



**UGA Computer Science
Research Day
Poster Competition**

April 9, 2010

12:00 – 3:00pm

Tate Reception Hall

Welcome to Computer Science Research Day at UGA.

This event is designed to showcase the accomplishments and abilities of our thriving graduate program and takes the form of a poster/demo competition among the graduate students. We invite the university community, potential graduate students, alumni, and current and potential industrial affiliates to:

- Meet our graduate students and view their research posters/demos.
- **Cast your vote** for your **top 3** favorite posters.
- **Cast your vote** for your **top 3** favorite demos.
- Drop your vote in the blue ballot box.

Please circulate around to meet our faculty members, discuss ideas for collaboration, identify potential assistants for your research or other funded work, or learn about our graduate program. Thanks so much for joining us today!

The Computer Science Research Day Committee

-- Professors Eileen Kraemer, Budak Arpinar, and Khaled Rasheed

#1 Field Valid Probability Assessment in Uncertain and Multi-agent Settings

Aryabrata Basu

In contemporary wartime events uninhabited agents such as UAV's are assuming increasingly promising roles in contemporary wartime theaters. Therefore, greater numbers of UAV's are deployed and so there is a need to reduce its reliance on human operators and transfer greater autonomy in decision making. Also, computational models of human decision-making are needed as UAV's may coexist with humans and human-controlled agents. The motivating scenario is: Human Judgment of uncertainty suffers from cognitive biases as operators of vehicles such as UAV's may generally assess probabilities of their predictions at levels not objectively justified and uncertainty in realistic settings is difficult to judge and not objectively quantified. Also, existing approaches are inapplicable as no consensus exists on key issues related to probability judgment and domain-general approaches for valid probability assessments may not apply to complex military context. We conduct a Field-Valid Probability assessment of human judgment using a simulated UAV setting to establish a relationship over human cognitive biases.

#2 Modeling Recursive Reasoning by Humans Using Empirically Informed Interactive POMDPs

Xia Qu

Recursive reasoning of the form what do I think that you think that I think (i-) arises often while acting rationally in multiagent settings. Several multiagent decision-making frameworks such as RMM, I-POMDP and the theory of mind model recursive reasoning as integral to an agent's rational choice. In two large experiments, we studied the level of recursive reasoning displayed by humans while playing sequential general-sum and fixed-sum, two-player games. Our results show that subjects in a general-sum game display first or second level of recursive thinking with the first level being more prominent. However, if the game is made simpler and more competitive with fixed-sum payoffs, subjects predominantly attributed first-level recursive thinking to opponents thereby acting using second level of reasoning. Subsequently, we model the behavioral data obtained from the studies using the I-POMDP framework, appropriately augmented using human judgment and decision models. Accuracy of the predictions by our models suggests that these could be viable ways for computationally modeling strategic behavioral data.

#3 Complex Event Detection in Delay Tolerant Network

Jianxia Chen

Complex event processing has been a popular research topic in the past decade. It is emerging as a key capability for many monitoring applications such as intrusion detection, sensor based activity and phenomena tracking, and network monitoring. Most of the event processing systems assume the underlying network is a TCP/IP based network or an overlay above it. For example, the complex event processing in a sensor network. Surprisingly, few research assumes complex event processing system on a Delay Tolerate Network (DTN). As society moves towards an increased commodity use of mobile devices, DTNs are necessarily becoming more commonplace. Communications in DTNs are characterized by long delays, frequent interruptions, and high error rates. The Interplanetary Network (IPN) is a good example of DTN. In this poster, we propose our own model of the interplanetary network. Based on the model, we have an exponential time optimal algorithm to detect the complex event in IPN. In order to improve the algorithm complexity, we also propose a novel heuristic algorithm which runs in polynomial time and yields close to optimal results.

#4 Improving Conversational Agent Response Relevance using Semantic Similarity Matching

Animesh A Thakre

The effectiveness of user interactions with a conversational agent largely depends on the relevance of responses that the system is able to produce given a user utterance. Existing systems primarily employ some form of syntactical matching to match input templates. These templates are time consuming to create, and are generally not scalable to large systems. We present an approach that efficiently uses the WordNet lexical database to match user input utterances to agent responses based on a semantic distance metric. Semantic similarity is a measure that determines how similar the meaning of two sentences is. A higher semantic score indicates higher relevance between two sentences. The semantic similarity score between user utterance and standard responses is computed to select the most relevant trigger, which maps to the most appropriate response for the virtual conversational agent.

#5 ProKinO: Design and Development of Ontology on Protein Kinases

Gurinder Gosal

The prominent role protein kinases play in cell regulation and disease has given rise to an abundance of information about the structure, function, interactions and evolution of these proteins. This information, however, is currently scattered across several heterogeneous resources, an obstacle to the kind of integrative approaches needed in utilizing existing knowledge for research related to diseases. We have designed and developed an ontology for protein kinases, ProKinO, that serves as a useful and efficient representation of the integrated knowledge about these complex proteins which are intimately involved in the genesis and behavior of cancer cells. ProKinO captures concepts and relationships important to protein kinases and the data is populated from disparate resources including KinBase, COSMIC, Protein Data Bank, Uniprot and Pfam. ProKinO has potential applications in text mining for the protein kinase literature; cancer genome annotation for cancer genome sequencing studies and research related to protein kinases and associated domains.

#6 Fine Granularity Parcellation of Gyrus via Fiber Shape and Connectivity-based Features

Dajiang Zhu

In vivo parcellation of the cerebral cortex via non-invasive neuroimaging techniques has been in active research for over a decade. A variety of model-driven or data-driven computational approaches have been proposed to parcellate the cortex. A fundamental issue in these parcellation methodologies is the features or attributes used to define boundaries between cortical regions. This paper proposes a novel DTI-derived fiber shape and connectivity-based feature for the parcellation of cortical gyrus into fine granularity segments. The gyrus parcellation is formulated as a surface vertex clustering problem, in which both of feature similarity and vertex adjacency are used to define the distance between vertices. The affinity propagation algorithm is employed for the vertices clustering. This methodology is developed and evaluated using the precentral gyrus (primary motor cortex) as a test bed, and motor task-based fMRI is used to validate the parcellation results. The experimental results show that the precentral gyrus can be consistently parcellated into 3 broad segments on both hemispheres across different subjects using the proposed method, which is reasonable according to neuroscience knowledge and motor task-based fMRI activations.

#7 Student Misconceptions in Concurrency

Zhen Li

Concurrency and synchronization are difficult topics for students to master. The design of visualizations and tools to address this problem requires a detailed understanding of student difficulties and misconceptions. Prior studies including both observational studies of students and interviews of instructors have concluded different difficulties students have as well as students' strategies of solving concurrent problems. However, these works did not systematically describe and evaluation of student's misconceptions. We conduct a study with six computer-based tutorials and a post test in which students are required to reason about synchronization scenarios. Based on students' answers and reasoning, we develop a misconception pyramid and two metrics to characterize the breadth and severity of student's misconceptions. We also propose an auxiliary visual notation, the context diagram, to help students overcome common misconceptions and to promote better comprehension of concurrent systems.

#8 An Exploration of Student Understanding of Concurrency and Synchronization

Zhe Zhao

In concurrent systems, several processes or thread execute simultaneously and may interact with one another in complex ways. Various visualizations, including UML state diagrams and UML sequence diagrams, have been applied to address the difficulties encountered in understanding how concurrent threads or processes may interleave and access shared resources. We seek to compare the usability of certain types of UML (Unified Modeling Language) diagrams when used by students in the software engineering of concurrent software.

#9 Transient Links

Douglas Brewer

Web bot fraud activity currently accounts for a large number of web accesses and is made easier with replay robots. Replay robots allow for easily scripting fraud activity by replaying a human session. In this poster, we propose a defense based on link uniqueness that is able to detect these replayed sessions. Our method, called Transient Links, works by transparently modifying the web pages of a protected website making each link unique. Transient Links creates unique links valid for only a single session on the protected website. Thus, when a replay bot replays a previous human session, it is detected.

#10 RNA²D : prediction of RNA structural elements

Yingfeng Wang and Deshen Lin

RNA tertiary structure prediction is an important component in bioinformatics research. We present a method to predict homomorphism from a secondary structure (stem graph) to a structural element topology (SET) graph. Datasets retrieved from RNA junction database will be used to test our approach.

#11 Question Answering in Linked Data for Scientific Exploration

Mustafa Nural

As more data is being semantically annotated, it is becoming more common that researchers in multiple disciplines rely on semantic repositories that contain large amounts of data in the form of ontologies as a source of information. One of the main issues currently facing these researchers is the lack of easy-to-use interfaces for data retrieval, due to the need to use special query languages or applications. In addition, the knowledge in these repositories might not be comprehensive or up-to-date due to several reasons, such as the discovery of new knowledge in the field after the repositories were created. In this work, we present SemanticQA system that allows users to query semantic data repositories using natural language questions. If a user question cannot be answered solely from the populated ontology, SemanticQA detects the failing parts and attempts to answer these parts from web documents and glues the partial answers to reply to the whole questions, which might involve a repetition of the same process if other parts fail.