DePaul University – College of Computing and Digital Media
School of Computer Science Research Colloquium Fall 2010

organized by Jose P. Zagal

September 10

James Riely, DePaul CDM

Understanding Relaxed Memory Models

The specification of the Java Memory Model (JMM) is phrased in terms of acceptors of execution sequences rather than the standard generative view of operational semantics. This creates a mismatch with language-based techniques, such as simulation arguments and proofs of type safety.

We describe a semantics for the JMM using standard programming language techniques that captures its full expressivity. For data-race-free programs, our model coincides with the JMM. For lockless programs, our model is more expressive than the JMM. The stratification properties required to avoid causality cycles are derived, rather than mandated in the style of the JMM.

The JMM is arguably non-canonical in its treatment of the interaction of data races and locks as it fails to validate roach-motel reorderings and various peephole optimizations. Our model differs from the JMM in these cases. We develop a theory of simulation and use it to validate the legality of the above optimizations in any program context.

Bio: I am an associate professor at DePaul University. My research centers on applications of programming language theory to practical problems, such as software security. This work is support by the NSF.

September 17

Runa Bhaumik, DePaul CDM

A Clustering Approach to Unsupervised Attack Detection in Collaborative Recommender Systems

Securing collaborative filtering systems from malicious attack has become an important issue with increasing popularity of recommender systems. Since recommender systems are entirely based on the input provided by the users or customers, they tend to become highly vulnerable to outside attacks. Prior research has shown that attacks can significantly affect the robustness of the systems. To prevent such attacks, researchers proposed several un-supervised detection mechanisms. While approaches such as VarSelect(PCA clustering)

and Neyman-Pearson statistical detection technique produced satisfactory results in detecting some well studied attacks, they suffered low accuracy in detecting real user profiles for an obfuscated attack studied recently. The UnRAP algorithm produced unsatisfactory results in detecting a focused "segment" attack, which targets a specific group of likely buyers.In this paper, we propose an unsupervised anomaly detection approach by computing detection attributes modeled on basic descriptive statistics. Our experimental results showed that attribute-based k-Means clustering algorithm can detect spam users with a high degree of accuracy in detecting attack users and low false positives regardless of attack strategies.

Tom Schimoler, DePaul CDM

Resource Recommendation for Social Tagging: A Multi-Channel Hybrid Approach

Social tagging systems allow users to annotate online resources with arbitrary labels producing rich information spaces. Given the complexity and size of these information spaces, recommender systems are essential in helping users discover new resources, tags or even other users. Building such recommenders has proved a challenge, because the data is noisy, large, and multi-dimensional. There has been active interest in sophisticated models that leverage all three dimensions of a social tagging system (user, resource, tag). In particular, hybrid algorithms that blend recommendation components drawing separately on complementary dimensions have demonstrated excellent results in tag recommendation. We extend these results to the problem of resource recommendation: predicting resources of interest to a user, given only the user's tagging history. We also examine characteristics of the data that may predict the performance of the different components. We call these characteristics "information channels" and offer metrics for their evaluation. Our evaluation on three large real world datasets demonstrate that hybrid recommenders surpass the effectiveness of their constituent components while maintaining their simplicity and efficiency.

September 24

Daniela Raicu, DePaul CDM

Medical Informatics: A Bridge Between Computer Science and Medicine

Abstract: Computer science can be a valuable tool for practicing medicine. In particular, applications of computer aided diagnosis and detection provide assistance to medical practitioners that can increase reliability and efficiency, and decrease the rate of false positives without subsequently increasing the rate of false negatives. I will discuss some of the projects that the CDM Medical Informatics research group has been involved with in the last few years - we will motivate the medical problems, describe how algorithmic ideas like

image processing and data mining are applicable, and discuss our results for lung nodule interpretation in Computed Tomography scans. This is joint work with Jacob Furst.

Bio: Daniela Stan Raicu is an Associate Professor of School of Computing, College of Computing and Digital Media at DePaul University, Chicago. She is the co-director of the Medical Informatics and the Intelligent Multimedia Processing Laboratories, and the Director of the Data Mining and Predictive Analytics Center at DePaul. Her research interests include medical imaging, multimedia retrieval, pattern recognition and data mining. Daniela's projects have been funded by the National Science Foundation (NSF), Argonne National Laboratory, Department of Education, and McArthur Foundation. Daniela holds a Ph.D. in Computer Science from Oakland University, Michigan, a M.A. in Computer Science from Wayne State University, Michigan, and a B.S. in Mathematics from University of Bucharest, Romania.

October 1

Peter Hastings, DePaul CDM

Research directions for Serious Games

In 2007, the US Department of Education issued a call for grant proposals for technology in education. The call included a dire assessment of current educational technology in grades K-12. Sixteen software packages for reading and math were studied and showed no significant advantage over classes that were not using the technology. The call went on to suggest a novel approach to educational technology, one that would inspire kids to work hard to improve their learning: video games.

In this talk, I will start with a brief overview of research findings about what makes learning effective, especially with technology. Then I'll explain why many people believe that games are so well suited for learning, and give examples of educational games. I'll conclude by talking about the challenges and important research directions for serious games.

October 8

Robin Burke, DePaul CDM

Data Mining and Machine Learning in Open Adversarial Environments

Machine learning algorithms are increasing presence on the web, in personalization and recommendation systems and computational advertising, just to name a few examples. The settings have two features not incorporated into the traditional evaluation paradigms for machine learning: openness and the presence of adversaries. A collaborative recommender system, for example, will seek ratings from as wide as possible a public audience, and among this audience there may be some who have an economic stake in the particular recommendations produced. Under these conditions, we might expect, and indeed there are many extant examples, to see 'denial of insight' attacks, interventions that use the public and adaptive nature of an application to corrupt its output by introducing biased input. In this talk, I will discuss the problem of denial of insight as a general problem for learning systems in open environments and examine various avenues for resolution.

October 15

Jonathan Gemmell, DePaul CDM

Tag Recommendation for Social Annotation Systems: A Hybrid Approach

Social annotation systems allow users to annotate resources with personalized tags and to navigate large and complex information spaces without the need to rely on predefined hierarchies. These systems help users organize and share their own resources, as well as discover new ones annotated by other users. Tag recommenders assist users in finding appropriate tags for resources and help consolidate annotations across all users and resources. But the size and complexity of the data, as well as the inherent noise and inconsistencies in the underlying tag vocabularies, have made the design of effective tag recommenders a challenge. Recent efforts have demonstrated the advantages of integrative models that leverage all three dimensions of a social annotation system: users, resources and tags. Among these approaches are recommendation models based on matrix factorization. But, these models tend to lack scalability and often hide the underlying characteristics, or ``information channels'' of the data that affect recommendation effectiveness. We propose a weighted hybrid tag recommender that blends multiple recommendation components drawing separately on complementary dimensions, and evaluate it on six large real-world datasets. In addition, we attempt to quantify the strength of the information channels in these datasets and use these results to explain the performance of the hybrid. We find our approach is not only competitive with the state-of-the-art techniques in terms of accuracy, but also has the added benefits of being scalable to large real world applications, extensible to incorporate a wide range of recommendation techniques, easily updateable, and more scrutable than other leading methods.

John Murphy, DePaul CDM

Videogames and the Ethics of Care

Videogames have the potential to create ethical experiences and encourage ethical reflection. Usually, discussions of this potential are understood in the context of the dominant moral theories: utilitarianism and Kantianism. It has been argued by feminist moral philosophers that a complete moral theory needs to include the concept of an ethics of care. We utilize the ethics of care as an alternative lens through which to examine the ethical frameworks and experiences offered by videogames. We illustrate how this sort of analysis can provide insights by examining the videogames Little King's Story and Animal Crossing: City Folk from the perspective of care ethics. We show how Little King's Story's fictive context, gameplay, and asymmetrical power relationships encourage the player to care for the citizens of his kingdom. In Animal Crossing: City Folk the player is a member of a small social network that encourages her to care for her neighbors as part of a larger interconnected social ecosystem. Both games result in the player feeling an emotional attachment to the game's characters, and the value placed in these relationships becomes the motivation for further ethical player behavior. We conclude by discussing some of the challenges and limitations of a care ethics perspective and outline a series of future research questions that should be explored.

October 22

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October 29

Brian Keegan, Northwestern University

Dark Gold: Statistical Properties of Clandestine Networks in Massively Multiplayer Online Games

Gold farming is a set of illicit practices in which players in massively multiplayer online games gather and distribute virtual goods for real money. Using anonymized data from a popular online game to construct networks of characters involved in gold farming, we examine the trade networks of gold farmers, their trading affiliates, and uninvolved characters at large. Our analysis of these complex networks' connectivity, assortativity, and attack tolerance indicate that farmers exhibit distinctive behavioral signatures which are masked by brokering affiliates. Our findings are compared against a real world drug trafficking network and suggest similarities in both organizations' network structures which reflect similar effects of secrecy, resilience, and efficiency.

November 5

Staffan Bjork, Gotland University (Sweden)

Gameplay Design Patterns - An Approach to the Wicked Problem of Game Design

The design of any interactive system is typically challenging since goals
and requirements often only become stable late in the design process. This
is especially true for the design of games, where a minor change can greatly
affect how players behave, the game balance, and the overall experience.
Adding to this problem is the fact that game development is a young design
discipline. Even if many aspects of modern game production can rely on the
knowledge from other fields, such as computer science and media studies, it
has yet to develop an extensive conceptual framework for its core - gameplay
design. This issue is especially important in educational settings which aim
to provide students with the theoretical underpinnings to be prepared for
practical work.

Bio:
Dr. Staffan Björk works as an associate professor at Göteborg University and as senior
researcher at the Game studio of the Interactive Institute. He heads the interaction design
unit at the department of computer science and engineering, a joint department between
the Chalmers University of Technology and the University of Gothenburg. His PhD thesis
from Göteborg University explored a focus+context visualization technique while his later
work focuses upon design-related work within interaction design, ubiquitous computing,
and gameplay design. He is primarily involved in EU-funded integrated projects with
extensive international collaboration, including the 3½-year 12M€ IperG project and the 4-
year 18M€ TA2 project as prime examples. Results from his work have been published at
the UIST, ACE, DiGRA, TIDSE, INTERACT and GDTW conferences. He is co-author to the
book "Patterns in Game Design".

November 12

Jim Whitehead, University of California Santa Cruz

Analyzing Level Design: A Genre-Specific Approach

A wide variety of computer games use the notion of levels to subdivide the gameplay
experience into a series of distinct spaces with associated goals. While there are many
examples of games that are segmented into levels, there is little written on how level design
should be performed. This talk presents a view of level design as a genre-specific activity,
where each game genre possesses its own approach for designing levels in the genre.
Analysis of the genres of 2d platform games, 2d space shooters (shmups), and first-person
shooters highlights how levels in each genre follow different design principles. The talk

ends by discussing how procedural level generation can be used to turn these design principles into operational theories of level generation, to better understand their strengths and limitations.

Bio:

Jim Whitehead is an Associate Professor and Chair of Computer Science at the University of California, Santa Cruz, where he helped create the Computer Game Design program. He is also the founder and board chair of the Society for the Advancement of the Science of Digital Games, which hosts the yearly Foundations of Digital Games conference. Jim's research interests in the area of games include level design and procedural content generation. In the field of software engineering, Jim performs research on software bug prediction, software repository mining, and software evolution. He runs both the Augmented Design Lab and the Software Introspection Laboratory at UC Santa Cruz. Jim received his PhD in 2000 from the University of California, Irvine, and his BS in Electrical Engineering from Rensselaer Polytechnic Institute in 1989.