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Mason's Data Mining Experts: Finding Needles in Database Haystacks

Consider the data you created today. Perhaps you bought a book on Amazon.com, paid a bill through Bank of America's portal, sold stocks through eTrade, downloaded an on-demand movie from Netflix, and then watched your lunch being created through Domino's Pizza Tracker. Now consider the data chain reaction that these everyday occurrences cause including inventory management, national financial transactions, international corporate profits, vendor and supplier communications, and fuel purchased by the pizza delivery employee in a particular ZIP code to bring your lunch. Multiply that by the hundreds of millions of people in just the United States doing similar activities 24-hours a day and well—that's a lot of data. And that data is valuable, very valuable. The ability to break down mind-numbing amounts of data into usable data sets that can then be analyzed and used for other applications comes from data mining.

Daniel Barbará, a data and text mining expert working and teaching in Mason's Department of Computer Science program, says, "Data mining provides a cornerstone to many other projects across all industries including medical research, government, commerce, intelligence analysis, and manufacturing just for starters." He explains that this area of computer science research involves high-level technical skills to develop programs that can analyze enormous data sets for variables that people are interested in discovering. However, he's quick to point out there's also a human creative element needed to understand and analyze the results. "There are no off-the-shelf data mining software tools," says Barbará. "We build programs using standards and known methods, but we must also know what we are looking to find." Barbará uses an example of text mining to explain how intelligence agencies could track political uprisings by looking for the frequency of specific key words or phrases in thousands of published news reports, social media feeds, and communications. Data sets could be as contained as

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reports from a few weeks from a few countries or expanded to cover several years from across the globe.

Barbará says that Mason is fortunate to have an incredible data mining faculty, Jessica Lin, Huzefa Rangwala, Carlotta Domeniconi, and Harry Wechsler, who are each sought-after researchers working with industry and who share their skills in the classroom. Barbará says another strong component of the team is that each faculty member has his or her own interest and specialty. They often work together breaking down complex problems using their specialized knowledge.

Jessica Lin is interested in time-series data analysis, a method that looks at data over a specific time sequence to see performance patterns. She and one of her research students are currently working on a three-year grant from computer chip maker Intel. They are looking at yield analysis for CPUs to map malfunctioning components, causes, and potential faults. She explains, "We are looking at data from good and bad chips to determine where problems may occur." She hopes to determine, for example, whether bad chips are caused by manufacturing faults at specific locations, problems with equipment, or even raw materials. With the data, Intel can work to improve its manufacturing and produce better and more consistent products.

Harry Wechsler, Director of the Center for Distributed and Intelligent Computation, takes data mining in a different direction - biometrics. For twenty years, he has been studying ways to measure physical traits, such as facial features, or behavioral traits, such as gait, to identify people. Law enforcement agencies use databases that house pictures of missing persons or criminals. The ability to identify people is useful. But, as Wechsler explains, the problem becomes more

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complex because of image reliability. "We don't look the same throughout the day, let alone throughout our lives," says Wechsler. Other questions are how to handle incomplete information, such as a profile, and whether models can be developed that measure a person's emotional intent based on his or her smile, health, and movement. Wechsler says, "If we have the ability to make predictions, we can make assumptions that can help with future findings." His research has broad commercial applications in our ever-connected world where we worry about protecting against identity theft, finding missing persons, and tracking down criminals.

Mason's data mining experts have many public and private research grants and opportunities. The need for experts who can make these types of connections from these growing data sets will only increase over the next few years. When asked what is next for the field, Barbará smiles and says, "Hadoop." This is a software platform originally developed by the Apache Software Foundation and first used by Yahoo and later adopted by Google and others. It is used to solve problems involving massive data sets. Barbará is teaching Hadoop through two classes: CS 757 (mining massive data sets) and CS 795 (specialized topics). He says that students who become Hadoop experts or gurus, as they are called, are in high demand.

Putting Teaching and Learning Together for Students

One of the hallmarks of computer science education at Mason is that faculty members teach all classes, from entry-level to PhD. This high-level instruction ensures that students are exposed to experts who bring a passion for their subjects and innovative teaching styles to their classes.

Professor Huzefa Rangwala is one such faculty member who is experimenting with an active learning teaching technique, "jigsaws," that he was introduced to in a preparing future faculty program at the University of Minnesota.

The premise of this teaching method is that students, either in groups or alone, divide learning tasks and topics or work into small groups to study the problem in-depth and to solve their portion of the assignment. Rangwala says, "The students are expected to read and study the subtopics at a sufficient depth so as to call themselves experts." The entire class then comes together, and each piece is explained to the entire group.

Rangwala has implemented this method in his classes, allocating about a half session to the exercise. "I oversee the discussions and facilitate the dialogue in each of

CS Faculty Makes the Grade

The CS Department has grown again to meet the demands of in-coming students and the explosive growth and interest in computer security. We'd like to introduce our newest faculty members: Damon McCoy, Avinash Srinivasan, and Mark Snyder.

Damon McCoy

Damon McCoy likes to dig head on into computer security and privacy issues. Last year, Damon and fourteen research colleagues from a consortium of California-based Universities made news with an investigative research project that traced spam messages coming from companies selling herbal and medicinal pharmaceuticals. The group presented their paper, "Click Trajectories: End-to-End Analysis of the Spam Value Chain" at the 2011 IEEE Symposium on Security & Privacy. The research revealed that most spammer credit card transactions were being funneled through only three international banks. The project revealed vulnerabilities and pointed to methods that law enforcement could use to stop spammers. Damon says that they didn't know what they were going to find when they began following email and even purchasing products online. Damon joins the department as an assistant professor. He says that his research will continue and that he's looking forward to bringing it to the department. He's excited about the collaborative nature of the faculty and the resources that the university has. He will continue his research into the economics of cyber crime and teaching network security. When he's not in front of a class or behind a monitor, he hopes to find some great snow in the mountains for snow boarding and hiking.

Avinash Srinivasan

Avinash Srinivasan - specializes in digital forensics and security with a special emphasis on Network and Apple forensics. He says, "Cyber criminals are getting better at covering their tracks." He is especially interested in forensic methods that allow investigators to piece together security breeches that do not have an obvious trace and ways to quickly extract information on malicious code while it's running but before system damage can spread. He explains that forensics is an ever changing and growing field with a lot of research opportunities. He joins the faculty as a term assistant professor and in addition to his research, he will be teaching courses on information security and assurance. Avinash and his family are excited to be here in Northern Virginia. He says that he became familiar with the area after a few visits and felt that there were tremendous opportunities here. He's looking forward to the collaborative environment of the department as well as access to the federal government and technology sector here in the area.

Mark Snyder

Rounding out our new faculty is **Mark Snyder** who has joined the Department as a term assistant professor and is teaching several sections of Introduction to Programming and Introduction to Computer Systems. Mark has an intense interest in teaching and working with students to make programming accessible and interesting. He is also as intrigued with the complexities of computer science as he is with music and dance and eagerly shares his passion for both. Mark grew up in Virginia and while in graduate school at the University of Kansas, he knew he wanted to teach and that he wanted a position that would bring him closer to home. Mark says that Mason is a good fit for his interests. "I come from a family of teachers," he says. "I want to be approachable to my students so that they come to class eager to learn and leave ready for their next challenge." In addition to CS classes, Mark also teaches ballroom dancing on campus and has links on his Mason webpage to his musical compositions.

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the groups," he explains.

He has been pleased with the results, saying that the overall feedback is that students like working this way. "The exercise also encourages everyone to participate in a subject where many times students are only used to attending classes and working alone. It's both an academic and team-building exercise."

Rangwala sees active learning as an important tool in his teaching and plans to continue using and sharing it with the rest of the department.

▼ Alumni Spotlight

Alan Harbitter

Alan Harbitter embodies a spirit that is common for Washington, DC–area alums: entrepreneurship, volunteerism, and a love of learning. Harbitter, a 2002 PhD recipient, has a personal focus and vision that has propelled him to the top of his career. Over the past three decades, he has used his executive and technical management experience to great success. His milestones include building his former company, PEC Solutions, with partners Dave Karlgaard and Paul Rice, into a multi-million-dollar, publicly traded company; and serving as founding chair of the Washington Area Chief Technology Officers' Roundtable; chair of the University of Maryland College of Computer Mathematics and Natural Sciences (CMNS) Board of Visitors; and treasurer/trustee of The Arc Foundation of Northern Virginia (advocacy for the handicapped) and the Medical Care for Children Partnership Foundation.

Computing News recently caught up with Harbitter, who splits his time between Washington, DC and California. With an energetic, enthusiastic attitude and easy-going personality, it's clear to see how he has been so successful at translating the abstract and technical language of high tech and security to boardrooms and business leaders.

Harbitter's work with Mason and the CS department began well before his PhD program. While at the technology helm of PEC Solutions, he sought out relationships with area universities as a way to find top talent and access to research. "I got the best response from the engineering school and the CS department," says Harbitter. "The department was eager to work with me and my company." Over the years,

Alan Harbitter

Harbitter's relationship with and support for the school have grown. He chaired the naming committee for the school, he served on the Advisory Council and the selection committee for the new dean, PEC Solutions endowed an undergraduate scholarship, and the Harbitter Family has endowed a scholarship and has included Mason in two charitable trusts. Additionally, his company provided jobs and internship opportunities to talented students.

However, Harbitter is never satisfied to rest on his laurels. At the time he and his partners were considering taking PEC Solutions public, he also began a PhD program at Mason. "There were ideas and concepts I wanted to explore," says Harbitter. "I didn't need the degree to further my career; I wanted the degree to see what I could learn." He looks back on that time in his life as chaotic: writing his dissertation at the same time he was about to take his company public and raising three daughters. He laughs, saying that he didn't know what he was thinking

but that the experience of the degree was worth more than he could have imagined.

And while becoming *Dr. Harbitter* didn't affect his company's IPO, he says it did affect how his peers viewed him. He recalls times in his life where he needed to be the technology expert on many high-level problems: the smartest person in the room. Having the PhD was a credential that smoothed the path. Harbitter views education as a powerful tool, and Mason's CS department as a place that lives up to the challenge of preparing students for a technology career—one that is constantly evolving and changing.

In 2005, Harbitter sold PEC Solutions to Nortel Networks Corporation, and he continued on for several years. Nortel filed for bankruptcy protection in 2009, and Harbitter is saddened by its demise but is quick to say that the division that grew out of PEC Solutions has survived and is now owned by Avaya. He has moved on as well. Today, Harbitter runs Harbitter Consulting, LLC, where he works with a hand-selected group of companies that are seeking strategy and planning advice to reach their goals.

Although his work as a business consultant seems far removed from his work as an information security expert, it's not. Harbitter began his career with an interest in computer and software performance and finding solutions to keep systems running efficiently and securely. Today he is working with business executives to establish business performance and growth solutions. He is enjoying this second career and his ability to apply all that he has learned and achieved to his clients.

▼ In Memoriam

Dr. Ricci Lynn Heishman

It is with extreme sadness that we report the loss of our dear friend and colleague, Ric Heishman who died last September after a long battle with cancer. Ric's life was filled with both adventure and love. As a young man he entered into military service and joined the United States Navy nuclear power program. It was here that his intelligence was rewarded and he followed his service with an engineering degree at the University of Cincinnati, an MS in information technology from American University, and his PhD in 2008 in information technology from our CS department here at Mason.

He combined his military experience and education into a twenty-year consulting career working with the defense industry. From there he took his real-world experience to the classroom and was both a faculty member for Northern Virginia Community College and served as Assistant Dean of Computer Science and Information Technology.

In 1991, he married Miriam Miller in what is said to be his "smartest decision." Tragically she died in January 2011. Their son Dmitri survives them both.

As a faculty member in our department, Ric taught both CS 112 and CS 211. These required introductory CS courses put him into contact with scores of entering CS freshman. He, for many students, was the gate-keeper to their degrees. Students describe his classes as challenging but say if "you listen to him you'll learn unbelievable things." Many students felt that his classes were essential to preparing them for their future. Heishman garnered their respect, admiration, and friendship. This was echoed by his fellow faculty who miss his upbeat attitude.

Ric left us all too soon but his devotion to his family and friends serves as a statement to the quality of his life. His dedication to his teaching and his students has inspired a new generation of computer scientists.

Graduation 2012

Join us for the

2012 Volgenau School of Engineering Convocation

May 17, 2012 at 1:15 at the Patriot Center.

Special guest speaker,
Dean Lloyd Griffith
of the Volgenau School

Game On!

A stereotype of a computer scientist is a nerd sitting in a dark basement somewhere mindlessly programming away. Video game developers, on the other hand, are perceived as cool innovators with the best jobs in the world. Interdisciplinary programs, such as the Volgenau School's BS degrees in Applied Computer Science (ACS), help attract young people to computer science and show them the vast possibilities available to computer scientists. Computer Game Design is one of the hottest ACS concentrations.

photo: Blizzard Entertainment

Today's computer games vary as widely as the technologies used to support them. From smaller, mobile games like *Angry Birds*, to sophisticated massively multi-player online games like *World of Warcraft*, to novel interaction devices like the *Kinect*, CS concepts and techniques lay at the core.

Moreover, mobile games allow people to jump into game development quickly and have playable, perhaps even marketable, results.

In addition to core CS classes, students pursuing the Computer Game Design concentration take four game specific courses, *Culture and Theory of Games*, *Introduction to*

▼ Chair's Message

Dr. Sanjeev Setia

Welcome to the spring 2012 Computer Science newsletter, my first since becoming department chair last fall.

It is an interesting and exciting time in the history of Mason, in light of all the leadership changes underway. We will have a new university president (Dr. Angel Cabrera) and a new dean of the school of engineering (Dr. Kenneth Ball) next fall. Both Mason and the Department of Computer Science are poised to take the next step towards greater national and international recognition for our excellence in education and research.

> Our PhD program continues to grow in size and reputation. This year, our PhD program was one of five programs at Mason selected for additional funding by the Office of the Provost.

Our faculty continues to win teaching and research awards. Amarda Shehu recently became the eighth faculty member in the department to receive an NSF CAREER award, and Tamara Maddox was selected as one of the recipients of the prestigious university-wide Teaching Excellence Award for 2012.

Our department research funding continues to increase with expenditures exceeding $4.25 M for the 2011 fiscal year. Undergraduate enrollments in Computer Science are up again reflecting national trends. In particular, student interest is high in the computer game design concentration of the BS in Applied Computer Science. At the graduate level, while overall enrollments in our Masters programs are stable, there is great interest in the MS in Information Security and Assurance, given the increasing importance of cybersecurity. Our PhD program continues to grow in size and reputation. This year, our PhD program was one of five programs at Mason selected for additional funding by the Office of the Provost. These additional funds will enable us to make more competitive financial aid offers to incoming PhD students.

Within the department, we mourn the untimely passing of our colleague, Ric Heishman, who died last September, after a lengthy battle with cancer. On a happier note, we welcome three new faculty members Damon McCoy, Mark Snyder, and Avinash Srinivasan, who are profiled in this newsletter. Also, Tamara Maddox and Dave Nordstrom were promoted to Term Associate Professor, and Danny Menasce was selected as a University Professor.

This issue of *Computing News* highlights some of the achievements and work of our faculty, specifically Huzefa Rangwala's use of active learning teaching techniques and the research being conducted by faculty in the area of data mining. Also included is a profile of Dr. Alan Harbitter, who is one of our most distinguished alumni.

Finally, I would like to thank Hassan Gomaa, my predecessor as chair and Pearl Wang, who is continuing as Associate Chair, for all their hard work and service over the last several years and for ensuring that the department is in excellent shape and well positioned for continued growth and success.

Computer Game Design, and *Game Programming I and II*. Courses in computer graphics, physics, linear algebra, and 2D and 3D animation are also required.

Graduates of the program have knowledge of the artistic process and pipeline and the strong mathematical and computer science skills needed for technologists in the entertainment industry. Furthermore, their experience with developing large, complex software systems with real-time requirements makes them attractive hires to the more traditional computer industries as well.

Interest in the program continues to grow. The CS department is currently interviewing several faculty candidates to fill a position that will further strengthen the department in this area. More information about the ACS Game Design degree can be found on its website: http://cs.gmu.edu/~acsgame/

Computing News