FALL 2017

# RazorBytes ©

The University of Arkansas Computer Science and Computer Engineering Department

## ALUMNI-FOCUSED ACADEMY

### 37 NEW CHARTERED MEMBERS INDUCTED

UNIVERSITY OF
ARKANSAS

College of Engineering
Computer Science
& Computer Engineering

# FROM THE DESK OF
## XIAOQING "FRANK" LIU

**Professor and Department Head
Rodger S. Kline Leadership Chair**

This is an exciting time in the Computer Science and Computer Engineering Department at the University of Arkansas in Fayetteville. The University of Arkansas in Fayetteville is the flagship campus in the University of Arkansas system. It has the highest Carnegie classification of doctoral-granting, research university with very high levels of research activity. The Computer Science and Computer Engineering (CSCE) Department in the University of Arkansas in Fayetteville is housed in the state-of-the-art J.B. Hunt Transport Services Inc. Center for Academic Excellence with modern faculty offices, laboratories suitable for hardware and software research and education, and classrooms for teaching. CSCE has comprehensive education programs in both computer science and computer engineering. It offers seven degree programs: B.S. in computer science, B.S. in computer engineering, B.A. in computer science, M.S. in computer science, M.S. in computer engineering, PhD in engineering (Computer Science), and PhD in Engineering (Computer Engineering). The degree programs of B.S. in computer science and B.S. in Computer Engineering are accredited by the Engineering Accreditation Commission of ABET.

The CSCE department did very well in research, education, and services in the past year. This resulted from excellent effort and dedication of faculty, staff, and students. CSCE now has 18 excellent faculty members. Four of them are endowed chair professors and four of them are NSF CAREER Awardees. Last year, CSCE hired two excellent tenure-track assistant professors Dr. Yarui Peng who graduated from the Georgia Institute of Technology and Dr. Alexander Nelson who graduated from the University of Maryland in Baltimore County. They cover a wide range of computer science and computer engineering domains, such as dig data and analytics, cyber security, artificial Intelligence, machine learning, service computing, recommendation systems, theoretical computer science, algorithms, Information retrieval, software engineering, computer vision, wearable computing, embedded systems, reconfigurable computing, digital integrated circuit design and analysis, extreme environment electronics, hardware security, and computer aided design.

CSCE continues to show success in maintaining and developing outstanding student-centered education programs. The CSCE enrollment in our undergraduate programs continues to grow and our current undergraduate enrollment excluding students in Freshman Engineering is 569. The quality of instruction continues to be excellent and the average instructor rating in the Department from the student evaluation of teaching was above 4.2 out of 5, indicating very high student satisfaction.

The Department is also active in research and the total amount of new research grants is $2.7M for 2016-2017 fiscal year. An average amount of new research award per tenure or tenure-track faculty members is more than $168K for the past fiscal year. CSCE PhD programs are growing fast and our PhD enrollment is 53 in 2016-2017 fiscal year compared with 39 in 2014-2015, representing an increase of 36% for the past two years. The PhD enrollment growth is supported by a significant increase in new research awards both internally and externally for the past two years.

In the past year, we also made a significant advancement in building excellent relationships with CSCE alumni and supporters. The University of Arkansas Academy of Computer Science and Computer Engineering was created in April 2017 to recognize the achievements of graduates from the Department of Computer Science and Computer Engineering and others closely affiliated with the department. It inducted a total of thirty-seven chartered members. These members of the academy have demonstrated professional activities that attest to a distinguished record in their career field.

In summary, CSCE did well for the past year in all areas of research, education program, and outreach. We are confident that CSCE has a bright future.

# AWARDS

## 2017 FACULTY AWARDS

CSCE Outstanding Research Award
**Matthew Patitz**

CSCE Outstanding Teaching Award
**Michael Gashler**

CSCE Outstanding Service to Students
**Gordon Beavers**

## STUDENT HONORS

### Best Student Paper Candidate
*Privacy Disclosure Through Smart Meters: Reactive Power Based Attack and Defense*,
Jingyao Fan, Qinghua Li, and Guohong Cao,
in IEEE/IFIP International Conference on Dependable Systems and Networks (DSN), 2017.

### 2nd Place ACM SIGSPATIAL Student Research Competition
Changgang Lai (advisor Miaoqing Huang), Second Place in the ACM SIGSPATIAL Student Research Competition.

### Best Capstone Design Poster, College of Engineering, University of Arkansas
*Autonomous Decentralized Indoor Robot Navigation Using Smart Cameras with ROS for Efficient Adaptability to Arbitrary Environments*
Joseph Fantinel, Andrew Felder, Joseph Gauthier, Nicholas Mize, and Dillon VanBuskirk
(advisor Christophe Bobda)

# Dr. Bobda Awarded NSF Grant

The National Science Foundation (NSF) has awarded Dr. Christophe Bobda, Professor of Computer Engineering $477,870 to conduct research in Reconfigurable In-Sensor Architectures for High Speed and Low Power In-situ Image Analysis. Cameras are pervasively used for surveillance and monitoring applications and can capture a substantial amount of image data.

The proposed architecture presents three novel contributions: a hierarchical, configurable architecture for parallel feature extraction in video streams, a machine learning based relevance-feedback method that adapts computational performance and resource usage to input data relevance, and a framework for converting sequential image processing algorithms to multiple layers of parallel computational processing units in the sensor.

The results of this project can be used in other fields, where large amounts of processing need to be performed on data collected by generic sensors deployed in the field. Furthermore, mechanisms for translating sequential constructs into functionally equivalent accelerators using hardware constructs will lead to highly parallel and efficient sensing units that can perform domain specific tasks more efficiently.

# CSCE Hosts UCNC 2017 Conference



The 16th International Conference on Unconventional Computation and Natural Computation was held June 5-9, 2017, on the campus of the University of Arkansas in Fayetteville, Arkansas. The UCNC series of international conferences is genuinely interdisciplinary and it covers theory as well as experiments and applications. It is concerned with various proposals for computation that go beyond the Turing model, human designed computation inspired by nature, and with the computational nature of processes taking place in nature. Typical, but not exclusive, topics are: hypercomputation; chaos and dynamical systems based computing; granular, fuzzy and rough computing; mechanical computing; cellular, evolutionary, molecular, neural, and quantum computing; membrane computing; amorphous computing, swarm intelligence; artificial immune systems; physics of computation; chemical computation; evolving hardware; the computational nature of self-assembly, developmental processes, bacterial communication, and brain processes.

Included during the conference were two workshops. The Workshop on Membrane Computing was organized by Matteo Cavaliere from the University of Edinburgh, UK, and Alfonso Rodriguez Paton from the Universidad Politcnica de Madrid, Spain. Invited speakers for that workshop were Alvaro Sanchez from Yale University, USA, and Sergey Verlan from the University Paris Est Creteil, France. The 1st International Workshop on Oritatami (Oritatami 2017) was organized by Shinnosuke Seki from the University of Electro-Communications, Japan, and the invited speakers for that workshop were Cody Geary from Cal-tech, USA, and Aarhus University, Denmark, and Nicolas Schabanel from CNRS,U. Paris Diderot (IRIF), & ENS Lyon (IXXI), France.

# Jia Di Awarded NSF CCSS Program Grant



Dr. Jia Di, Professor and 21st Century Research Leadership Chair, has received a grant from the NSF Communications, Circuits, and Sensing-Systems (CCSS) Program to conduct research with Radiance Technologies, Inc., on designing microcontrollers capable of operating reliably under extreme environments.

The market needs of extreme environment electronics encompass many commercial applications such as integrated gate drivers in power industry, in-engine sensing and control in automobile industry, well condition monitoring and drilling assistance in oil/gas exploration, cryogenic high-field magnet creation in medical imaging instrumentation, and many others like superconducting computing and energy storage systems, laser industry, space exploration, in-field distributed sensors, magnetic levitation transport systems, and infrared systems.

This Grant Opportunities for Academic Liaison with Industry (GOALI) project is a collaborative effort between the University of Arkansas and Radiance Technologies to develop quasi-delay insensitive asynchronous microcontrollers capable of operating reliably under extreme environments without extra protection or control/adjustment. With the industry-standard guidance, experience, and assistance from Radiance Technologies, a prototype NCL microcontroller incorporating the above innovations will be designed, fabricated, and tested. The results will be analyzed for further improvements, dissemination, and technology transfer for potential commercialization.

This 3-year, $350K project started on September 1, 2016.

# University of Arkansas Academy of Computer Science and Computer Engineering Engages Alumni

The University of Arkansas Academy of Computer Science and Computer Engineering was created in April 2017 to recognize the achievements of graduates from the Department of Computer Science and Computer Engineering and others closely affiliated with the department.

The academy provides advisory guidance and counsel to the department, as well as encourages scholarships, gifts and grants that support the department. A total of thirty-seven chartered members were inducted into the academy this time. These members of the academy have demonstrated professional activities that attest to a distinguished record in their career field.

"I'd like to thank the alumni, faculty, and staff of the Department of Computer Science and Computer Engineering who were instrumental in setting up this academy," said Xiaoqing "Frank" Liu, head of the department. " I am confident that it will be very successful in connecting our alumni and supporters to our department as we work together to strengthen and promote our computer science and computer engineering programs."



**About the University of Arkansas:** The University of Arkansas provides an internationally competitive education for undergraduate and graduate students in more than 200 academic programs. The university contributes new knowledge, economic development, basic and applied research, and creative activity while also providing service to academic and professional disciplines. The Carnegie Foundation classifies the University of Arkansas among only 2 percent of universities in America that have the highest level of research activity. U.S. News & World Report ranks the University of Arkansas among its top American public research universities. Founded in 1871, the University of Arkansas comprises 10 colleges and schools and maintains a low student-to-faculty ratio that promotes personal attention and close mentoring.

# OUTREACH

# 2017 High School Programming Contest

The Computer Science and Computer Engineering Department, along with Acxiom Corp. and the University of Arkansas Chapter of the Association for Computing Machinery (ACM), hosted the annual High School Programming Contest.  Dr. Wing Ning Li, professor in the Computer Science and Computer Engineering department, organized and hosted the event.

52 teams from 21 schools made up the 172 students and teachers registered for the contest (all three numbers set new records)...  Teams competed to solve as many programming problems as they could in three hours.

First place went to Dank Meme Machine from ASMSA. Teams[0] from ASMSA was awarded second place. Saturday Terror from Springdale High took third place. Bentonville High Smile and .wav received an award for most creative and LHSD Tech Team from Lead Hill High was awarded most improved. Seven new comer awards were given to teams from Clarksville High, Prescott High, Berryville High, Haas Hall Academy, Star City High, Valley View Public Schools, and Mammoth spring High.

While the students were competing, the high school teacher coaches held a roundtable discussion, exchanging experiences and ideas about the future of computer science education in high schools.

# INTERNATIONAL STUDENTS

# Computer Science, Computer Engineering Hosts International Student Researchers



The Department of Computer Science and Computer Engineering recently hosted 10 European students on campus as part of a summer research program. The program serves as a study abroad experience for international graduate and undergraduate students, while also allowing them to conduct hands-on research with University of Arkansas faculty members. Students who participate in the program are recommended by faculty members at their home institutions and spend three months on the Fayetteville campus carrying out computer science and computer engineering research.

"My favorite element of the program was the collaborative work on my research project," said program participant Marion Chiariglione. "I worked with a master's student on my project and, since I love working in groups, it was a really nice addition to the program. Being able to run your ideas past another person is amazing. I also really liked discovering how a research lab works."  Chiariglione enjoyed the program so much she decided to stay at the University of Arkansas to complete her undergraduate degree.

Christophe Bobda, a professor in the College of Engineering, implemented the program in 2010. Since that time, 40 students have participated in the program and several have opted to return to the University of Arkansas for graduate education. Program participants have come from Cameroon, France, Germany and Mexico.

Kevin Labille participated in the program in 2013 and chose to pursue a computer science doctoral degree at the University of Arkansas after completing the summer program. His decision to make Fayetteville his graduate school home was influenced by the academic and non-academic experiences he had at the U of A.

# Yarui Peng
## Assistant Professor of Computer Science and Computer Engineering
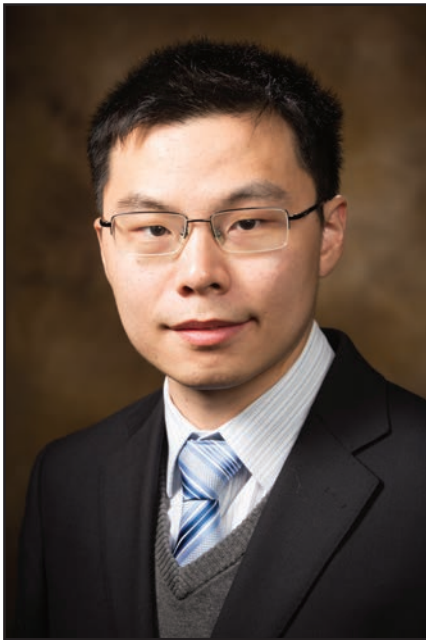
Yarui Peng earned his master's degree and doctorate in electrical and computer engineering from the Georgia Institute of Technology. He holds a bachelor's degree from Tsinghua University in Beijing, China. In his research, he develops methodologies and algorithms for parasitic extraction, analysis and optimization for signal integrity, and alleviating reliability issues in thermal and power delivery in 2.5D and 3D integrated circuits. Peng also works with the NSF-sponsored Engineering Research Center for Power Optimization of Electro-Thermal Systems.

# Alexander Nelson
## Assistant Professor of Computer Science and Computer Engineering

Alexander Nelson earned a doctorate in computer engineering at the University of Maryland, Baltimore County, and he holds a bachelor's degree and a master's degree in computer engineering from the University of Arkansas. He is interested in projects that have the potential to improve standards of living, such as emergency communications, assistive devices, and home automation. Nelson is also interested in the interworking and connectivity of all devices, especially with concern to the cloud and smart objects.

## Lynn Moore    BS, CSE, 1994, MS, CSE, 1996

**College of Engineering Distinguished Alumna 2017**

Chief Executive Officer, Motio, Inc.

Plano, Texas

Lynn Moore co-founded Motio, Inc. in 1999. Motio (formerly Focus Technologies) is a successful software development company in Texas. In his role as CEO, Moore is in charge of overall strategy and operations in the company. Under Moore's leadership and vision, Motio is recognized as the industry leader for its software solutions and has been first to market in all current product categories. Motio excels in developing useful products aimed at streamlining BI software and currently has nine products on its roster that work with IBM Cognos, IBM Cognos TM1, Microstrategy, and Tableau platforms.

Moore is a member of the Arkansas Academy of Computing and the Advisory Board of the Department of Computer Science and Computer Engineering. He has been working with the department to set up a University of Arkansas Academy of Computer Science and Computer Engineering (UAACSCE) whose members will be established CSCE alumni.

## Jonathan Schisler    BS, CEng, 2004; MS, CEng

**College of Engineering Early Career Award 2017**

Senior Information Systems Manager, Mobile Applications

J.B. Hunt Transport, Sprindale, AR

Jonathan Schisler has gained extensive software development experience in both technical and management positions. He started as a business analyst and software developer at Tyson Foods in 2005 and has accumulated rich experience at Tyson Foods, Acxiom, and J.B. Hunt. He helped start mobile development efforts at J.B. Hunt and is currently a senior information systems manager for mobile applications at J.B. Hunt Transport, Inc. In 2015 he received the IT Applications Top Gun Award from J.B. Hunt. He was also an honoree in the Northwest Arkansas Business Journal's 2015 class of Forty Under 40.

# OutstandingSeniors

### JASON TOWNSLEY **Outstanding Senior in Computer Engineering 2017**

The CSCE Department selected Jason Townsley as the Outstanding Senior for Computer Science. Jason graduated in May 2017 with a 4.0 GPA. Jason plans to seek full-time employment at a software focused company after graduation. He has interned at CaseStack CloudServices and J.B. Hunt Transport. Jason spent the summer of 2015 at the University of Connecticut doing a REU Trustable Computing Systems REU.

Jason has served as an officer in several campus student organizations and has volunteer experience with several organizations.

Jason has demonstrated excellent leadership skills both in and out of the classroom. He is well deserving of the Outstanding Senior in Computer Science award and an excellent candidate for the Outstanding Senior in the College of Engineering.



### BRENDAN MCGEEHAN **Outstanding Senior in Computer Science 2017**

The CSCE Department selected Brendan McGeehan as the Outstanding Senior for Computer Engineering. Brendan graduated in May 2017 with a 4.0 GPA. Brendan plans to continue his education by pursuing a master's degree in computer engineering at the University of Arkansas and has taken advantage of our accelerated masters program. He spent the summer of 2016 as a Software Engineering Intern at Boeing and will return in the summer of 2017. After completing his masters, he hopes to obtain a permanent position at Boeing.

Brendan has served as a Freshman Engineering Program Peer Mentor since May 2014. He was also a Project leader for Make a Difference Day in November 2014 and is a member of Tau Beta Pi.

Brendon has demonstrated excellent leadership skills both in and out of the classroom. He is well deserving of the Outstanding Senior in Computer Engineering award and an excellent candidate for the Outstanding Senior in the College of Engineering.

# Selected Academic Publications

Sen Ma and **David Andrews,** "Breeze Computing: A Just In Time Approach for Virtualizing FPGAs in the Cloud," *Proceedings of 2016 International Conference on Reconfigurable Computing and FPGAs (ReConFig 2016)*

Sen Ma, Zeyad Aklah and **David Andrews,** "Run Time Interpretation of Accelerators," *Proceedings of the 24th ACM/SIGDA International Symposium on Field-Programmable Gate Arrays (FPGA 2016)*

Jeffrey Kutchka, Danielle Tchuinkou, Joel Mandebi Mbongue, Erman Nghonda Tchinda, and **Christophe Bobda,** "Automatic Assessment of Environmental Hazards for Fall Prevention Using Smart Cameras," *IEEE Conference on Connected Health: Applications, System Engineering, Technology. Workshop on Cloud Connected Health*

Franz-Josef Streit, Md Jubaer Hossain Pantho, **Christophe Bobda** and Cindy Roullet**,** "Vision-Based Path Construction and Maintenance for Indoor Guidance of Autonomous Guided Vehicles Based on Collaborative Smart Cameras," *IEEE International Conference on Distributed Smart Cameras (ICDSC)*

N. Kuhns, L. Caley, A. Rahman, S. Ahmed, **J. Di**, H. A. Mantooth, A. M. Francis, and J. Holmes , "Complex High-Temperature CMOS Silicon Carbide Digital Circuit Designs," *IEEE Transactions on Device and Materials Reliability, 16, 2016.*

A. Rahman, S. Roy, R. Kotecha, R. Murphree, K. Addington, A. Abbasi, H. A. Mantooth, M. Francis, J. Holmes, and **J. Di** , "High Temperature SiC CMOS Comparator and Op Amp for Protection Circuits in Voltage Regulators and Switch-Mode Converters," *IEEE Journal of Emerging and Selected Topics in Power Electronics, 4, 2016.*

**Gashler, Michael S**. and Stephen C. Ashmore, "Modeling Time Series Data with Deep Fourier Neural Networks," *Neurocomputing, 188, 2016.*

Ashmore, Stephen C. and **Gashler, Michael S.**, "Practical Techniques for Using Neural Networks To Estimate State From Images," *The IEEE Fifteenth International Conference on Machine Learning and Applications ICMLA'16*

Kevin Labille, Sultan Alfarhood, and **Susan Gauch,** "Estimating Sentiment via Probability and Information Theory," *8th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management (KDIR 2016)*

Nirmal Jonnalagedda, **Susan Gauch,** Kevin Labille, and Sultan Alfarhood**,** "Incorporating Popularity in a Personalized News Recommender System," *Peer Computer Science, 2, 2016.*

Chenggang Lai, **Miaoqing Huang**, and Xuan Shi, "SRC: Accelerating the Calculation of Minimum Set of Viewpoints for Maximum Coverage over Digital Elevation Model Data by Hybrid Computer Architecture and Systems," *Proceedings of the 24th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems*

Hong Fan, **Miaoqing Huang**, Chenggang Lai, Jinming Yu, and Wujun Xu, "Accelerating DCT-based color image watermarking on GPUs," *Proceedings of 20th International Conference on Image Processing, Computer Vision, & Pattern Recognition (IPCV'16)*

John Calvin Alumbaugh, **Qinghua Li**, and Vincent C. Hu, ""Differentiating Non-Isomorphic Graphlets for Graph Analytics," *IEEE International Conference on Collaboration and Internet Computing (CIC)*

Ang Li, **Qinghua Li**, and Wei Gao, "PrivacyCamera: Privacy-Aware Photographing with Mobile Phones" *IEEE International Conference on Sensing, Communication and Networking (SECON)*

Joseph Sirrianni, Zhichun Xiao, and **Wing Ning Li**, "A Support Vector Machine Based Model for Predicting Heparin-binding Proteins Using XB Patterns as Features," *Int'l Conf. Bioinformatics and Computational Biology*

Buqing Cao, **Xiaoqing "Frank" Liu**, Bing Li, Jianxun Liu, Mingdong Tang, Tingting Zhang, Min Shi, "Mashup Service Clustering Based on an Integration of Service Content and Network via Exploiting a Two-Level Topic Model," *Proc. of the 23rd IEEE International Conference on Web Services*

Guosheng Kang, Mingdong Tang, Jianxun Liu, **Xiaoqing "Frank" Liu**, Buqing Cao, "Diversifying Web Service Recommendation Results via Exploring Service Usage History," *IEEE Transactions on Services Computing, 9,* 2016.

Katanosh Morovat and **Brajendra Panda,** "Policy Language for Access Control in Social Network Cloud," *Proceedings of the IEEE International Conference on Smart Cloud 2016 (SmartCloud 2016)*

Erik D. Demaine, **Matthew J. Patitz**, Trent A. Rogers, Robert T. Schweller, Scott M. Summers, and Damien Woods, Shinnosuke Seki, "The Two-Handed Tile Assembly Model Is Not Intrinsically Universal," *Algorithmica, 74,* 2016.

Jacob Hendricks, **Matthew J. Patitz**, and Trent A. Rogers, "Universal Simulation of Directed Systems in the abstract Tile Assembly Model Requires Undirectedness," *Proceedings of the 57th Annual IEEE Symposium on Foundations of Computer Science (FOCS 2016)*

N. Phan, Y. Wang, **X. Wu** and D. Dou, "Differential Privacy Preservation for Deep Auto-Encoders: an Application of Human Behavior Prediction," *Proceedings of the 30th AAAI Conference on Artificial Intelligence (AAAI)Data Mining (ICDM)*

S. Yuan, **X. Wu** and Y. Xiao., "Incorporating Pre-Training in Long Short-Term Memory Networks for Tweets Classification," *Proceedings of the IEEE International Conference on Data Mining (ICDM)*

# UNIVERSITY OF ARKANSAS

**College of Engineering**
*Computer Science & Computer Engineering*

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# Razor Bytes FAST FACTS

**18** FACULTY MEMBERS

**4** CAREER AWARDEES

**4** ENDOWED CHAIRS

**$2.7M** NEW RESEARCH AWARDS

**$150K** NEW RESEARCH AWARDS PER FACULTY*

**554** UNDERGRADUATE STUDENTS**

**53** PHD STUDENTS

**1,654** ALUMNI

* tenured/tenure track faculty  ** excludes students in freshman engineering