper**

Oleg Mishchenko, Ph.D. candidate, and Associate Professor Roger Crawfis achieved a Best Paper Award in Slovakia at the Spring Conference on Computer Graphics 2012. The paper, titled “Effective Texture Models for Three Dimensional Flow Visualization,” describes their approach to solving the problem of the clutter and occlusion in visualizing three dimensional flow with geometry primitives. Using semi-transparency, however, can make the visualization blurry and vague. They investigate perceptual limits and find specific guidelines on using semi-transparency for three dimensional flow visualization. The researchers base their results on the user study that they conducted. The users were shown multiple semi-transparent overlapping layers of flow and were asked how many different flow directions they were able to discern. The team utilized textured lines as geometric primitives; two general texture models were used to control opacity and create animation. They found that the number of high scoring textures is small compared to the total number of textures within our models. To test their findings, they utilized the high scoring textures to create visualizations of a variety of datasets.

**Visualization Team Awarded Best Paper**

Professor Han-Wei Shen and his student, Abon Chaudhuri, co-wrote the paper “A Self-adaptive Technique for Visualizing Geospatial Data in 3D with Minimum Occlusion” that won a Best Paper Award at the Conference on Visualization and Data Analysis (VDA 2012) in San Francisco. The conference is part of the IS&T/SPIE Symposium on Electronic Imaging 2012. This paper shows how to minimize the problem of occlusion when visualizing geospatial data in 3D. This work can help improve interactive 3D visualization of geospatial and similar data.

Chaudhuri is a Ph.D. candidate supervised by Professor Shen. He came to Ohio State in 2006. He works with fellow members of the GRAVITY research group on various problems related
to flow visualization, high-performance visualization of large scientific data and information visualization. Before coming to Ohio State, Abon completed his undergraduate studies at Jadavpur University in Kokata, India and interned at Oak Ridge National Laboratory and Argonne National Laboratory.

**BEST PAPER EARNED AT TACC**

Sreeram Potluri, Ph.D. candidate, and his coauthors received a Best Paper recognition at the Texas Advanced Computing Center (TACC)-Intel Highly Parallel Computing Symposium. This symposium was targeted to explore new designs with upcoming Intel-MIC (Many Integrated Core) architecture which will be a significant component in the upcoming NSF-TACC ‘Stampede’ 10-15 PetaFlop system.

Sreeram Potluri, Devendar Bureddy, Karen Tomko and **Dhabaleswar K. (D. K.) Panda** wrote “Intra-MIC MPI Communication using MVAPICH2: Early Experience.” This paper describes the team’s early experience using MVAPICH2, a popular open-source implementation of MPI, for communication within a KNF coprocessor. They present different versions of MVAPICH2 that are enhanced and tuned for the new architecture. The work compares the point-to-point and collective communication performance of these versions with an out-of-the-box version of MVAPICH2 to highlight the importance of these designs on the MIC architecture. Many Integrated Core (MIC) architecture announced by Intel is expected to be a critical component in their solution for exascale computing. Knights Ferry (KNF) is the first instantiation of the MIC architecture. It is a development platform which enables scientific application and library developers to prepare for the upcoming products based on the MIC architecture.

Sreeram Potluri is a Ph.D. student in the Department of Computer Science and Engineering at The Ohio State University. He is a member of the Network-Based Computing Laboratory lead by Prof. D. K. Panda. His research interests include parallel programming models, high speed interconnects, heterogeneous architectures and high-end applications. His current focus is on the design of a scalable high-performance MPI library for clusters with NVIDIA GPU accelerators and Intel MIC coprocessors. Sreeram is involved in the design and development of MVAPICH, a high-performance open-source implementation of MPI over InfiniBand, 10GigE/ iWARP and RoCE interconnects. This software is currently used by over 1,800 organizations in 66 countries.

**IEEE NAMES ALUMNI FELLOW**

**Dr. Yu-Chee Tseng** (Ph.D., ’94) received an Institute of Electrical and Electronics Engineers (IEEE) Fellow recognition. IEEE bestows this title on those “IEEE members whose extraordinary accomplishments in any of the IEEE fields of interest are deemed fitting of this prestigious grade elevation.” Specifically for Dr. Tseng, he was recognized for “fundamental contributions to wireless and mobile networks.”

Yu-Chee’s most distinct contribution is the discovery of the “Broadcast Storm Problem” in mobile ad hoc networks and the related solutions. The significance and impact of these contributions can proved in the over 3,000 articles referencing his work. These results have been taken up by many other researchers since these solutions are applicable to many kinds of wireless networks, such as sensor networks, mesh networks, and vehicular networks. Yu-Chee also has original contributions to the field of wireless sensor networks.

Currently serving as Chair Professor and Dean of the College of Computer Science of the
National Chiao-Tung University in Taiwan, Dr. Tseng has received many awards for his achievements in research, education, and service. In 2005 he was named an OSU College of Engineering Distinguished Alumnus. He has received an impressive three Outstanding Research Awards as awarded annually to the top 3% of researchers by the National Science Council, Taiwan. Yu-Chee has also attained the Best Paper Award (Int’l Conf. on Parallel Processing, 2003), the Elite I. T. Award (2004), and the Y. Z. Hsu Scientific Paper Award (2009).

His research interests include mobile computing, wireless communication, and parallel and distributed computing. His service to the field can also be seen in the editorial boards on which he has served, including IEEE Transactions, on Vehicular Technology (2005-2009), IEEE Transactions on Mobile Computing (2006-2011), and IEEE Transactions on Parallel and Distributed Systems (2008-present).

Professor Tseng is the tenth (10th) CSE Alum to be named an IEEE Fellow.

Steve May Named Distinguished Alumni

The Ohio State College of Engineering named Steve May, MS ’92 and PhD ’98, a 2011 Distinguished Alumni. This 47 year old annual award is given “to recognize distinguished achievement in one’s profession by reason of significant inventions, important research or design, administrative leadership, or genius in production.”

Upon leaving OSU-CSE (then CIS), Dr. May went to work for Pixar Animation Studios where he still creates. He began his tenure at Pixar Animation Studios as the shading and modeling technical director on Toy Story 2, working on the characters of Wheezy and Buster. On the film, Monsters, Inc., May worked as the simulation and effects sequence supervisor and helped pioneer the fur technology and overall look for the character Sully. That technology was recently fully re-engineered for the lead character’s hair in Brave. Following Monsters, Inc., Steve then worked on the Academy Award-winning feature Finding Nemo, as the computer graphics supervisor for the shark characters and Sydney Harbor environment.

May was the effects supervisor on Golden Globewinner Cars, overseeing all of the film’s visual effects. His next role was as the supervising technical director for Disney Pixar’s Academy Award-winning feature film, Up. That title set the note for what came next in Steve’s life because in 2010, he was promoted to Chief Technology Officer at Pixar, where he oversees the development of visual effects tools and processes for the entire studio.

Best Paper Win For CSE Alumnus

CSE alumnus Gabe Brown, BS ’06, coauthored an experience paper, “Scrum and Engineering Practices: Experiences of Three Microsoft Teams” and won an IEEE award for Best Experience Paper and the Empirical Software Engineering and Measurement (ESEM) Best Industry Paper Award. The paper’s results show that the three teams were able to improve quality, productivity and estimation accuracy through the combination of Scrum and nine engineering practices.

“The paper established empirical benefits that contribute to making Scrum effective for quality software. Many teams claim that Scrum alone is enough to make a quality product however,
teams that do not couple objective measures of quality into their product end up with “flaccid
scrum” which the team is producing results but cutting corners,” Brown said. “This paper
shows that teams can double quality with only taking 15-20% longer than teams that do not
leverage quality gates.”

Brown is now the Engineering Manager for Disney Interactive in Bellevue, WA, making
Playdom Facebook games. He had previously worked at Microsoft, producing projects from
Microsoft Research for the support organization. In his spare time, he enjoys teaching Applied
Agile Development at the University of Washington.

Fullbright Scholar

Joseph Hollingsworth, PhD ’92, was named a 2012 - 2013 Fulbright Scholar.

Hollingsworth received the Fulbright Scholar grant to lecture and do research at the University
of San Francisco, Quito, Ecuador (USFQ). His projects will include work on his National
Science Foundation grant covering how to use math and logic to prove the correctness of new
software, teaching a computing course, and work related to teaching & learning including peer
review of faculty, learning outcomes, and class & program assessment.

Dr. Hollingsworth currently serves as a Professor at Indiana University, Southeast. However,
he remains in close contact with the researchers in Software Engineering and Programming
Languages in OSU-CSE. On his webpage he refers to himself as a “distributed” member of the
Resolve/Reusable Software Research Group (RSRG), part of the SE/PL area.
As part of this year’s banquet celebrations, the Department of Computer Science and Engineering took a moment to look back to its beginnings.

Three of the computer scientists who were integral in the evolution of Computer Science and Engineering (then Computer and Information Science) from a division of College of Arts and Sciences to a full Department within the College of Engineering were invited back and honored for their contributions. This was the first in what is planned to be an annual recognition of those who have worked towards CSE’s growth and development.

The first honorees were Dr. Clint Foulk, Dr. Ted Hildebrandt and Dr. James Randles.

• It was the United States Air Force that set Dr. Clint Foulk on his path to becoming a computer scientist. After he enlisted in 1952, he was sent to the Digital Computer Laboratory of Wright-Patterson AFB to learn and become a computer programmer. When his tour of duty ended in 1956, he attended University of Illinois where he received a Ph.D. in mathematics. In 1963, he accepted a position at The Ohio State University as half-time Assistant Professor of Mathematics and half-time employee of the Computer Center. When the Division of Computer Science was established in 1966, Clint became a full-time Assistant Professor of Computer Science. Dr. Foulk retired from CIS in 1991 and now lives in Florida.

• Once OSU-CIS was established as a department, Dr. Ted Hildebrandt moved on for more challenges. First, he became the Director of the Academic Computer Center at Kansas State University, Manhattan, KS. Shortly thereafter he spent some time at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, eventually becoming the Director of the Computing Facility. In 1975, Ted resigned from NCAR and began a search for a new position, accepting one at the University of North Carolina, Greensboro, as Professor of Mathematics and Computer Science. He retired from UNCG in 1992 and currently resides in Colorado with his children and grandchildren.

• Dr. James “Jim” Randles also did some of his early work through the Air Force doing projects at the Wright Field Computer Center. After his active duty, in 1957, Jim entered the mathematics program at Ohio State University and worked at the university’s computer center. He briefly left OSU to work for the computer center at Space Technology Labs in Los Angeles. Returning in 1961, Jim accepted a job as Research Associate in the computer center, and starting work on a doctor’s degree in mathematics. When he completed his Ph. D. in March 1965, he accepted a dual position as Assistant Professor in Mathematics and Math Analyst in the computer center. In 1967, he left the Mathematics Department to help form the academic program which ultimately became the Computer and Information Science Department. He held several academic, administrative and technical support positions during his tenure at the university. In January 1989 he retired from OSU as an Associate Professor Emeritus.
2012 Departmental Awards & Scholarships

Scholarships

Central Ohio Chapter of Association of Computing Machinery (ACM)
  Zachary Boerger
Cisco Systems, Inc.
  Tiffany Bogantz
Crowe Horwath, LLP
  Andrew Buelow
Harris Corporation
  Christopher Powers
Ernest William Legget, Jr. Scholarship
The Leggett Family Award
  David Albert
  Joshua Glick
  Michelle Rush
  Carrie Scono
Matt J. Desch & Ann M. Murphy Award
  Nathaniel Diekman
  Albert Kyle
The O'Connell Family Award
  Jay Hines
Steve R. and Sarah O'Donnell Computer and Information Science Fund
  Evan deLaubenfels
  Simeon Georgiev
  Richard Hutcheson
  Kevin Landers
  Ryan McGowan
Raytheon Corporation
  Brad Hartshorn
  Jeremy LeDonne
CSE Undergraduate Scholarships
  Joseph Pedicini
  Anthony Zuccarelli
Department Founders Scholarship
  Rachel McIlrath

Department Awards

Outstanding Teaching Award
  Wayne Heym
  Rephael Wenger
B. Chandrasekaran & Sandra Mamrak Graduate Fellowship
  John Woodruff
Mike Liu Graduate Fellowship Award
  Vignesh Trichy Ravi
  Timothy Normand Miller
Eleanor Quinlan Memorial Awards
  Joshua Eckroth
Outstanding Service Award
  Neelam Soundarajan
  Nikola (Nikki) Strader
  David Kneisly
The Department of Computer Science & Engineering Undergraduate Research Award
  Chirantan Ekbote
Founders Recognitions
  Clint Foulk
  Theodore Hildebrandt
  James Randels

Ryan McGowan and his parents, Constance and Paul wait for the banquet to begin.
Dr. Xiaodong Zhang (above, left) and Dr. Hildebrandt (above, right), found a common link in their lives. Dr. Zhang’s first US mentor was Dr. Ralph Slutz with whom Dr. Hildebrandt had worked with in 1947 at the Institute for Advanced Study in Princeton, NJ. Xiaodong shared a photo (right) of Drs. Hildebrandt (2nd from right) and Slutz (2nd from left) carolling outside Einstein’s house with a group of colleagues.

In something of a role reversal, Marc Khoury presents an award to his mentor and advisor, Rafe Wenger. Marc was thrilled to have the chance to speak of someone who has meant so much to him in his career and his life.

Jonathan Woodruff (below, left) receives his award from his advisor, Dr. Leon Wang.

The Pedicini Family is all smiles in pride of Josephi Undergraduate Scholarship.

Carrie Ann Scavo and her father, Thomas.

Lorraine Cherry of Raytheon (right) presents award certificates to Brad Hartshorn (left) and Jeremy LeDonne (center).
**Automated Software Verification**

Who hasn’t used a computer program that crashed at an inopportune moment? Wouldn’t it be great if that would never happen again? Many people believe this is a pipe dream. They claim that it is literally impossible to rid non-trivial software of all errors, and that even if reliable and defect-free software were possible in principle it would be too expensive to produce in practice. Fred Brooks claims that “software entities are more complex for their size than perhaps any other human construct.” If other engineers cannot guarantee that their artifacts will always work, then why should we expect software engineers to be able to make such guarantees for software?

For the last 25 years, Bruce W. Weide and the Resolve/Reusable Software Research Group (RSRG) have been pursuing the long-term vision of a future in which no production software is considered properly engineered unless it has been fully specified and automatically verified as satisfying these specifications. This work directly tackles Tony Hoare’s “verifying compiler grand challenge.” Of course, even when this vision is realized it will not imply that verified application software will always operate perfectly. However, full behavioral specification plus modular verification that software meets its specification will imply a clear separation of concerns. For verified software, residual errors will be limited to whether the specification captures the requirements and to whether the supporting software and underlying hardware behave as advertised. Questions about the correctness of verified software components relative to their specifications will be effectively moot. As formal verification is applied to more and more software, more and more bugs will be squeezed out of computer systems.

Underlying software verification is a syntax-driven translation process from specifications and code into pure mathematics. One starts with a formal statement of what a piece of software is supposed to do, known as its behavioral specification (assertions written in the formal language of mathematics and mathematical logic); a formal statement of how it achieves that behavior (code written in another formal language, i.e., a programming language); and behavioral specifications of—but, crucially, not code for—all the software components that the above code relies upon to do its job. In a process very much like compiling source code into object code, one then combines the artifacts above into a set of verification conditions (VCs): mathematical assertions that establish the code is correct if and only if they are all valid. Finally, one tries to prove the VCs. If all of them can be proved, then one knows that the code when executed complies with its behavioral specification. If even one VC cannot be proved, then it points directly to the place(s) in the code that should be examined for errors.

There are two distinct flavors of automated software verification. Both involve the use of automated theorem-provers: computer programs that at a minimum can fully

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1. Some passages in this highlight are excerpted from Weide, B.W., “Software Verification with Towers of Abstractions”, in Neil Tennant, ed., Foundational Adventures: Essays in Honor of Harvey M. Friedman, Templeton Press (Online) and College Publications, London, 2011. Continuing support of RSRG from the National Science Foundation over the past 25 years is gratefully acknowledged.
check putative mathematical proofs of mathematical theorems provided by humans, and at best can discover such mathematical proofs by themselves. The first flavor has been demonstrated rather spectacularly in the last five years. Both simple compilers and operating system kernels have been verified “mechanically” in the sense that VCs have been generated as described above and the proofs of those VCs—proofs largely discovered by humans—have been checked by automated theorem-provers. Of course, each of these efforts has been accomplished at great expense in terms of human discovery of the proofs of VCs and their interactive presentation for checking. Yet a big investment of time and effort is reasonably easy to justify in order to establish correctness of software that is used as much as an operating system kernel or a compiler.

What about garden-variety software? This is where the other flavor of automated software verification comes in. Here, the goal is a push-button process in which a software developer simply clicks on a button labeled, say, “verify”, and the VCs are not only generated but also proved fully automatically—without the need for a human to discover proofs of any of the VCs. Though transition of research results to practice will take time, the foundations for a verifying compiler that does this are now close enough to completion that RSRG work is focused on the end-game for this second flavor of automated software verification: automatically proving VCs that are “obvious” to mathematicians, and devising styles of writing behavioral specifications and supporting mathematics that lead to VCs that are also “obvious” to automated theorem-provers. This research combines the interdisciplinary expertise of a group of investigators in software engineering (CS faculty and students at Ohio State, Clemson, and other locations) and in mathematical logic (Harvey M. Friedman of Ohio State’s Mathematics, Philosophy, and CSE Departments) to support a paradigm shift toward verified software.

This basic goal is being approached via research along the top path in the accompanying figure by about a dozen projects worldwide (many of them European). There is noteworthy convergence among these research groups on many key points, e.g.: software specialists will write formal annotations, i.e., specifications of behavior and justificational annotations such as loop invariants and progress metrics; mathematical logic specialists will develop definitions for use in specifications and annotations, and establish reusable results (i.e., lemmas and theorems) on which correctness justifications are based.

Fortunately, there has been considerable progress on the practical front in the past 10-15 years, partly as a result of improvements in automated theorem-proving technology and partly as a result of the availability of faster computers. How have faster computers (faster by a mere factor of perhaps 100) been able to make a serious difference in the ability to find proofs of mathematical statements, a problem
considered computationally intractable under the best of circumstances? The situation is analogous to that facing chess-playing programs until fairly recently. It was long considered impossible that a computer could defeat a human chess champion, but chess-playing programs underwent some improvements and the computers running them became faster, even as the difficulty of playing championship chess remained essentially fixed. Similarly over the years, the mathematical statements that one needs to prove in order to establish software correctness have not grown fundamentally more difficult, yet the tools to prove them have advanced and the computers that run those tools have become substantially more powerful.

A major contribution of RSRG research has been to show how interference between components that results from aliasing across “abstraction boundaries” can be mitigated by a careful design discipline and/or by rather minor programming-language improvements. There is now evidence that (1) programs without cross-boundary interference can be specified with considerably lower annotation overhead than in other languages, and that (2) the resulting VCs can be proved fully automatically at least as effectively—and far more quickly—than for other approaches in comparable situations. The last and purportedly hardest problem in a 2010 software verification competition involved implementing a queue with good amortized performance by representing it using two lists, one containing some of the queue elements in reverse order. The RSRG solution in the Resolve language included fewer than 40 tokens of “annotation overhead”: a loop invariant, a progress metric to show termination of a loop, and an abstraction function. For the component’s constructor and four other operations, the OSU Resolve tools generated 13 VCs that required any mathematical knowledge at all in order to be discharged. All 13 were proved automatically by OSU’s automated theorem-prover in a total of under 100 mS. Automatically proving the VCs for just a partial solution to the same problem using a similar tool from Microsoft Research took about 9 seconds, showing a substantial additional cost for handling VCs that have to deal with potential aliasing.

The conclusion is that automated software verification no longer can be dismissed as a real possibility for practical use in the near future.

February 21, 2012

OSU student Joanna Fedeli, asks John and Annie Glenn about their life and times together during the celebration dinner on the 50th anniversary of John Glenn’s historic flight.
Isosurface & Fractal Dimensions

Numerous applications, such as medical imaging and computational fluid dynamics, generate volumetric data. This data consists of numerical measurements such as density or temperature associated with locations in 3-D space. One way of visualizing this data is to construct geometric surface models representing points with the same values. Such surfaces are called isosurfaces.

For the past twelve years, Dr. Rephael Wenger has been studying the problems associated with isosurface reconstruction. With his colleagues and students, Dr. Wenger worked on generalizing isosurface reconstruction algorithms from three to four dimensions. Isosurfaces in 4-D model geometric surfaces in time varying sets, where time is the fourth dimension. Isosurfaces in 4-D can also track geometric surfaces as they vary in time. Projections of isosurfaces from 4-D to 3-D can also be used to efficiently model and tetrahedralize the region between surfaces in 3-D.

Isosurface construction algorithms generate numerous long, thin triangles. Such ill-shaped triangles create visual artifacts and are ill-suited for physical simulation such as modeling heat flow along the isosurface. Dr. Wenger and students worked on methods for constructing isosurfaces with well-shaped triangles with guaranteed lower bounds on the minimum angle of any isosurface triangle. The elimination of long, thin triangles has an added benefit of reducing the number of triangles representing the isosurface by factors of two or three.

The fractal dimension of a surface represents its geometric complexity. Smooth surfaces have fractal dimension of two while space filling surfaces have fractal dimension three. Fractal surfaces have dimension between two and three. Fractal dimension can be used to detect and filter noise in volumetric data sets.

Marc Khoury, an OSU undergraduate student, worked with Dr. Wenger on analyzing the fractal dimension of isosurfaces. Marc’s work appeared as a paper in the 2010 IEEE Visualization conference. For his undergraduate research work, Marc received a TechTomorrow scholarship from TechColumbus, the 2011 Undergraduate Research Award from the OSU CSE department, and an honorable mention from the CRA Outstanding Undergraduate Research Award. He also won a Churchill Scholarship to the University of Cambridge and an NSF graduate research fellowship.

Industrial CT (computed tomography) scanning uses X-rays to produce volumetric data sets of industrial components such as machine parts or engines. Such objects typically have sharp edges and corners. Isosurface reconstruction algorithms implicitly smooth the reconstructed surfaces, creating beveled edges and corners. Dr. Wenger is currently working on algorithms for generating isosurfaces with accurate representations of their sharp edges and corners.

Dr. Wenger is completing a book on isosurfaces, entitled “Isosurfaces: Geometry, Topology and Algorithms” which will be published by Peters Publishing, a subsidiary of CRC Press. The book describes isosurface reconstruction algorithms in three and four dimensions, multiresolution isosurfaces, data structures for faster isosurface reconstruction, metrics for measuring and comparing isosurfaces, and graph representations of isosurface structure.
## New Grants Established

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Grant Title</th>
<th>Primary Investigator - CSE Researchers</th>
<th>Co-Investigators</th>
<th>Date</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Speech Segregation Based on Binary Classification</td>
<td>Deliang Wang</td>
<td></td>
<td>5/1/12 – 4/30/16</td>
<td>$932,284</td>
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<td>Army Research Office: Multidisciplinary University Research Initiative</td>
<td>Multivariate Heavy-Tail Phenomena: Modeling and Diagnostics</td>
<td>NeSS Shroff</td>
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<td>6/1/12 – 5/31/17</td>
<td>$600,000</td>
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<td>Dept. of Energy (DOE)</td>
<td>Scalable Data-Management, Analysis, And Visualization (SDAV) Institute</td>
<td>Han-Wei Shen</td>
<td></td>
<td>02/15/12 – 02/14/17</td>
<td>$750,000</td>
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<tr>
<td>Dept. of Energy Small Business Technology Transfer (DOE STTR) phase ii (with Rnet technologies)</td>
<td>HPC Application Energy Measurement and Optimization</td>
<td>D. K. Panda</td>
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<td>02/15/12 – 08/14/12</td>
<td>$325,000</td>
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<td>Honda</td>
<td>Contextual Resolution of Locational References in Human-Computer Dialogue</td>
<td>Eric Fosler-Lussier</td>
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<td>01/01/12 – 06/30/12</td>
<td>$33,624</td>
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<tr>
<td>International Computer Science Institute (ICSI) { Intelligence Advanced Research Projects Activity (IARPA) subcontract}</td>
<td>SWORDFISH: Spoken Wordsearch with Rapid Development and Frugal Variant Subword Hierarchies</td>
<td>Eric Fosler-Lussier</td>
<td></td>
<td>03/05/12 – 06/30/14</td>
<td>$819,764</td>
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<td>JP Morgan Chase</td>
<td>Enterprise Systems Research</td>
<td>Rajiv Ramnath</td>
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<td>09/01/11 – 06/30/12</td>
<td>$32,000</td>
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<td>Kitware, Inc. {Dept. of Energy Small Business Innovation Research (DOE SBIR)}</td>
<td>Cloud Computing and Visualization Tools for KBase</td>
<td>Kun Huang</td>
<td>Raju Machiraju</td>
<td>2/1/12 – 10/31/12</td>
<td>$49,532</td>
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<tr>
<td>Kuzer Co. (Air Force Office of Scientific Research Small Business Technology Transfer (AFOSR STTR))</td>
<td>An Auditory Scene Analysis Approach to Speech Segregation</td>
<td>Deliang Wang</td>
<td></td>
<td>01/01/12 – 12/31/13</td>
<td>$300,000</td>
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<tr>
<td>National Science Foundation (NSF)</td>
<td>EXP: GeoGames – A Virtual Simulation Workbench for Teaching and Learning Through a Real-world Spatial Perspective</td>
<td>Karl Ola Ahlqvist (OSU – Geography)</td>
<td>Rajiv Ramnath, Kathryn Plank (OSU-University Center for the Advancement of Teaching)</td>
<td>10/01/11 – 09/30/13</td>
<td>$374,772</td>
</tr>
</tbody>
</table>
National Science Foundation (NSF)

**PC3: Collaborative Research: Wireless Sensor Networks for Protecting Wildlife and Humans**

*Anish Arora*
10/01/11 – 09/30/13  $178,209

**RI: Small: Algebraic and Spectral Structure of Data in High Dimension**

*Mikhail Belkin*
7/1/11 – 06/30/14  $450,000

**AF: Medium: Collaborative Research: Optimality in Homology – Algorithms and Applications**

*Tamal Dey*
08/01/11 – 07/31/15  $352,896

**AF: Small: Analyzing Spaces and Scalar Fields via Point Clouds**

*Tamal Dey*
Co-PI: *Yusu Wang*
08/01/11 – 07/31/14  $499,761

**CI-P: Collaborative Research: The Speech Recognition Virtual Kitchen**

*Eric Fosler-Lussier*
6/1/12 – 05/31/13  $48,608

**RI: Small: Hard Clustering via Bayesian Nonparameters**

*Brian Kulis*
6/1/12 – 5/31/15  $439,689

**Collaborative Research: Serious Play in Synthetic Worlds: Social Media Enhanced Organized Sensemaking in Emergency Response**

*Srinivasan Parthasarathy*
09/01/11 – 08/31/14  $270,000

**EAGER: Towards New Scalable Stochastic Flow Algorithms**

*Srinivasan Parthasarathy*
08/01/11 – 07/31/12  $150,000

**Nets: Medium: Collaborative Research: Enabling Cellular Services Over Unplanned Femto-Cell Deployments: From Theory To Implementation**

*Prasun Sinha*
06/01/12 – 05/31/15  $380,000

**U.S.- China Workshop on Environmental Monitoring for Public Health and Disaster Recovery**

*Dong Xuan*
5/15/12 – 04/30/13  $60,558

**SI2-SSE: A Unified Software Environment to Best Utilize Cache and Memory Systems on Multicores**

*Xiaodong Zhang*
06/01/12 – 05/31/15  $500,000

**Travel support for the 32nd IEEE International Conference on Distributed Computing Systems**

*Xiaodong Zhang*
04/01/12 – 03/31/13  $10,000

National Science Foundation (NSF): SI2-SSI: Collaborative Research:

*A Comprehensive Performance Tuning Framework for the MPI Stack*

*D. K. Panda*
Co-PI: Karen Tomko (Ohio Supercomuter Center)
4/15/12 – 04/14/15  $1,251,374

National Science Foundation (NSF): Software and Hardware Foundations (SHF):

*Small: GOALI: Addressing the Challenges of Parameter Variation in the Design of Ultra-low Power Chip Multiprocessors Using Near-threshold Technology*  
*Rădu Teodorescu*
Co-PI: Waleed Khalil (OSU - Electrical & Computer Engineering)  
7/1/11 – 06/30/14  $400,000

**NVIDIA Corporation**

*High-Performance MPI Design for InfiniBand Clusters with GPUs*  
*D. K. Panda*
07/01/11 – 03/31/13  $115,237

**Raytheon BBN Technologies**

*GENI Educational Kits for Wireless Sensor Networks*  
*Anish Arora*
Co-PI: *Rajiv Ramnath*
10/01/11 – 09/30/14  $204,884

**RNET Technologies (AFOSR STRR Subaward)**

*Highly-Scalable Computational-Based Engineering Algorithms for Emerging Parallel Machine Architectures*  
*P. Sadayappan*
Co-PI: Sandip Mazumder (OSU- Mechanical & Aerospace Engineering)  
01/01/12 – 09/30/12  $47,097
RNET Technologies (DOE STTR Subaward)

*Catalytic Converter Modeling on Emerging Personal Computers and Small Clusters*

Sandip Mazumder (OSU- Mechanical & Aerospace Engineering)
Co-PI: P. Sadayappan
2/20/12 – 11/19/12 $46,428

Uniformed Services University Health Sciences Tri-Service Nursing:

*Effectiveness and Benefit of Two STI Prevention Delivery Methods for Military Women*

Nancy Ryan-Wenger (OSU- College of Nursing)
Co-PI: Elizabeth Barker (OSU- College of Nursing), Rajiv Ramnath, Victoria Von Sadovszky Barker (OSU- College of Nursing)
8/1/11 – 7/31/12 $660,959

Xerox Corporation

*Customization and Individualization of Reading Materials for an Individual or Group*

Eric Fosler-Lussier
7/1/11 – 08/31/12 $19,468

**Grants Established Prior to July 1, 2011**

Air Force Office of Scientific Research (AFOSR)

*Internet Attack Traceback-Cross-Validation and Pebble-Trace*

Ten-Hwang (Steve) Lai
4/1/09 – 11/30/12 $500,000
Air Force Office of Scientific Research

*Network of Memories*

Simon Dennis (OSU-Dept. of Psychology)
Co-PI: Mikhail Belkin
4/1/09-7/14/12 $478,426

*Sequential Organization and Room Reverberation in Speech Segregation*

Deliang (Leon) Wang
2/1/08 – 11/30/11 $874,369

Air Force Research Laboratory

*Center for Automatic Target Research (CATR) Task 0006*

Anish Arora
11/16/10 – 11/19/12 $125,000

*Center for Automatic Target Research (CATR) Task 0002*

James Davis
5/1/10 – 9/30/12 $44,000

*Center for Automatic Target Research (CATR) Task 0006*

James Davis
11/16/10 – 11/19/12 $293,000

Aquilent, Inc. (National Library of Medicine subaward)

*A Comprehensive Workflow for Robust Characterization of Microstructure for Cancer Studies*

Raghu Machiraju
Co-PI: Kun Huang (OSU-Biomedical Informatics)
4/1/11 – 9/24/12 $150,000

Army Research Office: Multidisciplinary University Research Initiative

*Stochastic Control of Multi-Scale Networks: Modeling, Analysis and Algorithms*

Ness Shroff
5/1/08 – 11/28/12 $6,456,625

BBNT Solutions, LLC

*Genifying and Federating Autonomous Kansei Wireless Sensor Networks*

Anish Arora
Co-PI: Rajiv Ramnath
9/1/08 – 8/31/11 $500,000

Capstone Partners

*Capstone Partnerships*

Rajiv Ramnath
1/1/11 – 12/31/12 $15,000

CETI IUCRC Memberships

Jay Ramanathan
Co-PI: Rajiv Ramnath
10/1/06 – 04/30/12 $567,604.31
DARPA (Rice University Subaward)

A Platform-Aware Compilation Environment

P. SADAYAPPAN
Co-PI: ATANAS ROUNTEV
4/1/09 – 11/30/11 $820,004

Dept. of Energy (DOE)

Coordinated Fault Tolerance for High Performance Computing

D. K. PANDA
9/15/06-9/15/11 $1,000,000

Programming Models For Scalable Parallel Computing

D. K. PANDA
9/15/06-9/15/12 $1,000,000

A Fault-Oblivious Extreme Scale Execution Environment

P. SADAYAPPAN
9/1/10 – 8/31/13 $469,254

A Polyhedral Transformation Framework for Compiler Optimization

P. SADAYAPPAN
Co-PI: ATANAS ROUNTEV
9/1/10 – 8/31/13 $399,842

Programming Models for Scalable Parallel Computing

P. SADAYAPPAN
9/15/06-8/31/12 $500,000

Scalable Fault Tolerant Runtime Technology for Petascale Computers

P. SADAYAPPAN
8/1/08 - 7/31/12 $375,820

An Information Framework for Enabling Extreme-scale Science Discovery

HAN-WEI SHEN
9/1/10 – 8/31/13 $462,095

SciDAC Institute for Ultrascale Visualization

HAN-WEI SHEN
9/26/07-12/14/12 $750,000

Very Large 3D Flow Field Visual Analysis

HAN-WEI SHEN
10/28/10 – 9/30/13 $461,074

Hewlett Packard

Energy and Labor Efficient Sensor Networking for Underground Data Acquisition

NESS SHROFF
Co-PI: Can Emre Koksal (OSU-Dept. Electrical and Computer Engineering)
09/01/12 – 08/31/15 $300,000

Kuzer Co. (Air Force Office of Scientific Research (AFOSR STTR))

An Auditory Scene Analysis Approach to Speech Segregation

DELIANG (LEON) WANG
7/1/10 – 09/30/12 $40,000

Los Alamos National Labs

IRWIN Research in Wireless

JAMES DAVIS
7/1/10 – 9/30/11 $170,392

Mellanox Technologies, Inc

Research on High Performance and Scalable MPI over InfiniBand.

D. K. PANDA
4/4/04-3/31/11 $765,122

National Center for Research Resources (OSU CCTS)

CCTS NCTMP Pilot

RAGHU MACHIRAJU
Co-PI: Rebecca Jackson (OSU- Dept. of Physical Medicine and Rehabilitation)
7/1/10 – 12/31/11 $149,424

National Library of Medicine

A Comprehensive Workflow for Large Histology Segmentation and Visualization

RAGHU MACHIRAJU
Co-PIs: Kun Huang (OSU-Biomedical Informatics) and Lisa Lee (OSU- SBS-Division of Anatomy)
6/25/10 – 6/24/12 $150,000
A Language Independent Framework For Compiling Data-Intensive Applications on Highly Parallel Systems
Gagan Agrawal
9/1/08 – 08/31/12  $502,000

DC: Small: Data Intensive Computing Solutions for Neuroimage Analysis
Gagan Agrawal
Co-PI: Raghu Machiraju
9/15/09-8/31/12  $488,000

CPS: Small: Collaborative Research: Localization and System Services for Spatiotemporal Actions in Cyber-Physical Systems
Anish Arora
9/15/09-8/31/12  $200,001

DHB/Collaborative Research: Using Machine Learning to Model the Interplay of Production Dynamics and Perception Dynamics in Phonological Acquisition
Mary Beckman (OSU – Dept. of Linguistics)
Co-PI: Eric Fosler-Lussier
1/15/08 – 12/31/11  $273,284

CAREER: Geometry and High-Dimensional Inference
Mikhail Belkin
10/01/07 – 12/31/11  $498,972

Inferring Topology and Geometry for Dynamic Shapes
Tamal Dey
9/1/08 – 8/31/11  $220,000

MCS: Reconstructing and Inferring Topology and Geometry From Point to Point Cloud Data
Tamal Dey
Co-PI: Dan Burghelea (OSU-Dept. of Mathematics)
9/1/09-8/31/12  $462,000

Collaborative Research: RI: Medium: Explicit Articulatory Models of Spoken Language, with Application to Automatic Speech Recognition
Eric Fosler-Lussier
7/1/09-6/30/13  $334,469

CAREER: Breaking the Phonetic Code: Novel Acoustic-Lexical Modeling Techniques for Robust Automatic Speech Recognition
Eric Fosler-Lussier
12/15/06-11/30/12  $502,952
**Center for Experimental Research in Computer Systems- Research Site**

**JAY RAMANATHAN**
Co-PI: RAJIV RAMNATH
5/1/08 – 4/30/13 $190,000

**Curriculum for Accelerated Services Engineering (CASE)**

**RAJIV RAMNATH**
Co-PIs: JAY RAMANATHAN, NEELAM SOUNDARAJAN, Jerome D’Agostino (OSU-CoEHE, Quantative Research, Evaluation and Measurement)
9/1/09 – 8/31/12 $149,981

**CAREER: Dataflow Analysis for Modern Software Systems**

**ATANAS ROUNTEV**
9/15/06-8/14/12 $407,000

**SHF: Small: Algorithms for Dynamic Analysis of Run-time Bloat**

**ATANAS ROUNTEV**
9/15/10 – 8/31/13 $356,531

**Collaborative Research: An Environment for High-Productivity High-Performancy Computing using GPUs/accelerators**

**P. SADAYAPPAN**
9/15/09-8/31/13 $639,952

**Customizable Domain-specific Computing**

**P. SADAYAPPAN**
9/1/09-8/31/14 $749,998

**Collaborative Research: Petascale Simulations of Quantum Systems by Stochastic Methods**

**P. SADAYAPPAN**
9/1/09-8/31/13 $639,952

**Collaborative Research: CPA-CPL-T: An Effective Automatic Parallelization Framework for Multi-Core Architectures**

**P. SADAYAPPAN**
Co-PI: ATANAS ROUNTEV
8/1/08 – 7/31/11 $500,000

**GV: Small: Collaborative Research: An Information Theoretic Framework for Large-Scale Data Analysis And Visualization**

**HAN-WEI SHEN**
9/1/10 – 8/31/13 $292,147


**NESS SHROFF**
Co-PI: PRASUN SINHA and Can Emre Koksal (OSU-Dept. Electrical and Computer Engineering)
9/1/08 – 8/31/12 $500,000

**CAREER: On-the-Fly Protocols for Data Dissemination in Wireless Mesh Networks**

**PRASUN SINHA**
1/15/06-12/31/11 $412,000

**Collaborative Proposal: NOSS: Doing more with less: Tracking Movements Using a Sparse Sensor Network**

**PRASUN SINHA**
9/1/07 – 8/31/12 $216,017

**NeTS-NOSS: Collaborative research: Energy-Efficient Distributed Sensor Network Control: Theory to Implementation**

**PRASUN SINHA**
Co-PI: NESS SHROFF
9/1/07 – 8/31/11 $491,661

**AF: EAGER: Collaborative Research: Integration of Computational Geometry and Statistical Learning for Modern Data Analysis**

**YUSU WANG**
Co-PI: MIKHAIL BELKIN
09/01/10 - 08/31/12 $196,000

**CAREER: Geometric and Topological Methods in Shape Analysis, with Applications in Molecular Biology**

**YUSU WANG**
2/1/08 – 1/31/13 $420,000

**Similarity-based Indexing and Integration of Protein Sequence and Structure Databases DBI**

**YUSU WANG**
Co-PI: Chenglong Li (OSU- Div. of Medicinal Chemistry and Pharmacognosy)
8/15/08 – 12/31/11 $498,117

**Automated Support for Developing Logical Reasoning Skills in Discrete Mathematics Courses**

**BRUCE WEIDE**
Co-PIs: Harvey Friedman (OSU-Dept. of Mathematics), Dennis Pearl (OSU-Dept. of Statistics)
3/1/10-8/31/12 $199,775
NeTS: Small: Connected Coverage of Wireless Sensor Networks in Theoretical and Practical Settings
Dong Xuan
Co-PI: Ten-Hwang Lai
9/1/09-8/31/12 $400,000

Basic Research for Developing SSD-based Caching and Hybrid Storage Systems
Xiaodong Zhang
8/1/09-7/31/13 $400,000

Collaborative research: CSR-PSCE: TM: Effective Resource Sharing and Coordination Inside Multicore Processors For High Throughput Computing
Xiaodong Zhang
9/1/08 – 8/31/12 $330,000

National Science Foundation (NSF) CAREER:
Algorithm Design for Optimization Problems In Network Over-Provisioning
Dong Xuan
12/15/05-11/30/11 $400,060

National Science Foundation (NSF) SHF:
Small: Designing QoS-aware MPI and File Systems Protocols for InfiniBand Clusters
D. K. Panda
09/01/09 – 09/30/13 $491,570

National Science Foundation (NSF): CPA-SEL:
Collaborative Research: Continuing Progress Toward Verified Software
Bruce Weide
Co-PI: Harvey Friedman (OSU-Dept. of Mathematics)
9/1/08 – 02/28/13 $279,107 / $232,591

National Science Foundation (NSF): CT-ISG:
Collaborative Research: Router Models and Downscaling Tools for Scalable Security Experiments
Ness Shroff
10/1/08 – 9/30/12 $125,000

National Science Foundation (NSF): NeTS:
Large: Collaborative Research: Foundations for Network Cooperation at Signal Scale
Ness Shroff
07/01/2010 – 06/30/2015 $330,000

National Science Foundation (NSF): NeTS:
Medium: Collaborative Research: Mobile Content Sharing Networks: Theory to Implementation
Ness Shroff
Co-PI: Dong Xuan
07/01/11 – 06/30/15 $628,946

National Science Foundation (NSF): NeTS-Medium:
Collaborative Research: Unifying Network Coding and Cross-Layer Optimization for Wireless Mesh Networks: From Theory to Distributed Algorithms to Implementation
Ness Shroff
09/01/09 – 08/31/13 $350,000

Nile University
Educational Support for Nile University in the Area of Wireless Communications
Ness Shroff
3/1/10 – 8/31/12 $15,000

Ohio Department of Development (University of Dayton subaward)
Wright Center of Innovation, Institute for the Development and Commercialization of Advanced Sensor Technology (IDCAST)
Randy Moses (OSU-College of Engineering / Electrical and Computer Engineering)
Co-PI: James Davis
2/26/07 – 7/31/11 $190,000

Pennsylvania State University (ARO MURI Subaward)
Design of Urban Sensor Networks
Ness Shroff
6/15/07 – 02/05/13 $300,000

RNET Technologies (Dept. of Energy Small Business Technology Transfer (DOE STTR))
Accelerating Parallel Numerical Libraries to Petascale and Beyond
P. Sadayappan
8/15/10 – 8/15/12 $245,000
It was a sad day in June, when CSE wished Bon Voyage to one of its members - Dr. Rick Parent retired. Rick Parent is renown for his work in animation and many Hollywood animators benefited from his tutelage.

Above: Rick (left) poses with Wayne Carlson. The two started graduate school together and became faculty at the same time as well. Wayne is now the Vice Provost for Undergraduate Studies and Dean of Undergraduate Education.
SELECT PUBLICATIONS

ARTIFICIAL INTELLIGENCE


X. Zhou, M. Belkin and N. Srebro. “An Iterated Graph Laplacian Approach for Ranking on Manifolds.” Proceedings of the 17th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD 2011); San Diego, California, USA; Aug. 21-24, 2011; pp. 877-885


GRAPHICS


**NETWORKING**


SE/PL


N. Soundarajan, R Khatchadourian and D Bronish. “Formalizing Reusable Aspect-Oriented Concurrency Control.” Proceedings of the 23rd International Conference on Software Engineering & Knowledge Engineering (SEKE’2011); Miami Beach, USA, July 7-9, 2011; pp. 111-114

Systems


T. Liu and G. Agrawal. “Stratification Based Hierarchical Clustering Over a Deep Web Data Source.” *Proceedings of SIAM International Conference on Data Mining*; Anaheim, California, USA; Apr. 26-28; pp. 70-81


Y. Zhang and S. Parthasarathy. “Extracting, Analyzing, and Visualizing Triangle K-Core Motifs within Networks.” Proceedings of the 28th IEEE International Conference on Data Engineering (ICDE) (ICDE); Washington, DC, USA; April 1-5, 2012; pp. 1049 – 1060

X. Yang, S. Parthasarathy and P. Sadayappan. “Fast Sparse Matrix-Vector Multiplication on GPUs: Implications for Graph Mining.” Proceedings of the 37th International Conference on Very Large Data Bases 2011; Aug. 29 – Sept. 3; Vol. 4, No. 4, pp. 231-242


Y.-K. Shih and S. Parthasarathy. “Scalable Global Alignment for Multiple Biological Networks.” Proceedings of the ACM International Conference on Bioinformatics, Computational Biology and Biomedicine, Chicago, IL, USA: July 31 - Aug. 03, 2011; pp. 96-105

Y.-K. Shih and S. Parthasarathy. “Scalable Global Alignment for Multiple Biological Networks.” BMC Bioinformatics, Mar. 21, 2012; 13 Suppl. 3:S11


*D. K. Panda and 3 of his students strike the O*H*I*O pose at the IPDPS conference.*
Faculty Service

GAGAN AGRAWAL
International Journal of Next Generation Computing (IJNGC) – Associate Editor

ANISH ARORA
New Generation Computing – Editorial Board
Present Real Time Systems – Associate Editor

MIKHAEL BELKIN
IEEE Pattern Analysis and Machine Intelligence (PAMI) - Associate Editor
Journal of Machine Learning Research (JMLR) - Action Editor
25th Annual Conference on Neural Information Processing Systems (NIPS 2011) - Area Chair

JAMES W. DAVIS
International Conference on Advanced Video and Signal based Surveillance - Area Chair
International Conference on Advanced Video and Signal based Surveillance - Area Chair
IEEE Conference on Computer Vision and Pattern Recognition - Chair of Workshops

TAMAL K. DEY
Discrete & Computational Geometry – Editorial Board
Journal of Computational Geometry – Editorial Board
Graphical Models – Associate Editor

TEN-HWANG LAI
ACM/Springer Wireless Networks - Editor
International Journal of Ad Hoc and Ubiquitous Computing - Editor
International Journal of Sensor Networks - Editor

ERIC FOSLER-LUSSIER
Journal of Experimental Linguistics – Editorial Board
ACM Transactions on Speech and Language Processing – Associate Editor
Transactions of the Association for Computational Linguistics – Associate Editor
IEEE Automatic Speech Recognition and Understanding Workshop - Finance chair
IEEE International Conference on Acoustics, Speech, and Signal Processing - Area Chair
North American Association for Computational Linguistics: Human Language Technologies Conference (NAACL HLT) - Program Chair

D. K. PANDA
IEEE Transactions on Computers – Associate Editor
Journal of Parallel and Distributed Computing – Subject Area Editor
International Symposium on High Performance Computing (HiPC) 2012 – Program Chair
International Symposium on Cluster, Cloud, and Grid Computing (CCGrid) 2012 – Vice Chair (Architecture)
International Parallel and Distributed Processing Symposium (IPDPS) 2012 – Session Chair
Workshop on Communication and Architecture (CAC) – Steering Committee

SRINIVASAN PARTHASARATHY
ACM Transactions on Knowledge Discovery and Data Mining – Associate Editor
Data Mining and Knowledge Discovery: An International Journal - Editor
Distributed and Parallel Databases – Editorial Board
Journal of Parallel and Distributed Computing – Associate Editor
IEEE Transactions on Knowledge and Data Engineering – Associate Editor
SIGKDD Newsletter Explorations – Associate Editor
18th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, KDD 2012 - Senior Programming Committee
IEEE International Conference on Data Mining series (ICDM) 2011 – Vice Chair on Programming Committee
2012 SIAM International Conference on Data Mining – Steering Committee

RAJIV RAMNATH
ACM Symposium for Applied Computing (SAC) 2011 – Co-Chair Cloud Computing Track
Atanas Rountev
Journal of Information and Software Technology – Editorial Board
Journal of Object Technology – Editorial Board

Han-Wei Shen
IEEE Transactions on Visualization and Computer Graphics: Special Issue on PacificVis – Guest Editor
IEEE Computer Graphics and Applications (Special Issue on UltraScale Visualization) – Guest Editor
IEEE Computer Graphics and Applications (Special Issue on Pacific Visualization), – Guest Editor
IEEE Computer Graphics and Applications, Special Issue on Extreme Scale Visual Analytics – Guest Editor

Prasun Sinha
IEEE Transactions on Mobile Computing – Editorial Board

Neelam Soundarajan
Computing Accreditation Commission - Active Member

Christopher Stewart
IEEE Sustainable Computing Register - Chief Editor

Deliang Wang
Neural Networks - Co-Editor-in-Chief
Cognitive Neurodynamics – Editorial Board
EURASIP Journal on Audio, Speech, & Music Processing – Associate Editor
Neurocomputing – Neural Computing & Applications -
IEEE Transactions on Audio, Speech, and Language Processing – Associate Editor
International Neural Network Society Governing Board - Elected Member
IEEE Signal Processing Society Speech and Language Processing Technical Committee - Elected Member
International Conference on Intelligent Computing – General Co-Chair

Dong Xuan
IEEE Transactions on Parallel and Distributed Systems (TPDS) - Associate Editor
Ad Hoc & Sensor Wireless Networks - Associate Editor

Xiaodong Zhang
Journal of Computer Science and Technology - Executive Editor,
IEEE Micro - Associate Editor
Journal of Parallel and Distributed Computing - Subject Area Editor in Distributed Systems,
Journal of Parallel and Distributed Computing - International Conference of Distributed Computing Systems - Steering Committee Chair

Dr. Bruce Weide (left) is smiles after hooding his student, Derek Bronish.
Distinguished Guest Lectures

Ravi Kannan
Microsoft Research Labs
k-MEANS REVISITED

Kai Li
Princeton University
The Dual of Research and Innovation

Tomaso Poggio
Massachusetts Institute of Technology
The Computational Magic of the Ventral Stream

Doug Roble
Digital Domain
VFX Case Studies: 2012, Benjamin Button, Tron, Real Steal Behind The Scenes From a Software & Math Perspective

Stephen Smale
University of California, Berkeley
Joint CSE/Math Talk
Geometry of Data and New Vaccines

Xian-He Sun
Illinois Institute of Technology
Memory System for Extreme-Scale Computing

Jie Wu
Temple University
Some Routing Challenges in Dynamic Networks

Guest Speakers

Ricardo Bianchini
Rutgers University
Leveraging Renewable Energy in Data Centers: Present and Future

Theodoros (Theo) Damoulas
Cornell University
Probabilistic Machine Learning in Biology and Computational Sustainability

Qunfeng Dong
University of Science and Technology of China
Accommodating Two Genies Into One Jar — How Can Packet Inspection Become Both Fast and Scalable?

Dr. Chandra Krintz
University of California, Santa Barbara
AppScale: Open-source Platform-as-a-Service for Cloud Computing Research and Engineering

Steve Oudot
INRIA Saclay - Paris
A Few Concrete Applications of Topological Persistence Theory

Dr. James Rehg
Georgia Institute of Technology
Behavior Imaging and the Study of Autism

Lorenzo Rosasco
Massachusetts Institute of Technology
Learning Multiple Categories with Simplex Coding

Min-Té (Peter) Sun
National Central University, Taiwan
Dynamic Bit Encoding for Privacy Protection Against Correlation Attacks in RFID Backward Channel
CERCS for Enterprise Transformation and Innovation (CETI) combined its annual Industry Day and the capstone courses poster event. Local industry representatives were able to talk with students, view their project posters and learn about new research.

Top: Karsten Schwan of Georgia Tech explains the work he is doing. Karsten is a CETI collaborator.

Above: One of the “Best Project” winning teams is presented with certificates. Their instructor, Naeem Shareef is on the far left.
### Statistical Historical View

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### Graduate Program

The CSE Graduate Program continues to expand. The Department becomes more international with each bringing in students from Europe, Asia and South America. More women are appearing within our halls with the Masters program hitting nearly 22% female population.

The Graduate Studies Committee has faced a great challenge converting to semesters, but the process has allowed for some healthy updating and redesign of some class structures.

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<td><strong>Joe William Bolinger</strong></td>
<td>Dr. Jayashree Ramanathan</td>
<td>Columbus, Ohio, USA</td>
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<td>B.A., M.S., The Ohio State University, Columbus, Ohio, USA</td>
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<td>Micro-Modeling: A Visual Design Framework for Collaborative Tools in Complex Service Organizations</td>
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<td><strong>Derek A. Bronish</strong></td>
<td>Dr. Bruce Weide</td>
<td>Westlake, Ohio, USA</td>
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<td>B.S., The Ohio State University, M.S., The Ohio State University</td>
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<td>Abstraction as the Key to Programming with Issues for Software Verification in Functional Languages</td>
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<td><strong>William Louis Hartmann</strong></td>
<td>Dr. Eric Fosler-Lussier</td>
<td>Cincinnati, Ohio, USA</td>
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<td>B.S., Northern Kentucky University, M.S., The Ohio State University</td>
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<td>ASR - Driven Binary Mask Estimation for Robust Automatic Speech Recognition</td>
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<td>B.S., National Taiwan University; M.S., The Ohio State University</td>
<td>Amazon, Seattle, Washington, USA</td>
<td>Formal Analysis of Network Protocol Security</td>
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<td><strong>Teng-Yok Lee</strong></td>
<td>Dr. Han-Wei Shen</td>
<td>Taipei, Taiwan, ROC</td>
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<td>B.S., M.S., National Chiao Tung University</td>
<td>The Ohio State University</td>
<td>Data Triage and Visual Analytics for Scientific Visualization</td>
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<tr>
<td><strong>Timothy Normand Miller</strong></td>
<td>Dr. Mircea-Radu Teodorescu</td>
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<td>B.S., University of South Florida, M.S., The Ohio State University</td>
<td>Binghamton University, Vestal, New York, USA</td>
<td>Architectural Solutions for Low-Power, Low-Voltage, and Unreliable Silicon Devices</td>
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<td><strong>Xiangyong Ouyang</strong></td>
<td>Dr. Dhabaleswar Panda</td>
<td>Beijing, China</td>
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<td>Bachelor’s, Mechanical Engineering, Tsinghua University</td>
<td>Google, Mountainview, California, USA</td>
<td>Efficient Storage Middleware Design in InfiniBand Clusters for High End Computing</td>
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<td><strong>Vignesh Trichy Ravi</strong></td>
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<td>Columbus, Ohio, USA</td>
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<td>B.Engr., Anna University</td>
<td>Advanced Micro Devices (AMD), Austin, Texas, USA</td>
<td>Runtime Systems and Scheduling Support for High-End CPU-GPU Architectures</td>
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</table>
ISSAM SAVA  
B.S., Lebanese American University; M.S., Ohio University
The Ohio State University
Towards Topological Methods for Complex Scalar Data

KARTHIK SANKARANARAYANAN  
B.Engr., University of Pune; M.S., The Ohio State University
IBM Research, India
A Multiple Instance Learning Framework for Localization and Tracking of Persistent Targets

VENU M. SATULURI  
B.Engr., National Institutes of Technology
Twitter, San Francisco, California, USA
Scalable Clustering of Modern Networks

HONG SUN  
B.A., University of Science and Technology, Beijing, China; M.S., The Ohio State University
SRA International, Durham, North Carolina, USA
Detecting Multiple Protein Folding Trajectories and Structural Alignment

JOHN F. WOODRUFF  
B.A., B.S., University of Michigan, Ann Arbor, M.S., Northwestern University
Kuzer, Columbus, Ohio, USA
Integrating Monaural and Binaural Cues for Sound Localization and Segregation in Reverberant Environments

BOYING ZHANG  
B.Engr., University of Science and Technology of China, M.S., Chinese Academy of Science, M.S., The Ohio State University
Large Scale Message Dissemination in Mobile Opportunistic
Masters Graduates

Varadharajan Chandran  
Chennai, India  
Bachelor’s, Anna University

Arun Chockalingam  
Chennai, India  
Bachelor’s, Anna University

Nishanth Dandapanthula  
Hyderabad, India  
Bachelor’s, Vellore Institute of Technology

Isha Sanjay Deshpande  
Mumbai, India  
B.Tech., University of Pune

Ryan K. Feather  
Eglon, West Virginia, USA  
B.S., West Virginia University Institute of Technology

Srinivas Vijaykumar Hegde  
Thane, India  
B.Engr., University of Mumbai

Yating Hsu  
Taipei, Taiwan, ROC  
B.S., National Taiwan University

Jing Li  
Jinhua, China  
B.Engr., Beijing Information Science and Technology University

Timothy Normand Miller  
Columbus, Ohio, USA  
B.S., University of South Florida, Florida, USA

Sinduja Muralidharan  
Chennai, India  
Bachelor’s, Anna University

Sharada Krishna Patil  
Mumbai, India  
Bachelor’s, National Institutes of Technology, India

Aarthi Raveendran  
Tamil Nadu, India  
B.Engr., Anna University

Nathan Paul Stohs  
Logan, Ohio, USA  
B.S., Carnegie Mellon University

Xiaojie Su  
Beijing, China  
B.S., Beijing University of Technology

Enhau Tan  
Jiujian, China  
B.Engr., University of Science and Technology of China; Master’s, Chinese Academy of Sciences

Sravya Tirukkovalur  
Hyderabad, India  
B.Tech., Jawaharlal Nehru Technological University

Chiu Ni Wang  
West India, India  
Bachelor’s, West Bengal University of Technology

Dean Zhang  
Dayton, Ohio, USA  
B.A., Zhengzhou University

Wenbin Zhang  
Guangzhou, China  
B.Engr., M.S., Zhejiang University

Jiedan Zhu  
Guangzhou, China  
B.Engr., South China University of Technology

Syed Farooq Ali  
Lahore, Pakistan  
B.S., National University of Computer and Emerging Sciences; M.S., Lahore University of Management Sciences

Joe William Bolinger  
Columbus, Ohio, USA  
B.S., The Ohio State University

Boyi Cui  
Anshan, China  
Bachelor’s, Beijing Forestry University
Ravi Prakash Srirama Venkata Naga Darbha
Bangalore, India
Bachelor’s, National Institute of Technology

Amrita Ghosh
Jhargram, India
B.Eng., Vidyasagar University; M.S. (Electrical and Computer Engineering), The Ohio State University

Preethi Jyothi
Bangalore, India
B.Tech., National Institutes of Technology

Nived Kalappuraikal Sivadas
Chennai, India
Bachelor’s, Anna University

Yong Wook Kim
Seoul, Korea
B.S., Hanyang University; M.S., Illinois Institute of Technology

Abhisek Kundu
Arambagh, India
B.Eng., Jadavpur University

Chang Pil Lee
Seoul, Korea
Bachelor’s, Hongik University; B.S., Purdue University

Wei Liu
Xiangfan, China
B.Eng., Wuhan University

Jacob Emil Mainzer
Burlingame, California, USA
B.S., University of Rochester

Siddhesh Prakash Pai Raikar
Mumbai, India
B.Eng., University of Mumbai

Rohit Prakash Prabhavalkar
Pune, India
B.Eng., University of Pune

Hyunjeong Yoo
Seoul, Korea
B.S., Sookmyung Women’s University

Zhe Yuan
Xiangfan, China
B.Eng., Huazhong University of Science and Technology

Wenjie Zeng
Guangzhou, China
B.Eng., Shanghai Jiao Tong Technology

The fountains at Mirror Lake make a wonderful backdrop for photos.
Above: Newly minted Dr. Vignesh Ravi
Below: Masters graduate Vilobh Meshram
The changeover to semesters is even more challenging within the undergraduate program than the graduate program. The lines to the Undergraduate Advising Office have been long, but the advisors have handled the stress with grace and patience.

Due to the high demand for entry into CSE courses, the Department is once again re-introduced course management structures. Effective January, 2013, students will be required to maintain a 2.5 gpa for entrance into the major.

**Undergraduate Academic Advising Personnel**

**PEG STEELE**, Coordinator of Academic Advisement. Ms. Steele is active at the local and national levels of academic advising. The National Academic Advising Association awarded her the 2009 NACADA Service to Commission Award for her work on the Engineering & Science Advising Commission. In 2004, NACADA named Ms. Steele “Outstanding Advisor” and twice she received the same recognition from the local OSU chapter. She will be serving on the Board of Directors for the next two years for the National Academic Advising Association.

**NIKKI STRADER**, Academic Advisor & Staff Assistant. From 2006 through 2008, Nikki served as the President of the Academic Advising Association of Ohio State (ACADAOS), and in May 2007, was named one of two Outstanding Advisors at Ohio State by ACADAOS. She is the primary contact for all freshman pre-CSE students.

**MARY JO DEERWESTER**, Academic Advisor & Staff Assistant. Mary Jo graduated from OSU in 1971 with a Bachelor of Science degree in Education. (Major: English; Minor: Psychology) She followed that in 1983 with a Master’s Degree in Guidance and Counseling. Mary Jo previously worked as an Academic Advisor at Columbus State Community College and as an Academic Advisor/Staff Assistant for the OSU College of Engineering.

**KEITH CHIMA**, Graduate Advising Assistant. He is working on his Master’s degree in Computer Science & Engineering, with a focus on software engineering, and he intends to graduate after Autumn quarter 2011.

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These figures have been adjusted to reflect a change in reporting definitions.
Bachelors Degrees Awarded

College of Arts and Sciences

Bachelors of Arts

Alexander Emmett Bartlow
Westerville, Ohio, USA

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Henry Hao Zhang
Kent, Ohio, USA

Jie Zhang
*Magna Cum Laude*
Xuchang, China

Adam Jeffrey Zink
*Magna Cum Laude*
Gahanna, Ohio, USA
The 2012 event was a success with excellent attendance. This year marked the introduction of undergraduate researchers participating. They showed terrific maturity and scholarship. One of the undergraduates placed third, Vahid Rajabian Schwart in the “Best of” competition along with Oleksiy Busaryev, first, and William Hartmann, second.

<table>
<thead>
<tr>
<th>STUDENT</th>
<th>POSTER TITLE</th>
<th>ADVISOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humayun Arafat</td>
<td>Resource Sharing Barrier</td>
<td>P. Sadayappan</td>
</tr>
<tr>
<td>Derek Bronish</td>
<td>Abstraction as the Key to Programming, with Issues for Verification of Functional Languages</td>
<td>Bruce Weide</td>
</tr>
<tr>
<td>Oleksiy Busaryev</td>
<td>Animating Bubble Interactions in a Liquid Foam</td>
<td>Tamal Dey</td>
</tr>
<tr>
<td>Abon Chaudhuri,Teng-Yok Lee, Han-Wei Shen, Marc Khoury and Raphael Wenger</td>
<td>Exploring Flow Fields Using Fractal Analysis of Field Lines</td>
<td>Han-Wei Shen</td>
</tr>
<tr>
<td>Zhezhe Chen</td>
<td>SyncChecker: Detecting Synchronization Errors Between MPI Applications and Libraries</td>
<td>Feng Qin</td>
</tr>
<tr>
<td>Seth Darbyshire</td>
<td>ibBrutus</td>
<td>Rajiv Ramnath</td>
</tr>
<tr>
<td>David Fuhry</td>
<td>Efficient Community Detection in Large Networks using Content and Links</td>
<td>Srinivasan Parthasarathy</td>
</tr>
<tr>
<td>William Hartmann</td>
<td>ASR-Driven Top-Down Binary Mask Estimation using Spectral Priors</td>
<td>Eric Fosler-Lussier</td>
</tr>
<tr>
<td>William Harvey</td>
<td>Topological Landscapes for Analysis and Visualization of Massive Molecular Dynamics Simulations</td>
<td>Yusu Wang</td>
</tr>
<tr>
<td>Justin Holewinski</td>
<td>High-Performance GPU Code Generation for Stencil Computations</td>
<td>P. Sadayappan</td>
</tr>
<tr>
<td>Ke Hu</td>
<td>Svm-Based Separation Of Unvoiced-Voiced Speech In Cochannel Conditions</td>
<td>DeLiang Wang</td>
</tr>
<tr>
<td>Yin Huai</td>
<td>RSQ: A Framework to Utilize Out-of-band Data Items to Improve Performance and Productivity of a MapReduce System Environment</td>
<td>Xiaodong Zhang</td>
</tr>
<tr>
<td>Wei Jiang</td>
<td>A Map-Reduce-Like System for Programming and Optimizing Data-Intensive Computations on Emerging Parallel Architectures</td>
<td>Gagan Agrawal</td>
</tr>
<tr>
<td>Preethi Jyothi</td>
<td>Lexical access experiments with context-dependent articulatory feature-based models</td>
<td>Eric Fosler-Lussier</td>
</tr>
<tr>
<td>Onur Kucuktunc</td>
<td>A Large-Scale Sentiment Analysis for Yahoo! Answers</td>
<td>Hakan Ferhatosmanoglu</td>
</tr>
<tr>
<td>Jing Li</td>
<td>ThermoNet: Fine-Grain Assessment of Building Comfort and Efficiency</td>
<td>Anish Arora</td>
</tr>
<tr>
<td>Qihang Li</td>
<td>PDE based Interpolation in Diffusion Tensor Imaging Processing</td>
<td>Raghu Machiraju</td>
</tr>
<tr>
<td>Luo Tian</td>
<td>hStorageDB: Heterogeneity-aware Data Management to Exploit the Full Capability of Hybrid Storage Systems</td>
<td>Xiaodong Zhang</td>
</tr>
<tr>
<td>Name</td>
<td>Title</td>
<td>Author(s)</td>
</tr>
<tr>
<td>---------------------------</td>
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</tr>
<tr>
<td>Nan Meng</td>
<td>Investigating distribution of Inhibitory Interneurons in Neocortex with Spatial Statistics</td>
<td>Raghu Machiraju</td>
</tr>
<tr>
<td>Timothy Miller</td>
<td>Booster: Reactive Core Acceleration for Mitigating the Effects of Process Variation and Application Imbalance in Low-Voltage Chips</td>
<td>Radu Teodorescu</td>
</tr>
<tr>
<td>Oleg Mishchenko</td>
<td>Visualization of Three Dimensional Flow Datasets: Dealing with Occlusion</td>
<td>Roger Crawfis</td>
</tr>
<tr>
<td>Boonthanome Nouanesengsy</td>
<td>Load-Balanced Parallel Streamlines</td>
<td>Han-Wei Shen</td>
</tr>
<tr>
<td>Raghuram Onti Srinivasan</td>
<td>Single Cell analysis for Endothelial cells</td>
<td>Raghu Machiraju</td>
</tr>
<tr>
<td>Rohit Prabhavalkar</td>
<td>A Factored Conditional Random Field Model for Articulatory Feature Forced Transcription</td>
<td>Eric Fosler-Lussier</td>
</tr>
<tr>
<td>Vahid Rajabian Schwart</td>
<td>SAGA: Automated Validation for Synchronous Reactive Embedded Systems</td>
<td>Paolo Sivilotti</td>
</tr>
<tr>
<td>Pawas Ranjan</td>
<td>Eigen Deformation of 3D Models</td>
<td>Tamal Dey</td>
</tr>
<tr>
<td>Jin Teng</td>
<td>Connected Coverage in Wireless Networks with Directional Antennas</td>
<td>Dong Xuan</td>
</tr>
<tr>
<td>Vignesh TrichyRavi</td>
<td>Supporting GPU Sharing in Cloud Environments with a Transparent Runtime Consolidation Framework</td>
<td>Gagan Agrawal</td>
</tr>
<tr>
<td>Kaibo Wang</td>
<td>SCCG: Accelerating Spatial Cross-Comparisons on CPU/GPU Hybrid Systems</td>
<td>Xiaodong Zhang</td>
</tr>
<tr>
<td>John Woodruff</td>
<td>Binaural Speech Segregation Based on Pitch and Azimuth Tracking</td>
<td>DeLiang Wang</td>
</tr>
<tr>
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<tr>
<td>Xintian Yang</td>
<td>Analysis of Streaming Data from Twitter Social Networks</td>
<td>Srinivasan Parthasarathy</td>
</tr>
<tr>
<td>Yuan Yuan</td>
<td>YSmart: An SQL-to-MapReduce Translator</td>
<td>Xiaodong Zhang</td>
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<tr>
<td>Boying Zhang</td>
<td>TurfCast: A Service for Controlling Information Dissemination in Wireless Networks</td>
<td>Dong Xuan</td>
</tr>
</tbody>
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Department Research Area: SOFTWARE ENGINEERING AND PROGRAMMING LANGUAGES

Interests: Static and Dynamic Program Analysis; Programming Languages and Compilers; Software Understanding and Evolution; Software Testing; High-Performance Computing

Ponnuswamy (Saday) Sadayappan  Full Professor


Department Research Area: SYSTEMS

Interests: Compiler/Runtime Systems For High-Performance Computing; Performance Optimization; High-Productivity, High-Performance Scientific Computing.

Han-Wei Shen  Associate Professor

B.S., Computer Science, National Taiwan University, 1988; M.S., Computer Science, State University of New York, Stony Brook, 1992; Ph.D., Computer Science, University of Utah, 1998.

Department Research Area: GRAPHICS

Interests: Computer Graphics; Information Visualization; Parallel Visualization Scientific Visualization; Visual Analytics.

Ness B. Shroff  Ohio Eminent Scholar of Networking and Communications Endowed Chaired Professor

B.S., University of Southern California, 1988; M.S.E, University of Pennsylvania, 1990; M.Phil, Columbia University, 1993; Ph.D., Columbia University, 1994.

Department Research Area: NETWORKING

Interests: Wireless Networks; Next Generation Internet; Sensor Networks; Cloud Computing; Network Optimization; Network Design and Dimensioning; Network Security; Information Theoretic Security; Queueing Theory; Dynamic Control; Network Coding; Scaling Laws; Distributed Algorithms; Complexity and Approximability; Game Theory; Pricing.

Prasun Sinha  Associate Professor

B.Tech., Computer Science and Engineering, Indian Institute of Technology, Delhi, India, 1995; MS, Computer Science, Michigan State University, 1997; PhD, Computer Science, University of Illinois, Urbana-Champaign, 2001.

Department Research Area: NETWORKING

Interests: Sensor Networking; Ad-hoc Networking; Mobile Computing; Wireless Networking
PAUL A. G. SIVILOTTI  Associate Professor
Department Research Area: SOFTWARE ENGINEERING AND PROGRAMMING LANGUAGES
Interests: Distributed Systems; Software Engineering; and Tool-based Support for Testing Component Implementations.

NEELAM SOUNDARAJAN  Associate Professor
B.S., Physics, Bombay University, India, 1970; M.S., Physics, Bombay University, India, 1972; Ph.D., Computer Science, Bombay University, India, 1978.
Department Research Area: SOFTWARE ENGINEERING AND PROGRAMMING LANGUAGES
Interests: Software Engineering; Reasoning about Program Behavior; Specification; Verification; Testing; Issues in Engineering Education.

KANNA N SRI NIVASAN
B.S., Electronics & Communications Engineering, University of Madras, Chennai, India, 2000; M.S., Electrical & Computer Engineering, Oklahoma State University, 2002; Ph.D., Electrical Engineering, Stanford University, Stanford, CA, USA, 2010
Department Research Area: SYSTEMS

CHRISTOPHER STEWART  Assistant Professor
B.S., Computer Science, Morehouse College, 2003; M.S., Computer Science, University of Rochester, 2005; Ph.D., Computer Science, University of Rochester, 2008
Department Research Area: SYSTEMS
Interests: Operating Systems; Distributed Systems; Performance Management; and Power Management.

KENNETH J. SUPOWIT  Associate Professor
A.B., Linguistics, Cornell University, 1978; Ph.D., Computer Science, University of Illinois, 1981.
Department Research Area: THEORETICAL COMPUTER SCIENCE
Interests: Combinational Algorithms
RADU TEODORESCU Assistant Professor
Dipl. Eng. in Computer Science, Technical University of Cluj-Napoca, Romania, 2002; M.S., Computer Science, University of Illinois at Urbana-Champaign, 2005; Ph.D., Computer Science, University of Illinois at Urbana-Champaign, 2008.
Department Research Area: SYSTEMS
Interests: Computer Architecture, Multicore and Parallel Architectures; Support for Software Debugging; Nanoscale Technology; Scaling, Reliability, Variability and Power Management.

DELIANG (LEON) WANG Full Professor
B.S., Computer Science, Beijing University, 1983; M.S., Computer Science, Beijing University, 1986; Ph.D., Computer Science, University of Southern California, Los Angeles, 1991.
Department Research Area: ARTIFICIAL INTELLIGENCE
Interests: Machine Perception and Neurodynamics

HUAMIN WANG
B.Eng., Computer Science and Engineering, Zhejiang University Hangzhou, China, 2002; M.S., Computer Science, Stanford University Stanford, CA, USA, 2004; Ph.D. in Computer Science Georgia Institute of Technology Atlanta, GA, USA, 2009
Department Research Area: GRAPHICS
Computer Graphics, GPU programming for high-performance graphics and general-purpose computation, Computer Vision, feature tracking, optical flow, 3D reconstruction, finite element method, numerical integration, model reduction, motion control and design, efficient data structures.

YUSU WANG Associate Professor
Department Research Area: GRAPHICS

BRUCE W. WEIDE Full Professor and Associate Chairperson
B.S.E.E., Electrical Engineering, University of Toledo, 1974; Ph.D., Carnegie Mellon University, 1978.
Department Research Area: SOFTWARE ENGINEERING AND PROGRAMMING LANGUAGES
Interests: Component-Based Software; Verified Software.
REPHAEL WENGER Associate Professor
B.S.E., Computer Science, Princeton University, 1984; Ph.D., Computer Science, McGill University, 1988.
Department Research Area: GRAPHICS
Interests: Computational Geometry; Computer Visualization; Isosurface Reconstruction; and Image Processing.

DONG XUAN Associate Professor
B.S., Electronic Engineering, Shanghai Jiao Tong University, China, 1990; M.S., Electronic Engineering, Shanghai Jiao Tong University, 1993; Ph.D., Computer Engineering, Texas A&M University, 2001.
Department Research Area: NETWORKING
Interests: Distributed Computing, Computer Networks and Cyber Space Security

XIAODONG ZHANG Chairperson of Computer Science & Engineering Robert M. Critchfield Professor
B.S., Electrical Engineering, Beijing University of Technology, 1982; M.S., Computer Science, University of Colorado at Boulder, 1985; Ph.D., Computer Science, University of Colorado at Boulder, 1989.
Department Research Area: SYSTEMS
Interests: Distributed and High Performance Systems

EMERITUS APPOINTMENTS

Professor Emeritus
BALAKRISHNAN CHANDRASEKARAN
CHARLES A. CSURI
MING-TSAN (MIKE) LIU
SANDY MAMRAK
MERVIN E. MULLER
STUART ZWEBEN

Associate Professor Emeritus
CLINTON R. FOULK
DOUGLAS S. KERR
TIMOTHY LONG
WILLIAM F. OGDEN
ANTHONY E. PETRARCA
**Clinical Faculty**

**JAY RAMANATHAN** Research Associate Professor
*Director of Research of Center for Experimental Research in Computer Systems*

B.S., Computer Science, Purdue University, 1970; M.S. in Computer Science, Purdue University, 1972; Ph.D., Computer Science, Rice University, 1977.

Research Interests: Analysis and Engineering of the Complex Adaptive Environments to achieve overall objectives, performance and Business-IT alignment. Related applications include Serious Gaming and technology-mediated collaborative platforms. Tools and methods of interest include knowledge mining, complexity theory, autonomic computing; technologies such as OWL, Middleware, Workflow, Mobile Computing, and Web Services.

**RAJIV RAMNATH** Associate Professor of Practice
*Director, Collaborative for Enterprise Transformation and Innovation (C.E.T.I.)*

B.Tech., Indian Institute of Technology, New Delhi, India, 1981; M.S., Computer & Information Science, The Ohio State University, 1983; Ph.D., Computer & Information Science, The Ohio State University, 1988


**Courtesy Appointments**

**Wayne Carlson**
Chair, Industrial Design

**Harvey M. Friedman**
Mathematics

**Kun Huang**
Biomedical Informatics

**Furrukh Khan**
Electrical and Computer Engineering

**Michael Knopp**
Chair, Radiology

**Albert M. Lai**
Biomedical Informatics

**Virginia Nivar**
Davis Heart & Lung Research Institute

**Alan Saalfeld**
Geodetic Science

**Cathy Honghui Xia**
Integrated Systems Engineering

**Tao Shi**
Statistics

**Alper Yilmaz**
Civil, Environmental Engineering & Geodetic Science

**Adjunct Faculty**

**Kikuo Fujimura**

Wayne Heym
B.Phil., Miami University, 1978; M.S., Computer Science, Florida Institute of Technology, 1975; Ph.D., Computer Science, The Ohio State University, 1978.

Debby Gross

Bettina Bair

Paolo Bucci
Laurea in Scienze Dell’Informazione, Universita’ Degli Studi di Milano, Italy, 1986; M.S., Computer & Information Science, The Ohio State University, 1989; Ph.D., Computer & Information Science, The Ohio State University, 1997.

Doreen Close
B.S., Computer and Information Science, The Ohio State University, 1979; M.S., Computer Science and Engineering, The Ohio State University, 1981.

Debby Gross

Wayne Heym
B.Phil., Miami University, 1978; M.S., Cornell University, 1980; M.S., Computer & Information Science, The Ohio State University, 1989; Ph.D., Computer & Information Science, The Ohio State University, 1995.

Jeremy Morris
Ph.D., Computer Science and Engineering, The Ohio State University, 2010; M.S., Computer Science and Engineering, The Ohio State University, 2007; M.A., Education, The Ohio State University, 1998; B.S., Mathematics and Computer Science, Bowling Green State University, 1996.

Naeem Shareef
BALAKRISHNAN CHANDRASEKARAN  Professor Emeritus
Senior Research Scientist
B.E., Electrical Engineering, Madras University, India, 1963; Ph.D.,
Electrical Engineering, University of Pennsylvania, 1967

Research Interests:
Artificial Intelligence and Cognitive Science, specifically Knowledge
Systems, Diagrammatic Reasoning, Cognitive Architecture, and
Decision Support Systems.

JOHN JOSEPHSON  Research Scientist
B.S., Mathematics, The Ohio State University, 1968; M.S., Mathematics,
The Ohio State University, 1970; Ph.D., Philosophy, The Ohio State
University, 1982

Research Interests:
Artificial Intelligence; Computational Epistemology, Abductive
Inference, Causal Reasoning, Multiple Criteria Decision Making,
Perception, Information Fusion, Diagnosis, Theory Formation, Logic of
Investigation and Foundations of Science

WILLIAM M. LEAL  Research Scientist
B.A. Mathematics, University of California, Berkeley, 1969; M.S.
Computer Science, University of South Alabama, Mobile, 1994; M.S.
Computer Science, The Ohio State University, 2001; Ph.D., Computer
Science, The Ohio State University, 2001.

Research Interests:
Wireless Sensor Networks, Dynamic Resource Management,
Compositional Stabilization

RUBAO LI  Research Scientist
B.S., Mechatronics, Jingdezhen Ceramic Institute, 2000; M.S., Computer
Science, Beijing University of Technology, 2003; Ph.D., Computer

Research Interests:
Distributed and Parallel Computing Systems, Database Systems and
**Post-Doctorate Researchers**

Xavier Besseron  
Engin Demir  
Jihun Hamm  
Teng-Yok Lee  
Sonya Marcarelli  
Theodore Paul Pavlic  
Louis Noel Pouchet  
Kevin Streib  
Jerome Vienne  
Hao Wang

**Part-Time Lecturers**

Thomas Bihari  
Moez Chaabouni  
Michael Compton  
Matt Curtin  
Charles Giles  
Steve Gomori  
John Heimaster  
Perumal Krishnasamy  
Igor Malkiman  
Michelle Mallon  
William Thomas Martin  
Robert Mathis  
Steven Romig  
Issam Ibrahim Safa  
Al Stutz  
John Thomas  
Annatala Wolf

**Administrative Staff**

Catrena Collins: Human Resources Officer  
Tamera Cramer: Public Relations Coordinator  
Don Havard: Fiscal Officer  
Z. Lynn Lyons: Graduate Admissions and Graduate Studies Coordinator  
Meg Murnane: Information Associate  
Kitty Reeves: Academic Program Administrator  
Carrie Stein: Grants Administrator

**Computing Services Staff**

Michael Compton -- Director, Computing Services  
Aaron Jenkins -- Systems Manager  
Bob Joseph-- Systems Developer/Engineer, DBA  
Tami King -- Sr. Systems Developer/Engineer  
Milan Koppen -- Systems Administrator  
Dave Kneisly -- Systems Administrator  
Todd Lucal -- Systems Administrator  
Shaun Rowland -- Manager, Software Support and Development  
Ted Welch -- Systems Administrator  
Kat Wenger -- Systems Manager