COMPUTER SCIENCE AND ENGINEERING

BUILDING THE FUTURE PROGRESS

EXCELLENCE IN RESEARCH AND INNOVATION

Ever since the University at Buffalo, the State University of New York, became one of the first higher learning institutions to offer degree programs in the computing field more than 40 years ago, our Department of Computer Science and Engineering has succeeded in establishing itself as a leading research department, well known both nationally and internationally for its ground breaking foresight and pioneering innovations.

For decades, our highly motivated and dedicated faculty have engaged in world-class research in every aspect of computer science and technology, and are recipients of numerous national and international awards. They have founded, and currently direct, major research centers devoted to big data analysis, biomedical computing, biometric systems, cognitive science, document analysis and recognition, information assurance, and high-performance computing. In addition, they have played key roles in many other major areas of research, including optical and wireless networks, computer security, computer vision, databases, algorithms, complexity theory, and software and hardware systems.

Among many of their cutting-edge achievements, our faculty have pioneered in the science and technology of automated handwriting recognition and developed software systems for machine reading of handwritten addresses, which has saved the U.S. Postal Service more than a billion dollars in just a few years. They also have been credited with an algorithm developed for crystal structure determination, which has been ranked as one of the top algorithms of the 20th century. Moreover, our faculty have helped establish UB as one of the leading academic supercomputing centers in the world.

Equally distinguished are the accomplishments of our alumni, many of whom are prize-winning researchers and CEOs of some of the fastest-growing companies of information technology worldwide.

Our department has led the way in advancing the science and technologies of information, computing, and communication technologies that are indispensable to our world today, and we will continue to lead the way into the future.

Aidong Zhang
UB Distinguished Professor and Chair

ON THE COVER

A VIEW OF THE NEW HOME FOR COMPUTER SCIENCE AND ENGINEERING.

NEW CSE BUILDING OPENED IN 2011

CSE RESEARCH CENTERS

BUFFALO CENTER FOR BIOMEDICAL COMPUTING (BCBC)

The Center's mission is to establish a multi-disciplinary program to address fundamental research issues in biocomputing while contributing to mid-to long-term research, development, and experimental deployment challenges of analyzing genomic data for diseases and treatment effects. The Center provides the expertise and infrastructure that merges the research activities of computational and biomedical scientists. The focus of the Center research is the study of common diseases, such as cancer, multiple sclerosis and coronary artery disease in which the underlying causes are multi-factorial. We use advanced computational techniques and approaches to convert raw genomic data into knowledge that will advance the understanding of these common diseases and potentially identify new modalities of treatment.
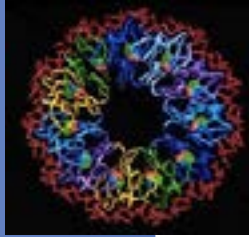
CENTER FOR UNIFIED BIOMETRICS AND SENSORS (CUBS)

CUBS is a vibrant research center whose mission is to establish a unified biometric framework, to facilitate the development of next-generation biometric systems from proof-of-concept to product readiness. This includes radically different biometric technologies geared toward applications to improve comfort, convenience,and security for personal and commercial use. CUBS research and development activities span the strategic application areas of machine learning and pattern recognition. Industry sponsors of current projects include eBay, Fujitsu, Google, Raytheon, BBN, and Lockheed. Its alumni base of over 70 graduates includes 25 PhDs.

CENTER FOR COGNITIVE SCIENCE

The Center's mission is to investigate the nature of cognition, i.e., of intellective processes as exhibited either by the human mind or by computer. Most centrally, cognitive science is the study of how the mind works, both in its conceptual organization and in its computational and neural infrastructure. Accordingly, cognitive science has brought together researchers from a number of traditionally separate disciplines -- primarily, computer science, psychology, linguistics, philosophy, anthropology , and neuroscience -- in order to build a new and unified understanding of cognition that is compounded from the different disciplinary perspectives and that moves beyond them. The Center organizes colloquia and conducts both an undergraduate major leading to a B.A. in Cognitive Science and a program of graduate tracks in cognitive science.

CENTER OF EXCELLENCE FOR DOCUMENT ANALYSIS AND RECOGNITION (CEDAR)

The Center's mission is to focus on the development of computational methods for the analysis of patterns in documents, text and two-dimensional images. While the application of such methods to the analysis of paper documents and handwriting recognition has been the Center's core strength since 1978, these applications has since been diversified to include computational forensics, e.g., fingerprints and shoe-prints. The methods of research are in the areas of pattern recognition, machine learning, information retrieval, data mining and text mining.

CENTER OF EXCELLENCE IN INFORMATION SYSTEMS ASSURANCE RESEARCH AND EDUCATION

The Center's mission is to promote Information Assurance (IA) in graduate education and coordinated research in computer security and information insurance by faculty members from several schools and departments at the University at Buffalo and promote collaborative relationships with companies engaged in security research and multidisciplinary research focus in IA.

A brand-new $75-million, state-of-the-art classroom and laboratory building is home to the Department of Computer Science & Engineering, modernizing our programs and facilities. Designed by renowned architects Perkins & Will, the 130,000-square-foot structure increases facility space of the School of Engineering and Applied Sciences by nearly one-third, accommodating significant new growth in the school's student enrollments, faculty hires, and research expenditures. The building features a cybertorium or smart auditorium, outfitted with the most sophisticated communications devices and smart technologies. Flexible research labs, classrooms, and meeting areas foster interdisciplinary work. The building was completed in 2011.

RESEARCH AT THE FOREFRONT

BIOINFORMATICS / BIOMEDICAL COMPUTING

Daniel Fischer | Aidong Zhang

Our faculty are active in development of novel algorithms and architectures for genomics, proteomics, and biomedical applications. The research areas include protein-protein interaction network analysis, microarray data analysis, high-dimensional biomedical data visualization, and a better understanding of life at the molecular level using "in silico" or computational tools to interpret the information encoded in biological macromolecules, from individual proteins to complete genomes. Daniel Fischer's research focuses on protein structure prediction - from homology modeling to ab initio, the use of protein models in experimental structure determination, protein structure comparison and docking, computational genomics and evolution. Aidong Zhang's research focus is on the areas of protein-protein interaction network analysis, microarray data analysis, and high-dimensional data visualization. To develop and ultimately predict the best treatment strategies for multiple sclerosis (MS) patients, she teamed up with pharmaceutics researchers at UB and Buffalo General Hospital to apply the technique of data mining to MS patient data generated by DNA microarray technology. She has worked on delineating genomic mechanisms in chronic complex diseases, pharmacodynamic analysis of drug-responsive gene expression changes, a central access data warehouse spanning multiple disease types, and a new technology for genome-wide detection of cancer-related genomic alterations.

CYBERINFRASTRUCTURE / GRID COMPUTING

Vipin Chaudhary | Steve Ko | Tevfik Kosar | Russ Miller

Cyberinfrastructure and grid computing sit at the core of modern stimulation and modeling, allowing for entirely new methods of investigation that allow scholars to address previously unsolvable problems. Vipin Chaudhary's research focus is on the areas of high performance computing, data intensive computing, and computer aided diagnosis and interventions. He is specifically interested in the areas of using accelerators like graphics processors for scientific computing and architectures and programming models for data intensive computations. He directs the Data Intensive Discovery Initiative, a multi-organization consortium that is targeting the use of data intensive computing for discovery and is funded by the NSF. He is also developing green resource allocation techniques for clouds and data centers. Steven Ko's research focuses on various aspects of cloud computing such as storage support and privacy for MapReduce as well as new networking architectures for data centers. In the past, he has worked on data center monitoring, Grid scheduling algorithms, and fault-tolerant peer-to-peer algorithms. Tevfik Kosar's research interests lie in the cross-section of petascale distributed systems, eScience, Grids, Clouds, and collaborative computing with a focus on large-scale data-intensive distributed applications; cyberinfrastructure design and development; end-to-end data and workflow management; I/O optimization, modeling, and scheduling; storage management; coordination of computation and I/O in distributed environments. Dr. Kosar is directing the Data Intensive Distributed Computing Laboratory (DIDCLab) at UB. Russ Miller's Cyberinfrastructure and Grid Computing Laboratory contains a 12,000+ processor machine that is one of the most advanced in New York State, as well as 60TB of storage. This laboratory is dedicated to the integration of research in disciplinary domains with research in enabling technologies and interfaces.

PHONELAB: A PROGRAMMABLE PARTICIPATORY SMARTPHONE ENVIRONMENT

Geoffrey Challen | Murat Demirbas | Steven Ko | Tevfik Kosar | Chunming Qiao

CSE faculty are enlisting hundreds of students to build an unprecedented smartphone network that will help scientists improve handheld computers and better understand how the devices are changing the world. Using $1.3 million National Science Foundation Research Infrastructure grant to create the PhoneLab, this network is believed to be the world's largest collection of smartphone users assembled for large-scale experiments. PhoneLab is a public test bed enabling smartphone research at a scale not previously possible. PhoneLab provides programmatic access to a large group of participants at SUNY Buffalo. Participants use their PhoneLab smartphone as their primary device, generating high geographic density and representative usage patterns. PhoneLab allows researchers to distribute applications or modify the core smartphone platform, facilitating a broad range of experiments. By providing repeated access to the same participates, results can be validated, competing approaches can be compared, and new experiments can utilize existing data. PhoneLab's capabilities will accelerate smartphone research and lead to advances in wireless networking, distributed and mobile systems, mobile sensing, social networking, and crowdsourcing.

RESEARCH IN OUR DEPARTMENT HAS DETECTED LETHAL PROTEINS IN PROTEIN

IMPROVING HEALTH, SECURITY, AND L

LIFE

COMPUTER INTEGRATED SURGERY AND BIOMEDICAL IMAGING

Vipin Chaudhary | Jason Corso | Jinhui Xu

Our faculty are active in all aspects of biomedical imaging, including computer aided diagnosis, computer integrated and tele-surgery, medical image reconstruction, segmentation and registration, and architectures and parallelization of biomedical algorithms. Vipin Chaudhary's current foci are diagnosis of orthopedic problems, computer-assisted neuro-surgeries, and high-performance bioinformatics. Jason Corso's current foci are tumor image analysis in brain and chest, and longitudinal modeling of tumor image appearance. Jinhui Xu's current foci are the algorithmic underpinnings of computer aided tomography, reconstruction and segmentation, and analysis and understanding of the organization and dynamics of the cell nucleus.

CYBERSECURITY

Kui Ren | Ramalingam Sridhar | Shambhu Upadhyaya | Sheng Zhong

Kui Ren's research focuses on cloud computing and wireless security. In particular, Dr. Ren focuses his research on enabling secure and privacy-assured data service outsourcing that is fundamental to the success of cloud computing deployment. Dr. Ren has developed a suite of novel techniques to achieve secure and privacy-assured data service outsourcing that is usable, scalable, and meets performance goals, including: i) Encrypted cloud data service, including fuzzy and ranked keyword search with strong privacy-assurance for large numbers of users and files; ii) Scalable and owner-controlled cloud data sharing service with fine-grained data access enforcement and scalability, and iii) Privacy-preserving secure cloud storage auditing service maintaining strong guarantees of storage correctness. Ramalingam Sridhar's research focuses on power aware security solutions for mobile devices, body sensors, cross-layer security and physical layer security for wireless networks, secure software & hardware architectures, holistic approach to data security, secure key management, and smartphone forensics. Shambhu Upadhyaya's research focus is on various aspects of security and dependability that include user-level anomaly detection, insider threat modeling, event correlation and cyber-attack recognition, security in mobile ad hoc networks, emergency sensor networks, malware detection, human-centered security, and empirical cyber-security. Sheng Zhong's research focuses on network systems, security, privacy, and applied cryptography. Dr. Zhong studies two types of problems: the incentive-compatibility problems with rational/selfish participants and the security and privacy problems with adversarial participants. Dr. Zhong has designed and implemented Sprite, a credit-based, cheat-proof system, which is the first purely software-based solution that provides provable incentive compatibility in wireless ad hoc networks.

SENSOR NETWORKS

Murat Demirbas | Dimitrios Koutsonikolas

Sensor Networks research focus is on developing distributed robust and resilient wireless sensor network (WSN) services and applications. Sensor networks is a new and challenging research area that has received an enthusiastic reception in the science community as they enable precise and fine-grain monitoring of a large region in real-time. Murat Demirbas' research aims to enable wide adoption of WSNs in long-lived maintenance-free urban-spaces monitoring applications, in providing physical-world spatial querying/search services (i.e., google-ing the physical spaces), and in achieving decentralized coordination and actuation for fulfilling the ubiquitous/pervasive computing vision.

SOCIAL RELEVANCE

Michael Buckley | Kris Schindler

Michael Buckley and Kris Schindler are employing computing technology to improve the quality of life of people with disabilities. Among the research projects and products under development are natural-voice talkers for the speech impaired, single-switch Internet surfing for quadriplegics, robotic wheelchairs, sensory systems to teach cause-and-effect to severely delayed children, Tablet PCs (in conjunction with Microsoft Corporation) that translate the uncharacteristic handwriting of people with spastic cerebral palsy, and a means to extend special-education classwork to home- and hospital-bound children.

ALGORITHMS AND THEORY

Roger He|Russ Miller|Hung Quang Ngo|Kenneth Regan| Atri Rudra | Alan Selman|Jinhui Xu

Design of efficient algorithms is often a critical first step in solving problems in many areas. Research interests of faculty in this area include parallel algorithms, graph algorithms, approximation algorithms for intractable problems, and theory of error-correcting codes.

Complexity theory is a mathematical discipline that classifies computational problems by relative difficulty and measures the computational resources needed to solve them. It explains why certain problems have no practical solutions and helps researchers anticipate the difficulties involved in solving problems of certain types. Research in this area is concerned with properties of complexity classes, relationships between classes, identification of properties of problems that affect their computational complexity, and the obstacles to proving non-trivial lower bounds in complexity theory.

Computational geometry is a branch of theoretical computer science devoted to the study of algorithms which can be stated in terms of geometry. Since real world problems can often be modeled as objects in certain geometric spaces, it has strong connection with many areas such as graphics, robotics, computer vision, biomedical imaging, networking, and VLSI design. Exploiting geometric & combinatorial properties of these problems often leads to better quality and more efficient solutions.

COMPUTER SCIENCE EDUCATION

Carl Alphonce | Michael Buckley | Russ Miller | Bina Ramamurthy | Kris Schindler

Computer science education is an area of research which focuses on curricular and pedagogic issues in the teaching of computer science, as well as related issues such as recruitment and retention of underrepresented groups in the discipline.

Research interests of faculty in this area include integrating sequential and parallel algorithms throughout the curriculum, object-oriented pedagogy, the pedagogy of CS1-CS2 courses and rapidly emerging areas (such as grid computing and server-side programming), software tools which support course pedagogy, and student and community engagement through socially relevant projects.

DATABASES AND DATA MINING

Jan Chomicki|Jing Gao|Oliver Kennedy|Aidong Zhang

CSE database research involves designing, studying, implementing, and evaluating novel query interfaces, query language constructs, and query processing techniques. In data integration we study how to combine and present data coming from many autonomous and heterogeneous sources to users in a unified way. In uncertain data management we develop new data structures and algorithms to efficiently query and represent data that is defined as a probability distribution over pos-

A WORLD OF
CSE RESEARCH

ARTIFICIAL INTELLIGENCE AND ROBOTICS

Robert Platt | Rohini Srihari | Sargur Srihari

Artificial intelligence research at CSE is focused primarily on computational linguistics (natural-language processing) and knowledge representation. Knowledge representation and reasoning is the study of techniques for representing and reasoning about the information used by an AI program. The objective is to build a computerized rational agent -- a computer system that can converse in English about various everyday and specialized topics; be taught about such subjects by instruction carried out in English, possibly with the aid of gestures, drawings, and diagrams; and reason about those subjects, discuss them with humans, and perform as instructed.

Robotics research at CSE focuses on developing new planning, control, and perception algorithms that perceive the state of the world and control the robot even when the state of the surrounding world is uncertain. Part of this focus in on developing planning under uncertainty algorithms that reason about how to gain information relevant to a task while disregarding irrelevant information. We also develop new perception algorithms for localizing objects or tactile features in the world around the robot efficiently and new control algorithms for controlling robot manipulators and hands. Our primary focus is on applications to robot grasping, manipulation, and assembly. With support from NASA, DARPA, and General Motors, the group is currently pursuing applications to manufacturing, space exploration, healthcare, domestic assistance, and the military. Our long term vision is to develop robots that will someday help and work alongside people by performing useful manipulation-related work in the real world.

sible values rather than through specifics. In incremental processing we develop techniques to efficiently query rapidly changing data by updating query results rather than recomputing them from scratch on each change. In preference querying we study the computation of the best query answers, according to user preferences. Other topics of interest include inconsistency resolution, collaborative web applications, distributed query processing, query algorithms, and query optimization. Our research projects combine engineering prototype systems with rigorous mathematical analysis.

The data mining research focuses on extracting valid, previously unknown, and ultimately comprehensible information from disparate data sources. Facing the big data challenge motivated by the daunting scale, heterogeneity and unprecedented speed in data collection, we devote our efforts to developing highly effective and scalable data analysis methods and systems, which transform noisy data into accurate, reliable and accessible knowledge. Of special interest are anomaly detection from networked and multi-source data, evolutionary trend discovery on streaming data, truth and trustworthiness inference from conflicting data sources, knowledge transfer from multiple source domains to a target domain, development of high-performance parallel computation algorithms, cluster analysis of high-dimensional data, feature extraction and analysis, and visualization tools for interactive pattern analysis. We are striving to integrate our research into real application domains such as biomedical industry, social media, cyber and society security to support critical decision making.

DISTRIBUTED / NETWORK SYSTEMS

Geoffrey Challen | Murat Demirbas | Steven Ko | Tevfik Kosar | Dimitrios Koutsonikolas | Chunming Qiao | Kui Ren | Shanbhu Upadhyaya

Research in systems involves both hardware and software, and spans both user space and operating systems. Topics include wide-area networks and local-area networks, wired technology and wireless/mobile technology, data and telephony communications and integrated services, and applications and modem access. Networking includes enabling technologies for other systems in distance learning, multimedia systems, distributed supercomputing, telemedicine, collaborative research, electronic commerce, and online entertainment. Distributed systems studies communication and coordination patterns of components found in networked computers.

CSE laboratories and research groups conduct research on networking architectures, protocols, network control and management issues, and performance evaluation. They focus on switching networks (including multichannel networks), wireless networks, and interconnection networks. They study wireless sensor networks and distributed and dependable computing. Work is done on security, privacy, and economic problems in wireless networks and mobile computing. Distributed systems research includes peer-to-peer alternatives to traditional client-server models and ubiquitous computing with location-based services at the application program level.

EMBEDDED SYSTEMS AND ARCHITECTURE

Vipin Chaudhary | Bina Ramamurthy | Ramalingam Sridhar | Shambhu Upadhyaya | Kris Schindler

Research thrust in embedded systems involves all aspects of hardware and software systems with particular emphasis on embedded applications. Computer architecture research focuses on the study and design of computer systems, meeting functional, cost, performance, security and energy requirements of the applications and the environment. Support for multi-core architectures, and their use in embedded systems is also researched. Foveal vision sensors, language-directed processors, architectures for mobile devices, digital signal processing, imaging, multimedia and networks, application specific processors are some of the research projects developed.

With increased demand for mobile devices running computation and memory intensive applications, VLSI (Very Large Scale Integrated Circuits) research has focused more on power aware reliable and verifiable solutions. Research on all aspects of VLSI systems, including circuits, device, architectural solutions, design for manufacturability, variation aware design, ultra low voltage, low power circuits, embedded memory circuits & architecture, power-performance-reliability tradeoffs, user & application aware adaptive design solutions, wave-pipelining, asynchronous logic, system level power modeling, System-on-Chips, built-in self testing of circuits, scheduling for SoC testing, defect analysis, fault model extensions in RF circuits and circuit diagnosis, and SoC verification & test are conducted.

MULTIMEDIA AND COMPUTER VISION

Chang Wen Chen | Jason Corso | Aidong Zhang

Research thrust in multimedia involves all aspects of multimedia systems from acquisition to display for both enterprise and consumer applications. Multimedia research has witnessed significant development in the last few years due to the unprecedented booming of mobile devices and the emerging of cloud infrastructures. One major research focus is in processing, analyzing, and delivering multimedia contents via mobile devices and networks, including video streaming over MIMO wireless networks and 3D video, multi-view video, and augmented reality for mobile applications. Other research projects include multimedia database, social media, multimedia security, and content-based multimedia retrieval.

Research thrust in computer vision focuses on the study of high-level imaging science with ubiquitous image data from biomedicine to recreational video. The CSE faculty in this research thrust investigates efficient technical tools aiming at complete understanding of information-rich image and video data. In particular, the coupled problems of segmentation and recognition are being studied from a Bayesian perspective emphasizing the role of statistical models in efficient visual inference. The ultimate goal in image and video analysis is to develop a comprehensive and robust methodology of automatically mining, quantifying, and generalizing information in large sets of projective and volumetric images and video.

PATTERN RECOGNITION AND MACHINE LEARNING

Jason Corso | Venu Govindaraju | Robert Platt | Sargur Srihari

Pattern recognition is the study of methods and algorithms for putting data objects into categories. While classical pattern recognition techniques are rooted in statistics and decision theory, the machine learning paradigm is commonly used to design practical systems. Machine learning is a method of programming computers in which the machine is programmed to learn from an incomplete set of examples. Prominent work on automated systems for pattern recognition and machine learning has made an impact on statistical methods, information retrieval, the analysis and recognition of handwriting, and computational forensics.

The interdisciplinary field of computer vision draws on concepts from signal processing, artificial intelligence, neurophysiology, and perceptual psychology. The primary goal of computer vision research is to endow artificial systems with the capacity to see and understand visual imagery at a level rivaling or exceeding human vision. CSE research includes developing techniques for visualizing common data-structures such as graphs and multidimensional data sets, and visualizing molecular structures. Applied research includes visualizing data from practical applications, such as bioinformatics, software engineering, pharmacokinetics, engineering and design, bioimaging, and digital art.

PROGRAMMING LANGUAGES AND SOFTWARE SYSTEMS

Bharat Jayaraman | Bina Ramamurthy | Lukasz Ziarek

Research in programming languages and software systems spans the design and implementation of new languages and programming constructs. Topics span both theory and implementation, ranging from formal semantic definitions to compiler construction. Additional topics begin studied are new visual debugging technologies, programming models, software engineering, test generation, model checking, and program validation and verification. Programming languages are enabling technologies for next generation software systems.

The CSE software systems lab conducts research on a wide variety of languages and their implementations including parallel ML, real-time Java, and Android. They focus on static and dynamic analysis for asserting properties over program executions and software systems, including predictability, security, and safety. The real-time Java group works on safety and mission critical systems; developing new techniques for the creation, deployment, and validation of aerospace and medical real-time embedded systems. The Android group is developing an optimizing compiler for DEX bytecode, to improve the performance, memory usage, and battery life of phone applications as well as automatic validation of security properties of Android applications. The parallel ML group is focused on developing language primitives and programming models for next generation hardware systems like the Intel Single Chip Cloud Computer (SCC).

SOCIETY FELLOWS

PROFESSIONAL AND SCIENTIFIC SOCIETIES RECOGNIZE AN ELITE GROUP OF LEADERS AND INNOVATORS IN THEIR FIELDS AS FELLOWS. CSE FELLOWS ARE:

Chang Wen Chen: IEEE, 2005, for contributions to digital image and video processing, analysis and communications; SPIE, 2007, for contributions in electronic imaging and visual communications.

Venu Govindaraju: SPIE, 2013, for contributions to Document Recognition and Biometrics; AAAS 2010, for contributions in modeling and experimentation in the areas of Document Recognition and Biometrics; ACM , 2009, for contributions to handwritten document image analysis, recognition, and retrieval; IEEE, 2006, for contributions to handwriting recognition; IAPR, 2004, for contributions to advances in handwriting recognition; IETE, 2002, for professional competence and recognition demonstrated by academic qualifications and work experience.

Russ Miller: IEEE, 2012, for contributions to theory and practice of parallel algorithms and architectures.

Chunming Qiao: IEEE, 2010, for contributions to optical and wireless network architectures and protocols.

Alan Selman: ACM, 1998, for having been an influential contributor to computational complexity theory and a dedicated professional within the academic computer science community.

Stuart C. Shapiro: AAAI, 1994, for contributions to theory and practice of knowledge representation and reasoning, and service to the AI community.

Sargur Srihari: IAPR, 1996, for contributions to Character Recognition and for Service to the International Association for Pattern Recognition; IEEE 1994, for contributions to Character Recognition and Document Understanding Systems; IETE, 1989, for his outstanding contribution to the discipline.

Satish Tripathi: AAAS, 1997, for meritorious efforts to advance science or its applications; IEEE, 1997, for advancing the state of the art in computer and network systems analysis and for excellence in technical and educational leadership.

Aidong Zhang: IEEE, 2009, for contributions to multimedia data indexing.

SOCIETIES:

AAAI: Association for the Advancement of Artificial Intelligence

AAAS: American Association for the Advancement of Science

ACM: Association for Computing Machinery

IAPR: International Association of Pattern Recognition

IEEE: Institute of Electrical and Electronics Engineers

IETE: Institute of Electronics and Telecommunication Engineers

SPIE: International Society for Optics and Photonics

SARGUR SRIHARI ILLUSTRATING A POINT

SUNY Distinguished Professors, the highest faculty rank in the SUNY system:

SUNY Distinguished Professor Venu Govindaraju has authored more than 360 scientific papers. His seminal work in handwriting recognition was at the core of the first handwritten address interpretation system used by the U.S. Postal Service. He was also the prime technical lead responsible for technology transfer to Lockheed Martin and Siemens Corp. for deployment by the U.S. Postal Service, Australia Post, and UK Royal Mail. Govindaraju has been the principal or co-principal investigator of projects funded by government and industry for about $60 million. The Center for Unified Biometrics and Sensors (CUBS) that he founded in 2003 has since received over $10 million in research funding. Govindaraju is the recepient of the 2010 IEEE Computer Society Technical Achievement Award.

SUNY Distinguished Professor Sargur Srihari teaches courses in pattern recognition, machine learning, and data mining, founded the Center of Excellence for Document Analysis and Recognition (CEDAR) in 1991. The handwriting-recognition technology developed by him and the Center served as the basis for the mail-sorting machines utilized today by the U.S. Postal Service, which has funded the work continuously for more than 20 years. Since 1991, Srihari has been funded by the National Institute of Justice to develop software tools for forensic science applications.

UB Distinguished Professors:

UB Distinguished Professor Russ Miller founded the Center for Computational Research (CCR) at UB and was its director from 1998 to 2006. During his tenure, CCR was continuously ranked as one of the leading supercomputing centers worldwide, supporting research, scholarship, education, outreach, and training for high-end computing, including leading-edge computers, storage, networking, and visualization. Miller is a codeveloper of the Shake-and-Bake method of molecular structure determination, which was included in the poster "Top Ten Algorithms of the Century" in Computing in Science & Engineering, produced in cooperation with the IEEE and the Computer Museum History Center.

UB Distinguished Professor Aidong Zhang has authored more then 250 scientific papers in a variety of research areas including bioinformatics, data mining, multimedia and database systems, and content-based image retrieval. Dr. Zhang is a leader in the new area of data analysis and bioinformatics and has published two books "Protein Interaction Networks: Computational Analysis" (Cambridge University Press, 2009) and "Advanced Analysis of Gene Expression Microarray Data" (World Scientific Publishing Co., Inc. 2006). Her groundbreaking approaches on genomic data analysis have opened a new direction to interactive mining multidimensional data. Her approaches build a fundamental basis of bioinformatics systems and have been applied by biomedical researchers to solve their real world problems.

CAREER AWARD WINNERS

Nine members of the CSE faculty have received the prestigious Faculty Early Career Development (CAREER) Award from the National Science Foundation. The award is one of the NSF's highest recognitions of junior faculty who "exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research within the context of the mission of their organizations." The funding is typically in the range of $400,000-$500,000 for a period of five years. CSE awardees include:

Jason Corso (2009) is focusing on developing techniques for automatically learning hierarchical statistical models of complex phenomena and deriving robust efficient inference algorithms on these models.

Murat Demirbas (2008) is investigating the design and implementation of an in-network collaboration and coordination framework for wireless sensor networks, providing a platform for developing and deploying distributed control applications.

Tevfik Kosar (2009) is investigating data-aware distributed scheduling and I/O optimization techniques for next generation data intensive distributed applications.

Hung Ngo (2004) is designing optimal algorithms for database join evaluation, routing algorithms on multichannel switching networks, and construction and decoding algorithms for group testing and compressed sensing.

Kui Ren (2011) is making enormous research progress on enabling secure and practical computation outsourcing, which reconciles the fundamental conflicts between data utility and data privacy protection in cloud computing.

Atri Rudra (2009) is studying efficient techniques for computing approximate solutions to problems involving very large amounts of data, especially for handling the increasing number of errors that will occur as more data is packed into physical media.

Jinhui Xu (2005) is developing efficient geometric techniques for application in cardiovascular interventional procedures, improving the quality of projection imaging (such as angiogram and CT imaging) and the guiding of stent implant procedures.

Aidong Zhang (1998) was recipient of a CAREER Award for multimedia database systems research and education.

Sheng Zhong (2009) is studying the design of an enforceable economic mechanism for mobile ad hoc wireless networks that will provide sufficiently strong incentives for cooperative behavior and security protection against cheating.

SUNY CHANCELLOR'S AWARD WINNERS

The Chancellor of the State University of New York recognizes outstanding faculty contributions to their respective professional fields, campuses, communities and the public at large. CSE faculty who have received such recognition are:

Venu Govindaraju, SUNY Chancellor's Award for Excellence in Scholarship and Creative Activities, 2007

William J. Rapaport, SUNY Chancellor's Award for Excellence in Teaching, 1981

Alan L. Selman, SUNY Chancellor's Award for Excellence in Scholarship and Creative Activities, 2004

Aidong Zhang, SUNY Chancellor's Research Recognition Award, 2003

UB EXCEPTIONAL SCHOLAR AWARD WINNERS

Sustained Achievements Awards: Chang Wen Chen, Venu Govindaraju, Chunming Qiao, Alan Selman, Stuart Shapiro, Aidong Zhang

Young Investigator Awards: Jason Corso, Murat Demirbas, Hung Ngo, Atri Rudra, Sheng Zhong

OTHER AWARD WINNERS

Chang Wen Chen, Humboldt Research Award, 2010

Jason Corso, Army Research Office Young Investigator Award, 2010

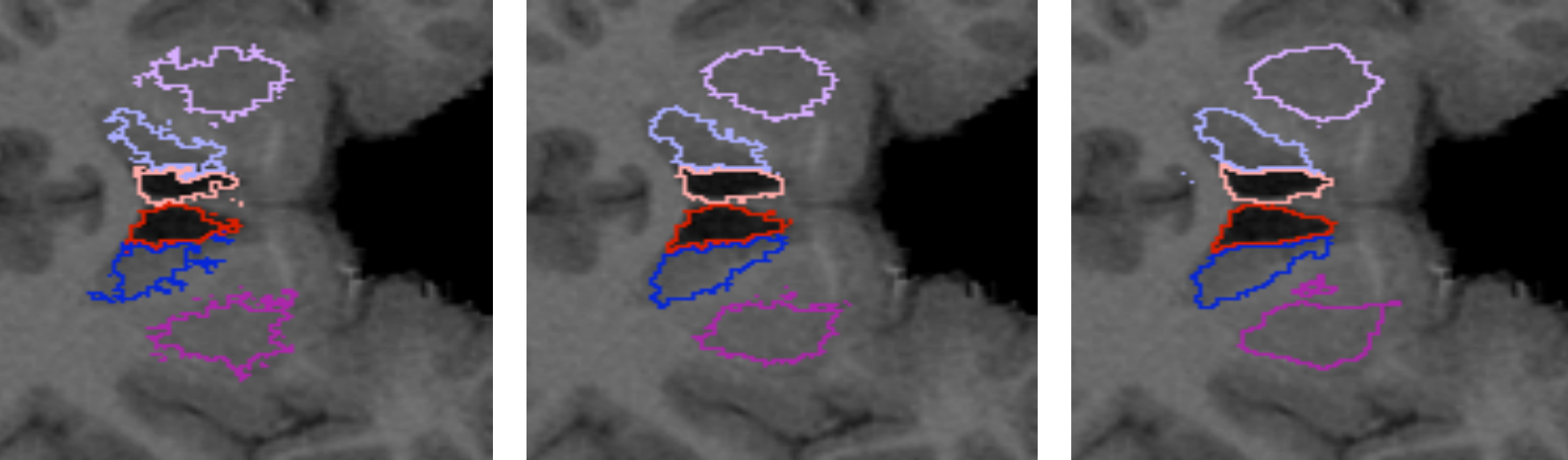Venu Govindaraju, IEEE Computer Society Technical Achievement Award, 2010

Russ Miller, SGI Innovator Award, 2003

Russ Miller, Best Practices Award, Bio-IT World, 2003

Alan Selman, Humboldt Research Award, 2005

GRANTS AND CONTRACTS

Air Force Office of Scientific Research
Bio-nanocombinatorics to Achieve Precisely Assembled Multicomponent, Functional Hybrid Nanomaterials, Aidong Zhang, co-PI, 2012-2017, $2,875,000.

Army Research Office
Two-Rank Mobile Robot Fleet for Swarm Surveillance, WarFighter Assistance, and Other Army-related Research and Research-related Education, Jason Corso, PI, 2011-2013, $250,000. *Guidance by Semantics – Using High-Level Visual Inference to Improve Vision-based Mobile Robot Localization*, Jason Corso, PI, 2011-2014, $150,000.

CUBRC
Computer Vision and Mobile Robot Technologies for Advanced Emergency Response, Jason Corso, PI, 2011-2013, $261,178. *Soft Biometrics*, Venu Govindaraju, PI, 2011-2013, $200,000.

DARPA
Transferring ACE to the Analyst, Jason Corso, PI, 2012-2013, $250,000. *Multilingual Automatic Document Classification, Analysis and Translation*, Venu Govindaraju, PI, 2011-2013, $1,410,00. *A Coordinated Control Architecture for Disaster Response Robots*, Robert Platt, PI, 2012-2013, $128,566.

Defense Threat Reduction Agency
A Robust and Resilient Network Design Paradigm for Region-based Faults Inflicted by WMD Attacks, Chunming Qiao, co-PI, 2012-2014, $173,000.

Google Research Awards
DRAP for Clouds, Chunming Qiao, PI, 2012, $102,000.

IARPA
Ontology, Event Agents and Event Recounting for ALADDIN, Jason Corso, PI, Rohini Srihari, co-PI, 2011-2016, $999,469.

Lockheed
Testing and Evaluation of Recognition Systems, Venu Govindaraju, PI, 2011-2012, $407,000.

NASA Goddard Space Flight Center
NRI-Small: Manipulating Flexible Materials Using Sparse Coding, Robert Platt, PI, 2012-2013, $756,378. *First On the Scene - Making Sites Safe for Humans*, Robert Platt, PI, 2012-2013, $100,000.

National Institute of Health
Imaging-Based Assessment of Smoking Behavior from Used Filters, Jason Corso, PI, 2011-2012, $164,313. *Virtual Group-Exercise at Home in Older Adults at Risk of Falling*, Ramalingam Sridhar, co-PI, 2012-2014, $273,877.

National Science Foundation
PhoneLab: A Programmable Participatory Smartphone Testbed, Geoffrey Challen, PI, Steven Ko, co-PI, Chunming Qiao, co-PI, Tevfik Kosar, co-PI, Murat Demirbas, co-PI, 2012-2015, $1,322,510. *CAREER: Generalized Image Understanding with Probabilistic Ontologies and Dynamic Adaptive Graph Hierarchies*, Jason Corso, PI, 2009-2014, $539,086. *Integrating Privacy Preserving Biometric Templates and Efficient Indexing Methods*, Venu Govindaraju, PI, Atri Rudra, co-PI, 2011-2014, $514,788. *CAREER: Data-aware Distributed Computing for Enabling Large-scale Collaborative Sciences*, Tevfik Kosar, PI, 2009-2014, $400,001. *STCI: Development of Stork Data Scheduler for Mitigating the Data Bottleneck in Petascale Distributed Computing Systems*, Tevfik Kosar, PI, 2009-2013, $495,514. *EAGER: Stork Data Scheduler for Azure*, Tevfik Kosar, PI, 2011-2013, $97,122. *Collaborative Research: Community Infrastructure for General Relativistic MHD*, Tevfik Kosar, Co-PI, 2009-2013, $400,000. *CPS: Medium: Addressing Design and Human Factors Challenges in Cyber Transportation Systems*, Chunming Qiao, PI, 2010-2013, $707,508. *CAREER: Secure and Privacy-assured Data Service Outsourcing in Cloud Computing*, Kui Ren, PI, 2011-2016, $498,680. *Mobile Content Distribution in Vehicular Ad Hoc Networks*, Kui Ren, PI, 2011-2014, $181,691. *Collaborative Research: Engineering Secure Data Computation Outsourcing in Cloud Computing*, Kui Ren, co-PI, 2011-2013, $120,000. *CAREER: (TF/TOC) Efficient Computation of Approximate Solutions*, Atri Rudra, PI, 2009-2014, $449,807. *Sparse Approximation: Theory and Extensions*, Atri Rudra, PI, Hung Ngo, co-PI, 2012-2015, $305,467. *An Interdisciplinary Information Assurance Curriculum*, Shambhu Upadhyaya, PI, 2012-2017, $1,645,559. *III: Small: Algorithmic Tools for Spatial Positioning Studies in the Cell Nucleus*, Jinhui Xu, PI, 2011-2013, $499,968. *III: Small: Overlapping Clustering Analysis of Biological Networks*, Aidong Zhang, PI, 2010-2013, $500,000. *III: Small: Dynamic Social Network Mining: Feature Extraction, Modeling and Anomaly Detection*, Aidong Zhang, PI, 2012-2015, $500,000.

Naval Postgraduate School
Comprehensive Object Detection Library for Large-Scale Image Analytics, Jason Corso, PI, 2011-2012, $190,975.

NYS Department of Economic Development
Data Intensive Supercomputing, Vipin Chaudhary, PI, 2011-2013, $237,053.

USPS
Testing and Evaluation Projects, Venu Govindaraju, co-PI, 2011-2013, $1,200,000.

AIDONG ZHANG CONSULTS

EDITORSHIP OF JOURNALS

CSE faculty serve on the editorial boards of over 30 prestigious journals, including:

Chang Wen Chen has been senior editor of the IEEE Journal on Emerging and Selected Topics in Circuits and Systems since 2010 and senior editor of the IEEE Journal of Selected Areas in Communication since 2011.

Jan Chomicki has been an editor of Knowledge and Information Systems and Proceedings of the VLDB Endowment, both since 2010.

Jason Corso has been an associate editor of Elsevier's Computer Methods and Programs in Biomedicine since 2009.

Venu Govindaraju is the editor-in-chief of the IEEE Biometrics Compendium (2012-on) and an associate editor of the International Journal of Document Analysis and Recognition (2003-on) and the IET Biometrics Journal (2011-on).

Russ Miller has been Associate Editor of the International Journal of Teaching and Case Studies since 2007 and is a member of the editorial board of Parallel Processing Letters since 1991.

Kui Ren has been an associate editor of the IEEE Transactions on Information Forensics and Security (TIFS), IEEE Transactions on Smart Grid, IEEE Communications Surveys and Tutorials (COMST), IEEE Wireless Communications, and Journal of Communications and Networks (JCN).

Alan Selman has been editor-in-chief of Theory of Computing Systems since 2001, an associate editor of Journal of Computer and System Sciences since 1982 and of Chicago Journal of Theoretical Computer Science since 1995.

Ramalingam Sridhar has been an associate editor of International Journal of Computers and Their Applications, Jan 2010 – Dec 2012.

Aidong Zhang has been on the steering committee for the IEEE/ACM Transactions on Computational Biology and Bioinformatics (TCBB) since 2012. She has also been an associate editor of the IEEE Transactions on Knowledge and Data Engineering since 2009, an associate editor of the International Journal of Bioinformatics Research and Applications since 2004, an associate editor of the International Journal of Knowledge Discovery in Bioinformatics (IJKDB) since 2012, an associate editor of the Health Information Science and Systems since 2012, and an associate editor of the International Journal of Data Mining and Bioinformatics (IJDMB) since 2009.

NORTH CAMPUS STUDENT UNION

NORTH CAMPUS CENTER F

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THIS IS UB

The University at Buffalo is a premier research-intensive public university, a flagship institution in the State University of New York system and its largest and most comprehensive campus with three locations across Buffalo Niagara. UB's more than 28,000 students pursue their academic interests through more than 300 undergraduate, graduate, and professional degree programs. Founded in 1846, the University at Buffalo is a member of the Association of American Universities.

OR THE ARTS

SOUTH CAMPUS

DOWNTOWN CAMPUS

A GREAT PLACE TO
LIVE AND WORK

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The second-largest city in New York State, Buffalo is one of the most livable, lively, and comfortable places in which to live, work, and play. It's an easygoing, inviting mix, from great music and food to spirited professional sports teams, renowned architecture and cultural institutions, and top-notch entertainment. Situated at the eastern end of Lake Erie where the Great Lakes empty into the Niagara River, Buffalo is in easy reach of the Canadian lakeshore and Niagara Falls, the most accessible of the world's natural wonders.

The Buffalo Niagara region offers all of the amenities of a major urban area—without the headaches. The average workday commute is less than twenty minutes, which is the lowest out of fifty major U.S. cities.
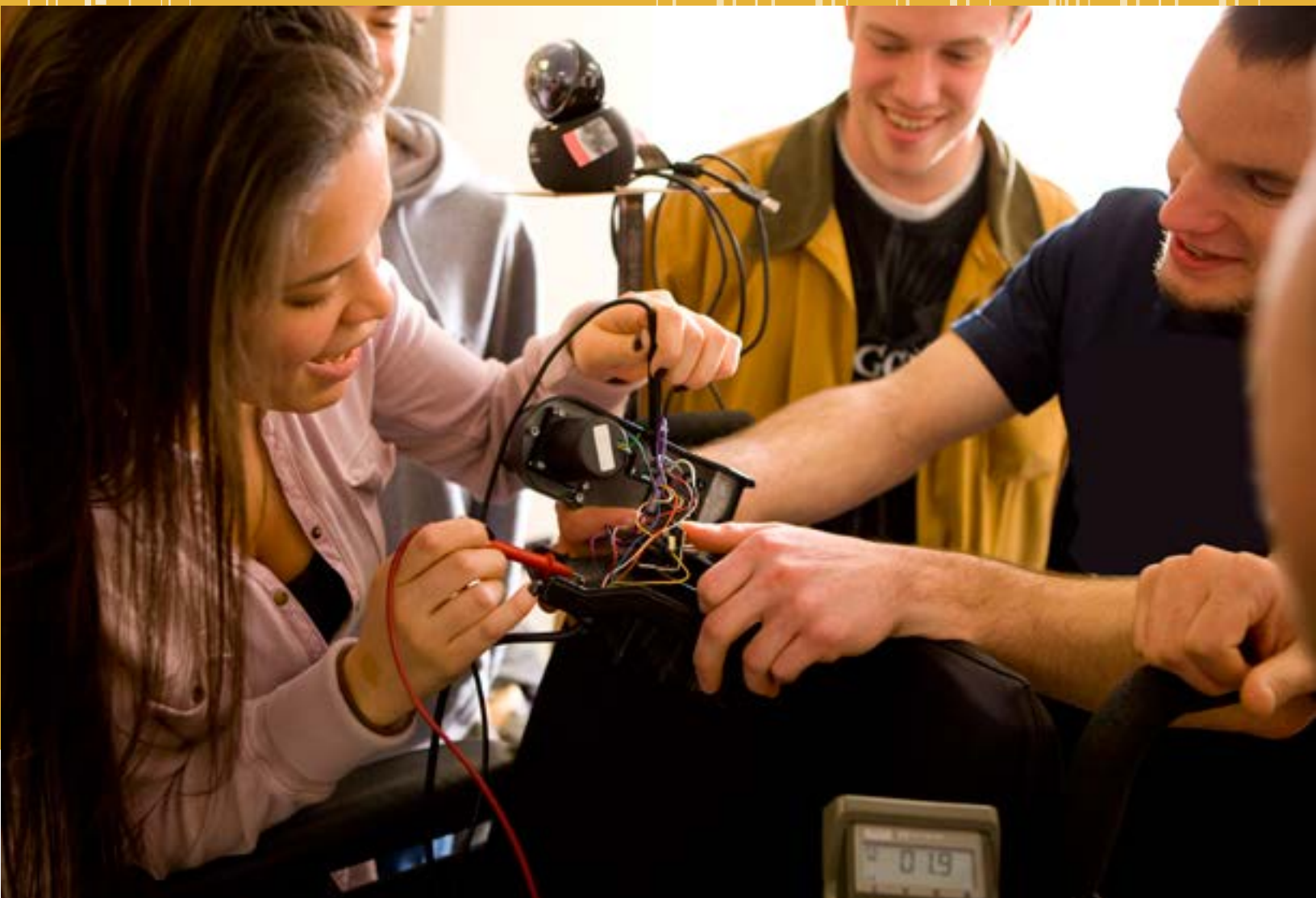
Affordable housing is widely accessible throughout the region, and a reasonable cost of living makes the good life possible on any budget. Most neighborhoods offer easy access to shopping, recreation, dining, and excellent schools.
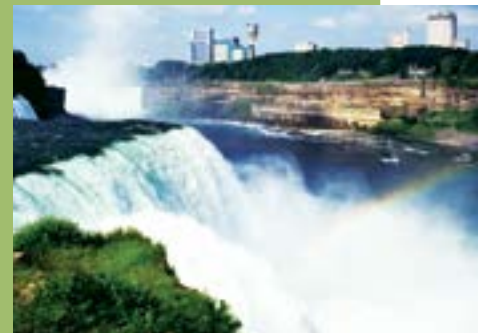
NIAGARA FALLS

CSE STUDENTS | AT WORK ON THE DEVELOPMENT OF A ROBOTIC WHEELCHAIR.