

FLAIRS Poster Abstracts

William Eberle and Chutima Boonthum-Denecke

Editors

SEM-COLLECTOR: A Collaborative Tool for Collecting and Annotating Linguistically Richer Textual Similarity Dataset

Rajendra Banjade and Vasile Rus
(The University of Memphis, USA)

Efforts have been made in the last decade for collecting and annotating datasets for textual similarity. But the problem is that some of the linguistic features which are very important in practical applications (such as negation) covered in existing textual similarity corpora generated automatically from collections of texts or collected using Mechanical Turk appear to be very limited. There is still a need for a balanced, linguistically richer, and larger corpus to better facilitate the development of robust approaches to the task of semantic similarity. Here, we present a web based tool called “SEM-COLLECTOR” developed with the aim of collecting pairs of texts that may or may not be semantically similar from people who have very good understanding of the problem domain and have the linguistic background necessary to create a high-quality textual similarity corpus. Using SEM-COLLECTOR, users can contribute in a various ways. A user can add new sentence pairs which are similar in meaning or which may have some differences, and provide a rating with respect to their similarity using a value in the range of [0, 10]. On the other hand, the tool can ask users to paraphrase for a given sentence and then ask to rate the similarity. In addition, one can simply browse through the list of existing sentence pairs and annotate for similarity. In each case, the user is asked to select the important aspect of each pair (such as, lexical overlap, temporal information) that is important for creating diverse and balanced datasets.

Multilingual Twitter Summarization

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Given an arbitrarily large set of unaligned, multi-lingual short unstructured messages, we present an approach that chooses a best-representational set of messages as a summary. Initially, our approach takes all of the messages, tokenizes the messages, and then assigns weights as follows: Term frequency is calculated within each message. Individual document frequency is tracked per token in the corpus. Final TF-IDF values are calculated per message by summing the products of each token’s message specific term frequency, and overall document frequency. Once the messages have all been scored in this manner, the distribution of message scores exhibits the behavior of an inverse sigmoidal curve. Using the technique of segmented linear regression, cut-points that can be used to filter the tails of the distribution are calculated. The final representational set is chosen as the first N messages less than the higher cut-point, with the further restriction that each message must exhibit a semantic dissimilarity with previously chosen messages. We have demonstrated this technique on multiple cross-linguistic messages sets and have shown that it outperforms the techniques of LexRank and TextRank and presents a summary that does not suffer from the typical overweighting of particular languages like Inouye and Kalita’s Hybrid TF-IDF techniques.

Replication of the Niche Radius Problem with Clustering Genetic Algorithm

Michael Brown and Jamar Young
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Niche Genetic Algorithms (NGA) are a specialized type of Genetic Algorithm (GA) that attempts to locate multiple optima. Many NGAs use a radius parameter. The success of the algorithm is dependent upon the selection of a

“good” radius, which is normally half of the distance between optima. Since the purpose of a GA is to locate the optima, this is normally not known in advance. If the optima is known, it negates the need for running the GA. If the radius is set incorrectly, not all of the optima are located. This problem is known as the Niche Radius Problem (NRP). This research replicates the NRP using a simple Clustering NGA. It compares a traditional GA to a Clustering NGA with the radius set too small, too large and correctly. Twenty trials of each were created for each of the four cases. All other parameter values, with the exception of the radius, were consistent throughout the trials. Statistical tests were performed on the results. This research concludes that traditional GAs can locate only one optimum in multiple optima problems. Setting the radius too small correctly identifies all of the optima, but decreases the average fitness of the generations. Setting the radius too large will locate one of the optimum, but not all of them. Finally, setting the radius to the correct distance locates all of the optima with high precision. The NRP is an ongoing area of research in the NGA field.

Using Robotics to Improve Student Satisfaction and Engagement in an Introductory Programming Course

E. Rebecca Caldwell and Elva Jones
(Winston-Salem State University, USA)

The United States Department of Labor predicts that between 2008 and 2018, 1.4 million computing jobs will have opened in the United States. It is imperative that colleges produce more students studying Computer Science if we are to fill those jobs. The computer science discipline teaches students design, logical reasoning, and problem solving. Most freshmen entering the computer science major have no previous programming experience. Computer programming is seen by a vast majority of students as more difficult and time consuming, and less interesting than other courses of study. Learning to program is a time consuming task, as a very large number of hours must be spent at computer writing and debugging code. Unfortunately, this gives students a sense of information overload as well as a seemingly unstructured set of concepts to link together. Introductory programming classes typically lose more than 50% of the students that enroll. Robotics is being used as a tool to improve student satisfaction and engagement in Computer Science. Why use robotics? Robotics systems are powerful and affordable. Course modules will be designed using a robotic context to engage students in Computer Programming I. The overall goal of this research project is to improve student comprehension of course content by providing students with a hands-on activity designed to

improve student satisfaction and engagement in an introductory programming course.

Developing Cyber Security Ontology and Linked Data of Security Knowledge Network

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James Geller and Arwa Wali
(New Jersey Institute of Technology, USA)

Developing a domain ontology typically requires a manual, labor-intensive and error-prone process that can be a bottleneck and is often not scalable. Developing a cybersecurity ontology is no exception. In this paper, we first present a bootstrapping approach to develop a cybersecurity ontology with a semi-automatic method, based on the index terms and term co-occurrences from cybersecurity textbooks. Secondly, obtaining specific knowledge on security events (attacks, vulnerabilities, and mitigating approaches) often requires a user to search and review different fragmented cybersecurity data sources to infer the relationships among them. We develop a linked data representation of the cybersecurity knowledge network. We present our approach to identifying and extracting of cybersecurity events from diverse sources and integrating the data sources that are in different formats and in different modalities, e.g., videos. We employ semantic annotation using the cyber security ontology. We present our prototype system that allows users, especially students, to search and browse the ontology concepts and to use the ontology to search the cyber security knowledge network. This will enhance learning of security concepts and definitions. Additionally, it will help searching concept-related security events and resources that are semantically or temporally related to each other. We discuss how the cyber security ontology and the cybersecurity knowledge network can facilitate semantic search services for security-related open training and learning resources that are linked by ontology concepts and relationships. (This work is supported by NSF SFS, Scholars for Security, Program Award No. DUE1241687.)

Case-Based Goal-Driven Autonomy for Character Development in Interactive Narratives

Alexandra Coman (Ohio Northern University, USA) and
Hector Munoz-Avila (Lehigh University, USA)

Goal-Driven Autonomy (GDA) is a model of goal reasoning in which agents identify, reason about, and, if necessary, modify goals that they will pursue. Goal modifications are usually undertaken as a result of identifying dis-

crepancies between expected and actual states of the environment. GDA has been demonstrated in a variety of domains, including real-time strategy games, robotics, and navy simulations. Character believability is considered one of the key requirements of a successful narrative, be it interactive or traditional. Believable characters act in accordance with personal memories and motivations, which are shaped through events occurring throughout the narrative. Motivations and memories should evolve as the story progresses, so as to create plausible and engaging character growth. We propose using a combination of case-based reasoning and GDA as the approach to modeling characters driven by changeable motivations. We adapt the GDA framework to character-centric narrative generation based on reusing episodic knowledge; we expand the notion of GDA discrepancy so that it no longer refers strictly to mismatches between expected states and actual states, but includes more subtle incongruities, such as those between a character's changed motivation and the character's previously-assigned goal/course of action.

Implicit Authentication

Diyé Dia, Olivier Coupelon, Yannick Loiseau and
Olivier Raynaud (Limos, France)

The theft of means of authentication or identity theft is a problem that causes Internet users to mistrust online service providers. Those online services could be e-commerce websites, virtual communities or digital safes. In order to regain online service customer's confidence and improve quality of service, the security issues concerning online services have to be addressed. To tackle that issue, we propose a new mode of implicit authentication based on a user's behavior. Owing to that new piece of technology, the browsing activities on a specific online service will be more secure for customers because they will still use a usual mean of authentication (login/password). In fact, when a user connects to an online service, he will be either authenticated each time he wants to use a feature (continuous mode) or each time he wants to use a critical functionality(point mode). When browsing on a website, online users leave an imprint collected in activity logs. The goal of our research is to extract knowledge from those logs and to use that knowledge to authenticate users. We propose first to use descriptive methods of data mining after using data cleaning procedures. The Apriori algorithm is tested on our data in order to extract the frequent itemsets and then build user profiles from the frequencies of appearance of web pages visited. Mining closed sequential patterns is applied to this particular problem to control the number of patterns generated and take into account the notion of order of web pages visited.

Beyond Reaction Time: Predicting False Responding with Arm Movement Trajectories

Nicholas Duran (Arizona State University, USA)

When asked a question about something you may or may have not done, such as "Have you ever been to Florida," responding falsely is thought to be more cognitively challenging than telling the truth. One of the challenges that must be overcome is a bias to tell the truth. To better understand how such a bias is resolved in time, an approach called action dynamics has recently been employed (Duran, Dale, & McNamara, 2010). Here, reaching movements are analyzed as participants move their arms towards a false response option in the presence of a true response option. Research has shown that properties of the movement trajectories, including velocity, acceleration, entropy, and degree of curvature, can provide new insights about the underlying cognitive processes involved in false responding, a behavior akin to deception. However, in terms of predicting whether someone is responding truthfully or falsely, it is unclear whether trajectory properties are any better than traditional reaction time measures. To evaluate possible differences, the data from a web-based version of the action dynamics false responding task was used to produce an expanded suite of trajectory properties. Given the many trajectory properties involved, a principal components analysis was then used to derive core measurement constructs, thus allowing an optimized set of composite variables. Lastly, in a series of logistic regression analyses, the trajectory composite variables were shown to account for unique variance above and beyond reaction time, and with the use of a k-fold classification technique, also revealed superior predictive performance.

Increasing the Granularity of Dynamic Difficulty Adjustment AI Using Manual Real-time Inputs

D. Michael Franklin and Jonathan R. Howard
(Southern Polytechnic State University, USA)

Artificial intelligence is an oft-used technique in the modern video game industry, where uses range from non-player character encounters to adjusting the flow and difficulty of a game based on player performance. The latter is known as dynamic difficulty adjustment (DDA). Conventional difficulty has a flaw: situations often arise where the easy setting becomes too easy or the hard setting is too difficult. This lack of granularity often frustrates players. DDA attempts to alleviate this problem by varying the difficulty while the game is being played. However, reaction based games such as Guitar Hero often use fixed difficulty

for level design & player metrics. In this case, conventional DDA breaks down. To alleviate this problem, we present player expandable bounded dynamic difficulty adjustment implemented in an open source Guitar Hero clone, FoFix. We added AI to produce a DDA agent that monitors player performance and adjusts the game difficulty accordingly without compromising level design. We further add a manual adjustment that affects the tuning variables of the AI during gameplay to fine-tune the difficulty. As a player begins to fail or the level becomes too easy, our system gives them the option of adjusting the dynamic difficulty bounds, thus increasing the influence DDA has upon gameplay.

Communicative Artificial Intelligence in Multi-Agent Gaming

D. Michael Franklin and Aaron Ware
(Southern Polytechnic State University, USA)

Many modern games use intelligent agents that are abstracted from their context and from each other. This leads to a disconnected experience that causes information to be lost from each agent once they are defeated. We present the Communicative Artificial Intelligence system for multi-agent games. This system provides adaptive AI across generations of agents that players encounter. As the player encounters the first wave of enemy AI near the perimeter of the target zone they must choose their weaponry. If they defeat the enemy these agents pass on their acquired knowledge to the next wave of enemy combatants. This second wave now has developed immunity to the same form of attack that was used by the player. As a result the player must choose a different attack. This information is passed along to the third wave of enemy agents who now have immunity to all weapons that the player has used (collected from each previous generation of enemy AI). We thus hope to create a more strategic approach to the game wherein the player must reason about weaponry knowing that they will lose effectiveness as they progress. The goal is for the player to have to use the least powerful weaponry that is sufficient for the task at each level or they will be hopelessly outmatched as the game progresses. This research aims to close a gap in current games that is created by agents not acting as a part of the greater whole.

Pharaoh: Conceptual Blending of Cognitive Scripts for Computationally Creative Agents

Rania Hodhod (University of York, Egypt) and
Brian Magerko (Georgia Institute of Technology, USA)

Improvisational acting is a creative group performance where actors co-construct stories on stage in real-time based on actors' perceptions of the environment. The Digital Improv Project has been engaged in a multi-year study of the cognitive processes involved in improvisational acting. This better understanding of human cognition and creativity has led to formal computational models of some aspects of our findings. In this work, we consider enriching AI improv agents with the ability to improvise new nontraditional scenes based on existing social cognitive scripts. This work shows how the use of Pharaoh - a context based structural retrieval algorithm for cognitive scripts - and simple blending rules can help AI improv agents to create new interesting scenes. The work also provides an illustrative example at the end.

The Effects of Computerized Tutor on the Mathematics Attitudes of Sixth Grade Students in After-School Program

Xudong Huang, Jun Xie, Arthur Graesser, Xiangen Hu
(University of Memphis, USA) and
Scotty Craig (Arizona State University, USA)

Our project evaluated the effects of ALEKS (Assessment and LEarning in Knowledge Spaces), a Mathematics intelligent tutoring system, on sixth grade students' attitudes towards mathematics learning and computer-assisted mathematics learning respectively. Students from five middle schools in a mid-sized city of Tennessee were used in this study. As part of a Mathematics after-school program, students were randomly assigned to the control group (75 students, taught using teacher-lecture instruction) and the experimental group (61 students, taught with ALEKS). The mathematics learning attitude scale and computer-assisted mathematics learning attitude scale were administered at the end of the program. A three-way ANOVA of group, ethnicity, and gender on computer-assisted mathematics learning attitude scale revealed a significant difference between the two groups in favor of the experimental group. $M_{\text{experimental}} = 44.014$, $M_{\text{control}} = 36.905$, $F(1, 102) = 10.116$, $p = .002$, $\eta^2 = .090$. An identical three-way ANOVA on the mathematics learning attitude scale reported two marginally significant main effects in favor of the experimental group [$M_{\text{experimental}} = 25.107$, $M_{\text{control}} = 22.501$, $F(1, 98) = 2.89$, $p = .092$, $\eta^2 = .029$] and African-American students [$F(1, 98) = 2.99$, $p = .087$, $\eta^2 = .030$]. This indicates that interacting with an ITS can

help to enhance students' positive attitude toward both mathematics learning and computer-assisted mathematics learning.

Big Data - Small Mammals: Using Statistics and Data Mining to Analyze Social Network Changes in the Naked Mole-Rat

Susan Imberman, Michael Kress and Daniel McCloskey
(College of Staten Island, USA)

Many statistical and data mining techniques have been used to analyze the deluge of data generated by computerized, sensing devices. Behavioral psychologists traditionally have relied on "low-tech" methodologies for observing animal behavior in the wild and the laboratory. These methods are time intensive and laborious. When the observed animal is a colony animal, with many individuals to observe, traditional methods fail. In previous work our approach to this issue was to inject RFID passive transponders under the skin of our study animal, the Naked Mole Rat (NMR). RFID readers are placed throughout the housing environment, allowing us to track all movements of all animals as they move through these areas, with sub-second resolution for long periods of time. This methodology generates huge amounts of data requiring Big Data analytical techniques. In past work we used techniques, such as frequent pattern analysis, adjacency matrix sampling, and principle components analysis to describe colony behavior as a social network. In this poster we show how we measured the tolerance of the network structure described by these methods. To measure this, we simulate the occurrence of animals in the colony losing RFID transponders in a randomly selected sample from 1, to the entire 33 members of the colony at three different times of day (least active, moderately active, and most active), and compare adjacency matrices of animal co-localization using a quadratic assignment procedure (QAP) correlation technique.

Evaluation of Google Translation: Topics

Haiying Li, Qinyu Cheng and Arthur Graesser
(University of Memphis, USA)

With China's increasing role in the world economy, the best means of understanding China is to access information written in Chinese language such as news, government information, culture as well as hotel or airline reservations. More and more people with the little knowledge of the Chinese language have employed Google Translate to translate Chinese into English for gapped information. Previous studies claimed that the Google Translate provided more accurate translations at the levels of words and

phrases. However, further studies are needed on the accuracy of Google Translate beyond the word level. This study examined the accuracy of Google Translation with the Chinese language as the source language and English as the target language from the perspective of topics. Three corpora of a political leader's speeches were included in this study, with 289 speeches in each corpus: (1) original Chinese speeches, (2) speeches translated by human experts, and (3) speeches translated by Google Translate. Topics were extracted for both English and Chinese speeches with the automated topic modeling tools, which were developed with Blei's algorithm of topic modeling. The accuracy of topics with Google Translate was evaluated by two sets of comparisons: (1) comparison of Google English translation with human expert English translation, and (2) comparison of both English translations with the original Chinese language. The results showed that the topics in Google Translation were significantly correlated with those in the human expert translation, and more highly correlated with the original Chinese as compared with human translation. Sometimes computers do a better job than some groups of humans.

A User Interface for Automatic Construction of Thematic Sheets: Application to Biomedical Literature

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Multi-document thematic sheets are considered as an organized and structured textual representation of textual segments. The thematic sheets construction is based on the semantic annotation of scientific publications according to a set of discursive categories called search viewpoints (such as speculation, results or conclusions). The semantic annotation is performed automatically by the Contextual Exploration process. This method is implemented by a semantic annotation engine. In order to evaluate the relevance of the results of our system, we used biological papers to evaluate the automatic annotation. It is a computational linguistic method based on a set of linguistic markers associated with search viewpoints. We present in this work an application that allows users to obtain thematic sheets organized according to semantic criteria configurable by the user.

Automated Theorem Proving Using the TPTP Process Instruction Language

Muhammad Nassar and Geoff Sutcliffe
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The TPTP (Thousands of Problems for Theorem Provers) World is a well-established infrastructure for Automated Theorem Proving (ATP). In the context of the TPTP World, the TPTP Process Instruction (TPI) language provides commands to input, output, and organize logical formulae, as well as control the execution of ATP systems. A TPI language interpreter has been developed in `perl`. The interpreter is a standalone program that executes one TPI command at a time. It can be used with, e.g., shell scripting, to provide a fully featured language for ATP processing. The following example demonstrates a simple use of the interpreter. Commands 1 and 2 load two axioms. A conjecture is added by command 3. The `iProver` ATP system is then invoked by command 4 to check for the axioms' satisfiability. Command 5 writes the `SZS` status returned by `iProver`. Command 6 asserts that the axioms are Satisfiable – if they are not an error code is returned. The `E` ATP system is invoked by command 7 to prove that the conjecture is a Theorem of the axioms. Command 8 writes the proof status and command 9 ends execution.

```
1 tpi input formula 'fof(ax,axiom,r).'
2 tpi input formula 'fof(ax2,axiom,r => s).'
3 tpi input formula 'fof(conj,conjecture,s).'
4 tpi execute 'SZS' = 'iprover 30
  $getgroups(tpi premises)'
5 tpi write 'Status:' & $getenv('SZS')
6 tpi assert '$getenv('SZS')' = 'Satisfiable'
7 tpi execute 'SZS' = 'eprover --cpu-limit=30
  --tstp-format $getgroups(tpi)'
8 tpi write 'Proof status:' & $getenv('SZS')
9 tpi exit.
```

Qualitative Preference Elicitation in a MAUT-Based Reverse Auction System

Samira Sadaoui and Shubhashis Kumar Shil
(University of Regina, Canada)

In the context of Multi-Attribute and Reverse Auctions (MARAs), several challenging problems need to be addressed, such as eliciting precisely the buyers' requirements and determining the winner accordingly. Maximizing the satisfaction of the buyers may be achieved by considering precisely their preferences and interests. This research proposes a MARA system where the buyers specify their requirements containing constraints and preferences (both can be conditional or non-conditional). Buyers are more comfortable in expressing their preferences qualitatively. However for the purpose of efficiency, it is more suitable for the auction systems to process quantitative

data. Hence, there is a remaining challenge to satisfy the buyers with more facilities and comfort, and keep the auctions efficient. To this end, we develop a MARA system that improves the Multi-Attribute Utility Theory (MAUT), a widely used technique in multi-attribute decision-making. Our system looks for the bid that completely satisfies the constraints and best satisfies the qualitative preferences. It takes advantage of the efficiency of MAUT by transforming the qualitative requirements into quantitative ones. In addition, our MARA system completely automates the MAUT calculation since it is a really difficult task for buyers to determine quantitatively all the attribute weights and utility functions, especially when there are a lot of attributes. The weights and utility functions are calculated based on the qualitative preferences. Our protocol is semi-sealed since the sellers' offers are kept private during the auction, and at the end of each round, MARA reveals the overall utilities and statuses of the submitted bids.

What's in a Hint? Understanding Scaffolds as Suggestions, Assertions, and Learning Task Modifications

James Segedy, Satabdi Basu, Maria Mendiburo, Kirk Loretz and
Gautam Biswas (Vanderbilt University, USA)

The scaffolding metaphor remains an important scientific construct within the educational technology research community. Yet, the precise meaning of “scaffolding” remains unclear. In this work, we present three commonly-used definitions of scaffolding in computer-based learning environments, compare them to the original definition of scaffolding, and argue that the “scaffolds as supportive actions” definition most closely aligns with the original definition. We then present a taxonomy of supportive action scaffolds. The taxonomy classifies these scaffolds as suggestions, assertions, and learning task modifications (SAMs). The taxonomy attempts to address the how of scaffolding by describing the tools and techniques available for scaffolding in computer-based learning environments. We then demonstrate the use of the taxonomy and discuss its value and limitations.

The Modeling of Complex Adaptive Emergent Systems Using Hierarchical Genetic Algorithms

Jennifer Seitzer (Rollins College, USA)

Hierarchical genetic algorithms (HGAs) converge on solutions at both the atomic and structural levels. They have been shown to be effective in domains where both fundamental building blocks and the optimal configuration

amongst the building blocks are being optimized. Complex adaptive and emergent systems (CAESs) are comprised of heterogeneous, interacting, adaptive agents that exhibit the properties of self-organization, emergence, and connectivity. CAESs are ubiquitous, appearing cross-disciplinarily as bee hives, to the Internet, to the brains in our heads that contemplate them. The nested structure of CAESs meshes particularly well with the nested algorithmic nature of HGAs. This research falls in the realm of artificial intelligence and offers a new modeling technique as well as a tool for generation and modeling of complex adaptive emergent systems. The technique of HGAs simultaneously evolves multiple levels of solutions many of which have only been done, so far, by accident, via emergent behavior. In this poster, we present the author's methodology of HGAs applied to problems of graph theory including Euler tour detection, Hamiltonian tour detection, and graph coloring. These problems all require both local and global considerations in finding a solution. This vacillation between the local and the global is exactly the alternation that takes place between the atomic genome and the structural genome in the HGA. The problems, HGA computer system architecture, subtleties of the CAESs being modeled, and results are presented.

Evolutionary Techniques for Multiple Instances of Items in Combinatorial Reverse Auctions

Shubhashis Kumar Shil and Malek Mouhoub
(University of Regina, Canada)

Winner determination is one of the prime challenges in combinatorial auctions and is identified as an NP-complete problem. Nevertheless, applying combinatorial auctions to a procurement scenario, such as transportation services, travel packages and sales of airport time slots, is cost saving. While Genetic Algorithms (GAs) have been applied successfully to solve many combinatorial optimization problems, not much work has been done to solve the problem of winner determination in the context of Combinatorial Reverse Auctions (CRAs) with GAs. Our goal is to tackle the problem of winner determination for combinatorial reverse auctions using GAs in the scenario of multiple instances of items. More precisely we propose a new GA-based method for finding the winner(s) with a minimum procurement cost in an efficient processing time. In order to assess the performance of our proposed method, we conducted several experiments on generated instances. The results clearly demonstrate the time performance of our method as well as the quality of the solution returned.

A Long-Term Learner Model to Drive Optimal Macro-Adaptive Decisions by Intelligent Tutoring Systems

Robert Sottolare and Keith Brawner
(Army Research Laboratory, USA)

Adaptive Intelligent Tutoring Systems (ITSs) use information about the learner to drive real-time instructional decisions. During each tutoring session, the ITS uses learner data to classify learner states (e.g., performance, affect or engagement). This learner data may be composed of real-time data or historical data (e.g., achievements). Historical data may be found in a learning record store (LRS) which forms a log of the learner's experiences and traits which we call a long-term learner model (LTLM). LTLM data can be used to initialize fields (e.g., domain competence) within the ITS's short-term learner model (STLM) which is sometimes referred to as a session learner model. In combination with real-time data, LTLM data can be used to classify learner states and identify trends (e.g., learner habits). These states and trends can in turn be used to drive instructional decisions (e.g., feedback) by the ITS. However, the content and structure of a LTLM lacks clear consensus. This research considers several candidate variables, provides rationale for their inclusion in LTLMs, and examines their utility in driving instructional decisions within ITSs and specifically within the Generalized Intelligent Framework for Tutoring (GIFT), an open-source tutoring architecture.

The Use of Anomalous Information to Improve Student Question Generation in a Multimedia Learning Environment

Jeremiah Sullins, Holly Smith, Ashley Moore, John Morrow
(University of Mobile, USA), and
Kimberly Goza (Middle Tennessee State University)

The purpose of this study was to explore the effects of presenting anomalous information on student question generation. Participants were randomly assigned to one of four different conditions: 1) *Pro-War Cognitive Disequilibrium* 2) *Anti-War Cognitive Disequilibrium* 3) *Pro-War Unedited* 4) *Anti-War Unedited*. Results revealed that under certain circumstances, the presentation of anomalous information did increase the rate of question asking. More specifically, participants in the *Pro-War Cognitive Disequilibrium* condition generated significantly more questions than the participants in the *Anti-War Cognitive Disequilibrium* condition. Although this finding was not in the predicted direction, there are some reasonable explanations as to why this might be occurring. Further analysis revealed that cer-

tain individual differences may influence precisely when anomalous information may be beneficial to learner generated questions. More specifically, a significant correlation was discovered between the participants' viewpoint on the war and the personality characteristic Openness to Experience/Intellect. Upon further review, it was discovered that the *Anti-War Cognitive Disequilibrium* condition contained more participants that were against the war (item contained in demographic questionnaire) than the *Pro-War Cognitive Disequilibrium* condition. Based on this finding, it could be hypothesized that because all participants were asked to think-aloud during the learning session, that some people would be more willing to actually verbalize their thoughts (this is not a naturally occurring behavior for most individuals) which could be operationalized as the Big Five personality characteristic "Open to Experience." These preliminary results shed additional light on the benefits of cognitive disequilibrium on student question generation.

Sentiment Detection and Annotation in a Treebank

Katerina Veselovska, Jan Masek and Vladislav Kubon
(Charles University in Prague, Czech Republic)

Although sentiment analysis has been gaining a booming interest recently, most experiments use only plain text corpora. This poster shows that an existing richly annotated Prague Dependency Treebank can be exploited as a source of valuable information important for various opinion mining subtasks. The idea of using parsed data in sentiment analysis is not completely unheard of, but very few treebanks provide such detailed information as the Prague Dependency Treebank. Its tecto-grammatical layer containing the annotation of co-reference and discourse relations provides reliable data for automatic detection of opinion source and target even for a pro-drop language. As a first step we detect the evaluative items within PDT, using the Czech subjectivity lexicon, a list of 4947 evaluative items annotated with part of speech and tagged with polarity. Second, we survey the syntactico-semantic relations of these items in their context. The poster describes how annotation of the tecto-grammatical layer of PDT allows one to effortlessly find the original source and target. It also shows how natural it is to assign the target attributes, no matter how far they are from the governing word in the surface structure. The automatic detection of opinion sources and targets is based on the fact that the source is usually a grammatical subject (semantic agent) and the target tends to be in most cases an object (semantic patient). The dependency data also allow an easy negation detection. Tests performed on a small sample of PDT indi-

cated that the Czech dependency structures improve the source-target detection significantly.

Using Kodu to Program Autonomous Robots

Troi Williams, Thorna Humphries (Norfolk State University, USA) and David Touretzky (Carnegie Mellon University, USA)

Microsoft's Kodu Game Lab is a programming environment in which children specify behaviors for characters in 3D virtual worlds. Kodu's high-level primitives such as "see" and "grab" were inspired by behavior-based robotics, suggesting that Kodu might also be useful for programming mobile robots. But this requires overcoming the perceptual and physical constraints all robots are subject to. While perception in a Kodu virtual world is omnidirectional, instantaneous, and error-free, and manipulation actions are effortless and perfectly reliable, none of these properties hold in the real world. In this poster we describe strategies for overcoming these limitations, allowing Kodu programs to run without modification on a mobile robot. We used the Calliope2SP, an educational robot comprised of a webcam on a pan/tilt mount, a two-degrees-of-freedom arm with gripper, an iRobot Create mobile base, and a netbook running the Tekkotsu software framework. The strategies include dividing the robot's attention among tasks to accommodate the camera's limited field of view, navigational error monitoring that checks if the robot's odometry error is within acceptable limits, and fault-tolerant manipulation that checks for grasp failures and automatically recovers from them. By using these strategies, and implementing our own Kodu interpreter in Tekkotsu, we have successfully run small Kodu programs on the Calliope2SP. This work points the way toward a new generation of robotic toys that will allow children to explore autonomous perception and manipulation.

The Effect of Math Ability on Students' Math Learning Behaviors in the Computer-Based Tutoring System

Jun Xie, Scotty Craig (Arizona State University, USA),
Xudong Huang, Arthur Graesser, and Xiangen Hu
(University of Memphis, USA)

This study investigated learning behaviors of sixth grade students in an after-school mathematics program using different math ability in the Assessment and LEarning in Knowledge Spaces (ALEKS) system. Using their 5th grade TCAP mathematics NCE scores, students were clustered into five groups with K-means: extremely low ability group (EL group, mean=-1.903, N= 18), low ability group (L group, mean=-.811, N=42), average ability group (A

group, mean=-.003, N=63), high ability group (H group, mean=.792, N=55), and extremely high ability group (EH group, mean=1.922, N=13). Two ANOVAs indicated that students varied on learning time ($F(4,186) = 2.723, p=.03, \eta^2=.055$) and mastered items ($F(4,186) = 5.941, p<.01, \eta^2=.113$). Follow-up analysis showed that the students in EH group ($M=.830$) spent significantly more time than other groups ($MEL=-.058; ML=-.185; MA=-.033; MH=.001$). Also, multiple comparisons revealed that the students in H group ($M=.402$) mastered significantly more items than the students in EL ($M=-.550$), L ($M=-.312$), and A ($M=-.080$) groups; the students in EH ($M=.455$) groups learned significantly more items than the students in EL ($M=-.550$) and L ($M=-.312$) groups. The study did not find significant difference of students' attendance and attempted items within groups. The results demonstrated that students with extremely high math ability exhibit different learning behaviors than other students. These high ability students, while not attempting more problems, put more time into problems and mastered more items in the system.

Multimodal Learning in Electronic Textbooks

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While the popularity of ebooks is increasing, students consistently report a preference for printed textbooks while showing no learning differences between textbook and etextbooks (Daniel and Woody 2013). It was found that student using etextbooks showed greater affective learning and psychomotor learning (Rockinson-Szapkiw et al 2013). However, current etextbooks are little more than static PDF versions of the textbook with little use of any additional features. Can an etextbook be designed to facilitate the potential beneficial affordances? To test this question, a framework is built in HTML5 that supports an etextbook chapter on JavaScript. In order to support learning, the created etextbook implements multimedia videos with tutorial overviews of the material (Craig and Brittingham 2013) to provide a structured model for learning and multiple choice questions providing feedback (Shute 2008) and with links review to address misconceptions. This poster will present an overview of the system as well as the results of a randomized effectiveness study.

A New Method for Finding the K Nearest Neighbors in Classification, Clustering and Outlier Detection

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K-Nearest Neighbor (KNN) is a well-known supervised learning method where a new instance is classified based on the majority of its k nearest neighbors. Due to its limitations in large data sets, such as low recognition rate, high computation complexity and no valuation of training samples, an increasing number of modifications have been proposed in recent years to improve the efficiency of KNN, including the well-known weighted-KNN. However, several major issues are still unsolved, including the randomness of the k value, outlier elimination, and excessive computing time. Thus, the need for a new method to solve these deficiencies is obvious. This has motivated us to develop a novel algorithm for enhancing the performance of classification. This new method provides rich information for clustering and outlier detection. We call it Natural Nearest Neighbor with Quality (3N-Q). Comparing to KNN, 3N-Q uses a completely different way to find the nearest neighbors passively, which will automatically get the k value. This value, as well as the distribution of neighbors and the frequency of being neighbors to others, offer a precious foundation not only in classification but also in clustering and outlier detection. Subsequently, we propose a fitness function that reflects the quality of each training sample, retaining the good ones while eliminating the bad ones according to the quality threshold. From the results of the experiments we conducted on datasets from the UCI repository, it is observed that 3 N-Q is an efficient and accurate classification algorithm.