A Message from the Department Chair

Faculty Promotions and New Hire

ProcessJ

Cybersecurity

Sustainable Transportation

Faculty Highlight: Andreas Stefik

Information Retrieval and Natural Language Processing

Undergraduate Research

App Development
Greetings from the Department of Computer Science. This has been a challenging year for all of us due to the global pandemic and its effect on all of us; however, together we have persevered and continue to set the example in both research output and remote instruction. What follows is a small sample of all the wonderful projects happening in our Department.

Kazem Taghva
Chairman and Professor, Computer Science Department
The department promoted Dr. Nasoz to the rank of Associate Professor of Computer Science.

The department also appointed Dr. Vasko to the rank of Assistant Professor In Residence. These are well-deserved promotions and appointments.

The department hired Dr. Prashant Modekurthy as the assistant professor of computer science. He is a 2020 graduate of the computer science department at Wayne State University. His research focuses on Real-Time control of wireless networks with applications in manufacturing, health care, and autonomous driving.
The research group’s main focus is on developing the ProcessJ process-oriented programming language, compile, and runtime-system. Process-orientation is a concurrent paradigm that was originally conceived in the 1980ies by British computer scientists and built on the foundation of Tony Hoare’s Communicating Sequential Processes (CPS); This makes programming written in languages that share such semantics verifiable with respect to certain behaviors like deadlock, livelock, and refinement.

The current focuses are threefold: Firstly, on meta languages for automatic generation of type checkers; we are working on developing a type-checker generator that can be used for quickly implementing type checkers for most domain specific and general programming languages. Secondly, we are working on developing an efficient runtime system written in C++ that utilizes a cooperative scheduler on a multi-core/multi-cpu system. Currently we have a single core version that has proven to be able to handle 2.5 billion cooperatively scheduled concurrent processes. We wish to extend this to both multi-core and multi-cpu, and, eventually, inter machine systems. The third major pillar in the research group is just starting: we will be looking into the possibility of using GPUs with a process-oriented programming model. Much of the research groups machine power comes from a cluster of 3 new very powerful computers: each has Two AMD EPYC Rome 7452 CPUs, clocked at 2.35GHz (turbo up to 3.35GHz), with 64 cores, 128 threads total. Also, these machines have 512 GB DDR4 SDRAM clocked at 2666MHz, with ECC.

-Dr. Matt Pedersen
UNLV Computer Science department offered a 3-day cybersecurity training class led by Dr. Yoohwan Kim in October 13 to 15 for MSTS engineers. Mission Support and Test Services (MSTS) manages operations at the Nevada National Security Site (NNSS) and at its related facilities and laboratories. The training covered the basics of control systems and its vulnerabilities, cryptographic foundation, SCADA system protocols, penetration testing for SCADA systems, and defensive measures against cyber-attacks. Attended hones their cybersecurity skills through 15 practical labs covering cryptography, packet sniffing, networks scanning, vulnerability testing, hacking of Modbus and DNP3 protocols. Ten MSTS engineers from multiple locations participated in it and rigorous procedures were taken to prevent COVID-19 spread. This event is expected to nurture future collaboration and strengthen the relationship between UNLV and MSTS.

Dr. Yoohwan Kim also presented his research on blockchain at the AFCEA Las Vegas Chapter conference on November 3. AFCEA (Armed Forces Communications & Electronics Association)
International is a non-profit association with more than 30,000 members serving the military, government, industry, and academia as a forum for advancing professional knowledge and relationships in the fields of communications, information technology. The AFCEA Las Vegas chapter (www.lasvegas.afceachapter.org) serves the intelligence and IT communities in the greater Las Vegas area to include Nellis AFB, Creech AFB, the Nevada Test, and Training Range, local contractors, and businesses. It hosts annual Technology & Cybersecurity Day Conference and this year it was held as a virtual conference. Various speakers presented on communications, cyber-crimes, cyber threat intelligence, and Prof. Kim gave a speech on “Blockchain for the USAF”. UNLV College of Engineering was also a community partner for this event. (https://www.eventbrite.com/e/afcea-las-vegas-chapter-technology-cybersecurity-day-virtual-tickets-115251012882#)
Wolfgang Bein reports new research activities in the area of sustainable transportation. The work seeks to bring algorithmic methods to an area of high societal impact. It is intended to use optimization techniques such as particle swarm optimization, optimization under uncertainty, online optimization, game-theoretic methods to navigate complex situations and machine learning approaches to harness the information hidden in very big data sets.

In 2020, Bein has advised two Masters' students in this area, who have both graduated. He is also currently advising one Ph.D. student and co-advising another Ph.D. student in this area. Yazmin Martinez works on machine learning methods to better control traffic flow in the Las Vegas valley using traffic data from the Regional Transportation Commission of Southern Nevada. Furthermore, Laxmi Gewali and Wolfgang Bein are collaborating on optimization techniques and methods from computational geometry to find new approaches for efficient EV battery exchange. Gewali and Bein share equally in advising the second Ph.D. student, Dara Nyknahad.
Andreas Stefik continues to lead with multidisciplinary projects, with a middle ground emphasis between accessibility, programming languages, software engineering, and computer science education.

Most recently he was asked by Microsoft Research to do a talk about evidence in computer science education related to individuals with disabilities.


In other news Stefik managed to pass an “Evidence standard” at a major ACM Transactions, which to our knowledge is the first journal in computer science to formally adopt a standard of formalized evidence for paper publications.

ACTIVE PROJECTS:

- Evidence-Based Programming Language Design
- The Quorum Programming Languages
- Engaging Students with Disabilities
- Microtonal Music Notation Project
The department has established a group in Information Retrieval (IR) and Natural Language Processing (NLP) that is led by Kazem Taghva and Jorge Fonseca. Currently there are seven Ph.D. students in this group working on research projects. The following is a list of highlights:

**New Equipment:** The group has purchased two new GPUs (Nvidia A100 and Quadro 8000RTX) to support the experiments. These GPUs were purchased from the NSF award 1625677 (Taghva, Gewali, Ge).

**Alzheimer’s Research:** In collaboration with Dr. Jeffrey Cummings in the Department of Brain Health, the group uses neural language models such as BERT to predict the Mechanism of Action of drug treatments in clinical trials for Alzheimer’s Disease to aid in creation of the Alzheimer’s Disease Drug Development Pipeline published yearly by Dr. Cummings.

**Master of Science in Data Analytics:** The Board of Regent has approved a new interdisciplinary M.S. degree in Data Analytics. Six colleges at UNLV are involved in this program. Kazem Taghva is appointed as the first director of this program. The group in IR and NLP will be involved with the development of the data analytics lab (TBE A308).
Undergraduate Research

This year several research projects involving undergraduate research took place that led to publications including Using Machine Learning to Process Filters and Mimic Instant Camera Effects with Undergraduate students: Deirdre Chong, John Farhad Hanifzai, Hassan Adam, and Jorge Garcia led by Jorge Fonseca.

Another notable project involves using Cameras and Computer Vision to detect whether users are violating social distance apps and interfacing them with our ULABS app to generate warnings to the users and the administrators of the lab.
Jorge Fonseca, Sam Black and Kazem Taghva led app development at UNLV by creating three apps for different organizations. The first app was for the Nevada Department of Transportation, in association with the School of Public Health, with the goal to encourage K-12 students to walk to school today.

Walk2School2Day is an app that allows Nevada parents and guardians to create, organize, and administer walking groups so students can walk to and from school safely. Parents can communicate within the app and get alerts when their children arrive safely. Encourage healthier and greener lifestyles by walking to school instead of driving there!

The second app, ULABS: University Lab And Broad Schedule, was created as a response to the SARS-CoV-2 pandemic. It enables computer labs to follow social distancing procedures by scheduling users to computers that are at least 6 feet apart, even if the workstations themselves are not, by disabling workstations between different users, but also by swapping them to allow for a cooldown, or cleaning, period. It also enables form download and virtual signature submissions. The app also allows scheduling of office hours, or any space usage, automatically and even has a quick notification system to be in constant communication and engagement with the students.

Finally the third app was sponsored by the UNLV Office of Economic Development and showcases UNLV technologies and license the innovations by faculty and students to entrepreneurs and other external reviewers.
Credits

This newsletter was prepared by:
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- Jorge Garcia (cover and campus photography)
- Submitted by Authors and other sources.