Greetings from Professor Diane Litman
Program Co-Director, 9/1/14-8/31/16 (with Professor Janyce Wiebe)
Program Director, 9/1/16-8/31/18

Dear ISP Family,

2016 is turning out to be a year for both looking forward and looking backward.

As computing enrollments continue to expand and computation becomes increasingly central to many academic disciplines, Schools and Colleges of Computing are all the rage. In case you haven’t heard, the University of Pittsburgh will be creating a new School of Computing and Information (SCI) that is expected to launch sometime in 2017 (Plans for CS/IS school proceed: http://www.utimes.pitt.edu/?p=39323). The initial version of the school will have three departments: Computer Science and two from the former SIS. A SCI Dean search is about to begin, with ISP represented on the search committee by both myself and SIS Assistant Professor (and ISP PhD) Rosta Farzan. Whether ISP stays in the Dietrich School of Arts and Sciences or joins SCI is being left up to the ISP faculty, so we have a very important decision ahead! If you have any thoughts you’d like to share (or have recommendations for a founding Dean) please feel free to contact me.

As part of my discussions with the Provost regarding the future home of ISP, I was sent a copy of the April 1986 “Proposal for an Intelligent Systems Studies Program at the University of Pittsburgh.” Since it looks like our first students were admitted in Fall 1987, it seems time to have a 30th Birthday Bash! Stay tuned for further news regarding a 2017 celebration, and again, I welcome your ideas and suggestions.

As for this newsletter, I hope you enjoy the current issue of what has seemed to have turned into a biennial publication. This issue highlights the research of two of our newer faculty members (Professors Adriana Kovashka and Ervin Sejdic), both of whom are working in exciting areas of research that are new to ISP. The newsletter also includes dissertation abstracts, interviews with graduating students, alumni updates (thanks to all who responded!), and other program highlights and photos.

Keep in touch!
Towards Human-like Understanding of Visual Content

Professor Adriana Kovashka started as an Assistant Professor in Computer Science at Pitt in January 2015, and holds a secondary appointment in ISP since October 2015. She received her PhD from The University of Texas at Austin in August 2014, under the supervision of Professor Kristen Grauman. She received BA degrees in both Computer Science and Media Studies from Pomona College in May 2008. Her research interests lie in computer vision and machine learning.

Professor Kovashka’s PhD thesis focused on interactive content-based image retrieval. A user could type a textual-based query (or initiate an image search system in a different way), and the goal of her work was to develop techniques that allow the user to *refine* the search results obtained, using very precise language. She proposed to do this through semantic visual attributes, namely adjectives for which computational detection models can be built. For example, after searching for a “thin white male” (where “thin” and “white” are attributes) and retrieving an initial set of results, the user could further specify that some particular result is roughly on target, but the true person of interest has for instance “curlier hair”. She extended this approach into an active learning framework, where the system elicited responses from the user via question-answering. Further, she showed that the attribute terms might be subjective, hence need to be modeled in a personalized way. She demonstrated how personalized attribute detection models can be built using domain adaptation techniques. She also showed how the fine-grained “shades of meaning” of an attribute can be discovered from crowd labels, using matrix factorization and clustering techniques.

In earlier work, Professor Kovashka developed an active learning system for object. The system could either query the object labels (e.g. “tell me what animal is in this image”), or it could request labels on the *attributes* of the unlabeled object (e.g. “tell me if there is something furry in this image”). She found that a system that could dynamically choose what labels to query actually requested more attribute labels, since they affect the system’s knowledge of multiple object categories. In another project, Professor Kovashka proposed a state of the art feature descriptor for action recognition.
Her work as an Assistant Professor has focused on using computer vision to analyze art and media. While computer vision analyzes the objective content of images, understanding photographs in the media often lies beyond their pure physical content. As a first step in understanding visual media, along with her students she developed a method that captures photographers’ styles and predicts the authorship of artistic photographs. To explore the feasibility of current computer vision techniques to address photographer identification, the computer vision team at Pitt created a new dataset of over 180,000 images taken by 41 well-known photographers. Using this dataset, they examined the effectiveness of a variety of features and convolutional neural networks for this task, including one trained specifically to identify photographers. They also used what their method learned to generate new “pastiche” photographs in the style of an author. In another work, they extended a method which predicts whether an image portrays a politician in a positive or negative light and as having certain qualities (e.g. competence).

In a recently funded NSF CRII CISE project, Professor Kovashka and her students aim to develop datasets and algorithms for automatic decoding of the visual rhetoric of images in the media. This is an AI-complete problem that requires the integration of natural language processing and knowledge representation with computer vision.
FACULTY NEWS

Interview with Professor Ervin Sejdić

Dept. of Electrical and Computer Engineering

Roya: Congratulations on receiving an early career award for scientists and engineers. How do you feel about this achievement?
Ervin: Thank you! It was a bit unexpected. I knew about the nomination but since it was fairly competitive, I was quite surprised when I was contacted by the White House about winning the award. So, a bit unexpected and certainly nice to be listed on the resume.

Roya: What would you like others to know about your research group at ISP?
Ervin: What I am trying to do with my own graduate students is to make them understand that I do not want them to write papers just for the sake of papers or do research just for the sake of the research. They should be trying to do something that actually matters to human kind. For example, the award was for my swallowing research. This is an aspect of our daily life, if we do not swallow properly, then there is a major issue. Despite its importance, not many people think about this topic. The goal of our group is to understand these human functions and model them properly.

Roya: Could you please explain more about this swallowing project?
Ervin: I actually started that when I was post-doc at University of Toronto. My supervisor, at the time, wanted that we develop a small medical device that could be installed on the human throat to understand when the food goes in the wrong way (because if the food goes the wrong way, it ends up in the lung). So, our goal was to develop this device and tell people maybe you should change your diet, or how you swallow food, etc. It’s a huge problem, currently the only way to tell if food goes in the wrong way is through X-rays, and of course, we’re not going to expose the patient all the time in front of the X-rays. That was Feb. 2008, i.e. 8 years ago. Since then, we have developed most of the algorithms that could preprocess the data collected from sensors. We are now in the stage that we could model this human function with an accurate classifier that could detect good or bad swallowing patterns. Now, we are working on it to make the classifier robust and more accurate so that we could get an accuracy of 90%+ on any swallowing datasets.
FACULTY NEWS

Roya: What direction do you think your research and writing will take from here?
Ervin: Besides swallowing difficulties, our group is looking at human gaits and handwriting but swallowing research would be the most dominant. And what we are interested in to explore is to understand causes of swallowing difficulties. We’re recruiting aging, and endoscopy, and we’re trying to study why this is happening and how it is happening.

Roya: What do you enjoy about your current position as an assistant professor at PITT?
Ervin: Well, the type of work that I do, and the fact that UPMC is across the street. We have a cart full of equipment and when we do data collection, we push it across street. It’s that easy 😊 So, this cohesion of medicine, engineering, bioinformatics, and all these kinds of IT areas at PITT are amazing, and I think we’re at unique position at the country.

Roya: What do you miss the most about being in Canada?
Ervin: Certainly my family, my dad is living there. And, also my friends. But the good thing is that it’s fairly close and it’s very easy to travel there.

Roya: What are you looking forward to about living in Pittsburgh?
Ervin: My hope is that with this presidential award in, what we’re doing now will put us on forefronts of some of the issues I mentioned earlier, and will be able to establish this research program that is fairly unique to us, that can grow and can make significant contributions to patient care. I wanted to work on projects that will really be connected to patients. We really want to use our research to change patient lives. Whatever I do I am trying to position that to have an impact on patient care and being here in Pittsburgh and the fact that UPMC is right across the street is a plus.

Roya: Do you have any new courses or publications that you would like us to know about?
Ervin: So for example, I’ve been teaching this course, called biomedical signal processing in ECE department. It’s a very diverse course and I am trying to introduce the basic tools that people could use to analyze some of the biomedical data, and especially physiological data. So, that’s maybe a course of interest to ISP students.

From publications, we try to publish heavily, we’re about 15 publications in a year, each of them has a special place in my heart. With each publication we are always trying to solve one puzzle at a time in order to build the body of knowledge that one day could be integrated to a comprehensive.

If you look at publication, they’re addressing several different issues, but most are addressing cerebral blood, or blood flow in general, swallowing, and gaits. We did not have many publications on handwriting but will have papers on that topic too.
Roya: How many graduate students are you advising now?
Ervin: 7 or 8. I think I have 5 PhD students. Until end of April (2016) I had 5 PhDs and 2 masters. It’s typically 5-6 PhDs, and 2-3 masters.

Roya: Are you accepting new students at this point? If yes, do you have any message for the ISP students who wish to join your research group?
Ervin: Papers, paper, papers. Especially at PhD level, it’s all about publications. Publications are a way for you to advertise what you have done. And, this is almost a must for students to publish one paper per semester. I work closely with my PhD students, especially on the first couple of papers -- I give them data, some initial code, and help them with writing the papers. During the first year they have to publish one-two papers. After the second year, they’re on a one paper per semester regime. At the end of second year, they need to have their proposal ready. So, my PhD group is fairly fast, it’s three years from beginning to end. And typically students come up with 6 to 8 papers; my group is fairly organized, demanding, and productive.

Roya: We have number of students who are on the job market. Do you have any advice for them?
Ervin: It depends whether they want to go to academia or industry. For both groups its papers, papers, papers. Let me explain why having papers is so important: for academia it’s a sign of being good researcher, for industry it shows that you have good project management skills, i.e., you can take a problem, come up with an intelligent solution that your peers thought is scientifically valid, and this is a big plus for everybody looking for job. Papers are quite important regardless of whether you want to go to industry or academia. Besides, they need to look at the subskills such as writing, and time management skills. Those are soft skills that typically the PhD program forgets about them. No matter how genius you are, you need to give coherent presentation about your research to be known and also successful. And, one thing that I keep telling my PhD students is to keep reading on their general area. This is quite useful because the moment you start working it’s highly unlikely that you’ll be working on the specific topic that you were working on in grad school. Often, you’ll be working on a general area.

Roya: Are there things you wish you had done or known when you were a PhD student?
Ervin: I wish I paid attention to the soft skills because I had to learn and I had to work on them in an accelerated fashion once I was a postdoctoral researcher. I wish I paid attention to some of those during grad school, I would network a lot more and I would probably take a course at business school about sales to help me better sell my ideas. Competition is becoming a lot tougher, it’s not just about having good ideas, and it’s all about how you’re selling it. You need to be able to sell the significance of your work and your innovation. That’s something that I did not realize once I was a PhD student and I wish I did.

Roya: Dr. Sejdić, thank you for your time. This was a great interview!
Ervin: You're welcome. Thank you too!
WHERE ARE THEY NOW? ALUMNI UPDATES

**Cristina Conati (1999)**

Cristina has been promoted to Full Professor of Department of Computer Science, University of British Columbia.

**Violetta Cavalli Sforza (1998)**

Violetta was promoted to Associate Professor at Al Akhawayn University in Ifrane, Morocco. She has also been Computer Science Coordinator (a kind of vice-Dean) for the last 2 years.

**Stefano Monti (1999)**

Stefano is currently an Associate Professor at Department of Medicine at Boston University. In March 2016 he and his colleagues at Boston University School of Medicine (BUSM) discovered how RNA editing may promote tumor growth. Later, in May 2016, this group had another significant achievement, discovering potential target in treatment of oral cancer.

Two ISP alumnae, Pamela Jordan and Patricia Albacete, along with Sandra Katz (a dissertation advisor to several ISP alumni, who is also married to an ISP alumnus), have been working under an Institute of Education Sciences (Department of Education) grant to investigate malleable aspects of tutorial dialogues and how they interact with student characteristics. The main goal of this project is to specify generalizable tutoring policies for natural-language tutoring systems that improve learning outcomes.

Under additional funding from the Institute of Education Sciences, the same team along with ISP alumnus Bruce McLaren are tackling the challenging problem of adding student modeling to a dialogue-based tutoring system.

Bruce McLaren (1999)

Bruce is the President-Elect of the International Society for Artificial Intelligence in Education (http://iaied.org/). The election was in Dec. 2015 and the term will be 2017-2019.

He and his colleagues won Best Poster Award at the AIED 2015 conference in Madrid, Spain last year: “Worked Examples are more efficient for learning than high-assistance instructional software” (Out of 78 posters).

Bruce has been invited to give a keynote talk at the ICCE 2016 conference in Mumbai, which will take place in Nov./Dec. 2016: http://www.et.iitb.ac.in/icce2016/keynotespeakers.html
Ioannis Tsamardinos (2001)

Ioannis is now Associate Professor at Computer Science Department, University of Crete, on the island of Crete, Greece.


After living in Pittsburgh for 18 years, Noboru and his family (except his daughter who is a rising senior at PITT) have moved to College Station, TX to pursue his new career as an Associate Professor of Cyber STEM Education in the Department of Teaching, Learning and Culture at Texas A&M University. He is very much amazed to know how flat and open the earth is as well as to realize how big the sky is (not to mention the heat and a scorpion crawling around a living room in his house). Noboru will continue working on the SimStudent project (www.SimStudent.org) and the evidence-based online course engineering project (http://1.usa.gov/1lIImv55).
Shyam Visweswaran (2007)

Shyam Visweswaran was promoted to tenured Associate Professor of Biomedical Informatics at the University of Pittsburgh. His new responsibilities include Co-Director of the Clinical and Translational Science Institute’s Informatics Component, and Director of Clinical and Translational Informatics in the Department of Biomedical Informatics. He is the Principal Investigator (PI) of a newly funded NLM R01 grant titled “Development and evaluation of a learning electronic medical record system”.

Along with Dr. Steven E. Reis, director of CTSI, and Dr. Oscar Marroquin, vice president of UPMC clinical analytics, he is a PI of the Pitt Precision Medicine Initiative (PMI) project. The Pitt PMI is a part of the national PMI project that is a landmark longitudinal research effort announced in the 2015 State of the Union address by President Obama that aims to engage 1 million or more U.S. participants to revolutionize how disease is prevented and treated based on individual differences in lifestyle, environment and genetics.

The joint work of Shyam and Andrew King, a graduate student in Biomedical Informatics who works on the learning electronic medical record (LEMR) system, won first place in a paper titled “Development and preliminary evaluation of a prototype of a learning electronic medical record system” in the American Medical Informatics Association 2015 Student Paper Competition.
**Ilya Goldin (2011)**

Ilya is working as a Director of Data Science at 2U, Inc. 2U partners with established universities to build online graduate degree programs. Ilya is building learning analytics technology to benefit university faculty, students, and internal 2U stakeholders. 2U is headquartered in Landover, MD, and Ilya works remotely from Stack, a new co-working office in the East End.

---


Min Chi (2009) and Collin Lynch (2013) and their two lovely children, KaQing and KaiYi, are currently living in Raleigh, NC. Both Min and Collin are Assistant Professors of the Department of Computer Science at North Carolina State University. Min had her first Ph.D. student graduated in August 2015. Both Min and Collin are proud of being part of the organizing committee for the 9th International Conference on Educational Data Mining (EDM 2016).
Matthias Grabmair (2016)

Matthias has been a visiting researcher at CMU LTI since last September and will become a postdoc in August 2016.

Matthias and his wife Tuna got married in Frick Park on August 10, 2014. They had ceremonies in Pittsburgh, Turkey and Germany with perfect weather every time.
FACULTY AND STUDENT HIGHLIGHTS

**Apr. 2016**

Dr. Madhavi Ganapathiraju and ISP alumni Thahir Mohamed had a recent high visibility publication. Their paper, "Schizophrenia interactome with 504 novel protein–protein interactions", published in NPJ Schizophrenia (Nature Partner Journals) has received tremendous attention and is continuing to grow in its Altmetric score.

[https://www.altmetric.com/details/7022137](https://www.altmetric.com/details/7022137)

---

**Feb. 2016**

Dr. Jingto Wang and Dr. Adriana Kovashka have each received a Google Faculty Research Award in 2016.

---

**Feb. 2016**

Dr. Ervin Sejdic won Presidential Early Career Award for Scientists and Engineers in 2016.


---

**Dec. 2015**

Professor and ISP Co-Director Jan Wiebe was honored by the Association for Computational Linguistics as a Fellow in Dec. 2015.

[https://www.aclweb.org/website/node/457](https://www.aclweb.org/website/node/457)
FACULTY AND STUDENT HIGHLIGHTS

Aug. 2015

Professor Diane Litman was elected in Aug. 2015 to a 3-year term as Councilor of the Association for the Advancement of Artificial Intelligence (AAAI).

Jun. 2015

PhD student Yun Huang was a tutorial co-organizer on the use of a toolkit that she has co-developed for modeling student learning at the 8th International Conference on Educational Data Mining.

https://sites.google.com/site/smarttutorialedm2015/

Andrew Mellon Predoctoral Fellowships Recipients

(2016- 2017)  

Yun Huang & Roya Hosseini

(2015- 2016)

Mahdi Pakdaman & Jaromir Savelka
EVENTS - ISP@Conferences

EDM 2016
Raleigh, NC (June 29-July 2)
From Left to Right: Bruce McLaren, Min Chi, Chas Murray, Shaghayeghi (Sherry) Sahebi, Peter Brusilovsky, Collin Lynch, Noboru Matsuda, Yun Huang

IJCAI 2016
New York City, NY (9-15 July)
From Left to Right: Mahdi Pakdaman, Homa Hashemi, Rebecca Hwa, Lingjia Deng

Hypertext & UMAP 2016
Halifax, Canada (10-17 July)
From Left to Right: Pamela Jordan, Peter Brusilovsky, Rosta Farzan, Yun Huang
Abstract: Robot swarms are large teams of inexpensive, usually homogeneous robots that interact with each other on a local scale. The control laws dictating these interactions can be designed to give rise to emergent global behaviors useful for robot teams--such as aggregating or flocking together as a group. These behaviors are called emergent because they arise from the local rules followed by each robot as they interact with neighbors and the environment. No single robot is aware of the global behavior, yet they all take part in it. Now that hardware and algorithms for swarms are advanced enough to allow for their use outside the laboratory, researchers are beginning to focus on how human operators can control them. Recent work has introduced multiple paradigms and metaphors for imparting an operator's intent on the swarm, yet less work has focused on how to facilitate visualizing the swarm, predicting future states, and improving the quality of input from operators as a result. Because giving optimal input to a swarm is dependent on correct recognition of the swarm's current state, and prediction of near-term future state, the goal of this dissertation is to determine how to best present limited data from the swarm to an operator so as to maximize their understanding of the current behavior and swarm state in general.

This dissertation will contribute new techniques for effectively visualizing and predicting swarm states depending on the properties of the swarm algorithm and communication channel. It will also contribute metrics for evaluating such visualizations by investigating their impact on the quality of input given by human operators as a result. Finally, this thesis will demonstrate that increased training can improve the effectiveness of operators at controlling a swarm and understanding the visualizations.

Committee: Michael Lewis (Advisor), Katia Sycara, Christian Schunn, Stephen Hirtle
Abstract: Most of the work in sentiment analysis and opinion mining focuses on extracting explicit sentiments, the sentiments revealed by certain sentiment expressions. However, opinions may be expressed implicitly via inference rules over explicit sentiments. The implicit opinions are indicated in the text, and they are important for a sentiment analysis system to fully understand the opinions in the text. In this thesis, we incorporate several inference rules as constraints in joint prediction models, to develop an entity/event-level sentiment analysis system which aims at detecting both explicit and implicit sentiments expressed from an entity toward an entity or event in the text. The entity/event-level sentiment analysis is a more fine-grained and more difficult task, compared to state-of-the-art sentiment analysis work which mostly are span based.

In this work, we propose to work in three aspects: 1) developing an entity/event-level sentiment corpus, MPQA 3.0, where both explicit and implicit sentiments are annotated; 2) developing an annotated corpus and two computational models focusing on inferring sentiments about a particular type of events: +/-effect event, which have positive effect or negative effect on the theme; 3) developing joint prediction models to improve detecting and inferring sentiments expressed from any entity toward any entity or event in the text, and jointly resolving various ambiguities in the entity/event-level sentiment analysis task.

Committee: Janyce Wiebe (Advisor), Rebecca Hwa, Yu-Ru Lin, William Cohen
Abstract: Learning probabilistic classification models that generate accurate probabilities are essential in many prediction and decision-making tasks in machine learning and data mining. This includes when we aim to use the classification models for cost-sensitive decision-making problems or when we plan to combine the classification scores with other sources of information (e.g., output of other classification models or the information provided by an expert’s belief that is represented as a probability score) for decision-making. One way to achieve this goal is to post-process the output of classification models, known as classification scores, to obtain more accurate probability scores. These post-processing methods are often referred to as calibration methods in machine learning and data mining literature.

In this thesis, we describe a suite of non-parametric calibration methods for pattern classification models. The proposed methods are classifier independent; thus, they can be readily combined with many existing classification models including naive Bayes (NB), logistic regression (LR), and support vector machines (SVM). In order to evaluate the calibration performance of a classifier, we introduce two new calibration measures that are intuitive statistics of the calibration curves (also known as reliability curves). Our theoretical findings show that by using a simple non-parametric calibration method known as histogram binning, it is possible to improve the calibration performance of a classifier without sacrificing discrimination capability. We also present extensive experimental results on both simulated and real datasets to evaluate the performance of the proposed methods compared with commonly used calibration methods in the literature. In particular, in terms of binary classifier calibration, our experimental results show that proposed methods are able to improve the calibration power of classifiers while retaining their discrimination power. The methods are also computationally tractable for large-scale datasets as they run in $O(N \log N)$ time, where $N$ is the number of samples.

Committee: Gregory Cooper (Advisor), Milos Hauskrecht, Shyam Visweswaran, Jeff Schneider
Abstract: Cross-domain recommendation has recently emerged as a hot topic in the field of recommender systems. The idea is to use rating information accumulated in one domain (known as a source or auxiliary domain) to improve the quality of recommendations in another domain (known as a target domain). One of the important problems in cross-domain recommendation is the selection of source domains appropriate for a target domain. Previous works mostly assume that the best domain pairs can be decided based on similarity of their nature (such as books and movies), or simulate domain pairs by splitting the same dataset into multiple domains. We argue that the success of cross-domain recommendations depends on domain characteristics and shared (latent) information among domains; therefore posing new questions: What makes a good auxiliary domain? How should we choose the best auxiliary domain for a specific target domain?

In this thesis, we propose to examine the success and failure of cross-domain collaborative filtering across three different datasets with various characteristics in the number of domains, nature of domains, and size of data. Our goals are to explore the added value of cross-domain recommendations in comparison with traditional within-domain recommendations, and to achieve some progress in uncovering the main mystery of cross-domain recommendation: how can we determine whether a pair of domains is a good candidate for applying cross-domain recommendation techniques? For the former goal, we propose a cross-domain collaborative filtering approach based on canonical correlation analysis. In order to address the latter goal, we pilot a canonical correlation approach as a possible predictor of successful domain pairs and examine a range of features of a single domain and domain pairs in order to see how they could be used to improve predictions.

Committee: Peter Brusilovsky (Advisor), Gregory Cooper, Yu-Ru Lin, Alexander Tuzhilin
PROPOSALS & DISSERTATIONS

An-kwok Ian Wong

Biomarker Discovery in Exome Data

Abstract: Current DNA sequencing technology enables inexpensive sequencing of the exome or the protein coding regions of the genome. The primary goal of the analyses of exome data is to identify sequence variants, such as single nucleotide variations (SNVs) that will help elucidate the genetic causes of common polygenic diseases such as Alzheimer's disease and chronic pancreatitis. Exome data analysis presents several challenges. These challenges include the large number of SNVs compared to the relatively small sample size, the rarity of many of the SNVs, and potential interactions among SNVs on their effect on disease.

In this work, I develop, implement, and evaluate new multivariate biomarker ranking algorithm called Bayesian averaged probabilistic rules (BAPR) that has several novel characteristics. It (1) learns probabilistic rule models from data, (2) performs Bayesian model averaging to rank biomarkers like SNVs, and (3) incorporates biological knowledge as structure priors of biomarkers. The BAPR algorithm was evaluated on several exome datasets with both synthetic outcomes and real outcomes. It incorporated a range of variant deleteriousness scores as structure priors. The quality of SNV rankings was evaluated with biomarker recovery plots, area under the Receiver Operating Characteristic curves, and evidence of biological validity as supported by the literature.

The BAPR algorithm performed statistically significantly better in identifying previously known disease associated SNVs and biologically meaningful SNVs when compared to chi-square. BAPR with uniform and expected number of predictors priors performed better than priors that were derived from variant deleteriousness scores. Also, combining several variant deleteriousness scores performed at least as well as the best performing single deleteriousness score. The variant deleteriousness scores have sparse coverage and typically scores are available only for a small proportion of SNVs that are measured in an exome dataset. The encouraging results obtained with these scores suggest that as coverage increases the performance of algorithms like BAPR that incorporate them will also improve.

Committee: Shyam Visweswaran (Advisor), Mahmud Barmada, Gregory Cooper, Milos Hauskrecht
Matthias Grabmair

Modeling Purposive Legal Argumentation and Case Outcome Prediction using Argument Schemes in the Value Judgment Formalism

Abstract: Artificial Intelligence and Law studies how legal reasoning can be formalized in order to eventually be able to develop systems that assist lawyers in the task of researching, drafting and evaluating arguments in a professional setting. To further this goal, researchers have been developing systems, which, to a limited extent, autonomously engage in legal reasoning, and argumentation on closed domains. This dissertation presents the Value Judgment Formalism and its experimental implementation in the VJAP system, which is capable of arguing about, and predicting outcomes of, a set of trade secret misappropriation cases.

VJAP argues about cases by creating an argument graph for each case using a set of argument schemes. These schemes use a representation of values underlying trade secret law and effects of facts on these values. VJAP argumentatively balances effects in the given case and analogizes it to individual precedents and the value tradeoffs in those precedents. It predicts case outcomes using a confidence measure computed from the argument graph and generates textual legal arguments justifying its predictions. The confidence propagation uses quantitative weights assigned to effects of facts on values. VJAP automatically learns these weights from past cases using an iterative optimization method.

The experimental evaluation shows that VJAP generates case-based legal arguments that make plausible and intelligent-appearing use of precedents to reason about a case in terms of differences and similarities to a precedent and the value tradeoffs that both contain. VJAP’s prediction performance is promising when compared to machine learning algorithms, which do not generate legal arguments. Due to the small case base, however, the assessment of prediction performance was not statistically rigorous. VJAP exhibits argumentation and prediction behavior that, to some extent, resembles phenomena in real case-based legal reasoning, such as realistically appearing citation graphs.

The VJAP system and experiment demonstrate that it is possible to effectively combine symbolic knowledge and inference with quantitative confidence propagation. In AI&Law, such systems can embrace the structure of legal reasoning and learn quantitative information about the domain from prior cases, as well as apply this information in a structurally realistic way in the context of new cases.

Committee: Kevin Ashley (Advisor), Marek Druzdzel, Alan Lesgold, Eric Nyberg
Roya: How was your experience at ISP?
Sherry: It was great! I think one of the ISP’s best aspects is its culture. ISP has been a second family for me during my PhD years. When I joined ISP, I met with so many friendly, smart, and humble people, who not only were great at what they were doing, but were warm and welcoming. If you had any problems, everyone was open and sympathetic. If you were happy, everyone celebrated with you. I miss the discussions we had in ISP office with each other, the birthdays we celebrated, the social nights, and the holiday celebrations.

Another great aspect of ISP is its flexible and multi-disciplinary program. Having biweekly talks, I was introduced to a broad set of research areas, all connected to each other through ISP. I have learned to understand the value of diverse research, and present my own research to a broader audience in ISP. Being associated with many departments, I could select my courses from a broad range of classes in many different areas. ISP opens the door for collaboration with experienced faculty in many departments. I can talk forever about how great ISP is. But I think the newsletter pages are limited. 😊

Roya: Do you have any suggestions for improving the program?
Sherry: I think the ISP program, as it is, is very well designed and implemented. I really appreciate the interdisciplinary nature of ISP, connecting so many different fields of research together with the core of AI. Being introduced to many different research areas, the flexibility of courses you can take at this program, and the organized and well-established milestones are all very positive aspects of this program.
As for improving the program, I can think of adding the TA experience for students. Currently, ISP students are introduced to CIDDE workshops, can give guest lectures at some classes, and can rarely be a TA for a course. I have attended the CIDDE workshops and have taught as a guest lecturer in some classes. I have learned a lot from both. However, teaching a whole class or being a teaching assistant for a course are invaluable experiences for a graduate student, especially if the goal of that student is to continue working in academia. It would be great if ISP can have a small TA budget from the associated departments to provide this opportunity to the students.

Roya: Do you have any message for the new students?
Sherry: Hmm, I’m not sure if I can really have a message. I know that ISP will remain smart and fun, because of its culture. I wish all of ISP students the best of success and happiness.

Roya: What do you plan to do after graduation?
Sherry: I am going to start my job as an assistant professor at the CS department of SUNY Albany this September. I am planning to continue my research on human-centered machine learning and data mining in the new department.

Sherry and her committee members after her defense, July 21 (2016)
Lingjia's dissertation defense will be on August 25, 2016. After graduation, she will join Bloomberg as a research scientist in the Natural Language Processing group. Lingjia wants to continue her research on sentiment analysis and information extraction.

Lingjia really likes ISP; she believes that the biggest advantage of the ISP program is that it focuses on application of AI in various domains and that the required courses are fundamental to students' research.

Lingjia likes ISP seminars and New Year party gift exchange :) She thinks that ISP seminars provide students an opportunity to discuss their research with faculties and other students.

Lingjia wishes there were more machine learning courses in the program. Also she suggests having more events like CS Wine&Research where students can present their work together (maybe as posters) to not only ISP faculties but also faculties from other departments. The event may be held before the New Year party.
ISP Welcome Picnic

As in prior years, ISP is holding a picnic to welcome new students and faculty and greet the current faculty, alumni, and students. The picnic is going to be held on Friday September 23rd at Bartlett Shelter in Schenley Park. We would like to include all the local ISP alumni and we hope to see all of you and families there. We'll have lots of food and beverages – you bring the Frisbees!

Here are the details of this event:
Where: Schenley Park
       Bartlett Shelter
       Intersection of Bartlett Street and Panther Hollow Road
When: Friday, September 23rd
       3:30pm – 6:30pm (or later)
Please let us know if you will be able to join us by emailing to Michele: paum4b@pitt.edu

ISP on Social Media

We have organized Google, Twitter, and Facebook accounts for ISP. Although they are not very active right now, we encourage everyone to follow ISP and be in contact with us through these pages. We are using a Google spreadsheet to collect updates and contact information from all ISP student and faculty alumni. We would appreciate it if you could update us through that page. You can access ISP on:

- https://twitter.com/ISPPitt (@ISPPitt)
- isp.pitt@gmail.com


This year, we have created the second Intelligent Systems Program newsletter. If you have news for ISP or wish to have a copy of the newsletter mailed to you, please email Michele Thomas at paum4b@pitt.edu. You can find ISP Newsletter on the web at:

http://www.isp.pitt.edu/newsletter

Director: Professor Diane Litman
Editor: Roya Hosseini