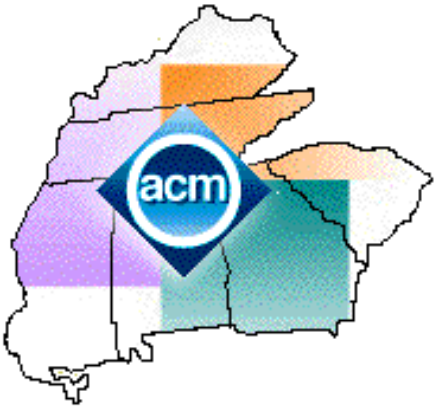
Fall Conference Proceedings

Mid-Southeast Chapter

of the ACM

Gatlinburg, Tennessee
Nov. 14-15, 2019

Mid-Southeast Chapter



of the ACM

For information on the 2019 Fall Conference, select the conference link from the official chapter website: www.acmmidsoutheast.org

Table of Contents

Message from the Chapter Chair

On behalf of the Mid-Southeast ACM Chapter, it is my privilege to welcome you to our sixty-first Fall conference. We are one of the oldest conferences in computer science, which stands to reason as the general-purpose electronic computer only predates us by 13 years. We were founded just as vacuum tubes were giving way to transistors, and integrated circuits were on the verge of mass production. We have met in East Tennessee during almost every major technological advance that our field has seen, and yet we remain a small and friendly conference. Many of you, like me, return here year after year. We all seem to know each other, and yet we also have a reputation for making newcomers feel welcome.

We have a proud set of traditions in this chapter, chief among which is welcoming computer scientists at all stages in their careers. I, like many before me, have experienced this first hand. When I was an undergraduate at MTSU, I gave my first research presentation right here in the Glenstone. I had completed a small computer architecture project, and I nervously shared it with my kind audience in Dogwood I. I still remember how frightened I was in the time leading up to that presentation, and how relieved I felt when it was over. After my talk, however, I decided I was hooked. I knew then, and there I wanted to make research a part of my life. Throughout my graduate school career at UT, I brought preliminary findings to this conference and received valuable feedback that helped in securing publications. As a professor, I have always found new teaching methods and delighted in sharing my own innovations with my colleagues. Throughout each step of my own journey, this conference has been the one I look forward to the most.

I hope you will find the same nurturing experience this weekend, and in the years to come. If you are here to give your first presentation, I hope you take the time to savor the experience. For the graduate students among us, I hope you will have a rewarding experience and that you make the acquaintance of many future colleagues. For my fellow professors, I look forward to swapping battle stories with you in the hospitality suite this evening! Most of all, I would like to urge everyone to look over the many abstracts and names in these proceedings. We truly have a cross-section of our diverse field, with the names of seasoned scientists alongside the researchers of the next generation. This is a rare sight, and perhaps the best part of our annual meeting.

Robert Lowe -- Maryville College

ACM Mid-Southeast Chapter Officers

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Chair

Mir Hasan, *Austin Peay State University*

Undergraduate

Xiangdong An, *Univ of Tennessee at Martin*

Saeid Samadidana, *Austin Peay State University*

Craig Tanis, *University of Tennessee Chattanooga*

Khem Poudel, *Middle Tennessee State University*

David Luginbuhl, *Samford*

Karen Carter, *University of Virginia*

Graduate

Greg Kawell, *Samford*

Yingbing Yu, *Austin Peay State University*

Conference Session Chairs

Azalea

Session I: Karen Carter – *University of Virginia*

Session II: Craig Tanis – *UTC Computer Science and Engineering*

Session III: Mir Hasan – *Austin Peay State University*

Session IV: David Luginbuhl – *Samford*

Dogwood I

Session I: Khem Poudel – *Middle Tennessee State University*

Session II: Saeid Samadidana – *Austin Peay State University*

Session III: Posters

Session IV: Posters

Dogwood II

Session I: Yingbing Yu – *Austin Peay State University*

Session II: Greg Kawell – *Samford*

Session III: Xiangdong An – *University of Tennessee at Martin*

Session IV: No Presentations

Highlander I

Session I: Mellissa Wiggins - *Mississippi College*

Session II: Robert Lowe - *Maryville College*

Session III: James Church – *Austin Peay State University*

Session IV: No Presentations

Highlander II

Session I:	James Church – *Austin Peay State University*
Session II:	Bob Bradley – University of Tennessee at Martin
Session III:	Sahithya Reddivari – Georgia State University
Session IV:	No Presentations

Notes

ACM Mid-Southeast Chapter
2019 Fall Conference
Gatlinburg, Tennessee
Glenstone Lodge

Conference Program

Thursday, November 14, 2019

4:00 – 6:00 p.m.	**Registration**
6:00 – 7:30 p.m.	**Social Meeting, Hospitality Suite**
7:30 – 9:00 p.m.	**Dinner — (Individual Arrangements)**
9:00 – 11:00 p.m.	**Social Gathering, Hospitality Suite**

Friday, November 15, 2019

7:30 – 9:00 a.m.	**Registration**
7:30 – 8:00 a.m.	**Morning Coffee**
8:00 – 8:10 a.m.	**Welcome/Announcements — Azalea**
	Welcome Chapter Chair
	Conference Announcements Conference Chair
	Program Announcements Program Chair
8:10 – 9:00 a.m.	**Keynote Address**
9:00 – 9:15 a.m.	**Coffee Break**

Session I: **9:15 – 10:35 a.m.**

Azalea: **Undergraduate Student Presentations**

Session Chair: Karen Carter

9:15 – 9:35 *Color Buddy*
Christina Hinton and Lukas Saul

9:35 – 9:55 *Implementing Artificial Intelligence for Noise Filtering in Small-Scale Motion Sensor-Based Platforms*
Alexander Hewitt

9:55 – 10:15 *Aerial Drone Swarm for Search and Rescue Applications*
Jordan Williams and Ali Khan

10:15 –10:35 *Introduction to Viper: A Systems Security Solution*
Cody Woods

Dogwood I: **Undergraduate Student Presentations**

Session Chair: Khem Poudel

9:15 – 9:35 *Solving WKU Parking Pains with OpenCV*
Patrick O'Boyle, Jeffrey Galloway and Austin White

9:35 – 9:55 *ThinkFast VR*
Jay Downing and Fate Hardin

9:55 – 10:15 *Applying a Math Oriented Programming Language to Solve Mathematics Education Problems*
James Ellerbee and Levar Small

Dogwood II: **Graduate Student Presentations**

Session Chair: Yingbing Yu

9:15 – 9:35 *Load Balancing of Financial Data using Machine Learning and Cloud Analytics*
Dimple Jaiswal

9:35 – 9:55 *Minimum Density of an Open-Locating-Dominating Set in the Infinite King's Grid*
Robert Dohner and Suk Seo

9:55 – 10:15 *Secure Container for Data Protection in Transit and at Rest*
Christian Bare, Bradley Northern, Vadim Kholodilo, Abhijeet Solanki, Yuliya Durova, Aleks Malkhasov, Braxton Westbrook and Denis Ulybyshev

Highlander I:	**Professional Presentations** Session Chair: Mellissa Wiggins
9:15 – 9:35	*The Effects of Information Stagnancy on Distributed Problem Solving* Saeid Samadidana
9:35 – 9:55	*AI is here … what about XAI?* Shamim Khan
9:55 – 10:15	*An Introduction to PowerShell: A Tool for Task Automation* Ken Adcock
10:15 –10:35	*Parallel and Distributed Computing Topics for Undergraduate Computer Science Curriculum* Srinivasarao Krishnaprasad

Highlander II:	**Professional Presentations** Session Chair: James Church
9:15 – 9:35	*Interaction Effects of Age, Income, Marriage and Gender on Distress* Xiangdong An and Christie Chen
9:35 – 9:55	*Generational Ethical Archetypes* Karen Carter
9:55 – 10:15	*A Multi-criteria Decision Support System for Ph.D. Supervisor Selection: A Hybrid Approach* Mir Hasan
10:15 –10:35	*Secure Coding for the New Programmer* David Frazier

Session II: 10:40 – 12:00 p.m.

Azalea: **Undergraduate Presentations**
Session Chair: Craig Tanis

10:40 – 11:00 *Assignment Keeper*
Joshua Freeman and Presson Drew

11:00 – 11:20 *Toward evading malware detection via adversarial machine learning with functionality-preserving perturbations*
Luke Koch

11:20 – 11:40 *Validating Numeric Results in a Modular Finite Element Code*
Andrew Nguyen

11:40 – 12:00 *THECR*
Garrett Hay and Nick Reid

Dogwood I: **Undergraduate Presentations**
Session Chair: Saeid Samadidana

10:40 – 11:00 *Integrating Cloud Computing into Virtual Reality Exposure Therapy in Order to Increase the Effectiveness of Combat-related Post-traumatic Stress Disorder Treatment*
Jeffrey Galloway, Shreeya Arora, Austin White and Patrick O'Boyle

11:00 – 11:20 *A Self-Driving Golf Cart: Lessons Learned from a Student-led Research Project*
Ryan Diaz

11:20 – 11:40 *PhysicsSim: An Intelligent Tutoring System to teach Kinematics*
Maidel Fletes, Mary Harrell, Taylor Woods and Paul Halford

Dogwood II: **Graduate Presentations**
Session Chair: Greg Kawell

10:40 – 11:00 *Automated Essay Evaluation using Natural Language Processing and Machine Learning*
Harshanthi Ghanta

11:00 – 11:20 *Data Mining of Social Media*
Sahana Deb

11:20 – 11:40 *Analyzing Awareness on Data Privacy*
Vernon Andrews

11:40 – 12:00 *A Study of Recent Municipal Ransomware Attacks, their Human Aspects, and Guidance for their Victims*
Hilary Hok, Gregory Bryant and Arthur Ryan

Highlander I:	**Professional Presentations** Session Chair: Robert Lowe
10:40 – 11:00	*Using GitHub in First Year Computer Science Courses* Robert Lowe
11:00 – 11:20	*Secure Communications in Industrial Control Systems* Denis Ulybyshev
11:20 – 11:40	*How to lose 159 dollars and 27 cents to a cyber thief?* Haifei Li
11:40 – 12:00	*Simple 2D Block Lighting using JavaScript and the HTML Canvas* Jeff Roach

Highlander II:	**Professional Presentations** Session Chair: Bob Bradley
10:40 – 11:00	*No-Cost/Low/Cost Educational Resources--an Alternative to Traditional Textbook: Pros and Cons* Masoud Naghedolfeizi, Nabil Yousif and Xiangyan Zeng
11:00 – 11:20	*Extracting APT Cyber Object Analytics from Cyber Threat Intelligence* Ghaith Husari
11:20 – 11:40	*Using Angular NX to share the same codebase for the front end and back end* Bob Bradley
11:40 – 12:00	*Exploring Key Concepts for an Analysis and Design Class* Denise Williams and David Williams

Lunch **Patio Restaurant 12:00 – 1:00 p.m.**

Session III 1:00 – 2:20 p.m.

Azalea: **Undergraduate Presentations**
Session Chair: Mir Hasan

1:00 - 1:20 *Smart Security Motion Detector*
Dominique Capers

1:20 - 1:40 *Cyber Ambassador Program*
Brayden Faulkner and Chris Humphreys

1:40 - 2:20 *Meta-Analysis of Biology Research Literature*
Evan Suggs

2:00 - 2:20 *Polarimetric Thermal Face Recognition Using Non-Linear Transformation*
Nhat Phan and Chunhua Dong

Dogwood I: **Posters**

Healthcare Internet of Things Solutions Architecture
William Trentham and Saeid Samadidana

Using facial recognition to secure access of facilities
Peter Keres and Maidel Fletes

Developing Measures of Effectiveness for Evaluating Dynamic Honeypots
Jason Pittman, Kyle Hoffpauir, Nathan Markle and Cam Meadows

Integrating Cloud Computing into Virtual Reality Exposure Therapy in Order to Increase the Effectiveness of Combat-related Post-traumatic Stress Disorder Treatment
Jeffrey Galloway, Shreeya Arora, Austin White and Patrick O'Boyle

Dogwood II: **Undergraduate Presentations**

Session Chair: Xiangdong An

1:00 - 1:20 *WebDocker: An Accessible Online Platform for Containers*
Lucian Freeze, Garrett Hay and Brett Whitson

1:20 - 1:40 *Chattlesnake, A chat service that communicates via web services*
Cameron Justice, Nathan Byrnes, Chris Gerspacher, Clay Sewell, Justin Wade and Khem Poudel

1:40 - 2:00 *MTConnect , A Fully Functioning Web Application*
Sam Hollingsworth, Tristan Lotivio, Cody Maness, Chaning Mullinax, Ian Seal and Khem Poudel

Highlander I:	**Professional** Session Chair: James Church
1:00 - 1:20	*Developing Programming Contest Problems* Joshua Guerin and Kathleen Ericson
1:20 - 1:40	*Document Summarization Satisfying User Query Based On Sentence Classification* Fatma Elsherif
1:40 - 2:00	*Getting Involved in Hackathons: A Faculty Perspective* Kathleen Ericson
Highlander II:	**Peer Reviewed** Session Chair: Sahithya Reddivari
1:00 - 1:20	*Digital Forensics Evidence Ethics and Critical Thinking: An Alternative to Discussion Based Pedagogy* William Confer
1:20 - 1:40	*Implementing High Performance Search Using SIMD for Cybersecurity Applications* Joe Elarde and Barry Bruster

Break **Poolside 2:20 – 2:35 p.m.**

Session IV **2:35 – 3:55 p.m.**

Azalea: **Undergraduate Presentations**
Session Chair: David Luginbuhl

2:35 - 2:55 *SimBPM: An Intelligent Business Simulation to Predict Management Styles*
Valencia Coleman

2:55 - 3:15 *Micro-benchmarking Algorithmic Sorting in C++, Java, Python*
Ethan McCrary and Douglas Ferguson

3:15 - 3:35 *Improved Viola-Jones Face Detection Method Based on Cross-Object Comparison*
Dytalyan Holmes

3:35 – 3:55 *Programming the NAO Humanoid Robot to Play "Simon Says"*
Cen Li, Ebosehon Imeokparia, Micheal Ketzner and Tsega Tsahai

Dogwood I: **Posters**
Applying Machine Learning to Develop an Adaptive Robotic System for Patients with Amputations
Hayden Richard and Saeid Samadidana
Binary Classification for Network Intrusion Detection In Drones
Sierra Wyllie and Ismail Abumuhfouz
My experience of using MongoDB for financial data management
Guangya Liu
Machine Learning based Critical Thinking Assessment Tool
Moumita Deb and Sahithya Reddivari

4:30 – 5:00 p.m. **Business Meeting, Highlander I**

5:00 – 7:00 p.m. **Social Gathering, Hospitality Suite**

7:00 – 8:30 p.m. **Awards Banquet, Azalea**

8:30 – 11:00 p.m. **Social Gathering, Hospitality Suite**

Notes

Keynote Address
Abstract

Joseph Hagerman
Oak Ridge National Laboratory

From Rural Cooperatives to Building Cybersecurity: New Thinking on Cyber Physical Resilience

Abstract

The need for cybersecurity is rapidly expanding as the Internet of Things permeates physical devices and systems. From nation state attacks, insider threats, and cyber extortion, physical systems are left vulnerable to this new era thanks to cheap connectivity. Over the years, utilities have risen to the challenge to secure their systems while also developing methods to restart their interconnected and complex networks after an attack or infection. The focus should now shift to growing good cybersecurity practices in building, manufacturing systems, and other civic infrastructure. How can utility cyber security thinking apply to building level cyber physical resilience?

Joseph Hagerman has recently transitioned from National Rural Electric Cooperative Association where he served as the Deputy Chief Scientist exploring cybersecurity research for the ~900 rural electric cooperatives serving America. Currently, Mr. Hagerman is a group leader at Oak Ridge National Lab for building integration and controls RD where he continues to apply utility cybersecurity methods to building device control (enabled through IoT). Attendees will learn about cyber physical threats within the utility space and how the knowledge of those threats can be leveraged to strengthen building level cyber and physical security in order to construct resilient control systems and interfaces.

About the Speaker

Joseph Hagerman, Joe, received his Bachelor of Architecture from Mississippi State University (MSU). Upon graduating, Joe joined MSU as a lecturer instructing architecture design studios, engaging in building research, and leading community design initiatives throughout MS and the Delta. Joe attempted, unsuccessfully, to save Fielder's Pharmacy (on Fifth Street, Meridian, MS) home to Andrew Goodman and Michael Schwerner during the Freedom Summer (depicted in "Mississippi Burning").

Joe received a Master's in Civil Engineering at the Fu Foundation School of Engineering at Columbia University in New York City. His academic work focused on engineering mechanics (in cellular mechanics and the utilization of combustion fly ash in concrete). While at Columbia, Joe worked for Steven Winter Associates in South Norwalk, CT where he focused on building materials/product development. Joe received the 2005 Metropolis Next Generation Award and the 2005-2006 Rafael Viñoly Fellow from Rafael Viñoly Architects, NYC.

Upon graduating Columbia, Joe became the project manager for the Building Technologies Group at the Federation of American Scientists (FAS) where he conducted research in new building technologies while demonstrating these technologies in the public sector (under the direction of Dr. Arthur Rosenfeld and Dr. Henry Kelly). Joe's efforts helped address environmental and energy injustices in energy-efficient, affordable construction. FAS is an DC based advocacy organization with the intent of using science and scientific analysis to attempt to make the world more secure through the public promotion of science – and the freedom/integrity of scientific research. FAS was founded in 1945 by scientists who worked on the Manhattan Project and currently includes over 60 Nobel laureates on its Board of Sponsors.

Starting in 2009, Joe served the Assistant Secretary of DOE Energy Efficient and Renewable Energy Office (EERE), Cathy Zoi, as a senior technical advisor. At EERE, he focused on building energy efficiency and new building technology development. He led DOE initiatives in

smart buildings, transactive energy & transactive controls, and building-to-grid research. Concurrently, Joe had oversight for various negotiated federal regulatory and related new initiatives -- including all activities related to emerging topics such as connected equipment, building cybersecurity, interoperability, and equipment characterization. He also directed the Building Innovators Program, which awarded innovative graduate student teams to develop market-based technology solutions. Joe was the recipient of 2016 DOE Secretary Honor Award (for work on Appliance Standards to meet the Climate Action Plan) and 2010 & 2014 DOE Distinguished Service Award.

Joe joins ORNL from National Rural Electric Cooperative Association as NRECA's Deputy Chief Scientist. At NRECA, he managed NRECA's federal research program (with funding from DOD and DOE) and research staff who develop new research offerings for NRECA members at, primarily, the Utility Distribution Level to include cybersecurity, modeling, distributed controls, and application of transactive energy concepts. Joe also worked to position NRECA and its members with federal clients and serves as the primary contact to DOE national labs and outside research groups.

Mr. Hagerman has also held positions with Booze Allen Hamilton, an American management and information technology consulting firm, and ICF International Inc, a global consulting and technology services company.

Student Abstracts
Undergraduate Degree Programs

Color Buddy

Christina Hinton and Lukas Saul
University of Tennessee at Martin

Imagine you're shopping at your favorite clothing store. You find an amazing shirt, but you don't know if it goes with anything you own. If it doesn't match anything, you will have wasted money on a shirt you'll never wear. What if there was a way to know without having to have to make any more wasteful purchases?

Color Buddy is an Android app developed with Kotlin and Firebase which helps users curate the perfect wardrobe, interior design scheme, and more. It holds color data for each item in the user's collection. When a user wants to add a new item to their collection, the user takes a picture of the object. Color Buddy forms a palette of the object's most prominent colors and, using color theory concepts, checks to see if a new item matches anything in the collection. Users are alerted if the new item matches or not, so they can make the most informed decisions.

Implementing Artificial Intelligence for Noise Filtering in Small-Scale Motion Sensor-Based Platforms

Alexander Hewitt
Columbus State University

Many home security systems, using PIR and microwave radars, often struggle with false positives, especially now when so much is done wirelessly. PIR sensors, for example, often have trouble dealing with increases in ambient heat from heaters, stoves, fireplaces, etc. False alarm rates are very high among current home security systems.

Our approach is to experiment with using neural networks to determine the differences in received microwaves/infrared waves that warrant triggering the alarm. A method in our approach aims to take the previous received signal and the current one, passing them to a forward-feeding neural network to determine if the difference warrants an alarm, with neural networks having been trained for homes in which they are set up. This differs from current home security systems, which have very high rates of false alarms. Many home security systems looking to implement artificial intelligence are attempting to do so using facial recognition cameras; however, this is expensive, complex, and requires large, possibly inconvenient cameras. Our approach should be more reliable than other motion sensor-based approaches.

Currently, the experimental approach has many limitations with regards to how the AI would be trained and the time it may take to tune hyperparameters. Some degree of symbolic AI may be implemented to guide the system's categorization to make it easier to train, as systems' behaviors must adjust to the homes in which they are set up relatively quickly to be effective. The neural networks would also have to be run on a cloud, as the nodes of the home security system will not have the hardware to run a neural network. For this, the motion sensor results will be passed to the main hub, which will send these results to a cloud-based neural network for propagation.

Aerial Drone Swarm for Search and Rescue Applications

Jordan Williams and Ali Khan
Fort Valley State University

Over the past decades, the types and applications of drones, known as unmanned aerial vehicles (UAVs), have substantially increased. Many industries from private to governmental are utilizing drones for applications such as military, surveillance, photography, search and rescue, entertainment, and object delivery. While most applications are currently focused on utilizing single drones to accomplish specific tasks, research is being carried out to extend the applications to synchronized drones.

With today's technology drones are now able to be flown through software-controlled flight patterns paired with various sensors to achieve autonomous flight. In this study two drones will be programmed to work as a team (Utilizing various sensors) to support a weight and automatically stabilize themselves to keep that weight in the air. A centralized control algorithm is being developed to accomplish the synchronization of drones through measuring the drones' proximity to one another while tethered to a net. . If a weight placed in the net causes the drones' proximity to decrease their motors should be signaled to spin faster lifting the weight higher, resetting the net to the stretched out position. Additionally, this control algorithm prevents the drones from colliding with each other or objects in their path. If completed this research will have its main applications in areas such as efficient search and rescue and fast mapping of an environment.

Introduction to Viper: A Systems Security Solution

Cody Woods
University of Virginia College at Wise

Assessing Cyber Security infrastructure is an afterthought for most businesses today. Typically, most people fall into one of three key categories - Do, Know, or Be with the majority falling into the "Do" category, meaning they are simply aware that an asset is insecure but can't or won't mitigate the vulnerability. My presentation will discuss this state of mind and introduce a security solution that I am developing called Viper. Viper is a one-stop-shop vulnerability scanner with a hardening feature that allows for on-demand scanning of the system with realtime calculations of risk and potential threats in a comprehensive web interface.

Solving WKU Parking Pains with OpenCV

Patrick O'Boyle, Jeffrey Galloway, Austin White
Western Kentucky University

Parking pains ultimately cost US drivers $95.7 billion annually due to the costs of search times, overpayment, and parking fines. These issues extend to college campuses, where parking can be especially troublesome. Western Kentucky University (WKU) is no exception. New dorms opened in 2018, but parking problems persisted. Though smart parking solutions are becoming more common, the smart parking market is dominated by companies that use expensive sensors and proprietary software. The objective of this research project was to investigate computer vision as an alternative smart parking solution for WKU. Computer vision is underutilized in the smart parking industry, but it can be a more cost-effective and versatile method for capturing data. For this study, a simple, open source client-server architecture, based on MobileNet-SSD and OpenCV, was developed and tested. The system was then deployed at Cherry Lot on campus. A Raspberry Pi camera client was used to send incoming frames to the in-lab server. The server then applied object detection and tracking algorithms to register vehicles and events, which are either entries or exits. Based on whether cars were entering or exiting, the server updated the lot occupancy count accordingly. Data was successfully collected from 9:00am to 4:00pm over a 5 day period. This research is a contribution to open source, and it serves as a foundation for collecting and mining transportation data at WKU to improve campus life.

ThinkFast VR

Jay Downing and Fate Hardin
University of Tennessee at Martin

ThinkFast VR is a virtual reality game created using Unity and SteamVR. Since virtual reality lends itself to games that utilize intuitive, reflex based movements, the goal of this project was to create a game that builds on these platform-specific strengths. The game focuses on an endless series of short, fast-paced minigames which focus on having the player perform instinctive tasks such as catching a ball or sorting objects into bins. The player unlocks more minigames as they progressively attain higher scores, providing more varied and challenging gameplay as their skills improve. The game is cross platform between all supported SteamVR headsets, including the HTC Vive and Valve Index, among others.

Applying a Math Oriented Programming Language to Solve Mathematics Education Problems

James Ellerbee and Levar Small
Columbus State University

There exists a prominent issue of students struggling with mathematics in all levels of education. For example, students misunderstanding mathematics as pointless, thinking it is boring, or obstacles relating logic to numbers and expressions. Math instructors from institutions in Muscogee County, via a survey, ranked statements that critically affect math students' ability to learn and apply math. The statements ranked among the highest follows: "Students must practice" and "Students must understand reason instead of relying as much on memorization". In response, MPL exists to address these statements by providing an interpreted language for students.

MPL connects mathematical arguments with expressions in an effort to be a resource for students and to address factors affecting student's ability. MPL does so through expression evaluation and syntax that reads similarly to phases seen in mathematical arguments or word problems. Enabling students to practice understanding key phases in math. In contrast, MIKA exists to personalize lessons to the student's skill level using AI, which addresses interactivity. MPL does this using error handling and reporting, and computation.

Successes. MPL utilizes Java as the backend for the interpreter, granting platform independence and reliability. Using the ANTLR library allowed rapid development of context-free grammars, and quick refinement of MPL. Limitations. MPL uses a command-line interface and symbols on the keyboard for first iteration. Directions for the future of MPL include: term rewriting, support for equations and functions, a built-in variable solver, factoring of common expressions, and support with matrix output. Implementing control structures for a more general scripting environment, and optimization.

The presentation will include exploration of PL concepts, examples of source code, context-free-grammar, parse trees, and a live demonstration of the source code and interpreter. Further comparison of related works. Finally, closing by reiterating contributions, limitations, and directions for future work.

Assignment Keeper

Joshua Freeman and Presson Drew
University of Tennessee at Martin

Assignment Keeper is an online writing center that allows students to upload papers along with the assigned requirements directly to the writing center. Staff members of the writing center will see students' papers, with the requirements attached, that are pending review. After reviewing a student's paper, staff members can provide feedback. Students will be notified of the status of their paper(s) (i.e. pending review, under review, review complete) as well as the reviewers' feedback. In this presentation we will discuss how we used the progressive framework Vue and tools from Google Firebase to create a user-friendly website that provides users with authentication options and real-time updates. We will then provide a demo of how
well Assignment Keeper works.

Toward evading malware detection via adversarial machine learning with functionality-preserving perturbations

Luke Koch
Maryville College

Malware detection systems that rely on Machine Learning Algorithms (MLA) are vulnerable to code perturbations. Numerous studies have established code perturbation techniques that trick the MLA into classifying malware as benign. However, none of these studies have guaranteed that the perturbed malware retains full functionality while performing non-trivial perturbations. In order to be a real-world threat, the obfuscating perturbations have to guarantee that functionality is not lost. Moreover, reverse-engineering every piece of malware "caught in the wild" into easily-edited source code is an intractable problem. Thus, our system performs perturbations on the executable file itself instead of relying on reverse-engineering. These perturbations allow an executable file that has previously been identified as malware to pass as benign. We use a number of different methods to perturb the code. These include overwriting non-essential header information, replacing x86 assembly instruction with equivalent code, and code caving. Our system enables the development of more resilient ML models by providing obfuscated malware as training data.

Validating Numeric Results in a Modular Finite Element Code

Andrew Nguyen
University of Tennessee at Chattanooga

Code verification entails proving that the equations modeling the physics of a problem calculate the correct numeric solutions. In large code bases, it is important that a coded solution works as intended to ensure the system functions in a cohesive manner consistent with expectations. A Python program that parses input data from an XML file to generate C++ unit tests for a multiphysics solver based on the finite element method is presented. The generalized structure of the program allows for reading various configurations of data or settings to generate a test program. The solver utilizes linear algebra data structures and Kokkos, a templated C++ library, to implement parallel algorithms. Generated test programs could be executed on heterogeneous system architectures and compared to results from prior experiments to evaluate for expected output. The nature of complex physics models containing many systems of equations drove the desire to create a structured method of testing for the numerous variables and functions present in the solver. It allows for testing of different physics models without having to understand the underlying algorithms and layers of parallelism that the solver uses.

THECR

Garrett Hay and Nick Reid
University of Tennessee at Martin

The University of Tennessee at Martin (UTM) administration team for institutional research has to give semesterly reports of any and all students taking classes that semester term to the Tennessee Higher Education Commission (THEC). In order to gather and organize all of the student data that THEC requires them to gather they query information from UTM's own Oracle database management service and then organize it to match what THEC wants, which usually exceeds 100 queries. However those queries have become increasingly depreciated as time went on, to the point that most of the report is being done by hand. This not only increases the difficulty of retrieving the information but also the accuracy of the information as human error is injected into the process.

Our program, THEC Reporter (THECR), is to be the solution to not only the remaking of the report, but also simplifying its upkeep. The program itself was made using .NET Core allowing it to be cross-platform and an Oracle's Data Provider for .NET Core (ODP.NET) that allows it to access and review over the oracle database. The desktop application's functionality with a connection to the Oracle database allows the program to load a specified PL/SQL file holding the THEC report into itself; the user can then choose to modify the report to match exactly the information required. Within the program the user is given a simplified report to work and edit with by allowing users to see the queries in shorthands as some of the team do not know nor need to know PL/SQL when needing to generate the report. Next the user can run the whole report with the program then recording the received report into a file send able and readable for THEC in the form of a
comma separated values (csv) file.

Integrating Cloud Computing into Virtual Reality Exposure Therapy in Order to Increase the Effectiveness of Combat-related Post-traumatic Stress Disorder Treatment

Jeffrey Galloway, Shreeya Arora,
Austin White, Patrick O'Boyle
Western Kentucky University

Virtual Reality Exposure Therapy (VRET) is the use of virtual reality technology for psychological therapy, for example, the treatment of post-traumatic stress disorder (PTSD). The goal of exposure therapy is to help reduce a person's fear and anxiety, with the ultimate goal of eliminating avoidance behavior and increasing quality of life. The types of events that result in combat-related PTSD cannot be reproduced in the clinic setting, thus Virtual Reality (VR) is used. It allows the presentation of traumatic events that cannot be recreated, allowing individuals to be in touch with traumatic cues that elicit arousal, and through repeated contact, decrease that arousal. Several studies have proven the effectiveness of VRET to treat combat-related PTSD. Studies have also found that group therapy is more effective. It was then suggested that therapy would be more effective if patients could complete the VR component with the ability to interact.

In order to create VRET where patients are able to interact in a single VR environment, cloud computing technology was integrated into the software. A High-Level API (HLAPI) System was used to create a network between patients. HLAPI is a server authoritative system which allows one of the participants to be a client and the server at the same time, thus no dedicated server process is required. Therefore, the model is software-as-a-service. To host and develop the environment, Unity, a real-time development platform, was used. When a new client connects to the server, that patient's GameObject becomes a “local player” GameObject on the client of each other patient. Unity is then instructed to associate the new player’s connection with the player’s GameObject. As a result, by integrating cloud computing technology, patients are able to interact within a single environment which increases the effectiveness of VRET combat-related PTSD treatment.

A Self-Driving Golf Cart: Lessons Learned from a Student-led Research Project

Ryan Diaz
High Point University

Over the course of three years, a group of undergraduate students at High Point University were tasked with building an autonomous golf cart. The overall goal of the project was to have the following subsystems to facilitate driving: a master control system, computer vision to assist with object avoidance, a GPS based navigation system, and a mobile application for destination selection. At the conclusion of the project, all systems were in place but the golf cart was only able to be driven with a joystick connected to the master control system. Logistical and technical challenges that were not initially identified in the requirements and specifications phases of the project presented significant challenges for the team. An overview of the project, the collaboration methods used, and some of the unforeseen technical challenges encountered in the project will be discussed along with ideas and recommendations for how other student-led research could be planned to ensure long term success.

PhysicsSim: An Intelligent Tutoring System to teach Kinematics

Maidel Fletes, Mary Harrell, Taylor Woods, Paul Halford
Columbus State University

Understanding and interpreting relationships and functional trends with 2-D graphs are foundational skills in STEM fields, in other sciences and in all disciplines that utilize data analysis. In comparison with other representational methods that describe relationships (e.g. tabular, mathematical, narrative), graphs not only convey the greatest amount of information in the most compressed way but they also allow for a comparatively quickest discernment and understanding of the information they embed and represent. Yet, the ability to do that requires skill and practice. Introductory physics courses regularly start with the topic of kinematics which heavily utilizes 2-D graphs that describe motion. Students are expected to discern the nuances of the same motion from the perspective of three different and interrelated quantities: those of position, velocity and acceleration. This is why difficulties that students face in understanding 2-D graphs surface early on in physics. Yet, for this same reason kinematics can be used as a great opportunity to teach graphing skills in general. The goal of this project is to develop an interactive intelligent tutoring system (PhysicsSim) that makes use of kinematics to help students understand the nuances of motion types and their graphical representations.PhysicsSim is developed using the language of C# in the Unity environment which provide a controlled environment restrained by the bounds of physics and a user friendly experience. PhysicsSim uses a student model to track the user's mastery level and guides the learning process based on the current level of achievement to provide a personalized learning experience. Initial testing shows that PhysicsSim interface is appealing to students and more testing will optimize it further. Future work aims at building foundations for kinesthetic involvement and gamification of the system for multiplayer competition. The system will be piloted in Introductory Physics classes in Spring 2020.

Smart Security Motion Detector

Dominique Capers
Columbus State University

This project focuses on the use of internet of things (IoT), in particular the creation of a home security system prototype. The intended system acts as a detection device that is securely connected to an authorized computer(s) via Wi-Fi. Raspberry Pi 4 and a ESP8266 devices are the main components used in this project as they act as the motion detection device and communication media. The system behaves as follows: when a motion is detected, a home security key will provide a real-time response and send a signal to an authorized handheld device via Wi-Fi. This device would not only be perfect for residential homes but could also be used for a range of small businesses. The expectations of this system is to provide the owner with an accurate and immediate alert without any delays.

Cyber Ambassador Program

Brayden Faulkner and Chris Humphreys
University of Tennessee at Martin

Cyber security is a rapidly growing and evolving field, with a huge shortage of skilled professionals available to fill open positions. This presentation details how we created a Cyber Ambassador Program at the University of Tennessee at Martin, and illustrates tools and techniques that can be used at other schools to replicate and build upon the model we have created. We will begin identifying the reasons students are not pursuing cyber security knowledge in the same way they do other areas of computer science. Following this identification, we present the reasons we believe these blocks exist. Finally, we lay out what we did at the University of Tennessee at Martin to remove these barriers and discuss our future plans for the project.

Meta-Analysis of Biology Research Literature

Evan Suggs
University of Tennessee at Chattanooga

Comparative studies have been powerful tools in generating a broad understanding about the evolution of animal social systems but they currently rely on the slow, manual process of reading each abstract and paper a large volume of papers in research databases. For instance, in searching for papers on field work with the peccary a traditional search might yield as many or more papers focused on lab research. A researcher must read through abstracts and if those seem interesting the respective paper, which may or may not be kept after a final full reading. This process is done thousands of times before an actual study may be compiled from a final dataset.

Previous work using a manual analysis of papers is currently being done in the University of Tennessee at Chattanooga (UTC) environmental science department. Over the past several years, they have compiled a dataset on papers in the mammalian order Artiodactyla. The goal of this project is to be able to match the quality of manual work in the UTC environmental science department with software in a time frame of hours or days rather than years.

The program will take in keywords (based on biology terminology and species classification) for a search from a user to compile a dataset of papers. Then, this dataset will have papers removed according to the keywords and guidelines set by the user. Automated search methods for large research databases informed by modern unstructured text extraction and machine learning techniques should greatly increase data collection efficiency and hence, improve progress towards publication and scientific advancement. Machine learning methods like capsule networks and document vectorization, are trained to detect the context, position and semantic correlation of words in order to more accurately identify useful papers from searches.

Polarimetric Thermal Face Recognition Using Non-Linear Transformation

Nhat Phan and Chunhua Dong
Fort Valley State University

With the fast-growing pace of technological advancement, cross-modal face recognition plays an important role in many applications, such as forensic investigation and homeland security. Thermal imaging is much desired in the night-time surveillance application, while most face databases only contain facial imagery in the visible spectrum. The task becomes to match an unknown thermal image to a set of known visible images. In this study, we propose a cross-model thermal and visible face recognition algorithm using the non-linear transformation. First, band-pass filters called the difference of Gaussians (DoG) are used to emphasize edges and other details in addition to removing high and low-frequency noise. Next, a non-linear transformation function is applied to generate much stronger responses in the filtered image, which can better distinguish between small variations. Then the texture features of images are extracted using the histogram of oriented gradients (HOG), which reduce the modality discriminant between visible and thermal facial features. Finally, we use a one-vs-all SVM-based framework to achieve cross-modal recognition. A binary SVM model is built for each subject in the training dataset, in which visible face images of this subject are positive samples and visible face images of the remaining subjects are negative samples. To improve the cross-modal discriminability between the subjects, a set of unrelated thermal face images are added as cross-examples to all the SVM models as negative samples. The trained SVM models were used to identify the corresponding subjects of test thermal images. Experimental results have demonstrated that the non-linear transformation significantly improves the cross-modal recognition performance.

WebDocker: An Accessible Online Platform for Containers

Lucian Freeze, Garrett Hay, Brett Whitson
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In recent years, the concept of containerization has experienced a boom in software development and information technology circles. A container, in short, provides software and all needed dependencies packaged into an isolated and lightweight virtualization instance. Regretfully, new platforms which utilize this model are often difficult to use or have a significant learning curve. Containerization software may also prove to be resource-heavy and taxing on everyday hardware, further creating a barrier to entry for first-time users. In general, these issues combined with the difficulty of configuring containers to be readily accessible amount to a significant hurdle in beginning to use these platforms. We created WebDocker to allow users easy access to the benefits of using containers without the hassle of immersing oneself in the intricacies of setting up and maintaining a containerization platform. To accomplish this, we constructed a web application built with Docker, Node.js, and Firebase allowing users the capability of directly creating and managing containers, serving as a customizable "sandbox" for containerized projects and ideas.

Chattlesnake, A chat service that communicates via web services.

Cameron Justice, Nathan Byrnes, Chris Gerspacher, Clay Sewell, Justin Wade, Khem Poudel
Middle Tennessee State University

The purpose of this paper is to explain the development and purpose of the Java based app called Chattlesnake. Chattlesnake is a chat service that communicates via web services to allow instant communication between two people. Utilizing a client to server connection while locally storing the chat log on each users device, the application will allow the users to communicate text-based messages. Chats will be sent and received instantaneously between two individuals and chat logs will be stored in order to view previous conversations. The program is developed with Java and is projected using JavaFX. Java provides the functionality and interaction while JavaFX provides a front-end GUI to the user. This means creating an interface that the user is able to interact with, whether that be actively chatting or managing chats, the user is able to view a functional application. In order to manage all of the imports easily and seamlessly Maven was an obvious choice since most of the development occurs in Intellij. In order for the chats to be sent we use a Node.js / express server that is hosted on Heroku, utilizing the Socket.io API to communicate. To design the actual layout of the interface we used a JavaFX tool called Scene Builder that shows in real time what is being changed within the interface, and bypasses direct CSS and FXML editing.

MTConnect, A Fully Functioning Web Application

Sam Hollingsworth, Tristan Lotivio, Cody Maness, Chaning Mullinax, Ian Seal, Khem Poudel
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The concept of MTConnect is an exploration into the development process of a fully functioning web application. The foundation of MTConnect is to create an aforementioned web application that will contain the following: a login page, register page, search page, and map page. We designed in large part with Java and Java embedded software in order to show mastery of the language and its tools, as well as for efficiency. Other languages will be used, such as MySQL, Java's SQL embedded library, and a java web framework known as Vaadin. We employed the Web Framework Vaadin and the Project Management tool Maven in order to achieve all the fully functional web applications. We have tasked with developing the database, the information to go in it, as well as the pathways, were taken to organize and send that data to the front end efficiently and effectively. It is in this collaborative effort that we will learn how to efficiently and effectively write large scale software in order to bring to fruition, MTConnect. We planned on using Eclipse IDE with Maven and Vaadin repositories in order to develop the pathways that connect to our database as well as the server that will eventually host this application. For all general hosting, we will be using Amazon Web Services, for the Front-End of the Web Application, as well as a proprietary MySQL server that will house the data necessary for the project. We used MySQL WorkBench for all administrator-level manipulations, like setting up dimension tables.

SimBPM: An Intelligent Business Simulation to Predict Management Styles

Valencia Coleman
Columbus State University

Business management styles are important for efficient task completion. Many people have tried to find the perfect management style for teams to get work done efficiently and effectively in software engineering, where it is important to find out what type of business management is best for a project. Management styles can be categorized as transactional or transformational management. This project aims to develop SimBPM, a simulation that uses artificial intelligence to determine the player's management style; if it is transactional management or transformational management. Transactional management is the manager leading through objective-based management. Transformational management is the manager is leading a mixture of objective-based and people-based leadership. SimBPM gives the player several realistic business scenarios and the player types up their solution to the situation in the answer box provided. After the player finishes the game, the artificial intelligent algorithm would give them the results of the simulation and what management style they follow. SimBPM is made to help business students in college-level class determine what kind of management style suits them best.

Micro-benchmarking Algorithmic Sorting in C++, Java, Python

Ethan McCrary and Douglas Ferguson
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We created micro-benchmarking utilities for each test language: C++, Java, and Python, the three highest rated programming languages according to the TIOBE index. The utility was used to analyze each language's ability to efficiently and quickly execute hard-coded sorting algorithms.

Our algorithms were HeapSort, MergeSort, QuickSort, BitonicSort, and TimSort. The languages created predefined arrays of 10,000,000 random integers between 0 and 10,000,000 and sorted them at each iteration of the benchmark.

Each language has different methods of retrieving the system time. For example, obtaining the system time in Java requires using the Java.lang.System.currentTimeMillis() method. Its equivalent in C++ is high_resolution_clock::now(), which can then be cast to milliseconds. These methods were called immediately before and after the test operation occurred. All arrays, variables, methods, or objects not part of the test operation were declared and initialized before the system time was captured.

Each of the benchmarks were completed with 100 warm-ups and 500 tests. Each benchmark was run individually, so that they did not interfere with another. We subtracted the final system time capture from the previous system time capture, and the resulting difference is known as the execution time of the test operation. The 500 execution times were written to an XML document and averaged.

Each benchmark produced varying results. C++ executed faster in some, and in others Java was just as fast as C++. It is very dependent on the algorithm. Python usually resulted in higher execution times.

Improved Viola-Jones Face Detection Method Based on Cross-Object Comparison

Dytalyan Holmes
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Face recognition is a popular area of research in the applications of artificial intelligence. Accurate detection of region of interest (ROI) is a key step in a face recognition system. Viola-Jones is an object detection framework primarily for face detection. However, the performance of the Viola-Jones algorithm may suffer from missed faces and wrongly detected non-face objects.
To eliminate the non-face objects and improve the face detection performance, we propose to incorporate a cross-object comparison technique into the Viola-Jones framework. Firstly, the face objects detected by the Viola-Jones framework are cropped and resized into a common dimension. Next, the feature descriptor of histogram of oriented gradients (HOG) is extracted for each object. The HOG features provide unique texture information about the image, which helps achieve more accurate face detection. Finally, a discriminative weight is calculated for each object using a validation comparison process. Non-face objects are then removed based on these discriminative weights. Experimental results show that the proposed scheme can effectively eliminate the non-face objects and thus achieves a higher accuracy of face detection than the classical Viola-Jones method. Our future work is to reduce the number of missed face objects in the Viola-Jones algorithm.

Programming the NAO Humanoid Robot to Play "Simon Says"

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Middle Tennessee State University

Utilizing the NAO robot developed by Adebaran Robotics to explore and experiment with its visual and computational capabilities by having it play a game of "Simon Says". In this game, the NAO robot acts as "Simon" telling the human player(s) to make pose(s) according to its instructions. Simon determines if the player's pose is correct by completing several steps. An image of the player(s) is captured and sent to a computer through a socket to be processed. Tools like the OpenPose package and the Common Objects in Context Dataset (COCO) were used to process the captured image. The processed image was compared to a model developed using Keras that helps determine if the player(s) actions were valid from a set of pre-selected poses. The tools used to produce our results included Choreographe, a visual programming environment that was used to incorporate NAO's sensory capabilities and capture visual data. The visual data collected was processed using the OpenCV APIs and OpenPose package. These tools were used to manipulate raw images consisting of one or two players standing in front of a mixed background to make them better suited for pose classification. The COCO dataset was used as a model to recognize and build a skeletal form of objects within an image. This was used to simplify the captured images of the players to easily compare to the built model to recognize the poses made. The Keras APIs were then used to construct a convolutional neural network to learn the pose classification model based on the training data collected. In order to introduce multiplayer functionality to "Simon Says", the images collected were cut in half and processed separately and fed into the Keras model. In the end, the complete "Simon Says" game was tested and implemented successfully.

Impact of DDoS Attacks on the Power Usage of Virtual Execution Environments

Jeffrey Galloway, Austin White, Patrick O'Boyle, Sierra Wyllie, and Shreeya Arora
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A machine's power consumption relies heavily on the processes being executed within that machine. A Distributed Process Execution Environment is a common process that can have varying degrees of efficiency and use of computing resources. The efficiency and use of computing resources can depend on the type of Distributed Process Execution Environment and the tasks being executed within the environment. Comparing different types of Distributed Process Execution Environment's effect on the host machine's power consumption, by executing tasks with a varying level of demand within the Distributed Process Execution Environment, will demonstrate the cost efficiency of each. Distributed Denial of Service, DDoS, attacks are one method of achieving varying levels of stress on different components of the Distributed Process Execution Environment. The experiment was performed by having several compute nodes as Attackers that worked together to perform a DDoS attack on a single machine, the Defender, running the Distributed Process Execution Environments. As the Defender was undergoing the DDoS attacks, its performance was measured over time in the areas of CPU, GPU, Networking Bandwidth, Memory, and power consumption.

DNA Quality Previewer and File Trimmer

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The amount of DNA data that can be collected has increased rapidly over the course of many years. With this in mind it is almost impossible for a human to read through the vast amounts of data that is now available. DNA files can be extraordinarily large while the data contained in them may not be the most reliable. Our DNA Quality Previewer and File Trimmer will allow the user to select which data they believe is valuable to them by selecting a percentage of certainty, and trim the unreliable data out of their files and writing the more reliable data to a seperate file. Our application will take two files, each containing the information of one strand of the double helix in DNA. The user will be able to preview a small portion of the file so they can determine which settings they wish to use. These settings can then be sent to the DNA trimmer which will read through these files and separate the contents of the file based on the users selected settings. To accomplish this task, we employed the use of the .Net Core framework while using WPF to create the user interface. The user interface should allow the user to easily preview the file, select the settings they wish, and then run the trimmer with those settings. This will then create a smaller file that contains data that meets their specifications.

Student Abstracts
Graduate Degree Programs

Load Balancing of Financial Data using Machine Learning and Cloud Analytics

Dimple Jaiswal
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The rising use of technology for web applications, android applications with growing awareness and use of digital marketing, e-application systems for financial investments benefits a large sector of stakeholders and common people. It allows investors to make an appropriate choice for investment and to increase their capital growth. This needs a proper research of investment companies, their trends in price and analysis of historical and current information. In addition, prediction of prices makes the process of investment more comfortable and reliable for investors as shares are most volatile type of investment. To offer this service to multiple users spread across the globe, there are certain vulnerable challenges for developers - to handle peak conditions and to channelize requests to servers in an optimal way. This demands high performance, cost-effective and sustainable approach to manage - the concurrent user request on servers and increasing utilization of computing resources to satisfy the increasing requirement.

The process of balancing simultaneous requests is highly complicated, non-trivial and critical at times, which forces to add a subsystem or an external service - to handle requests and balance the resource utilization as per requirements. Load balancing is a method used to channelize requests across the servers in back-end. It helps in improving the performance of the system by optimizing the use of resources, maximizing the throughput and reducing the latency. The traditional method to balance load is inadequate and inflexible to satisfy the growing demand and increasing only hardware resources to balance the system is not an effective approach all the time. This needs an in-depth study of jobs to be performed and analysis of various approaches to organize sub-tasks to fulfil the objective. This can be more advantageous using machine and deep learning techniques.

Machine learning is a field used for making predictions and decisions based on different mathematical models. Thus, designing a decision making system to organize job requests to access financial data using machine learning approach is highly beneficial in terms of computation, energy, response time and resources. Furthermore, the performance of system can be improved by analysing metadata of cloud and logs generated when users access the application on cloud. This can be used to train algorithm to manage - low, medium and peak load conditions, which also brings flexibility to scale all over and produces a dynamic and healthy environment in the system.

Minimum Density of an Open-Locating-Dominating Set in the Infinite King's Grid

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For a graph G, locating-dominating sets can be used for detection purposes. Whether it be setting up sensors to detect a thief in a facility or detecting a faulty component in a network of processors, these types of sets can be used to minimize the number of sensors required for the grid or network. Recently, there has been a lot of research into dealing with these types of sets, including the open-locating-dominating (OLD) sets, which will be the set we will focus on.

A dominating set is a subset of vertices in G where all vertices in G are either in the set or adjacent to some vertex in the set. An open-dominating set is a set where a vertex cannot dominate itself. A locating code of a vertex is a finite vector representing distances of a vertex to an ordered subset of vertices within G. A locating set is a subset of vertices in G where all distinct vertices have distinct locating codes. An open-locating-dominating set is a set that follows both of these properties.

For a given graph G, OLD(G) denotes the minimum cardinality of an OLD-set and the problem of determining the value of OLD(G) for an arbitrary graph G is known to be a NP-complete. Since the problem was first introduced in 2010, much study has been done in finding the values of OLD(G) for various classes of graphs including paths, cycles, trees, and infinite grids. For our research, we will be using an infinite king's graph. A king's graph is a graph where each vertex is adjacent to eight other vertices, like a king's movement on a chessboard. We investigate the problem of finding the minimum density of an OLD-set for G, denoted by OLD%(G), where G is an infinite king's graph.

Secure Container for Data Protection in Transit and at Rest

Christian Bare, Bradley Northern, Vadim Kholodilo, Abhijeet Solanki, Yuliya Durova, Aleks Malkhasov, Braxton Westbrook and Denis Ulybyshev
Tennessee Technological University

Under the Health Insurance Portability and Accountability Act of 1996 (HIPAA), there are strict regulations on how personal medical data must be stored and transferred.
This project presents a software solution for data protection that is compliant with HIPAA regulations. Our approach enables role-based access control for data. We support peer-to-peer data networks so that central authority is not needed to store data or to enforce access control policies. Our solution stores data and metadata as an encrypted Excel table. This approach can be applied to store Electronic Health Records (EHRs) of patients. Encryption is done by AES-256 bit encryption, which has its key generation done on the fly, rather than being stored in a database. The bulk of the backend system runs on C++ for its speed and efficiency, which is wrapped in NodeJS for ease of simplicity. The whole backend system is wrapped in an interplanetary file system, so that it can run peer to peer, therefore update continuously. This makes it decentralized, including the fact that the final package is in a docker container for portability. For web design, we have applied a bootstrap. It will allow compatibility and scalability across multiple devices and different browsers.
In order to achieve role-based access control, VBA subroutines and functions were implemented that provide secure viewing. Upon the launching of the application, the user must pass appropriate authentication through the use of a username and password. The only worksheet accessible at this time is a default page with no personal information. Once authenticated, the role that corresponds to the user is applied and the worksheets that the role is allowed to view are decrypted and produced.

Automated Essay Evaluation using Natural Language Processing and Machine Learning

Harshanthi Ghanta
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Manually evaluating essays is time-consuming, human graders can unintentionally be biased while grading and it is expensive to pay human graders. To prevent inconsistent grading and feedback, we can train computers by feeding the essay datasets scored by different human graders and developing a grading model which can be defined as automated essay scoring. Automated Essay Scoring (AES) is the task of assigning grades to essays without human interference. AES is used in classrooms, English proficiency tests, and online practice exams. It helps users learn English by assigning scores and provide feedback on writing quality. It is a method of educational assessment and an application of natural language processing (NLP) by computers.

Most of the current systems focus on qualitative features. The aim of this project is to include the features' context into the scoring system to improve reliability. In this research, the Hewlett essay dataset will be used to train and test the efficacy of the technique adopted. The natural language text analyzer Coh-Metrix and the NLP framework ELMO will be used to extract features from essays and represent words in vectors. The machine-learning algorithm to be developed will use these word vectors extracted from the essays and score them.

Data Mining of Social Media

Sahana Deb
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Social media is any network of interlinkages involving nodes (containing actors) and edges, defined as the relationships between the actors. [1] It appears that Facebook, with over 24.1 billion monthly users, is vulnerable to phishing attacks. The authors of a study [2] have examined ways in which data can be extracted by third parties from Facebook using techniques like false friendship requests, random and targeted compromise for data collection. [3] They conclude that Facebook accounts are vulnerable to phishing attacks and less number of accounts is required to compromise the network. [4] In another study, the authors used the SocialSpamGuard; an online social media spam detection system, based on data mining for social security. [4] It yields spam activities in social networks through monitoring of social sensors. [5] Twitter is another popular micro blogging site which has been valuable in disaster and emergency situations like the 2010-2011 Australian floods and the 2008 Mumbai terror attacks. [6] A tool called "Tweedr" has been proposed in a study, which extracts relevant information about disaster relief workers from tweets generated during the disaster. [7] Another study, employing the Social Networking Approach to study the community of Twitter users who circulated information about the casualties caused by the floods, reveals interesting patterns and features about it. [8] Data obtained from social media can be analyzed to predict the occurrences of possible cyber attacks.

Currently I am working on a project that explores data mining of social media in order to detect threats of various cyber attacks, including social engineering attacks. We plan to build a python based tool to automate threat detection. In my presentation, first I will provide a survey of existing research on this topic, along with merits and demerits of these solutions. Then I will provide an outline of our project.

Analyzing Awareness on Data Privacy

Vernon Andrews
Columbus State University

The transition away from the old way of handling and storing information on the internet has completely shifted the entire world. Unfortunately, the new method of internet storage has created a lot of issues that concern individuals on a daily basis. We often underestimate how our data is being stored and shared on the internet. Within the last decades, there have been data breaches that have brought light to the issues of data privacy. In order to ensure data privacy, individuals need to be aware of the situation. In this paper, I have proposed a method that analyzes the awareness on data privacy. To address the issues of data privacy, individuals will be asked to complete a questionnaire. The questionnaire will measure individuals' competence level regarding data privacy.

A Study of Recent Municipal Ransomware Attacks, their Human Aspects, and Guidance for their Victims

Hilary Hok, Gregory Bryant, Arthur Ryan
Columbus State University

In 2018, the city of Atlanta suffered a major cyberattack in the form of ransomware exploit. The exploit began on March 22, 2018 when a virus that had infected the city's network demanded payment of $51,000.00 in bitcoin (Deere, 2018). According to Deere, the city had employees shut off their computers and refused to make the ransom payment. Since that time, the Atlanta Journal-Constitution was able to gain access to a report that was marked "confidential and privileged". The report identifies $6 million dollars in contracted costs to repair the damage along with $11 million potential future costs (Deere, 2018). The combined total of $17 million is a staggering amount when compared to the hacker demand of $51,000.00. Although Deere states that Atlanta did have insurance against a cyberattack, it is unclear how much the coverage was for.

Since the Atlanta attack occurred, there have been numerous attacks against state and municipal agencies, many of them in the state of Georgia. The attacks include:

The Georgia State Patrol – July 26, 2019 (Barth, 2019)
The Lawrenceville, GA. Police Department – July, 2019 (Barth, 2019)
Jackson County, GA., (Freed, 2019)
Georgia Municipal Courts – June 2019 (Newman, 2019)
Baltimore City MD. – 2019 (Collier, 2019)
22 Municipalities in Texas – 2019 (Allyn, 2019)

The number of state and local governments hit by these attacks is very troubling. Not only is it a cost to the taxpayers in terms of remediation and/or ransom payments, but it is also costly in terms of loss of functionality. With many of these attacks impacting law enforcement agencies, the safety of the public is also negatively affected.

This paper will conduct in-depth research on the financial impact of the recent attacks and compare the cost of the ransom requested with the remediation costs. In doing so, we also will look into proper defense and action in the case of such a ransomware attack. This should provide insight on what these cities can do in such cases, and how they can prepare. We will also explore the human aspects side of ransomware to include the motivation of the perpetrator(s) and the decision-making process of the victims.

Professional Abstracts

The Effects of Information Stagnancy on Distributed Problem Solving

Saeid Samadidana
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Distributed systems depend on communication to solve problems. While in many studies, it is assumed that delay is negligible, the effect of delay and loss on real problems cannot be ignored. In this study, these issues and the impact of communication network topology are investigated. When the structure of the constraints network differs significantly from the underlying constraint graph, the difficulty of the problem increases.

Several protocols are tested using dynamic DCOP problems where the problems change at various rates. The results are discussed to identify how protocols naturally suffer from information stagnancy. Furthermore, the computational and communication costs of protocols are investigated. The analysis of a protocols' running time helps identify the impact of their design, which prevents them from taking the most up to date information into the account. As shown, protocols such as RODA only consider the latest changes to the problem every four cycles leading to poor performance.

Furthermore, topology of a network affects the quality of the solution. The average degree (ratio of variable to constraints) is closely related to the difficulty of a problem. As it will be explained some protocols exhibit significantly different behaviors when operating on small-world networks when compared to a completely random one.

AI is here … what about XAI?

Shamim Khan
Columbus State University

The combination of advances in artificial intelligence, computer hardware and big data is making it possible for computers to perform tasks that seemed beyond technology's reach until a few years ago. While the argument over whether super-intelligent AI is going to take over the world continues, machines driven by AI are making more and more decisions for us. There is a lot of excitement on the progress made by AI based on machine learning, but there is also a deep unease about what exactly AI is learning when it is being trained using data. Even if AI performs better than humans, the ultimate decision is made by humans. And humans will only trust AI when it can explain itself – in other words, when AI becomes XAI – or explainable AI. After a quick overview of AI and machine learning, we discuss the problem of trust in AI algorithms because of the opaque nature of machine learning models. We look at some of the current approaches towards explainable AI and their limitations.

An Introduction to PowerShell: A Tool for Task Automation

Ken Adcock
UPS

Software development doesn't always involve creating new applications. In many organizations, a lot of development time is spent on task automation. The fact is large enterprises have numerous business critical functions that must be done in order to operate. However, many of those functions aren't what truly differentiates the organization. The idea of Digital Transformation is to focus on those things that differentiate one in the marketplace, while automating those functions that don't. This involves the use of technology. Not surprisingly, a key enabling technology is often the use of a scripting language.

This presentation will provide an introduction to PowerShell, which is a scripting language developed by Microsoft for the purpose of task automation. Under the official version 1 release in 2006 as a Windows-only solution under the name of Windows PowerShell, the language is certainly not new. In summary, the language is regarded as a success. With significant investment by Microsoft, the language has branched out from its Windows roots. As examples, it became a central underpinning of the Azure platform and, more recently, became cross-platform with Linux as PowerShell Core. PowerShell is now an open-source project and will remain a key technology in the Microsoft portfolio. Finally, there is a very interesting story behind the creation of PowerShell involving both business and technical dimensions, which will be discussed.

Parallel and Distributed Computing Topics for Undergraduate Computer Science Curriculum

Srinivasarao Krishnaprasad
Jacksonville State University

Parallel and Distributed Computing (PDC) concepts and techniques have rapidly evolved in the computing landscape. In many Computer Science programs, these are covered in graduate-level courses and advanced undergraduate electives courses. Increasingly though, the computing profession and academia have recognized the significance of these concepts and have recommended them for all undergraduate students majoring in Computer Science. Recently updated ABET CAC Criteria for Computer Science programs requires exposure to parallel and distributed computing. The latest ACM Computing Curriculum guidelines specifies many topics related to Parallel/Concurrent Computing as Core-Tier-1 and Core-Tier-2 hours knowledge items; it also specifies many Distributed Computing topics to be considered in elective courses. In this presentation, we will share some thoughts on how to cover the various concepts and techniques related to parallel and distributed computing landscape in the undergraduate Computer Science curriculum.

Typical curriculum in Computer Science is already populated with enough courses and hence there will be no room for adding stand-alone courses, either required and/or elective, in PDC. A more practical approach would be to spread the concepts across traditional courses in Computer Science such as Operating Systems, Computer Networking, Database Systems and Computer Architecture. We will suggest how one can incorporate various concepts/topics related to PDC in many of these existing courses.

Interaction Effects of Age, Income, Marriage and Gender on Distress

Xiangdong An and Christie Chen
University of Tennessee at Martin

In the literature, there are a lot of published results on the main effects of age, income, marriage, and gender on psychological distress, but there are few on their interaction effects on distress. We are interested in knowing whether these independent variables might interact with each other to influence the relationship between these independent variables and the dependent variable distress. The interaction effects make the model more complex, but it is critical to incorporate them if the real world behaves this way. In this research, we examine whether independent variable gender interacts with each other 3 independent variables and generates interaction effects on the dependent variable distress. In the future, we would examine interaction effects of more independent variables on distress.

Generational Ethical Archetypes

Karen Carter
The University of Virginia's College at Wise

Higher education has held the distinction of opening doors, developing special skills and inspiring knowledge that are to be used in the development an ethical workforce. Should higher education also help an individual grow personally, intellectually, and ethically as well, to be effective? A resounding YES, of course!! However, the issue of ethics becomes clouded when intertwining generational views points. For example, the resent investigation of ethical values in the design of the Fortnight videogame which appears to target minors as its main user. An overview of data regarding higher education, adapting to changing technology, and responding to the country's changing demographics reveals a complex archetype developing. Indeed, when the ACM updated its Code of Ethics and Professional Conduct in 2018, the Code had not been updated since 1992 when the Internet was still in its infancy. Now, nearly thirty years later the world is only just beginning to grasp the omnipresence of the computing technologist's work and the tremendous consequences, intended or otherwise, this individual can affect upon a user's daily life. This review of the literature provides a generational lens examination of what it means to have a good work ethic and professional conduct. Both are noted as being a result of higher education and essential to being successful in today's workforce. While Gen Z appears to be mirroring the Millennial mindset and ethical development, these two younger realms appear to hold significantly different views from the older dominions of the Silent Generation, Baby Boomers and Gen X'rs. This presentation juxtaposes higher education, its reckoning of generational viewpoints, and strategies in clarifying ethical basics in the development of a socially conscience, technology workforce.

A Multi-criteria Decision Support System for Ph.D. Supervisor Selection: A Hybrid Approach

Mir Hasan
Austin Peay State University

Selection of a suitable Ph.D. supervisor is a very important step in a student's career. This paper presents a multi-criteria decision support system to assist students in making this choice. The system employs a hybrid method that first utilizes a fuzzy analytic hierarchy process to extract the relative importance of the identified criteria and sub-criteria to consider when selecting a supervisor. Then, it applies an information retrieval-based similarity algorithm (TF/IDF or Okapi BM25) to retrieve relevant candidate supervisor profiles based on the student's research interest. The selected profiles are then re-ranked based on other relevant factors chosen by the user, such as publication record, research grant record, and collaboration record. The ranking method evaluates the potential supervisors objectively based on various metrics that are defined in terms of detailed domain-specific knowledge, making part of the decision making automatic. In contrast with other existing works, this system does not require the professor's involvement and no subjective measures are employed.

Secure Coding for the New Programmer

David Frazier
University of Virginia College at Wise

That educators should be encouraging secure coding is not a novel assertion. The question then is how to introduce topics that are often above the heads of new programmers. The traditional way of doing this is to ignore secure coding techniques in an introductory class. If secure techniques are in the curriculum at all, they are probably in a specialized, upper-division class. This is problematic, as it ingrains in the student unsound ways of reasoning about code. For these students, security concerns will be an afterthought at best.

In my presentation, I will detail some of the techniques I have developed to make first-time programmers aware of the security implications of the code they write. I will also discuss ways to help them develop the ability to reason properly about their code.

Using GitHub in First Year Computer Science Courses

Robert Lowe
Maryville College

According to my students, requests for GitHub user names are becoming more and more common on computing job applications. Employers seem to be increasingly using GitHub as a sort of portfolio when evaluating new programming talent. Because of this, I have started using GitHub in my first year computer science courses, with the goal of helping my students build a portfolio of coding projects.

In this presentation, I will detail when and how I introduce git to my students. I will also describe how, over the past two years, I have developed a workflow for GitHub which grows with my students. By the end of their first year, my students are at least somewhat adept with git itself and have published at least one public GitHub repository. They learn git along with Unix, and this does not seem to have caused an undue burden on them. As it turns out, this has served my students well in that this also provides a mechanism for gathering assignments, distributing grades, and for collaboration during group projects.

Secure Communications in Industrial Control Systems

Denis Ulybyshev
Tennessee Technological University

Industrial Control Systems (ICS), used to control manufacturing processes, are vulnerable to cybersecurity attacks. Communication protocols widely used in ICS, such as Modbus that was developed in 1979, were designed with no security. It would be too expensive to replace the existing hardware deployed in industry.

I present a secure data container to protect data in transit and at rest with providing leakage detection capabilities, role-based and attribute-based access control. The idea was inspired by an Active Bundle concept. Data container incorporates encrypted data and metadata with watermarks, access control policies, policy and attribute enforcement kernel. This container is used to store log files and sensor data snapshots. It is implemented in two ways: as a Java Executable Archive or as an Excel file with encrypted worksheets, one worksheet per data subset. Policy enforcement kernel is implemented as a VBA macro in excel file. It makes an integration in existing ICS and IT infrastructures easier since container is compatible with Microsoft Office and Open Office software. Moreover, data container supports RESTful API. Each data subset is encrypted with separate symmetric key, generated on-the-fly based on the unique information that includes X.509 certificate for a given role. Unauthorized modification of policy evaluation code or metadata results in the wrong decryption key derivation. Furthermore, container has embedded watermarks aiming to detect data leakages that can be made by authorized insiders. The novelty of the proposed solution is that it provides data protection in transit and at rest in both centralized and decentralized peer-to-peer architectures.

"Winnowing and chaffing" method provides data protection over genuinely insecure Modbus communication channels. This method adds "noise" to real data on a dedicated network bridge, so that only authorized entity knows how to extract real data out of the noise.

How to lose 159 dollars and 27 cents to a cyber thief?

Haifei Li
Union University

Nowadays, cybersecurity is in everyone's mind because of extensive news reports about security breathes. Even though most breathes happen to organizations, unfortunate individuals can suffer serious consequences. The paper describes an incident that causes the author to endure personal financial loss. First, the background information is provided. Second, the root causes are examined to help readers avoid bad practices. Third, recommendations are listed to encourage good practices that improve the security process for cloud-based application development.

Simple 2D Block Lighting using JavaScript and the HTML Canvas

Jeff Roach
East Tennessee State University

Video games, such as Minecraft, use lighting to affect the mood of the game. The farther an area is from a light source the darker it becomes. These games use a simple attenuation formula to determine the light's intensity at a point in space. The attenuation of light is the reduction of its intensity as it travels through a medium. This phenomenon is described with the Attenuation Law for light photons in matter. This law is an exponential function that can be used to describe the physical world, which can be applied to virtual video game worlds.

In a simple 2D game, the virtual world may be viewed as a large rectangle. The rectangle can be divided into small square blocks. The size of the block depends on the desired smoothness of the world's light intensities. In the world, there can be a number of light sources both fixed and moving. The intensity of each block can then be determined using the Attenuation Law.

Programming techniques and a demonstration using JavaScript and the HTML canvas will be presented. A simple animated 2D world will show the results of applying the Attenuation Law function on a layered HTML canvas.

No-Cost/Low/Cost Educational Resources--an Alternative to Traditional Textbook: Pros and Cons

Masoud Naghedolfeizi, Nabil Yousif, Xiangyan Zeng
Fort Valley State University

In recent years, there has been a growing movement in U.S. higher education to adopt no-cost/low-cost educational resources in an effort to reduce the high cost of textbooks and also help students have access to educational materials for their courses from day one of classes. A number of scholarly research works in this area have shown that not only could this improve academic performance of students, it will also help them financially to afford the cost of higher education in a better way.

In response to this national trend, the University System of Georgia (USG) has established a program called Affordable Learning Georgia (ALG). The primary goal of this program is to award Textbook Transformation Grants to USG member institutions that adopt no-cost/low-cost (below forty dollars) course materials for their courses. This project has been so far focused mainly on core curriculum courses and in fact eCore, the USG online course offering system for core curriculum, uses no-cost/low-cost textbooks for all its online course offerings. ALG has reported that this program has been very successful and improved learning outcomes and retention rates of students and up to now impacted 296,005 students of USG system and saved them approximately 51.9 million dollars.

Encouraged by the above results, the Computer Science program at Fort Valley State University (FVSU) has decided to adopt no-cost/low-cost learning materials for a number of its lower division courses. However, the pros and cons should be carefully examined in order to make a sensible decision. In this article we describe the FVSU computer science courses that could be good candidates for low-cost/no-cost learning materials as well as if this alternative would be detrimental to future publications of high quality textbooks.

Extracting APT Cyber Object Analytics from Cyber Threat Intelligence

Ghaith Husari
East Tennessee State University

Despite the recent research effort, sharing and responding to cyber threat intelligence remains to be time-consuming. This paper presents a new approach that aims to identify and extract cyber object analytics from the unstructured text of cyber threat intelligence.

Using Angular NX to share the same codebase for the front end and back end

Bob Bradley
University of Tennessee at Martin

In this talk I will show how to create a single project that contains an Angular front end, Express back end and Firebase function that all share a common JavaScript/TypeScript codebase and modules. I will be using an Angular CLI plugin called NX by NRWL to create what is called a monorepo. I will show how to create a single project that has independent submodules that can be deployed separately but can still share common reusable library code. This approach is used by Google and Facebook, and many others.

Exploring Key Concepts for an Analysis and Design Class

Denise Williams and David Williams
University of Tennessee at Martin

This project will seek to identify important concepts and skills in the area of systems analysis and design. A survey will be used for the purpose of collecting data. The potential answers will be sought from professionals working in information technology. The authors especially seek to include information technology professionals with experience working in software development, while also including information technology professionals working in other areas of information technology. Ideally the survey will include responses from people with varying levels of experience working in information technology.

Developing Programming Contest Problems

Joshua Guerin and Kathleen Ericson
The University of Tennessee at Martin

The International Collegiate Programming Contest (ICPC) is a team-based programming competition sponsored yearly by the ICPC foundation. Contests are held at regional, national, and international levels annually. Each contest requires a set of new, unpublished problems.
In this presentation we will discuss our experiences proposing, reviewing, and developing contest problems. We will discuss how faculty and graduate students can get involved in the problem authoring process, including case studies of past problems that we have had accepted into the ICPC.

Document Summarization Satisfying User Query Based On Sentence Classification

Fatma Elsherif
Columbus State University

Automated text summarization is an emerging field since the 1950s. Summarization resurfaced a large-scale interest due to the huge amounts of information on the web and high storage capacity of text data, in addition to the evolvement of the field of natural language processing (NLP) and statistics-based learning techniques. Generating representative summaries that can satisfy both, the writer's most important aspects and the reader's query, enables users to cope with large amounts of information in less time and in a more efficient way. The aim of this talk is to present a novel framework for semantically aware representations of sentences in the domain of agriculture. The framework is based on statistical heuristics approach that uses Vector Space Model to measure the similarity between the user's query and sentences in an extended document. The implemented system successfully summarizes extensive Arabic agriculture documents according to a user's query. The system results have been evaluated using Recall, Precision and F-score measures.

Getting Involved in Hackathons: A Faculty Perspective

Kathleen Ericson
University of Tennessee at Martin

Hackathons are a unique and challenging experience. Hackers work on a project from inception, through design and implementation, then presenting a final product to a panel of judges. Hackers are e/ncouraged to work with new frameworks, tools, and languages, with multiple training sessions offered throughout the hackathon to help them learn. Hackathons are a chance to put to practice both technical and soft skills and are great experiences for our students.

In this presentation I will discuss hackathons in general, as well as my experiences getting involved in hackathons. I will also discuss ways in which faculty members can help to grow a culture of hacking at their schools.

Peer Reviewed Papers

Digital Forensics Evidence Ethics and Critical Thinking: An Alternative to Discussion Based Pedagogy

William Confer
Austin Peay State University

The three important pedagogical themes in our digital forensics course are critical thinking, evidence-based conclusions, and ethical decision making. Typically we employ classroom discussions to examine these concepts. Although instructor-led discussions are generally effective in our experience, we were interested in exploring alternatives to improve student engagement. This paper examines how we employed a "mock trial" to examine current ethical issues involving technology and privacy protections.

Implementing High Performance Search Using SIMD for Cybersecurity Applications

Joe Elarde and Barry Bruster
Austin Peay State University

Cybersecurity applications such as log analysis, intrusion detection systems, password vulnerability testing, etc. re-quire high performance search capabilities to enable real time operational performance improving the effectiveness of these applications. This paper discusses experiments performed using the Intel AVX-SIMD (Advanced Vector Extensions -Single Instruc-tion Multi-Data) vector instructions for search, that demon-strate significant performance improvements in searching memory based datasets.

Poster Abstracts

Developing Measures of Effectiveness for Evaluating Dynamic Honeypots

Jason Pittman, Kyle Hoffpauir,
Nathan Markle, and Cam Meadows
High Point University

Cybersecurity is the science of making things in cyberspace secure. With that in mind, we can investigate concepts related to what cybersecurity entails as part of the STEM family. Generally speaking, making objects secure involves detecting, preventing, and correcting that which may result in security breaches. These three behaviors assume one critical fact: defenders know enough about what an attacker is doing to identify an attack. To that end, we can employ a particular type of cybersecurity technology called a honeypot. As the name suggests, honeypots attract attackers with the goal of capturing the attackers' behavior so that cybersecurity experts can analyze the information and develop better defensive technologies. Unfortunately, honeypots are extremely difficult to implement and maintain. Dynamic honeypots, one specific type of honeypot intended to learn about the enveloping computing environment and modify itself to blend in, are specifically problematic in this manner. In fact, existing literature contains a plethora of suggestions as to how dynamic honeypots can be effectively deployed or managed. However, there is little quantitative validation of effectiveness in this regard which leaves professionals, researchers, and educators without the means to differentiate between implementation or management modalities. This left us to wonder if there are common features across dynamic honeypot management systems which may facilitate development of measures of effectiveness metrics. Accordingly, we sought to develop a standardized set of measures and validate these through a series of pretest posttest experiments. If used on a wide scale, the measures of effectiveness would enable cybersecurity professionals to rigorously evaluate how to best manage their dynamic honeypot implementations. Furthermore, such measures ultimately will help researchers quantitatively differentiate between improvements to honeypot technology.

Machine Learning based Critical Thinking Assessment Tool

Moumita Deb and Sahithya Reddivari
Georgia State University

Critical thinking is an essential educational outcome across college majors. The success of developing critical thinking skills among students is closely tied to the ability to assess these skills accurately and frequently. While there are many validated assessment tools for critical thinking (Assessing Critical Thinking in Higher Education, Liu et al. 2014, ETS Research Report), there are very few validated assessments that provide formative feedback. Moreover, the assessments that do provide formative feedback, constructed response rubrics, are heavily reliant on human scorers that come at very high costs or sometimes even limited access.

In order to enable instructors and students to assess critical thinking skills frequently and provide timely formative feedback, this study proposes to develop a machine-learning-based automated essay assessment tool. This tool will use the AAC&U Critical Thinking Value Rubric to train, validate, and test student essays from introductory engineering courses to provide formative feedback to instructors and students. The tool is developed using the Text Analytics Toolbox and Deep Learning Toolbox of the MATLAB programming suite. The training and validation sets will be created based on ratings from two human scorers. This poster will present the development process of the training set, present preliminary results of the training and validation process. The proposed applications and implementations of the program will be addressed.

Binary Classification for Network Intrusion Detection in Drones

Sierra Wyllie and Ismail Abumuhfouz
Gatton Academy of Mathematics and
Science and Western Kentucky University

The technological growth of drones and other Unmanned Aerial Vehicles (UAVs) is inevitable. They are currently used in a variety of fields, but this usage is susceptible to cyberattacks; which may endanger privacy, national security, and even human life. Network Intrusion Detection Systems (NIDS) are used to monitor a network or systems for malicious activity or policy violations. The current NIDS are ineffective in protecting drones against novel attacks. This project seeks to create a binary classification NIDS to protect drones from WIFI attacks. We combine the NIDS with Artificial Intelligence (AI) to increase detection of previously unidentifiable attacks. Several AI-enabled NIDS already exist in different fields, but to the best of our knowledge, this is the first NIDS that is tailored specifically for drones. We evaluate the performance of the AI algorithms of random forests, stochastic gradient boosting, and K-Means for binary classification on the CICIDS2017 dataset.

Using facial recognition to secure access of facilities

Peter Keres and Maidel Fletes
Columbus State University

Technology has become increasingly part of our daily lives from conducting work on our laptops to measuring our sleep cycle with wearables. With advanced technology being introduced into our lives the topic of security is more prevalent than ever. Various companies have taken action to enhance security by incorporating various practices; Some assign their employees credentials to monitor company access.

However, security measures to ensure confidentiality can be reinforced utilizing biometrics. Our prototype allows employees in/out of facilities with facial recognition technology; Most facial recognition technology has the capability to grant and deny users access, however, no data is kept on the intruders. Our prototype notifies the system administration of the intruder via email, containing the intruders face and attempted access time. The prototype begins with creating a database of employees faces. Once the database has been created and the recognizer has been implemented. When an employee stands in front of the camera and if their face is a match in the database, access will be granted to the facility However, if no match is found an email is sent to the system administrator of the intruder. Our prototype provides a connection between an individual and their record in the database. The direct interaction between the system and the system administration allows for a safer work environment and attention to security only when necessary.

My experience of using MongoDB for financial data management

Guangya Liu
Tennessee Tech University

MongoDB is a NoSQL, document-based, and distributed database.
MongoDB is very suitable for financial data storage and analysis. Giant financial services firms, such as HSBC, HIS Markit and so on, are reinventing their core systems with MongoDB. There are two main reasons for it. First, high-frequency financial trading data is real-time, massive and valuable. As a result, frequent data mining and establishment of new models are needed to utilize the data. MongoDB satisfies these needs better because it stores data in Json-like documents and is a distributed database. Second, financial data types are complicated and various. Comparing with traditional SQL database, MongoDB can deal with the unstructured data easier and more efficiently.
I use MongoDB to manipulate financial data with Python language. In order to get real-time and clean financial data, I use a Python library called tushare, which is a utility for crawling data of China stocks, to get the data in Json or CSV format. The financial data includes both structured and unstructured data. There are mainly three types of structured data. First, basic information about the stocks, such as the stock name and basic information of listed companies. Second, real-time and historical market data, such as date line. Third, listed companies' financial data, such as cash flow. Unstructured date includes listed companies' announcements, news report and so on. Then I store the data in MongoDB. MongoDB can do most of the things that a SQL database can do, supporting ACID transactions and joins of queries (1), so I use a Python Library called Pymongo to complete various types of manipulations. Furthermore, I am exploring how to use visual tools, such as Echarts (a visualization library), to visualize the financial data.

Applying Machine Learning to Develop an Adaptive Robotic System for Patients with Amputations

Hayden Richard and Saeid Samadidana
Austin Peay State University

Machine learning has many different use cases and one interesting case is in IoT health care such as helping stroke victims with physical therapy. The therapy consisted of a wearable armband that had sensor on the inside to be able to detect muscle movement. The band is attached around the forearm of the patient to feel for muscle movement. The armband would send information to a IoT device that controls a robotic arm that would predict the full muscle movement the patient is trying to make from sensors. Experiments have been done showing that with the use of a IoT device like this was much more effective with assisting patients with physical therapy. The conventional way of therapy can lead to low moral and reduce the patient's willingness to try, due to the repetitiveness of the activities. The accuracy of the armband was 99.76% accurate but if the armband was taken off and put back on the accuracy would drop by 6%. Do to the fact that the sensors in the band wouldn't be in the same exact spot. Research should be done to increase accuracy of the armband, by creating a new learning system for when the patient first puts on the band so that it can recalibrate to its's new position. This new system will be able to contain robotic device that would be able to substitute if someone has had a finger removed. That would be able to monitor the movement of a patient's arm movement and send it to a robotic finger that would be able to move naturally with the rest of the patient's hand. Allowing for patients to be able to regain full control of their hand.

Healthcare Internet of Things Solutions Architecture

William Trentham and Saeid Samadidana
Austin Peay State University

The Internet of Things in the healthcare sector is becoming widely popular. The ability to remotely view a patient's vitals and other health related data helps the healthcare providers provide better services for the patient and it can also help to keep the cost of healthcare down. These Internet of Things solutions generally have similar architectures. This architecture consists of 3 separate levels; Wearable body sensors, internet connected gateways, and the cloud. These 3 components work seamlessly together to gather data, analyze the data, and share this data with the healthcare professionals.

The wearable body area sensors are worn by the patient which collects health center data. One example is an ekg monitor monitoring heart activity. These sensors do not have much processing power; however, they do not need to perform any taxing data analysis. However, instead they transmit the data gathered to the gateway devices. These gateway devices are generally smart phones, tablets, or laptops. These devices are essential because of the mobility of the devices. These gateways are responsible for storing some of this data and performs some data analyses, but the main function is transmitting the data to the cloud. The cloud is where all the data is stored and then actions like data mining and machine learning are performed on the data in order to get useful information from this data. This information determined by the cloud computing is sent to the healthcare professionals where they can analyze it and provide the patient with the appropriate treatment. All of these components are essential to the success of the Internet of Things architecture. Using this architecture in an Internet of Things solution can help revolutionize the Healthcare sector for all parties involved. Different IoT health care architectures will be investigated.

Conference at a Glance

	Azalea	Dogwood I
7:30 AM	**Morning Coffee–Poolside**	
8:00 AM	**Welcome and Keynote Address**	
9:00 AM	**Coffee Break–Poolside**	
	Session I– Undergraduate	**Session I– Undergraduate**
	Chair: K. Carter	Chair: K. Poudel
9:15 AM	C. Hinton and L. Saul	P. O'Boyle, et al.
9:35 AM	A. Hewitt	J. Downing and F. Hardin
9:55 AM	J. Williams and A. Khan	J. Ellerbee and L. Small
10:15 AM	C. Woods	
	Session II– Undergraduate	**Session II– Undergraduate**
	Chair: C. Tanis	Chair: S. Samadidana
10:40 AM	J. Freeman and P. Drew	J. Galloway, et al.
11:00 AM	L. Koch	R. Diaz
11:20 AM	A. Nguyen	M. Fletes, et al.
11:40 AM	G. Hay and N. Reid	
12:00 PM	**Lunch–Patio Restaurant**	
	Session III– Undergraduate	**Session III– Posters**
	Chair: M. Hasan	
1:00 PM	D. Capers	W. Trentham, et al.
1:20 PM	B. Faulkner and C. Humpreys	P. Keres and M. Fletes
1:40 PM	E. Suggs	J. Pittman, et al.
2:00 PM	N. Phan and C. Dong	J. Galloway, et al.
2:20 PM	**Break–Poolside**	
	Session IV– Undergraduate	**Session IV— Posters**
	Chair: D. Luginbuhl	
2:35 PM	V. Coleman	H. Richard, et al.
2:55 PM	E. McCary and D. Ferguson	S. Wyllie and I. Abumuhfouz
3:15 PM	D. Holmes	G. Liu
3:35 PM	C. Li, et al.	M. Deb and S. Reddivari
4:30 PM	**Business Meeting–Highlander I**	
7:00 PM	**Awards Banquet–Azalea**	

	Dogwood II	Highlander I	Highlander II
7:30 AM	**Morning Coffee–Poolside**		
8:00 AM	**Welcome and Keynote Address**		
9:00 AM	**Coffee Break–Poolside**		
	Session I - Graduate	**Session I– Professional**	**Session I– Professional**
	Chair: Yingbing Yu	Chair: M. Wiggins	Chair: J. Church
9:15 AM	D. Jaiswal	S. Samadidana	X. An and C. Chen
9:35 AM	R. Dohner and S. Seo	S. Khan	K. Carter
9:55 AM	C. Bare, et al.	K. Adcock	M. Hasan
10:15 AM		K. Krishnaprasad	D. Frazier
	Session II– Graduate	**Session II– Professional**	**Session II– Professional**
	Chair: Greg Kawell	Chair: R. Lowe	Chair: B. Bradley
10:40 AM	H. Ghanta	R. Lowe	M. Naghedolfeizi, et al.
11:00 AM	S. Deb	D. Ulybyshev	G. Husari
11:20 AM	V. Andrews	H. Li	B. Bradley
11:40 AM	H. Hok, et al.	J. Roach	D. Williams, D. Williams
12:00 PM	**Lunch–Patio Restaurant**		
	Session III– Undergraduate	**Session III– Professional**	**Session III– Peer Reviewed**
	Chair: Xiangdong An	Chair: J. Church	Chair: S. Reddivari
1:00 PM	L. Freeze, G. Hay, B. Whitson	J. Guerin and K. Ericson	W. Confer
1:20 PM	C. Justice, et al.	F. Elsherif	J. Elarde, B. Bruster
1:40 PM	S. Hollingsworth, et al.	K. Ericson	
2:00 PM			
2:20 PM	**Break–Poolside**		
	Session IV–	**Session IV–**	**Session IV–**
2:35 PM			
2:55 PM			
3:15 PM			
3:35 PM			
4:30 PM	**Business Meeting–Highlander I**		
7:00 PM	**Awards Banquet–Azalea**		

Glenstone Floor Plan