COMPUTER SCIENCE **NEWS**

THE UNIVERSITY OF **MEMPHIS**®

CHAIR'S MESSAGE

I am the acting chair for the Computer Science Department while Dr. Lan Wang is on sabbatical for spring 2019. Our department is steadily growing. We welcomed three new tenure-track faculty members during the 2018–19 academic year and are expecting two more in the upcoming year. In addition to Cybersecurity, our undergraduate majors will soon have the opportunity to choose new concentrations in Data Science and Artificial Intelligence.

Our faculty continued to receive federal funding for their research. The MD2K Center of Excellence led by Dr. Santosh Kumar was awarded more than $2 million. Dr. Vasile Rus and Dr. Scott Fleming, who are experts in Natural Language Processing and Software Engineering respectively, also received more than $750,000 in federal funding for building intelligent systems. Wang is part of a team that was awarded more than $400,000 to work with the City of Memphis to map building interiors to facilitate the work of first responders. Our faculty members were recognized by the University with various awards.

Additionally, Rus and Dr. Deepak Venugopal, who led the UofM's initiative in Data Science, helped organize the inaugural Memphis DATA Conference. We look forward to continuing this trend of success.

Dr. Vinhthuy Phan
Associate Professor and Acting Chair

WELCOME NEW FACULTY

Three new tenure-track faculty joined the department in the 2018–19 academic year:

Dr. Xing Gao (PhD, Computer Science, College of William and Mary, 2018) brings his expertise in security, cloud computing and mobile computing.

Dr. Myounggyu Won (PhD, Computer Science, Texas A&M University, 2013) brings his expertise in cyber-physical systems, mobile computing and intelligent transportation systems. Won was previously an assistant professor at South Dakota State University.

Dr. Xiaofei Zhang (PhD, Computer Science, The Hong Kong University of Science and Technology, 2013) brings his expertise in graph databases as well as distributed and parallel computing.

MD2K NEWS

Under the direction of **Dr. Santosh Kumar**, the Center of Excellence for Mobile Sensor Data-to-Knowledge (MD2K) landed two grants totaling more than $2 million. Now in its fifth year, MD2K will use the grants to enhance its software infrastructure and join the effort to curb opioid abuse.

The larger of the two grants (mResearch), for $1.75 million from the National Science Foundation (NSF), will support significant new enhancements to MD2K's mobile sensor big data software infrastructure. This will provide an opportunity to accelerate research in sensor design, mobile computing, privacy, analytics and visualization. The enhanced MD2K software will facilitate reproducible and extensible computing research with high-frequency mobile sensor data. The mResearch project is a collaboration among five universities: the UofM, Georgia Tech, Ohio State, UCLA and UMass Amherst.

The second grant, for $313,357 from the National Institutes of Health (NIH), enlists MD2K in the fight against the nation's opioid problem. Researchers from MD2K and Johns Hopkins University will investigate whether stress measurements obtained via mobile sensors can predict the day-to-day fluctuations in prescription opioid use among patients with sickle cell disease. Earlier this year, the NIH announced the HEAL initiative to "speed scientific solutions" for the opioid crisis.

MD2K held its fifth annual meeting at the FedEx Institute of Technology and Shelby Farms Park on Oct. 1–2. This meeting is the only annual event where all MD2K team members are required to attend in person. Attendees included MD2K team members, center staff, NIH/NSF officials, other BD2K affiliates and University of Memphis officials. The goals of the annual meeting are to interact face-to-face with other team members, share and learn the progress made so far, review/revise the policies and procedures of the center and chart the direction for the future of MD2K. This year's meeting included a keynote address by pioneer biologist **Dr. Leroy Hood**. Details can be found by visiting the MD2K meeting website at **md2k.org/events/md2k-2018.html**.

On June 4, MD2K organized a well-attended mHealth Technology Showcase at the NIH campus. Marking ten years of NIH investment in mobile health, the showcase presented mHealth technology that is now ready to use in health research. At this showcase, MD2K launched a personal edition of their software, which allows anyone to become a citizen scientist and analyze their own data. They can discover new mHealth biomarkers or visualize and discover patterns in a time series of mHealth biomarkers collected on themselves. Several hundred mHealth data streams are already included in the personal edition. A story on this event was featured in the NIH Record newsletter at **nihrecord.nih.gov/newsletters/2018/08_10_2018/story4.htm**.

NEW NSF GRANT TO DEVELOP AN INTELLIGENT TUTORING SYSTEM FOR SOURCE CODE COMPREHENSION

Dr. Scott Fleming

Dr. Vasile Rus

Dr. Vasile Rus and **Dr. Scott Fleming** were awarded a three-year, $759,136 grant from the National Science Foundation. The grant, titled "Investigating and Scaffolding Students' Mental Models during Computer Programming Tasks to Improve Learning, Engagement and Retention," will focus on using educational technology in early computer science courses to increase students' programming skills, self-efficacy and retention rates. Rus and Fleming are co-PIs on the grant along with **Dr. Peter Brusilovsky** from the University of Pittsburgh.

This project proposes advances towards the development of effective and engaging instructional interventions to improve comprehension and learning in introductory Computer Science courses at the college level, to reduce attrition rates and increase retention and to ultimately produce more and better-trained graduates. The result will be a beneficial situation for aspiring students, CS programs and their organizations and the overall economy.

As outcome variables, Rus and Fleming will focus on comprehension measures (e.g., quality of comprehension processes and products such as mental models), learning gains (e.g., knowledge of language-specific syntactic constructs, semantics of major control structures, programming patterns such as finding the maximum value of an array of integers), engagement level, retention and self-efficacy.

MAP901 GRANT FROM NIST

Dr. Lan Wang is on a team that was awarded a $418,000 grant from the Public Safety Communications Research Division of NIST to work with the City of Memphis to map building interiors for first responders.

The project — Map901: Building Rich Interior Hazard Maps for First Responders — is a collaboration among the City of Memphis, Wang and **Dr. Eddie Jacobs** in the Department of Electrical and Computer Engineering. The team will survey 1.86 million square feet of interior space with LiDAR, camera, temperature, humidity and acoustic sensors to create detailed building models for use in emergency scenarios. The project also involves several software components, including real-time visualization, image processing with machine learning, data representation and data encryption.
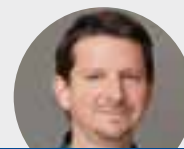
More information can be found in the proposal overview at **nist.gov/ctl/pscr/map-901-building-rich-interior-hazard-maps-first-responders**.

11TH ANNUAL MID-SOUTH CYBERSECURITY SUMMIT

The Center for Information Assurance hosted the 11th Annual Mid-South Cybersecurity Summit at the FedEx Institute of Technology on Oct. 5. This annual summit aims to provide a platform for companies and institutions in the Mid-South region to learn, discuss and exchange information and technologies about cybersecurity. Guest speakers at this year's event included representatives from the City of Memphis, Boeing, XLNTEC, Methodist LeBonheur Healthcare and FedEx.

More information is available at **memphis.edu/cfia/cybersummit**.

FACULTY HONORED
AT CAS MEETING

Several Computer Science faculty were honored at the annual College of Arts and Sciences faculty meeting in August.

Dr. Thomas Watson and **Dr. Bernie Daigle Jr.** (affiliate faculty with the Department of Biology) received the College of Arts and Sciences Early Career Research Award.

Dr. Scott Fleming received the College of Arts and Sciences Distinguished Research Award (CASDRA).

Dr. Vinhthuy Phan was awarded the Pat Burlison Professorship.

Dr. Dipankar Dasgupta was awarded the Hill Professorship, a new position created to recognize outstanding research achievement.

NEW UNDERGRADUATE
CONCENTRATIONS

Two new undergraduate concentrations in Data Science and Artificial Intelligence will become available for the BS degree starting in the fall. Along with the existing Cybersecurity concentration, these options give students an official way to specialize their degrees. All concentrations involve taking 12 hours of guided elective courses.

MEMPHIS DATA CONFERENCE

Dr. Vasile Rus and **Dr. Venugopal** continue their multi-year effort to promote Data Science regionally by helping organize the Memphis DATA conference — **memphis-data.org**.

Data Science is emerging as a new, transformative paradigm in science and technology. With large volumes of data being generated every day from multiple sources (including business data, biomedical data, educational data, science data, engineering data and personal data), the importance of systematic and rigorous approaches to understanding and putting these large volumes of data to good use is now well recognized.

The Memphis DATA conference is meant to support the Data Science initiative, bring together the local community, train future data scientists and create an environment to foster research in this area. Additionally, the aim is to build a Data Science community of practice that would include members from academia and government as well as industry in West Tennessee, the Mid-South and beyond.

DATA SCIENCE IN PYTHON WORKSHOPS

Since 2016, the department has held a regular series of workshops aimed at professional clients on using Python in Data Science. These workshops are typically offered in sets of two — an introductory session on Python Programming and Data Analytics, and a follow-up advanced session on Data Science and Machine Learning.

For upcoming workshop dates and registration, visit **memphis.edu/cs/outreach/ds_workshops.php**.
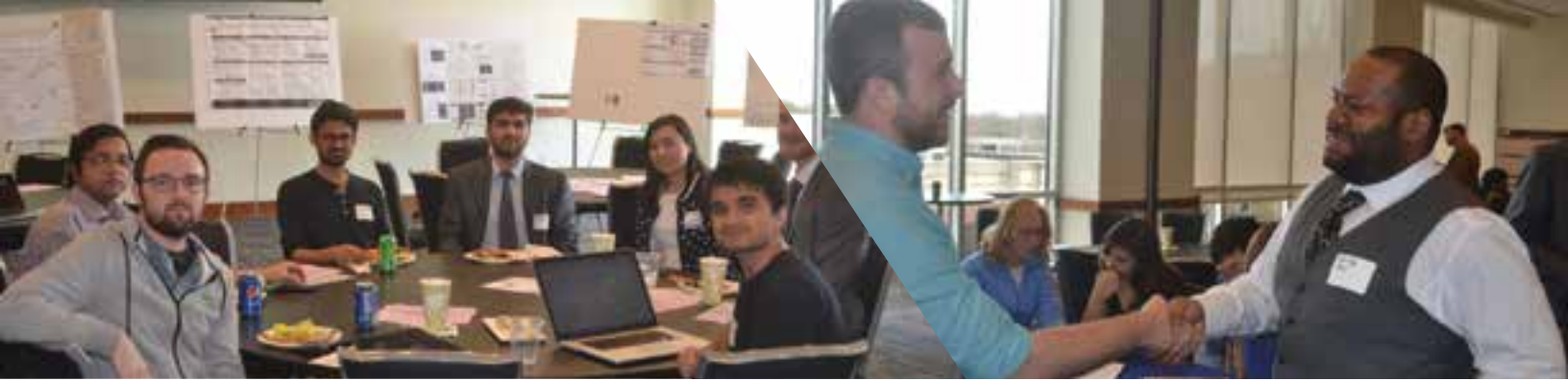
14th & 15th ANNUAL CS RESEARCH DAY

Computer Science faculty and students gathered on March 23, 2018 in the University Center Memphis Room and on April 12, 2019, in the Michael D. Rose Theatre to view presentations and posters from participants in a variety of exciting research areas. Prizes were given to the top placers in the presentation and poster categories, and all participants did an excellent job. The prizes included an Amazon Echo, Amazon Echo Dot, Amazon Fire 7 tablet with Alexa and a fitness tracker.

14th Annual Oral Presentation Awards

1. **Sambriddhi Mainali** (advisor: **Dr. Max Garzon**), Genomic Reconstruction of the Tree of Life

2. **Md Lutfar Rahman** (advisor: **Dr. Tom Watson**), Complexity of Unordered CNF Games

3. **Quang Tran** (advisor: **Dr. Vinhthuy Phan**), Unknown Bacteria Detection in Oral Microbial Communities Using 16S rRNA Genes

15th Annual Oral Presentation Awards

1. **Sayma Akther** (advisor: **Dr. Santosh Kumar**), mORAL: An mHealth Model for Inferring Oral Hygiene Behaviors in-the-wild Using Wrist-worn Inertial Sensors

2. **Stephen Lee** (advisor: **Dr. Vasile Rus**), Who Wrote This? Classifying the Source of News Articles

14th Annual Poster Presentation Awards

1. **Noah Coomer**, Combining Syntactic, Semantic and Discourse Parsing for Knowledge Extraction

2. **Diem-Trang Pham** (advisor: **Dr. Vinhthuy Phan**), General-Purpose Toolkit for Discovery and Visualization of Heteroplasmy in Cytoplasmic Genomes

3. **Nabin Maharjan** (advisor: **Dr. Vasile Rus**), A Tutorial Markov Analysis of Effective Human Tutorial Sessions

4. **Damian Coomes** (advisor: **Dr. Lan Wang**), Named Data Networking-Focused App Development

15th Annual Poster Presentation Award

1. **Saurab Dulal** (advisor: **Dr. Lan Wang**), Experimental Comparison between Geohyperbolic and Hyperbolic Routing in NDN

RAYMOND JAMES VISITS CYBERSECURITY PROGRAM

Kishen Sridharan, an executive from Raymond James, visited the UofM in Feb. of 2018 to meet with cybersecurity faculty, staff and students.

The Center for Information Assurance partnered with the Department of Corporate Engagement and Career Services to host this event. The directors of the Cluster to Advance Cybersecurity and Testing and the director of the Financial Infrastructure Stability and Cybersecurity Center were also in attendance. During the student session of the meeting, students presented their cybersecurity-related work and gave a demonstration of the tools that they helped develop.

MEDIA EXPOSURE

Dr. Dipankar Dasgupta, director of the Center for Information Assurance, was interviewed on WREG News Channel 3 about the recent TNReady testing issues in April of 2018. The online testing was temporarily halted on April 17, due in part to what test vendor Questar called a "deliberate cyber attack." Dr. Dasgupta indicated that although it is difficult to pinpoint who may be responsible for the attack, companies like Questar must take proactive measures to ensure the security of their websites and other software. The full newscast can be seen at **wreg.com/2018/04/18/tnready-testing-troubles-over-for-now**.

Dasgupta was also interviewed on WMC Action News 5 about the Cyber Ambassadors Tech Camp held last June. Dasgupta was joined by Erica Boyce from the School of Public Health, who helped organize the week-long day camp. More information about the camp is available at **memphis.edu/cfia/projects/tech-camp.php**.

PhD student **Jamal Mosakheil** was interviewed on WREG News Channel 3 in September on how to avoid the growing number of phishing emails. The full newscast can be seen at **wreg.com/2018/09/03/consumer-alert-how-to-avoid-possible-phishing-emails-texts**.

FACULTY AND STAFF ACHIEVEMENTS

Three KEYNOTE TALKS by Dr. Vasile Rus

Dr. Vasile Rus gave a number of keynote talks at several international conferences. The first of 2018 came at the IEEE 14th International Conference on Intelligent Computer Communication and Processing. The second was delivered at the Sixth Computational Behavior Sciences Conference. A third talk was delivered at the Sixth International Conference on Mining Intelligence and Knowledge Exploration.

Dr. Dipankar Dasgupta was awarded U.S. Patent No. 9,912,657 for an "Adaptive multi-factor authentication system" (A-MFA) which uses a combination of passwords, biometrics, cognitive behavior and other factors to create a trustworthy authentication system that intelligently selects the most appropriate authentication factors. The patent, which was granted by the United States Patent and Trademark Office on March 6, 2018, also names former students **Abhijit Nag** and **Arunava Roy** as co-inventors.

On June 27, Dasgupta was a guest speaker at the Massachusetts Institute of Technology's 2018 Professional Development Summer Workshop on Applied Cybersecurity, where he highlighted his work on the A-MFA system. There were more than 50 participants from different companies and several countries. Dasgupta has been an Advisory Board member of MIT's Geospatial Data Center since 2010, and has worked on joint research with the center.

Dasgupta also delivered a keynote speech on July 15 at the ACM Workshop on Genetic and Evolutionary Computation in Defense, Security, and Risk Management; and he presented his A-MFA research at iChain, a company in Tokyo that is currently applying blockchain technology for insurance portfolio management.

STUDENT NEWS

Undergraduates **Kareem Dasilva** and **Brandon Ellis** were on a team that placed first among five competitors at the StartCo 48 Hours Launch Competition on Nov. 11. The team created SensorSpot, a Bluetooth sensor which tracks devices that come close to it.

A team of three Computer Science undergraduates participated in the ACM International Collegiate Programming Contest on Nov. 3, placing first at the UT Martin local site. Named LossNotFoundException, the team (left to right: **Marshal Hayes**, **Michael Bowman** and **Daniel Linn**) bested eight others and placed 39th out of 125 teams in the Mid-Central USA region (five states). They received Amazon Echo Dots as prizes for winning at the local site. **Dr. Thomas Watson** was the team coach. Final standings can be viewed at **mcpc18.kattis.com/standings?filter=1807**.

Nine students from the Memphis chapter of Black Data Processing Associates qualified to attend the annual BDPA National Conference in New Orleans last August. Two mobile apps were presented at the conference — Microball Gaming (by **Bryce Ellis**), a three-in-one video game with augmented reality and real-time multiplayer; and Edesia (by **Kareem Dasilva**), an app that finds nearby food trucks in real time. Ellis won second place in the app competition, receiving a $2,500 scholarship.

Three BDPA students won other scholarships (**Jada Thomas**, Monsanto Scholarship, $2,500; **Brandon Ellis**, Oracle Scholarship, $2,500; **Cody Seymour**, Oracle Scholarship, $2,500) and three students participated in judging the High School Computer Coding Competition. High school participant **Milton Turner** placed second in the Information Technology Showcase for his presentation on the risks of having a smart city. BDPA Memphis' advisor and CodeCrew Executive Director **Meka Egwuekwe** was awarded the Individual Pace Setter Award for his leadership in developing STEM education in Memphis.

Jeisson Prieto, a student from the National University of Colombia co-advised by **Dr. Max Garzon**, received a nationwide award for best capstone project in computer science and engineering. The project led to a paper presented at the International Congress on Evolutionary Computation at the 2018 World Congress on Computational Intelligence (WCCI) in Rio de Janeiro.

STUDENT NEWS (CONTINUED)

Graduate student **Maminur Islam** had a paper accepted to the Association for the Advancement of Artificial Intelligence (AAAI) 2019 conference, a premier AI conference. The paper, "On Lifted Inference using Neural Embeddings," is on learning neural representations for symbolic probabilistic models and is a joint work with Adobe Research collaborator **Somdeb Sarkhel** and research advisor **Dr. Deepak Venugopal**. This year AAAI had a record number of submissions (more than 7,500), and the acceptance rate was only about 16%.

PhD student **Nabin Maharjan** had a paper nominated for the Best Student Paper Award at the 31st International Florida Artificial Intelligence Research Society Conference (FLAIRS-31). The paper, entitled "Discovering Effective Tutorial Strategies in Human Tutorial Sessions," was co-authored with research advisor **Dr. Vasile Rus** and PhD student **Dipesh Gautam**.

In the fall, the Department's student chapter of the Association for Computing Machinery received a $300 gift from the University of Memphis Ambassadors program at International Paper. An IP representative stated, "We recognize the importance of this student organization and how it helps prepare students for job opportunities at International Paper."

A team of UofM undergraduates took first place in the Department of Energy Cyber Defense Competition held at Oak Ridge National Lab in April of 2018. All five students are with the Center for Information Assurance under faculty advisor and CfIA director **Dr. Dipankar Dasgupta**. "Our student team demonstrated excellent performance in this competition by protecting the assigned network from red team attacks, showing their skills in multi-level cyber defense and the specialized education they receive at the University of Memphis," said Dr. Dasgupta. "We are all proud of our students' continued success for the last few years."

The team is pictured from left to right: Dr. Dasgupta, **Craig Miller**, **McKittrick Swindle**, **Jon Cobb**, **John Hardin** and **Coby Glass**.

Machine Learning, a new student organization, was officially created in the spring. Members consist of people from many different fields, including Computer Science, mathematics, engineering and others. The group is advised by **Dr. Deepak Venugopal** and has a website at **mluofm.github.io**.

ALUMNI NEWS

Former M.S. Applied Computer Science student **Charles Lancaster, Jr.** received the 2017 Sedgwick Most Valued Performer Award. Lancaster, who is currently an IT systems analyst technician, joins 52 other Sedgwick colleagues from the U.S., Canada, UK and Ireland who were recognized for exemplary performance of their duties. In addition to the MVP Award, Lancaster received Sedgwick's prestigious 2017 Diamond Award.

Steve Ash (PhD '17, MS '12) co-wrote an Amazon Alexa blog post (**developer.amazon.com/blogs/alexa/post/ ec66406c-094c-4dbc-8e9f-01050b27d43d/automatic-transliteration-can-help-alexa-find-data-across-language-barriers**) about the work he's doing as a senior machine learning engineer in the Amazon Web Services AI organization. The post, titled "Automatic Transliteration Can Help Alexa Find Data Across Language Barriers," describes a machine learning system that was developed to automatically convert a name from one language script to another. The work was also presented in a paper at the 27th International Conference on Computational Linguistics (COLING 2018).

ALUMNI SPOTLIGHT: RAJENDRA BANJADE

Rajendra Banjade completed his PhD in the summer of 2017 at the UofM working with **Dr. Vasile Rus** on natural language processing (NLP) and machine learning. He is working as a senior data scientist at Audible (Amazon) in New Jersey.

During the summer of 2016, Banjade worked as an intern on the Data Science team at Audible, an Amazon company and a global producer and seller of spoken audio entertainment. Banjade worked on improving audiobook recommendation systems and analyzing the full text of the titles in the Audible catalog. He developed scalable and effective recommendation algorithms using advanced language modeling concepts. In this work, he was inspired by his previous research in the NLP field, where language models are used to predict the next word in a sequence of words. One of his recommendation algorithms has since been used in production, serving millions of customers. In addition, Banjade worked on analyzing the full text of titles in the Audible catalog in order to categorize the content and identify how different titles can be linked together.

His manager at Audible, Dr. Dan Stefanescu, praised Banjade's work: "The applied research Rajendra conducted during his internship in 2016 laid down the foundation for a series of algorithms and tools that are now in production internationally, and which greatly enhance customer satisfaction and business insights. This remarkable work eventually led to a permanent senior position on the Audible Data Science team."

RECENT JOB PLACEMENTS

Austin Henley accepted a tenure-track faculty position in the Department of Electrical Engineering and Computer Science at the University of Tennessee, Knoxville.

Daya Ram Budhathoki is at Google.

Rojina Maharjan is at FedEx.

Sharif Mehedi Tanmay is at Sandow.

Ayushi Mehta performed an internship at Intel.

Miguel Betances Lee is at ALSAC/St. Jude.

Benjamin Brown is at FedEx.

Jon Cobb is at Methodist LeBonheur Healthcare.

Chase Cook is at SmartBear Software.

Robert Edstrom is at Discover.

Brianna Frye is at SmartBear Software.

Eric Gladden is an instructor at Persevere.

William Jabbour is at FedEx.

Duy Pham is at Jackson Labs, a Boston biotech firm.

McKittrick Swindle is at Methodist LeBonheur Healthcare.

Matthew Weihl is at Lockheed Martin.

Berkeley Willis is at Discover.

SPRING, SUMMER AND FALL 2018 GRADUATES

PhD

Austin Henley (advisor: Dr. Scott Fleming) –
Thesis: "Human-Centric Tools for Navigating Code"

Kul Subedi (advisor: Dr. Dipankar Dasgupta) –
Thesis: "A Framework for Analyzing Advanced
Malware and Software"

MS

Ravi Bhattarai (advisor: Dr. Max Garzon)

Daya Ram Budhathoki
(advisor: Dr. Dipankar Dasgupta)

Adithya Chakilam (advisor: Dr. Nirman Kumar)

Craig Kelly (advisor: Dr. Lan Wang) – Thesis: "Parallel
Adaptive Collapsed Gibbs Sampling"

Rojina Maharjan (advisor: Dr. Vasile Rus)

Sharif Mehedi Tanmay
(advisor: Dr. Deepak Venugopal)

Duy Pham (MS Bioinformatics, advisor: Dr. Max
Garzon) – Thesis: "Genomic Methods for Bacterial
Infection Identification"

Anjana Tiha (advisor: Dr. Vasile Rus)

BS

Alex Austin	Richard DeSaussure	Andrew Hayes	Patrick Neal
Miguel Betances Lee	Kyle Drennen	William Jabbour	Kendrick Nelson
Clayton Bolding	Paul Edwards	Christopher Kent	Robert Rogers
W. John Britton	Samantha Elkouz	Brennan Kersey	Benjamin Sell
Benjamin Brown	Brianna Frye	Jason Kolwyck	Maxwell Skenandore
Nickolas Chastain	Amanda Garner	Daniel Linn	McKittrick Swindle
Jon Cobb	Eric Gladden	V. Sai Manikonda	Jimmy Vuong
L. Chase Cook	Coby Glass	Terrell Martin	Daniel Waldrop
Damian Coomes	Naim Hakeem	Tyler Miles	Matthew Weihl
James Craft	Joshua Hatcher	Clifford Montjoy	Da Ziang

SUPPORTING THE DEPARTMENT

The department has been fortunate to receive several generous gifts from donors. Gifts can endow professorships, scholarships, fellowships, classrooms and labs for our students. They can also be used to help defray travel expenses for conferences to present research papers as well as many other activities that are extremely meaningful to our students and the Memphis community.

If you are interested in making a tax-deductible donation, please visit the University of Memphis Giving site at **bit.ly/2wFQwim**. Select "All CAS Funds" at the top, then "Computer Science Discretionary Fund."

Your support is greatly appreciated!

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