FLAIRS-30 Poster Abstracts

Vasile Rus, **Zdravko Markov**

Editors

Group Decision Making Mechanisms and Evaluation

Badria Alfurhood, Marius C. Silaghi
(Florida Institute of Technology, USA)

We identify outstanding challenges for intelligent support of group decision-making. Decision-making is a multidisciplinary term. Technology for large group decision making is undergoing significant advancement with the widespread use of social networks and online decision support tools. Manual rules that govern traditional face-to face meetings need to be adapted to suit virtual meetings where co-decisions have to be made virtually. Collaborative virtual group decision-making is essential for several applications where face-to-face meetings is not pertinent. As information technology has added more dimensions to problems tackled by humans, it is a challenge to make decisions in such dynamic era. Online group decision-making can impact people's significant choices in different ways. The scale of technology-supported decision-making has grown to the point where virtual group decision-making influence has been accused or lauded in the last few US elections. Certain attributes are highly required. Various mechanisms and evaluation criteria are used to study and analyze group decision-making processes. Communications and different threats may affect critical decisions. Multiple attacks have been revealed. More intelligence could be integrated into group decision-making processes to support better communication and visualization of information concerning decision alternatives. Information available about decision alternatives has to be analyzed and adequately presented to decision makers. Varied decision information could be structured by the aid of decision support systems. Solid evaluation criteria for virtual group decision-making processes are needed. Numerous research directions that contribute to group decision-making advancement are highlighted.

Human-Computer Interaction in a Debate Decision Support System

Abdulrahman Alqahtani (Najran University, Saudi Arabia),
Marius C. Silaghi (Florida Institute of Technology, USA)

There are different types of user interaction possible with debate systems, and we identify those that lead to a better quality of the information exchange. We evaluate the I formation exchange based on its amount. We identified and analyzed a set of fora that were specially designed for debates. We used surveys and interviews as a question driven mode of evaluating the understandably for each studied system by asking the user to respond with yes, no, or with a value showing the clarity of the ideas presented on the system as perceived by them. The questions for surveys and interviews, a data-driven mode, were designed to capture general and specific expectations and beliefs that users have concerning the threading, structure, and content of debates on the corresponding user interfaces/platforms. Different types of inter-comment links lead to different degrees of understanding and memorization, which can be evaluated with interviews. We found out that DirectDemocracyP2P mechanisms of keeping only the last comment per user offer the best understandability in terms of number of ideas involved in the debate that are learned by users in a fix amount of time. YourView mechanisms of allowing for multiple final comments per user offer the best refined understandability in terms of remembering which ideas out of a list of ideas were used in support or rejection of the central thesis. The familiarity of the user with a given system was factored out by the execution of multiple experiments with each system and with randomized order between addressed theses.

Q-Table Compression for Reinforcement Learning

Leonardo Rosa Amado, Felipe Meneguzzi (PUCRS, Brazil)

Reinforcement learning algorithms are often used to compute agents capable of acting in environments with no prior knowledge. However, these algorithms struggle to converge in environments with large branching factors and their large resulting state-spaces. In this paper, we develop an approach to compress the number of entries in a Q-value table using a deep auto-encoder that uses a binary representation of the state, compressing it to a smaller representation. Our approach focuses specifically in mitigating the large branching factor problem resulting from dealing with multi-agent scenarios. We apply these techniques in the scenario of the MicroRTS Real-Time Strategy (RTS) game, where both state space and branching factor are a problem. To reduce the branching factor on the MicroRTS game, we use separate instances of Q-Learning for each agent, and we separate agents by roles. We combine both the auto-encoder and the separate instances of Q-Learning, creating an AI capable of playing the MicroRTS game. We empirically evaluate an implementation of the technique to control agents in an RTS game scenario where classical reinforcement learning fails. Our results shows that our approach is able to compete against pre-coded AIs and other works in the literature.

Distributed Trust for Intrusion Detection

Timothy Atkinson, Marius C. Silaghi
(Florida Institute of Technology, USA)

When we consider the typical approach to how a computer trusts another computer, the trust is either complete for the given action, or there exists no trust at all. Namely, either an authentication process based on passwords, keys or some other cryptographic mechanism succeeds, and all the corresponding service is provided for as long as the client is connected; or no information is provided and the client/attacker can try again, until some hard-coded rules are met and the peer is black-listed. If the computer at the remote end has been compromised, no amount of certainty given by the authentication protocol can protect the local machine. Further, if the local machine has some critical resource the hacker is trying to gain access to, then disconnecting the remote machine may be the only mechanism available to prevent it from identifying a vulnerability in the local machine. The question we address is to dynamically evaluate reliability as a probability of trustworthiness for a computer's communication channels and hypothesize if that communication channel has been compromised in a network unknown to the agent. A computer can decide to offer services and information according to the probabilities assessed. Namely, one can restrict dynamically the channel to block or disconnect it when the value of the information provided is lower than the perceived risk to the local machine. To that end we develop dynamic trust reevaluators based on belief networks, and linked in a network of probabilistic measurements, that do not fully trust each other.

A Supervised Classification Approach to Predicting Knee Pain Improvement in Osteoarthritis Patients

Deya Banisakher, Naphtali Rishe, Mark Finlayson
(Florida International University, USA),
Ivanka Marinovic (University of Split, Croatia)

The data-driven prediction of an individual patient's response to particular treatments is a major goal of precision medicine. We are tackling this problem in the domain of chronic diseases, specifically Osteoarthritis (OA), using the Osteoarthritis Initiative (OAI) dataset, which comprises OA-related medical records for more than 4000 patients over 10 consecutive years. Using these data, we have developed three new supervised machine learning classifiers that can determine at better-than-baseline rates as to whether osteoarthritis patients are experiencing improved, unchanged, or worsened pain relative to their previous assessment. Such a classifier is a necessary first step to predicting longer-term treatment outcomes. We use the standard Knee Injury and Osteoarthritis Outcome Score (KOOS) as labels, and train our classifiers on a set of easily observable features capturing demographics, related injuries, therapies (excluding medications), overall measures of pain, and measures of both physical activity and rest required during such activity. We trained three types of classifiers (Support Vector Machine, Random Forest, and a Multi-layer Neural Network), and all classifiers performed at better-than-baseline rates (baseline most-frequent-class gives 0.4 F1), with the neural network performing the best with over 0.7 F1. We further analyze which features are most predictive (particularly types and intensity ofrimarily walking and stand-sit activities coupled with the amount of time spent performing them), and identify several promising next steps for investigation, including integrating medications into the feature set.

DTLBO: A Diversified Optimization Algorithm for Uncertain and Deceptive Environment

Atm Golam Bari, Alessio Gaspar (University of South Florida)

Maintaining diversity in converging population and balance of search space exploration versus exploitation are

two important aspects of any population-based optimization technique. The beauty of the Teaching Learning Based Optimization (TLBO) algorithm is that it simulates the knowledge transfer process between teacher and learners during in-class interactions as well as out-of-class interactions among learners. Though TLBO produces groundbreaking success in optimization of both constrained and unconstrained engineering problems, it gets trapped into local optima especially in high dimensional multi-modal or deceptive functions. We investigate the performance of TLBO with different benchmark functions on stationary and non-stationary fitness landscape; and compare it with other optimization algorithms e.g. Differential Evolution (DE) and a Simple Genetic Algorithm (SGA). We found that the moment of inertia of population in TLBO decreases very rapidly. The algorithm exhibits a pronounced unbalance in its exploration vs. exploitation tradeoff which is clearly detrimental to maintaining a diversity level in its population that would allow it to perform better in problems where converging rapidly to a local optimum is not necessarily the best strategy. We propose to Diversify TLBO by injecting random immigrants into its population, thus balancing the exploitation of the teacher phase by introducing different "teaching strategies". This results in deploying small world network property in learner phase to direct the search toward the global optimum while still maintaining diversity in the population.

Visual Localization of a Flying Drone

Roman Barták, Lukáš Jelínek, Jiří Harasim, Jindřich Vodrážka
(Charles University, Czech Republic)

One of the most critical tasks that each mobile robot needs to continually solve is precise localization. Without knowing its own location, the robot can be controlled only with simple commands, such as "move forward for a while". To issue the robot with a command to move to a specific position, it must know its current coordinates and where the specified position is relative to those coordinates. Although external localization mechanisms such as GPS are very useful, there are times where robots cannot rely on them. Inside large buildings or underground complexes like tunnels and caves, the GPS signal is usually disturbed or not working at all. In environments like that the robot has to rely on its own sensors. In this work we present a way to combine monocular visual odometry, namely Direct Sparse Odometry (DSO) with various other sensors on a flying drone Bebop.

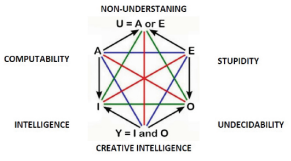
A Dynamic Task Allocation Mechanism for Flooding Disaster Scenarios

Tulio Basegio, Rafael H. Bordini
(Pontifical Catholic University of Rio Grande do Sul, Brazil)

Disasters, such as flooding, bring about losses and can be especially life threatening for people living in the affected areas. During a rescue phase, teams with individuals playing different roles are called into action to work in tasks such as locating and rescuing victims. Task fulfillment during the rescue stage poses a number of risks to the teams. Using robots in a coordinated way to help the team may minimise those risks. It was this scenario that inspired us to work on a multi-robot task allocation mechanism. However, one of the challenges in developing multi-robot systems today is the design of coordination strategies in such a way that robots perform their operations efficiently. Without such strategies, the use of multi-robot systems in complex scenarios becomes limited or even unfeasible. Thus, a mechanism for allocating tasks in real-world scenarios should consider features such as the heterogeneity of robots, the impact of individual variability to assign specific roles to robots, the allocation of tasks with different complexities and structures and other domain specific constraints. However, most of the solutions found in liter-ature do not consider these aspects together or have high computational cost. Thus, we propose a decentralised mechanism for the dynamic allocation of different types of tasks to heterogeneous robot teams, considering that they can play different roles and carry out tasks according to their own capabilities. We evaluate our mechanism by running Monte-Carlo simulations. The results demonstrate that our mechanism seems to scale well, as well as provid-ing near-optimal allocations.

Hexagon of Intelligence

Jean-Yves Beziau (Federal University of Rio de Janeiro
and Brazilian Research Council)



Artificial Intelligence has been developed to produce programs / robots / computers that can simulate, imitate or replicate human intelligence. But what is intelligence? To answer this question, we propose a hexagon of opposition tentatively characterizing intelligence. This hexagon is a structure based on three notions of opposition: contradiction, contradictory, contrariety; like the square of opposition. This construction provides a meaning to intelligence

by logically relating it to notions such as computability, creation and undecidability.

Acoustic Analysis of Read Speech for Detection and Monitoring of ALS

Archna Bhatia, Kristy Hollingshead, Bonnie J. Dorr,
Ian Perera (Florida Institute for Human and Machine Cognition, USA), Barbara McKenzie, Samuel L. Phillips
(James A. Haley VA Hospital, USA)

Speech impairments eventually affect 80% to 95% of patients with Amyotrophic Lateral Sclerosis (ALS) (Beukelman et al. 2011). These impairments often include defective articulation, slow laborious speech and hypernasality (Duffy 2013). Several studies (Yunusova et al. 2016) have shown that speech impairments – particularly reduced speaking rate – correlate with physiological changes associated with ALS. Since ALS speech shifts gradually from asymptomatic to impaired speech, we expect the fine-grained, continuous nature of acoustic features to capture the gradual changes caused by the neurodegeneration of ALS. Hence, we focus on the development of an acoustic measure of speech impairment and on testing the correlation of this measure with a physiological measure of the functional status of ALS patients (i.e., Forced Expiratory Capacity (FVC)). The goal is to discover acoustic features that can be extracted automatically and whose values correlate readily with the physiological progression of the disease. We demonstrate that a set of fine-grained, automatically-extracted acoustic features provides the foundation for this correlation and that this same set of features can be leveraged to develop speech-based assessments for ALS. Most physiological assessments of ALS are invasive, expensive, and require trained clinical personnel to administer the tests and interpret the results. Speech-based assessments, on the other hand, may enable a new, non-invasive measure for assessing the functionality of an ALS patient without significant overhead for personnel training and administration.

Closed-Loop Detection and Mitigation of Mind Wandering during Learning from Text

Sidney D'Mello (University of Notre Dame, USA),
Caitlin Mills (University of British Columbia, Canada),
Nigel Bosch (University of Notre Dame, USA),
Robert Bixler (University of Notre Dame, USA)

Mind wandering, defined as shifts in attention from task-related processing to task-unrelated thoughts, is a ubiquitous phenomenon that has a negative influence on performance and productivity in many contexts, including learning. We propose that intelligent educational interfaces should have some mechanism to detect and respond to mind wandering in real-time. Towards this end, we developed an interface that automatically detects mind wandering from eye-gaze during learning from instructional texts. When mind wandering is detected, the interface intervenes by asking just-in-time questions and encouraging re-reading as needed. After multiple rounds of iterative refinement, we summatively compared the interface to a yoked-control condition in an experiment with 104 participants. The key dependent variable was performance on a post-reading comprehension assessment. Our results suggest that the system was successful in correcting comprehension deficits attributed to mind wandering, thereby highlighting the potential for intelligent educational interfaces that improve learning by "attending to attention."

eSense: BioMimetic Modeling of Echolocation and Electrolocation Using Homeostatic Dual-Layered Reinforcement Learning

D. Michael Franklin, Derek Martin
(Kennesaw State University, USA)

This research explores different approaches to finding a moving target in a grid world through reinforcement learning. One well known method for implementing reinforcement learning is the SARSA-λ algorithm. The traditional SARSA- λ algorithm is inefficient at finding a moving target because it relies only on the learned values of a stationary Q-table. While this works in static environments (e.g., finding optimal routes through a challenging environment to a stationary goal). The proposed solution to this problem is eSense, which is a dual-layered, dynamic, homeostatic SARSA-λ algorithm with eligibility traces. It gives the AI a temporal sense (so it knows what is around it) to aid in the learning process. The dual-layered descriptor signifies that there are actually two grids in place, one for the navigation within the environment and another one that tracks the area surrounding the agent. Because this second grid moves around on the environment grid it is dynamic. Additionally, the target the agent is pursuing is also moving, so it is also dynamic. Additionally, since this second grid is centered around the agent it is homeostatic (centered around the agent). Finally, the eligibility traces provide enhanced learning within this environment by providing more feedback per iteration (i.e., more states are updated each iteration). This enhanced configuration has helped eSense learn the targetâAZs tendencies while still relying on the Q-table to guide it away from walls and other obstacles. This layered approach provides an improvement to the standard SARSA- λ approach.

The Effect of Distance and Ambient Lighting on the Accuracy of a Machine Classifier to Detect Learner Smiles

Tommy Goris, Robert Sottilare (U.S Army Research Lab, USA)

This poster examines the accuracy of a machine learning algorithm in classifying discrete smiling events (smiling/not smiling) of learners interacting with various computer systems. The Generalized Intelligent Framework for Tutoring (GIFT) was used to deliver content and sequence events for the validation of the chosen smile detector. Detection of user smiling behavior is associated with user emotional state of 'joy' and linked to positive user experiences in the literature. While the classification of user emotion and specifically smile behavior is not new, the validation of this algorithm contributes by examining variables affecting smile detection accuracy. Specifically, learner distance from the sensor (a webcam) and ambient lighting conditions were examined in this validation study. The findings included a decline in accuracy beyond five feet and no significant difference between the two lighting conditions. Future experiments will include more granular lighting measurements which we estimate will show the significant influence of ambient light.

How to Detect the Students' at Risk in Online Learning Platforms

Fazel Keshtkar (St John's University, USA)

Nowadays, most universities use online learning platforms in both online and face-to-face courses. The information that provide by these platform are somehow beneficial in Early Alert System (EAS) that ca be used to monitor students that are in risk. In this poster we aim to use these information that are potentially useful to develop a new student learning models to predict outcomes, especially those whom are at Risk of Failure (RoF). Along with grade book, we also applied other source of information such as meta-data, tracking students tracking attendance system, and other type of students' interaction that provided by these platforms. At the first stage we conduct to analyses the student-platform interaction. Recently, we found out that student's wont check their course content, for example in Blackboard, if there is no alert or announcement. In this poster we present a model by which we can predict and detect the students that are at risk of negative learning outcome within early semester. We also aim to analyze these data and using machine learning algorithms to predict Risk-of-Failure patterns. In general, we aim to investigate the following problems: find the correlation between risk-of-failure final grade, and predicting final grade using Risk-of-Failure analyses. Our future plan is to use both online courses and face-to-face courses data for deeper analysis and comparison.

Automatic Detection and Monitoring of Radicalization Processes in Social Networks

Daniel López-Sánchez, Jorge Revuelta, Francisco Prieto Castrillo, Juan M. Corchado (BISITE Research Group, Spain)

In the recent years, several terrorist groups have started to make an intensive use of the Internet and various online social networks to spread their message and radicalize vulnerable individuals. In this context, security forces are in charge of detecting and monitoring ongoing radicalization processes, which often take place publicly, in social networks such as Twitter. Unfortunately, effective countermeasures can only be taken through early detection, which is not always possible through manual analysis due to the growing amount of information to be analyzed. We propose a novel framework to enable the automatic detection and monitoring of radicalization processes that occur in Twitter. In particular, our system performs two different tasks: (1) Detects influential users with a radicalization agenda, suggesting relevant profiles to human supervisors; and (2) Monitors the interactions of confirmed radical users, estimating the risk of radicalization for vulnerable users which interact with them. The first task is accomplished by analyzing the global stream of public tweets, filtering relevant tweets based on an AND/OR tree of common terms in the specific radicalization domain. For the second task, the risk of radicalization is computed based on network-topology and social interactions; incorporating sentiment analysis techniques to identify interactions with strong emotional loads. Finally, we present a case study on the monitoring of a far-right extremist group from Spain.

Multi-Robot Navigation with Limited Communication

Md Suruz Miah (Bradley University, USA), Fazel Keshtkar (St. John's University, USA)

In this poster an indoor navigation strategy using a team of homogeneous mobile robots with limited communication is presented. Despite a large body of research work in the field of robotics in the literature to date, the study of navigation strategies using multiple autonomous robots still faces significant challenges. Among them, the problem of limited communication among robots is a crucial one that needs to be addressed. Even though several researchers have proposed a set of solutions to address this problem, but such solutions for navigating a group of autonomous mobile robots suffer from an overwhelming degree of

computational complexity or limited to theory and simulations.

The navigation strategy presented herein consists of several well-known modules in the field of mobile robotics, such as robot navigation, control, obstacle avoidance, and collision avoidance. Here, the navigation technique is illustrated with multiple mobile robots. In case, a robot loses its data packet that is to shared with other robots, a local estimator on-board each agent is embedded. The navigation and obstacle avoidance modules of the proposed robot navigation strategy are implemented with fuzzy logic controllers. The fuzzy logic– based control algorithms are well-known for their capability to deal with robots' human–like reasoning mechanisms. In addition, the fuzzy logic-based robot navigation strategy proved its power when mathematical models of robots and environment are not precisely known. A team of mobile robots is supposed to navigate along a predefined set of waypoints (structured navigation) in an indoor environment. The collision avoidance module of the proposed robot navigation strategy is illustrated with a Petri net model. A part of the theoretical results is backed up by computer simulations. The re- search work is currently being conducted to tackle the limited communication strategy of the proposed algorithm.

Application of Argumentation Logic for Decision on Bug Handling

Roussi Roussev, Marius C. Silaghi
(Florida Institute of Technology, USA)

We address the application of argumentation logic to one of the most common workflows in decision making for software bug handling. The first step in such a problem is making a decision on whether the bug is valid. That includes whether there is sufficient data to understand the behavior described by the bug report. During a triage process, the undesired behavior is discussed, the appropriate criticality is assigned depending on the historical or perceived damage caused by the bug, and it is decided whether a fix is necessary. The next step is to assign it to the best available engineer who investigates the issue given the available data, generates a closure of all duplicates and proposes a fix for review including a description of what was done to verify that the fix worked (by referencing some test code). Reviewers try to understand how the fix works, whether there are any side effects, and respond with comments and suggestions. Once they are satisfied with the overall value, they approve and deploy it. If there are any further failures, the bug is reopened and the process starts again. If there is proof that the fix worked, the issue is closed. As engineering is a social process, every step involves a varying degree of trust. We model the argume tations steps encountered in the above process using a new logic specially designed for hard decisions, and extract the most comprehensive arguments to be presented to reviewers and engineers leading the decision making process.

Evaluation and Application of Utility-Based Approaches to Privacy in Distributed Constrained Problems

Julien Savaux (Université de Valenciennes et du Hainaut-Cambrésis, France), Julien Vion (LAMIH - CNRS, Université de Valenciennes et du Hainaut-Cambrésis, France), Sylvain Piechowiak, Rene Mandiau (LAMIH, Université de Valenciennes, France), Toshihiro Matsui (Nagoya Institute of Technology, Japan), Katsutoshi Hirayama (Kobe University, Japan), Makoto Yokoo (Kyushu University, Japan), Shakre Elmane, Marius Silaghi (Florida Institute of Technology, USA)

In artificial intelligence, many distributed problems can be treated using the constraint programming paradigm, as well as the related frameworks (Distributed Constraint Satisfaction and Optimization Problems) and algorithms. In such problems, agents' privacy has been a major motivation for the distribution of the problem. Several approaches have been proposed in existing works, both based on cryptographic techniques or not. However, they may require resources that may not be available or have limitations in practical applications. Thus, privacy in distributed constrained problems remains an open issue. We propose an approach using utilities that integrates privacy directly in the decision making process of the agents, where the reward associated to the solving of the problem is compromised by the cost for revealing confidential data. We evaluate this utility-based approach on distributed meeting scheduling problems with privacy requirements, commonly used in the field of distributed constraint satisfaction and optimization problem for their properties and simplicity of understanding. At http://UDisCPs.fit.edu, we present our distributed meeting scheduling problem generator as well as the file format used to describe such problems using constraints. We present possible practical applications, namely autonomous vehicles problems, where participants want to calculate their itineraries and coordinate their actions while retaining their personal information private.

Decentralized Decision Making in Dynamic Groups for Distributed Free and Open-Source Updating

Elmane Shakre, Badria Alfurhood, Timothy Atkinson (Florida Institute of Technology, USA), Khalid Alhamed (Ryad Institute of Public Administration, Saudi Arabia), Julien Savaux, Rene Mandiau, Sylvain Piechowiak (Universite de Valenciennes, France), Marius Silaghi (Florida Institute of Technology, USA)

We identify and address new hazards due to churning of reviewers used in automatic free open source software

(FOSS) updates mechanisms. We introduce new insight into the taxonomy of decision group making processes for such situations, and propose new approaches. With software, newer is not always better! The newer version could be missing some features, that are essential to some users, but are dropped by the developers. Another scenario, with even more serious consequences, is a project taken over by malicious developers who target users' sensitive data, or do other types of damage to their systems or goals. We improve on the FOSS Updates Meta-Recommendations framework integrated with DirectDemocracyP2P. With group recommendations there is a call for properties such as transparency and balance. Quality of decision making was linked to the quality of the information available to decision makers as well as to the number of decision makers contributing observations and opinions. Communication was identified as the main bottleneck. We classify communication in a group decision support system along the following dimensions: 'face to face' vs. 'online' meetings, 'synchronous' vs. 'asynchronous' interactions, 'close' vs. 'dispersed' geographically located, 'collaborative' vs. 'competing' participants, 'semi-structured' vs. 'unstructured' problems, 'anonymous' vs. 'authenticated' participants, 'access restricted' vs. 'open' meetings, 'advisory' vs. 'constituent' roles for participants, 'static' vs. 'dynamic' group. Solution quality is also measured by the number of casualties and users' happiness. Increasing information exchange proves being the most effective, but simulations show that simple information aging can achieve comparable performance.

Cuckoo Search via Lévy Flight Applied to Optimal Water Supply System Design

Ricardo Soto, Broderick Crawford (Pontificia Universidad Catolica de Valparaiso, Chile), Rodrigo Olivares (Universidad Valparaíso, Chile), Pia Escarate, Steve Calderón (Pontificia Universidad Catolica de Valparaiso, Chile)

A water supply network is a vital component of any urban infra-structure and its optimal design may clearly reduce installation, operation, and maintenance costs. Several methods have been proposed to design efficient water distribution networks, but the presence of inherently interrelated design parameters such as the water demand, pressure requirements, network layout, energy uses, and pipe types make the problem tedious to solve. Indeed, the corresponding mathematical modeling of a water supply network leads to a non-linear and non-convex problem classified as NP-hard. The research work devoted to this problem can be seen as a long story from the 1960's, where different classic complete search methods and modern metaheuristics have been reported. In this paper, we propose a cuckoo search algorithm for the optimal water supply system design. Cuckoo search is a modern metaheuristic based on the obligate brood parasitic behavior of cuckoo birds. Particularly, cuckoos are known for laying their eggs in nests from other bird species, and also for removing the other bird eggs to increase incubation probability. In practice, an egg represents a solution and cuckoo eggs represent potentially better solutions. This behavior is combined with the interesting Lévy flight mechanism, which mimic the exploration process of some birds and flies, that move by combining straight flights and ninety degrees turns. The proposed approach results in a fast convergence algorithm able to noticeably reduce the number of objective function evaluations needed to reach the best known optimums in contrast to previously reported work from the literature.

Solving the Manufacturing Cell Design Problem Using Artificial Bee Colony with Adaptive Population

Ricardo Soto, Broderick Crawford, Leandro Vásquez, Roberto Zulantay, Ana Jaime, Maykol Ramirez, Boris Almonacid (Pontificia Universidad Católica de Valparaíso, Chile)

The Manufacturing Cell Design Problem (MCDP) aims at dividing an industrial production plant into a certain number of cells. A cell contains a limited set of machines that processes similar parts of a product. The goal is to minimize the flow of such parts among cells in order to reduce costs and improve efficiency. The problem belongs to the NP-hard class of problems and has largely been tackled with different optimization techniques, from exact methods such as linear programming to more modern metaheuristics such as bat and flower pollination algorithms. In this paper, we employ a relatively recent metaheuristic called Artificial Bee Colony (ABC) to efficiently solve this problem. ABC is inspired on the interesting ability and organization of honey bees to get food. In ABC, food sources are considered as the solutions of the problem and the population is composed of three types of bees that operate during the process: employed bees, onlookers and scouts. Each type of bee has specific exploration / exploitation tasks in order to find the solutions. We implement an interesting ABC algorithm that incorporates adaptive population, that is, the population varies de-pending on the exploration / exploitation requirements of the problem. An efficient heuristic is used to control the quantity of bees acting on the resolution, which depends directly on the improvement of the fitness on a given number of iterations. We perform an experimental evaluation on a set of classic MCDP benchmarks, where the proposed algorithm outperforms the performance of several approaches reported on the literature.

Using Universal Dependencies for Advanced Sentiment Analysis

Kateřina Veselovská (Institute of Formal and Applied Linguistics, Faculty of Mathematics and Physics, Charles University in Prague, Czech Republic)

This poster is to present a project of parallel treebank annotation and a case study of its practical use. We describe the project of Universal Dependencies, explain the methodological approach, illustrate the basic principles of parallel annotation and introduce the annotation scheme. Also, we provide a contrastive analysis of evaluative sentences in typologically different languages. Over a long time, computational linguistics has been witnessing a growing interest in dependency analysis related to availability of richly annotated treebanks for many languages. However, annotation styles of the treebanks often differ and it is difficult to provide reliable studies concerning cross-linguistic comparison of various linguistic features conducted on large syntactically annotated datasets. The project called Universal Dependencies is to develop cross-linguistically consistent treebank annotation for typologically different languages. Its annotation scheme is based on an evolution of Stanford dependencies (de Marneffe et al. 2006, 2008, 2014), Google universal part-of-speech tags (Petrov et al. 2012), and the Interset interlingua for morphosyntactic tagsets (Zeman 2008). The general concept of the project is to provide a universal inventory of categories and guidelines to facilitate consistent annotation of similar constructions across languages, while allowing language-specific extensions. In this study, we use Universal Dependencies to compare syntactic features in evaluative structures of selected languages. Based on the contrastive analysis, we create universal rules for evaluated entity detection in given structures. These universal rules can be further employed in advanced sentiment analysis, namely in opinion target identification in which the evaluated entities need to be automatically identified in texts.

Topic Modeling to Detect Student Expressions of Understanding in Collaborative Problem-Solving Dialogues

Angelica Willis, Ashana Evans, Jung Hee Kim, Kelvin Bryant (North Carolina A&T State University, USA), Michael Glass (Valparaiso University, USA)

When students are working together solving a problem, can a computer gauge how often they show understanding? In the COMPS project, students in small groups engage in typed-chat problem-solving dialogues. The instructors can oversee and join the conversations. This project applies topic modeling toward real-time computer assessment of the degree of understanding that the students exhibit, with the aim of posting an assessment of the state of the conversation to an instructor dashboard. Working from transcripts, we have manually annotated dialogue turns where students exhibit understanding of the exercise's concepts. Here we report on training machine classifiers to recognize these instances. From each dialogue turn some domain independent features are extracted directly, representative examples are discourse marker words, emoticons, and timing information. Other features have been synthesized in an unsupervised way by topic modeling. Topic modeling derives latent bag-of-word features by clustering, using Latent Dirichlet Allocation. Named entity recognition is applied before topic modeling to remove particular features such as names. We have been training classifiers to identify the turns that were identified as either a) understanding of a concept before somebody else has enunciated the concept within the discussion, and b) showing understanding after the concept has been expressed. The dashboard will contain an indication of the numbers of turns classified into those categories. The "fail-safe" mode is for the computer to avoid a false report that the students don't need assistance. Examples of dialogue along with a description and evaluation of the classifiers are reported here.

Intelligent Unmanned Aerial Vehicle for City Flooding Monitoring

Zoe Jing Yu Zhu, Albert Jiang (University of Guelph, Canada), Jizhou Lai (China Nanjing University of Aeronautics and Astronautics, China), Yang Xiang, Benjamin Baird, Ed McBean (University of Guelph, Canada)

Flooding is a major concern in many cities. It can cause considerable destruction and fatalities. Real time monitoring of the impact of flooding after rainfalls is often crucial in flooding control. Due to availability and cloud conditions, satellite imaging does not satisfy such monitoring need. This work studies feasibility of monitoring city flooding using unmanned aerial vehicles (UAVs). A UAV was flown after rainfalls over the study area and aerial photos were taken to identify ponding locations. The area has the typical city land cover: medium rise buildings, paved roads, and grass fields. The flying route was programmed into UAV for automatic monitoring. Series of image by UAV were processed into panorama for visualization of ponding conditions in the entire region. Through experiment, suitable flying altitude, speed, picture taking frequency, and other parameters are obtained. The experiment used flying plans with uniform coverage. It is effective for monitoring landscape of equal chance of flooding. That is not the case when large buildings exist since they do not provide information on flooding. By avoiding flying over such buildings, UAV monitoring efficiency can be improved. We developed a novel algorithm for automated

generation of UAV flying plans when large buildings exist. The simulation study shows that it can generate shorter flying path for the same area. This allows coverage of a larger area with the same UAV battery power. This preliminary work opens a new direction of research and practice in city flooding control and storm water management.

Understanding the Expressive Functions of Jingju Music Rhythmic Types Through Lyrics Text Mining

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Jingju (also known as Beijing or Peking opera) is the most representative genre of traditional Chinese performing arts, in which music plays a fundamental role. One of the major means for conveying the emotional content of Jingju arias is a set of pre-defined metrical patterns known as banshi, each of them associated with a specific expressive function. In the context of Music Information Retrieval (MIR), we propose a novel approach to study the expressive functions of banshi by applying text mining analysis on a comprehensive corpus of Jingju lyrics that we built through web scraping www.xikao.com (a comprehensive online Jingju script repository), guided by musicological expertise. Topic modeling techniques are applied (LDA, and LSA with NMF) to Jingju lyrics text documents grouped at different levels according to the rhythmic and melodic types they are associated with. We then contrast feature sets obtained from topic models with alternative vector-space representations in a series of document clustering and classification experiments, with the aim of analyzing the semantic content at inter- and intra-banshi levels. The results show that topic modeling reveals reasonable topic distributions compatible with musicological descriptions at a macro-level related to melodic structures, despite its problems of describing emotional content at a micro-level related to rhythmic structures of Jingju. We are able to achieve high F1 scores in classifying lyrics documents into different banshi categories using a vector-space representation. We discuss the technical and musicological implications and possible future improvements over topic modeling and sentiment analysis in this particular domain.