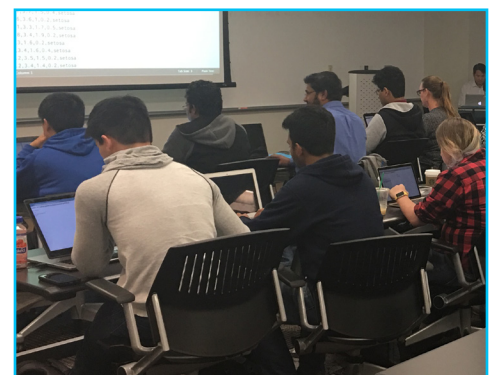## DEPARTMENT HOSTED PYTHON DATA SCIENCE WORKSHOP

From Oct. 14-16, the department hosted a workshop on Python programming for data science.

Taught by **Professor Vinhthuy Phan,** the workshop started with basic Python programming and progressed to processing of text files, data visualization and analysis, and machine learning. There were a total of 46 attendees, including 10 professionals and 36 students.

The workshop was a success, with attendees giving very positive feedback about the event. The majority indicated that they found the workshop extremely helpful and are extremely likely to attend a similar event in the future.

Professor Phan gave a second Python workshop exclusively to FedEx employees in November 2016. This more advanced workshop focused on practical data analysis and data science. Participants learned how to use powerful libraries such as scikit-learn to create models and make predictions based on large datasets.

NEW FACULTY

The department welcomed three new faculty members for the fall 2016 semester.

DR. NIRMAN KUMAR *(above left)* joins us as an assistant professor. Professor Kumar completed his Ph.D. in 2014 at the University of Illinois, Urbana-Champaign, and he was afterwards a postdoctoral research scholar in the Center for Geometric Computing at the University of California, Santa Barbara. His research interests are broadly in algorithms and computational geometry.

DR. THOMAS WATSON *(above center)* is also joining us as an assistant professor. Professor Watson completed his Ph.D. in 2013 from the University of California, Berkeley, and he has since been a postdoctoral research scholar at the University of Toronto. He brings his expertise in computational complexity theory and theoretical computer science in general.

DR. FATIH SEN *(above right)* joins us as an instructor. Sen holds a Ph.D. in computer science from the University of Arkansas, Little Rock, and he has worked as a biomedical informaticist at Le Bonheur Children's Hospital in Memphis.

NEW NAMED DATA NETWORKING GRANT

Professor Lan Wang is part of a team that received a $2.5 million NSF CRI grant that began Sept. 1. The "CRI-New: Collaborative: Building the Core NDN Infrastructure" project (with U. Arizona, UCLA, and Washington University at St. Louis) aims to support the evaluation, experimentation, and further development of the Named Data Networking (NDN) architecture. The NDN project has received over $16 million of NSF funding since 2010.

THE UNIVERSITY OF **MEMPHIS**®
Department of Computer Science

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CHAIR'S MESSAGE

With interest and enrollment in computer science at their highest levels in nearly a decade, last fall has been an exciting semester for our department. Our research visibility has continued to grow, with more than $20M in currently funded grants including new major awards in cyber security, Internet architecture and data cyberinfrastructure.

Our instructional programs are expanding: we recently added a graduate certificate in data science, and we will introduce an undergraduate concentration in cyber security starting in fall 2017. In addition, we have been able to better serve our students by offering the majority of our core undergraduate courses every fall and spring semester.

We have stepped up our outreach activities within the Memphis community, with several summer programs for middle and high school students, an ongoing partnership with Memphis nonprofit CodeCrew to teach high school students game development with Unity 3D, and a Python data science workshop for students and working professionals.

We welcomed two new tenure-track and one teaching faculty last fall and are expecting an additional tenure-track member in the spring. This will be followed by at least one more tenure-track and one more teaching faculty beginning in fall 2017. I look forward to continuing our growth over the next few years!

Lan Wang
Professor and Department Chair

RESEARCH FUNDING

The department has more than $20 million in currently funded research grants; the list is available at memphis.edu/cs/research/active_grants.php

UofM TO LEAD $4M NSF CYBERINFRASTRUCTURE PROJECT

Professor Santosh Kumar is the PI on a new $4 million data cyberinfrastructure grant from NSF.

The UofM will lead a team of researchers from three other universities — UCLA, UC San Francisco, and University of Pennsylvania — on the project, entitled **"mProv: Provenance-based Data Analytics Cyberinfrastructure for High-frequency Mobile Sensor Data."** Other collaborators on the project include Open mHealth, Open Humans and Quantified Self.

The mProv cyberinfrastructure will annotate high-frequency mobile sensor data with data source, quality, validity and semantics to enable sharing of such data with the wider research community. This will help unleash the potential of mobile sensor data to improve health and wellness on an individual level by developing computational models of human health and behavior.

Professor Kumar is also the PI on the NIH-funded Center of Excellence for Mobile Sensor Data-to-Knowledge **(MD2K)**, also involving UCLA and UCSF. The open-source software developed by MD2K allows any researcher to collect, analyze, and interpret high-frequency sensor data from the natural environment. However, research with such sensor data is still out of reach for most researchers; it involves significant resources and expertise to acquire sensors, obtain study approva and recruit human subjects before collecting the data.

Kumar said, "With the mProv provenance cyberinfrastructure complementing MD2K's software, investigators can collect, curate, analyze and interpret mobile sensor data, as well as share data. Doing so can amplify the research utility of their data and, most importantly, help establish benchmarks and bring reproducibility, which are key to scientific rigor."

The mProv: Provenance-based Data Analytics Cyberinfrastructure for High-frequency Mobile Sensor Data project is part of the National Science Foundation (NSF) Data Infrastructure Building Blocks **(DIBBs)** program and Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21) initiative.

Press releases for this new project are available from **Congressman Steve Cohen's website.**

TENNESSEE HIGHER EDUCATION COMMISSION GRANT

The department will be involved in a $75,000 2017 Improving Teacher Quality grant from the Tennessee Higher Education Commission to develop online CS education modules for middle school students.

The grant will focus on the development of five online modules by teachers in Hardeman County Schools, Hardin County Schools and the Jackson-Madison County School System. The module development will culminate in a series of Summer 2017 workshops to familiarize all middle and high school teachers in the participating school districts with the material.

The UofM faculty involved include:

Professor Lee Allen from the Department of Instruction and Curriculum Leadership will oversee the project and coordinate the summer workshops.

Professor Stephanie Ivey from the Department of Civil Engineering will be primarily responsible for the delivery and dissemination of the online modules, using the existing West TN STEM Hub online resources.

Kriangsiri Malasri from the Department of Computer Science will serve as a content reviewer for the teacher-developed online modules.

SUMMER 2016 GRADUATES

PHD
Daqi Dong
Nam Sy Vo

MS
Tara Baniya
Hari Charan
  Cheekati
Yehui Liu
Kul Subedi
Minsheng Zhang

BS
Daniel Ault
Torbir Dhaliwal
Josh Restuccio
Bryce Sharp
Tyrin Whitfield-
  Anderson
Caleb Williams
Denzel Young

FALL 2016 GRADUATES

PHD
Mustafa Hajeer
Abhijit Nag
Hillol Sarker

MS
Sharifa Begum
Saikat Das
Shanshan Gao
Swaroop Goli
Ruthvik Gopidi
Ruchi Ruchi
John Shrein
Sujit Shrestha
Parya Zareie

BS
Herve Aniglo
Joseph Ciskowski
Khadeidre Dean
Lucas Garcia
 Roma Novoa
Nicholas Gordon
Gregory Lawrence
Aaron Marshall
W. Cannon Moyer
Corderrius Muse
Kevin Williams

2017 SUMMER CAMPS

The department will tentatively host several summer camps for middle and high school students. Keep an eye on our website at www.memphis.edu/cs for details!

The Creative Game Design Camp will give an introduction to game design and programming. Historically, this camp has used the RenPy visual novel framework for Python.

Pending grant approval, we will hold at least one NSA-sponsored GenCyber

Boot Camp to introduce cyber security with interactive activities, guest speakers and campus facility tours. In 2016, GenCyber camp attendees got to create their own software projects using App Inventor and Scratch.

As an official chapter of 100 Girls of Code, we will continue holding free one-day coding workshops for girls ages 10-18. Two to three summer dates are likely. Past workshops have covered Scratch, HTML/CSS, JavaScript, App Inventor, and Python.
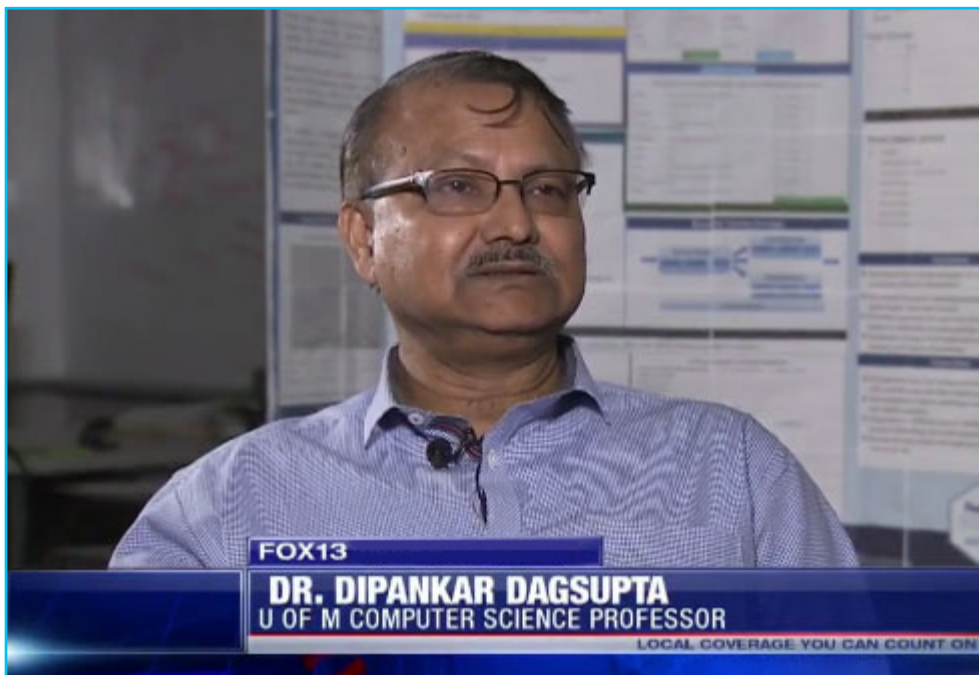
UofM WILL SHARE $3 MILLION DHS/FEMA CYBER SECURITY GRANT

The National Cybersecurity Preparedness Consortium (NCPC), of which the UofM's Center for Information Assurance (CfIA) is a core member, has been awarded a $3 million grant from DHS/FEMA to develop and deliver cyber security training as part of the Continuing Training Grants (CTG) program.

For this collaborative project, CfIA will receive a sub award of $500,000 for three years to develop research-based best practices for cyber identity and authentication. The project will deliver a unique and innovative approach with "tabletop" scenarios supplementing the online training to demonstrate participants' knowledge and skillsets to protect and defend systems with different authentication tools and techniques. The online training will assist state and federal jurisdictions with coordination and management of response efforts between emergency response organizations and critical infra-structure IT personnel necessary to prevent cyber incidents.

The NCPC core members are the UofM, University of Texas at San Antonio, Texas A&M University, University of Arkansas and Norwich University. Under the leadership of Professor Dipankar Dasgupta, the UofM's CfIA has been at the forefront of cyber security research in the Mid-South region.

MEDIA EXPOSURE

FOX13
DR. DIPANKAR DAGSUPTA
U OF M COMPUTER SCIENCE PROFESSOR
LOCAL COVERAGE YOU CAN COUNT ON

PROFESSOR DASGUPTA FEATURED ON LOCAL NEWS

Professor Dipankar Dasgupta, director of the Center for Information Assurance, was featured on a Nov. 22 FOX 13 Memphis news story about cell phone privacy concerns.

In the newscast, Professor Dasgupta indicated that sharing cell phone numbers adds to users' digital footprint, as well as making them more susceptible to fraud. Unlike Social Security numbers, cell phone numbers are not legally regulated. The full newscast is available from the FOX 13 Memphis website at http://www.fox13memphis.com/top-stories/fox13-investigates-how-giving-your-cell-phone-number-out-can-put-you-at-risk/469494136.

Professor Dasgupta was also featured on a WMC Action News 5 segment in June, publicizing the GenCyber Boot Camp for middle-school students. That clip can be seen at http://www.wmcactionnews5.com/clip/12567144/watch-gencyber-bootcamp-with-dipankar-dasgupta.

PROFESSOR SANTOSH KUMAR FEATURED IN ARTICLES AROUND THE WEB

Professor Santosh Kumar has had his work with the mHealth Systems Lab featured in several recent news articles.

The Commercial Appeal featured some recently published results on the NIH-sponsored MD2K project, which aims to use data from wearable sensors to improve patient health. The paper, "Finding Significant Stress Episodes in a Discontinuous Time Series of Rapidly Varying Mobile Sensor Data," focuses on identifying stress episodes in opioid-dependent drug users. The work was presented at the ACM CHI'16 conference.

A BuzzFeed article on wearable stress sensors includes input from Professor Kumar, referring to his UbiComp '15 work on finding the best metrics to assess stress levels. Although that work concluded that heart activity and respiration are the best indicators, getting reliable stress measurements remains a challenge.

EurekAlert highlighted a paper coauthored by Professor Kumar in the June 2016 issue of IEEE Computer, summarizing the privacy and security challenges facing mobile health.

MD2K FEATURED AS COVER STORY ON MIT TECHNOLOGY REVIEW

MD2K
Center of Excellence for
Mobile Sensor
Data-to-Knowledge

The MD2K project was featured as a top story on MIT Technology Review.

MD2K, the Center of Excellence for Mobile Sensor Data-to-Knowledge, is a project headquartered at the UofM spanning 11 universities and Open mHealth. Broadly speaking, the program's goal is to use data from wearable sensors to improve patient health.

MD2K is under the direction of Professor Santosh Kumar and is funded by a $10.8 million grant from the National Institutes of Health.
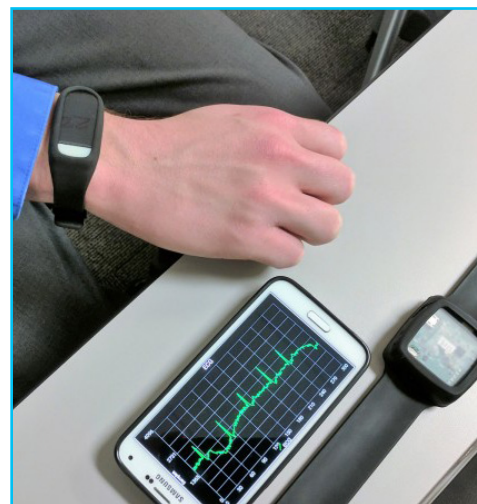
FACULTY & STAFF ACCOLADES

PROFESSOR DIPANKAR DASGUPTA
Received a $20,000 technology inventor grant from the Office of Technology Transfer of the FedEx Institute of Technology in November 2016.

PROFESSOR SCOTT FLEMING
Finalist for the 2016 Alumni Association Distinguished Teaching Award.

PROFESSOR SANTOSH KUMAR
Delivered the keynote address at the Fall 2016 UofM general faculty meeting. He discussed the Center of Excellence for Mobile Sensor Data-to-Knowledge (MD2K) that he directs, an NIH-funded project spanning 11 universities and Open mHealth headquartered at the UofM. Since its inception in September 2014, MD2K has made a tremendous impact on the research community, with 200+ published articles, $17 million of research funding through NIH and NSF, and 70+ scholars trained during the 2016 Summer Training Institute.

KRIANGSIRI MALASRI
Finalist for the 2016 Alumni Association Distinguished Teaching Award.

PROFESSOR VASILE RUS
Awarded a Dunavant Professorship from the UofM College of Arts and Sciences. His research interests lie at the intersection of artificial intelligence, machine learning and computational linguistics with an emphasis on developing interactive intelligent systems based on strong theoretical findings in order to solve big challenges such as automatically answering questions from large collections of documents, furthering the effectiveness of educational technologies such as intelligent tutoring systems, increasing the pace of discovery in biomedical domains, developing interactive systems that optimize the effectiveness of substance abuse treatments or improving the quality of very large software projects.

PROFESSOR LAN WANG
Had a patent for "Devices and Methods for Forwarding Information Base Aggregation" issued on Nov. 8, (US Patent 9,491,087). This a joint patent with collaborators at University of Arizona (Beichuan Zhang, Xin Zhao) and former student Yaoqing Liu, who is an assistant professor at Clarkson University.

Co-chairing the Program Committee of the 3rd Named Data Networking Community Meeting. NDNcomm 2017, which will be held at the University of Memphis from March 23 - 26, 2017, at the FedEx Institute of Technology (www.caida.org/workshops/ndn/1703/). This meeting is open to anyone interested in the new data-centric Internet architecture NDN.

Serving on the Organization Committee of ACM SIGCOMM 2017 as a Travel Grant Co-chair.

Gave a presentation entitled "Named Data Networking of Things" at the NIST Workshop on Named Data Networking (www.nist.gov/news-events/events/2016/05/workshop-named-data-networking) on May 31, 2016.

Promoted to full professor.

KENDRA TILLIS, BUSINESS OFFICER II
Received a 10-year service award.

RESEARCH PAPER ACCEPTANCES AT MAJOR CONFERENCES

Professor Scott Fleming and Austin Henley, along with collaborators from Oregon State, have had a full research paper accepted at ACM FSE'16, one of the two top software engineering conferences.

Nazir Saleheen and Soujanya Chatterjee (from Professor Santosh Kumar's mHealth Systems Lab) have one paper each in ACM UbiComp'16 as lead authors.

Nazir Saleheen is also a co-author on an ICML'16 paper with collaborators from the University of Massachusetts - Amherst.

Hillol Sarker (from Professor Santosh Kumar's mHealth Systems Lab) had a paper in ACM CHI'16 as lead author.

Professor Deepak Venugopal and Kyle Cherry presented a full paper at UAI'16, the premier conference for probabilistic models.

Professor Deepak Venugopal has had two papers accepted at COLING 2016, one of the premier conferences on natural language processing. The papers are "Joint Inference for Mode Identification in Tutorial Dialogues," based on collaborative work with Professor Vasile Rus, and "Joint Inference for Event Coreference Resolution," based on collaborative work with HLTRI at UT Dallas. Both papers apply Markov logic were presented at the conference this December in Osaka, Japan.

Professor Lan Wang has a paper accepted by IEEE INFOCOM 2017: "M. Zhang, V. Lehman, L. Wang, "Scalable Name-based Data Synchronization for Named Data Networking", to appear in IEEE INFOCOM 2017.

NETWORKING RESEARCH LAB NEWS

Students working on an NDN hackathon project with Anil Jangam from UMBC

We have two new papers published this year and one paper accepted by IEEE INFOCOM 2017.

V. Lehman, A. Gawande, R. Aldecoa, D. Krioukov, B. Zhang, L. Zhang, L. Wang, "An Experimental Investigation of Hyperbolic Routing With a Smart Forwarding Plane in NDN," in Proceedings of the IEEE IWQoS Symposium, June 2016

J. Cao, D. Pei, Z. Wu, X. Zhang, B. Zhang, L. Wang, Y. Zhao, "Improving the Freshness of NDN Forwarding States," in Proceedings of IFIP Networking, May 2016

M. Zhang, V. Lehman, L. Wang, "Scalable Name-based Data Synchronization for Named Data Networking", to appear in IEEE INFOCOM 2017, March 2017

Our students participated in the 3rd NDN Hackathon in Nov. 2016 at Colorado State University. Nick Gordon and Laqin Fan won the Best Internal Impact for their project "nlsrSIM"

We released version 0.3.0 of Named-data Link State Routing Protocol (NLSR) and 0.2.0 of Mini-NDN in August 2016. More information about NLSR and Mini-NDN can be found at **http://named-data.net/doc/NLSR/0.3.0/** and **https://github.com/named-data/mini-ndn.**

STUDENT NEWS

BEST PAPER AWARDS

PhD student **Austin Henley** *(above left)* and **Professor Scott Fleming** *(above center)* are authors of a paper that received the **ACM SIGSOFT Distinguished Paper Award** (DPA) at FSE 2016.

The DPA recognizes exemplary work in up to 10% of accepted FSE papers. Out of this year's 74 accepted full-length research papers, seven were selected to receive the award. The paper, "Foraging and Navigations, Fundamentally: Developers' Predictions of Value and Cost," is joint work with researchers from Oregon State University.

Last year, Austin and Dr. Fleming also won the Best Paper Award at **VL/HCC 2016**. That paper, "Yestercode: Improving Code-Change Support in Visual Dataflow Programming Environments," is based on work supported by National Instruments and conducted on-site there.

PhD student **Nazir Saleheen** *(above right)* received an Honorable Mention at **ACM UbiComp 2016.** The Honorable Mention indicates that the paper was nominated for the conference's Best Paper award. The paper, "mSieve: Differential Behavioral Privacy in Time Series of Mobile Sensor Data," has Nazir as the lead author and also involved contributions from UofM visiting research assistant professor **Nasir Ali**; graduate students **Md Mahbubur Rahman**, **Syed Monowar Hussein** and **Rummana Bari**; and **Professor Santosh Kumar.**

IGNITECS GRANT FROM GOOGLE

Undergraduates **Herve Aniglo** and **Kareem Dasilva** have received a $10,000 grant from Google's **igniteCS** program to hold a drone programming camp starting in April 2017.

The camp will target middle school students from underserved Memphis communities such as Orange Mound. The igniteCS funds will cover Patriot AR drones, which camp participants will program using the Node.js library. The camp will also include Web development with Wordpress and communication/presentation skills.

Memphis nonprofit **CodeCrew** is a partner in the project, and CodeCrew Executive Director **Meka Egwuekwe** is serving as the project's igniteCS advisor.

We are currently seeking mentors/volunteers for the camp, which will run from April 6 – May 5. Volunteers do not need any prior experience in drone programming; they just need to dedicate five Saturdays from 9:00 a.m. – 4:00 p.m. each day. Interested people can contact Herve at **haniglo@memphis.edu** for more information.

CENTER FOR INFORMATION ASSURANCE STUDENT HIGHLIGHTS

The Center for Information Assurance (CfIA) has established a successful student-centered research environment involving both undergraduate and graduate students in several federal-funded projects. The Center has continually maintained its designation as a National Center for Academic Excellence in Information Assurance/Cyber Defense Education (CAE-CD) and in Research (CAE-R) by the National Security Agency (NSA) and the Department of Homeland Security (DHS).

2016 STUDENT SUCCESS STORIES:
CyberSEED 2016 was hosted by the University of Connecticut on October 10-11. Four UofM students attended the CyberSEED Challenge, which included three types of security challenges: (1) capture the flag (CTF), (2) social engineering challenges and (3) secure coding. The UofM team, named nu11t3st3r, had an outstanding performance, placing 7th out of 30 teams from around the country. Competition results are posted at https://ctftime.org/event/371.

UofM students participated in the CANSec (Central Area Networking and Security) cyber defense competition held on Oct. 2 in St. Louis. The team received third place in the one-day event.

The NSA Codebreaker Challenge provides students with a hands-on opportunity to develop their reverse-engineering/low-level code analysis skills while working on a realistic problem set. There are six different levels or "tasks" to the challenge, with each one being progressively more difficult and building off of the previous tasks. Our student team has so far solved four of the six tasks.

Graduate students **Abhijit Nag** and **John Shrein**, along with undergraduates Irfanur Rahman and McKittrick Swindle, participated in the A-MFA project which resulted in a prototype development for Tech Transfer. A patent application has been submitted for this research, and a licensing agreement is underway with a company. A video highlighting the features of A-MFA is available at https://www.youtube.com/watch?v=x7i2w5vfzYY.

SPONSORING DEPARTMENTAL SCHOLARSHIPS

Your generous support helps us offer scholarships that are potentially life-changing for our students. We currently offer the Peter I. Neathery Scholarship/Fellowship to both undergraduate and graduate students. We are also planning to start a new Diversity in Computer Science Scholarship to encourage underrepresented groups including women, African-American and Hispanic students, to pursue undergraduate studies in computer science. Donations are tax-deductible and can be made online at https://umwa.memphis.edu/new_giving/index.php/donation. Please select Choose from a list of areas to support > Colleges and Schools > College of Arts and Sciences > **Computer Science Discretionary Fund** when making a donation. Thank you!

SUMMER AND FALL 2016 INTERNS

Last summer and fall, several UofM students were awarded internship positions at local and national companies, including ALSAC/St. Jude, AutoZone, Facebook, FedEx, Intel and International Paper. A full list is available at http://www.memphis.edu/cs/career_opportunities/past_interns.php.
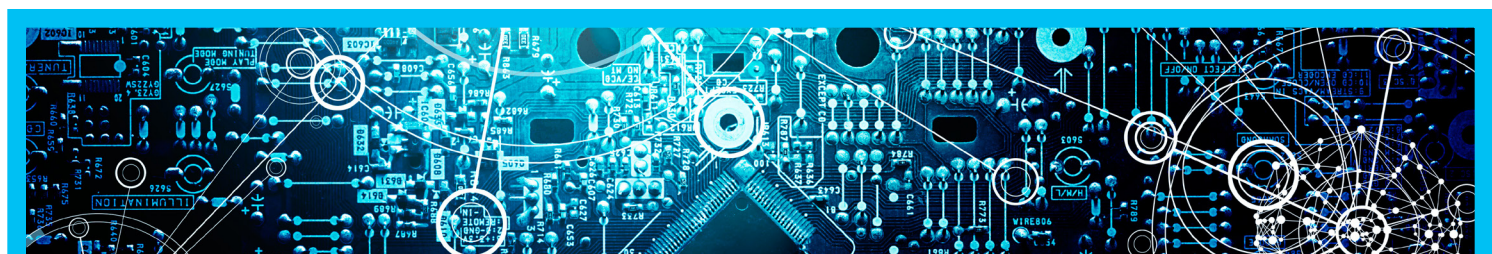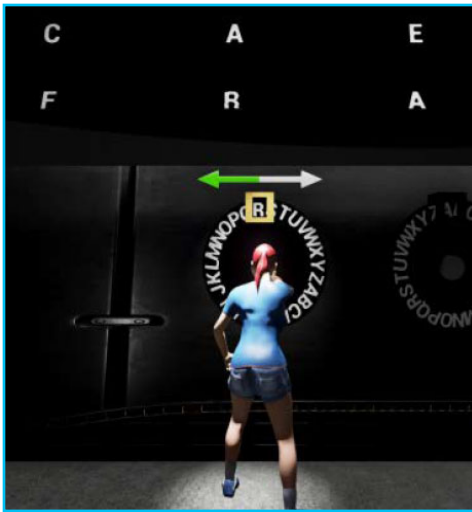
Undergraduate students **Robert Edstrom** and **Aaron Marshall** worked with graduate students on an NSF-funded research project to develop innovative games to teach cybersecurity concepts, enabling critical thinking through solving complex puzzles. A multi-level PBL game has been developed using the Unreal 3D game engine. We demonstrated and distributed the PBL software at three national conferences in 2016 and received excellent feedback on our cybersecurity education research. Further details on this project are available at http://www.memphis.edu/cfia/pbl-sec/index.php.

Two undergraduate students received awards for their poster presentations at the 12th Annual Computer Science Research Day held last April. **Robert Edstrom** got 1st place for his research entitled "Puzzle-Based Learning in Cyber Security Education," and **Berkeley Willis** (with graduate partner Sujit Shrestha) received 3rd place for his research on "Web Application Security Exercise and Testing Platform."

UofM STUDENTS COMPETE IN ACM ICPC

Several UofM undergraduates participated in the regional division of the ACM International Collegiate Programming Contest (ICPC) last November at Rhodes College. The students were: **Herve Aniglo**, **Kareem DaSilva**, **Demetrius Gregory**, **Caleb Miller**, **Albert Nguyen**, **Ryan Nguyen**, **Joseph Blasingame**, **Robert Edstrom**, and **Berkeley Willis. Professor Tom Watson** was the faculty coach.

TIGERCREW BRINGS GAME DEVELOPMENT TO LOCAL HIGH SCHOOL STUDENTS

Four Computer Science undergraduates (**Allen Dorris, Kyle Kalmon, Matt McCullar** and **Alex Ziegenhorn**) are involved in the ongoing TigerCrew project, a partnership with Memphis nonprofit CodeCrew to have UofM undergraduates teach game design to high school students. The students are using the Unity 3D game engine to introduce these high schoolers to computer science concepts.

TigerCrew is funded with a $18,500 grant from the Strengthening Communities Initiative (SCI), sponsored by the UofM's School of Urban Affairs and Public Policy. CS faculty **Professor Vinhthuy Phan** and **Kriangsiri Malasri** were involved in the grant application.

Department of Computer Science