Reports of the AAAI 2012 Spring Symposia

Harith Alani, Bo An, Manish Jain, Takashi Kido, George Konidaris, William Lawless, David Martin, Caroline Pantofaru, Donald Sofge, Keiki Takadama, Milind Tambe, Tomas Vitvar

■ *The Association for the Advancement of Artificial Intelligence, in cooperation with Stanford University's Department of Computer Science, was pleased to present the 2012 Spring Symposium Series, held Monday through Wednesday, March 26–28, 2012, at Stanford University, Stanford, California, USA. The six symposia held were AI, the Fundamental Social Aggregation Challenge (cochaired by W. F. Lawless, Don Sofge, Mark Klein, and Laurent Chaudron); Designing Intelligent Robots (cochaired by George Konidaris, Byron Boots, Stephen Hart, Todd Hester, Sarah Osentoski, and David Wingate); Game Theory for Security, Sustainability, and Health (cochaired by Bo An and Manish Jain); Intelligent Web Services Meet Social Computing (cochaired by Tomas Vitvar, Harith Alani, and David Martin); Self-Tracking and Collective Intelligence for Personal Wellness (cochaired by Takashi Kido and Keiki Takadama); and Wisdom of the Crowd (cochaired by Caroline Pantofaru, Sonia Chernova, and Alex Sorokin). The papers of the six symposia were published in the AAAI technical report series.*

AI, the Fundamental Social Aggregation Challenge, and the Autonomy of Hybrid Agent Groups

The focus of the AI, The Fundamental Social Aggregation Challenge, and the Autonomy of Hybrid Agent Groups symposium was to explore issues associated with the control of teams of humans, autonomous machines, and robots working together as hybrid agent groups. Bill Lawless of Paine College kicked off the meeting by pointing out the need for a new theory of social dynamics. He showed that majority rule is far better than consensus for group decision processes and proposed a new mathematical model for characterizing social group dynamics based on interdependence. Albert-Lazlo Barabasi of Northeastern University showed how scale-free networks are very common, and that they are robust to random failures but susceptible to targeted attacks. The hubs in social networks are often not the managers or people in charge. He then explored how to control complex networks. He showed that spare and heterogeneous networks are harder to control than homogeneous networks. Jonathan Barzilai of Dalhousie University pointed out that the current prevailing mathematical foundations of the social sciences are in error because ordinal elements are not vectors, cannot be added or multiplied, do not live in vector spaces, and cannot be differentiated.

Volkan Isler from the University of Minnesota discussed the carp threat in lakes in Minnesota and described efforts using a team of robots to track them. Tracking is used to understand the behavior of the fish to assist in efforts to harvest them using fishing nets.

Shu-Heng Chen of the National Chengchi University, Taiwan, addressed the question of whether we need smart agents at all for group decision making. The prevailing theory is that marginal traders are the key to making the prediction market work. Chen's work shows that the power of the prediction markets depends on the participation of good (intelligent) predictors.

William Griffin of Arizona State University described the social dynamics of pairs, such as married couples and divorced couples. He concluded that in such relationships history matters, fidelity cannot be assumed, and latent structures modify group processes. Milind Tambe of the University of Southern California described the application of game theory to challenges in security, including searching for terrorists at LAX and scheduling checkpoints because human schedulers are too predictable. Ramya Pradhan of the University of Central Florida discussed the effects of interagent variation on developing robust and stable teams. She showed how bees regulate nest temperature by fanning and shivering, and offered a method to select agents to join a team to work on a task based on experience.

Ani Hsieh of Drexel University discussed distributed aggregation in the presence of uncertainty, and the design of group behaviors. Ensemble models give us the ability to predict and design agent-based behaviors for teams. She showed how to design controllers that are scalable and robust to noise and uncertainty and that minimize communication. She also showed how to use notch filters to design group behaviors for robots.

Geert-Jan Kruijff of the German Research Center for Artificial Intelligence discussed efforts to model cohesiveness in human-robot teams performing under stress. Trust between the robot and human is key. Lt. Gregory Gibson, USN, discussed efforts using autonomous agent-based systems to counter asymmetric threats from non-state-sponsored terror organizations. A key issue is understanding how humans interact with network information systems, and using this information to predict human behavior. Debra Duong of Agent Based Learning Systems discussed the importance of signs for interactive multiagent systems. She used coevolution to learn the vicious and virtuous cycles of social interactions, and concluded that diversity of behavior is key to flexibility.

Finally, George Alexander from the University of North Carolina Charlotte reiterated Marvin Minsky's observation that to understand something, you need to be able to understand it in several different ways. He discussed mining social media data to generate concept models, and utilizing Minsky's K-line theory to store and reactivate mental states. The symposium concluded with an open discussion on trust in autonomous systems and the various facets of trust between humans and machines.

William Lawless and Donald Sofge acted as cochairs of the symposium. The papers of the symposium were published as AAAI Press Technical Report SS-12-01.

Designing Intelligent Robots: Reintegrating AI

The Designing Intelligent Robots: Reintegrating AI symposium aimed to bring together a diverse and multidisciplinary group of researchers interested in extending and combining various AI techniques with the goal of developing robots that behave intelligently.

The goal of building intelligent robots has been a motivating problem for generations of AI researchers, going back at least as far as Shakey the robot in 1966. Creating such a robot is both the fully realized expression of the original impulse behind AI and an immensely rich source of research questions that address real-world problems. However, AI is a fragmented field: well developed and largely independent research communities exist for learning, planning, reasoning, language, perception, and control. Since the challenges posed by each of these subfields are immense, most researchers have found it necessary to devote their careers to specializing in a single subfield.

The symposium brought together researchers from a wide variety of specialties, including mechanical design, machine learning, planning, vision, natural language processing, motion planning, and knowledge representation and reasoning. While each attendee has a home community, the attendees' research agendas — and therefore their technical innovations — are driven primarily by the goal of developing intelligent robot systems. This reverses the more common scenario where specialist technical innovation drives the identification of suitable applications within a subfield. The symposium provided a venue where the attendees could share their progress and results, build collaborations across specialist technical areas of expertise, and discuss the unique challenges posed and opportunities presented by their efforts to unify technologies from disparate research communities.

The symposium proved timely as there has been a recent explosion in the number of research projects of this type, partly due to the availability of standardized sophisticated hardware platforms and

software frameworks that lower the bar for entry to the field, facilitate the distribution of source code, and enable reproducibility. The seven invited speakers and 16 accepted papers all presented compelling examples of AI techniques being applied to produce robots displaying complex behavior that would not have been imaginable a mere five years ago. A major goal of the symposium was to take advantage of this momentum to create a significant and permanent presence in AI.

The symposium closed with a discussion about successful strategies for conducting integrative research and for finding appropriate publication venues. The attendees were very enthusiastic about the new Robotics Track at AAAI, and largely agreed that broad AI venues that draw researchers from many different areas are the most appropriate venues for their work.

George Konidaris, Byron Boots, Stephen Hart, Todd Hester, Sarah Osentoski, and David Wingate served as cochairs of this symposium. The papers in the symposium were published as AAAI Press Technical Report SS-12-02.

Game Theory for Security, Sustainability, and Health

The goal of the Game Theory for Security, Sustainability, and Health AAAI symposium was to discuss challenge issues as well as solution techniques of applying game theory to security, health, and sustainability.

There is a large and growing interest in applying game theory to security, health, and sustainability, which are named as the grand challenges for engineering in the 21st century by the National Academy of Engineering. In fact, the last five years have seen game-theory-based systems developed and applied to real-world domains. For example, software assistants have been developed for randomized patrol planning for the Los Angeles International Airport police, the United States Federal Air Marshal Service, the United States Coast Guard, and the United States Transportation Security Administration. Also game theory has been utilized for decentralized control, operation, and management of future generation of electricity. While there has been significant progress, there still exist many major challenges facing the design of effective approaches to deal with the difficulties in security, health, and sustainability. Addressing these challenges requires collaboration from different communities including artificial intelligence, game theory, operations research, social science, and psychology. This symposium was structured to encourage a lively exchange of ideas among members from these communities. This symposium brought together researchers from these and other communities to foster collaborations, share accomplishments, identify common issues and challenges, and propose directions to move forward.

The symposium featured seven distinguished invited speakers: Andrea Bertozzi (University of California, Los Angeles), Dorit S. Hochbaum (University of California, Berkeley), Sarit Kraus (Bar-Ilan University), Mathew D. McCubbins (University of Southern California), Guillermo Owen (Naval Postgraduate School), Alex Rogers (University of Southampton), and Manuela Veloso (Carnegie Mellon University). These invited speakers have different backgrounds, including AI, game theory, operations research, and psychology.

Fourteen papers were selected to be presented at the symposium and the topics of the presentations include game theory, algorithms for scaling to very large security domains, facing human opponents and intelligent user interfaces, risk analysis, decision making under uncertainty, multiagent simulation, negotiation and recommendation agents for patients, and distributed control in energy systems. There was one panel on fundamental challenges of applying game theory for security, sustainability, and health. The participants discussed the advantages and limitations of game theory. They also discussed three different ways of tackling the research challenges: formal analysis-based approach; data-based approach; and integrating formal analysis with data. Limitations of game theory were also discussed. The final agreement is that it is more promising to build realistic formal models through data analysis.

Bo An and Manish Jain served as cochairs of this symposium. Other organizers included Vincent Conitzer, Sarit Kraus, Kevin Leyton-Brown, Sarvapalli Ramchurn, and Milind Tambe. The papers of the symposium were published as AAAI Press Technical Report SS-12-03.

Intelligent Web Services Meet Social Computing

The goal of the Intelligent Web Services Meet Social Computing AAAI symposium was to foster interdisciplinary work building on approaches from these two vital research areas.

Development of web services faces significant challenges concerning quality of design, development costs, endorsement of services by the community, integration and interoperability of services from different domains, and effective sharing of services among users and developers. In particular, web service design quality tends to suffer from common mistakes, development cost is often high due to lack of collaboration and reuse, integration with other services is difficult because of lack of semantic service descriptions, sharing with other developers and users is not well supported, and the

social requirements to boost endorsement by the community are not well understood or met.

This spring symposium brought together two lines of research whose combination can help in dealing with these issues, namely intelligent web services and social computing research. Social computing is a promising approach that can help to understand user and community behaviour and related computational challenges around web services development. The symposium participants discussed real-world examples of web service architectures, and how social computing techniques such as social network analysis, crowdsourcing, or recommendation methods can help in dealing with the web services problems.

The symposium had three keynote speakers, an open panel, and 13 presentations. The keynotes were given by John Musser from ProgrammableWeb, who presented the ProgrammableWeb repository of web APIs; Jamie Taylor from Google, who spoke about FreeBase, a collaborative knowledge base, and crowdsourcing algorithms that Google developed to evaluate Freebase data semantics; and Fausto Giunchiglia from Trento University who spoke about Entitypedia, a project for moving linked data to linked entities. The paper presentations covered topics such as crowdsourcing techniques for web services annotations, enrichments of data by using web APIs, personalization of services in the enterprise, automation of web service discovery through crowdsourcing, and enrichment of service descriptions with social aspects.

As a result of the two days of presentations and discussions, the symposium participants identified two main areas where social computing research could be applied to deal with central challenges in web service technology. The first area is related to how service use tasks such as service description, discovery, composition, and mediation could be enhanced with information and functionality from social networks of services' users and developers. A broad range of possibilities was considered in this area, such as collaborative online creation and maintenance of service description ontologies; description of social parameters of web APIs; crowdsourcing the identification of existing web service APIs; crowdsourcing the annotation of web service descriptions; personalization of web services in the enterprise based on recommendation techniques (including multisource and crossdomain recommendations); web resources recommendations based on dynamic prediction of user consumption; and optimization of web service composition networks based on social network analysis. Several ideas were extended in promising ways by considering mixed collections of automated and human-provided services, as well as a mixture of automated and human handling of service-use tasks.

The second area is about modeling web service architectures as a network graph with social network analysis techniques applied to it. Symposium participants explored challenges such as service functional overlaps, effective services' reuse, shortening time to deliver new services, controlling and tracking of services' reuse, and measuring dependencies and the impact of change. The participants then discussed how fundamental social network analysis techniques such as betweenness centrality, clustering, triangular closures, and cliques can be applied to the social graph of web services to help ease these problems.

Tomas Vitvar, Harith Alani, and David Martin served as cochairs of the symposium. The papers of the symposium were published as AAAI Press Technical Report SS-12-04.

Self-Tracking and Collective Intelligence for Personal Wellness

The goal of the Self-Tracking and Collective Intelligence for Personal Wellness symposium is to explore approaches of improving personal wellness by quantifying our health and integrating our health data into personalized medicine, which also contributes to scientific discovery.

For this purpose, our symposium employs an integration of the individual and collective approaches. The approach from the individual viewpoint, on the one hand, focuses on recently developed self-tracking technologies for monitoring personal health conditions, such as sleep, diet, exercise, and vital signs data, and for analyzing personal medical data and personal genome data. The approach from the collective viewpoint, on the other hand, focuses on collective intelligence as a potential resource for finding useful knowledge on personal wellness from the knowledge of other individuals and groups. The role of artificial intelligence and other technologies is examined in helping to create value in our future personal wellness. These examples include (1) self-tracking for personal wellness (sleep monitoring, diet monitoring, vital data monitoring, personal medicine, personal genome, new type of self-tracking devices, portable mobile tools), and (2) collective intelligence for personal wellness (data mining for scientific discovery on collective data, biomedical informatics and systems biology, data visualization). In addition to these examples, our symposium focuses on (1) field study of personal wellness (life log analyses such as vital data analyses, life-style related disease improvement experiment such as metabolic syndrome or diabetes, sleep improvement), and (2) application for personal wellness (life log applications, wellness service application, medical recommendation system, care support system for aged persons, web service for personal wellness,

games for health and happiness), and (3) community platform for personal wellness (citizen science platform, do it yourself [DIY] trials, quantified self business model).

To promote discussion on possible solutions for the issues just mentioned, this symposium brought together an interdisciplinary group of researchers, such as biomedical informatics, natural language processing, intelligent agent systems, mobile health applications, cognitive psychology, social science, neural science, and sport science and behavior science. Furthermore, the symposium included six invited talks to give us new perspectives on personal wellness. For example, Ernesto Ramirez (University of California, San Diego and San Diego State University) introduced the recent movements on the self-tracking community with discussion of a fundamental pathway of behavior change. Atul J. Butte (Stanford University) spoke on data-driven personalized medicine, introducing the recent hot topic of the personal genome. Rollin McCray (HeartMath Research Center) had a talk on heart rhythm coherence tracking technologies to improve wellness and cognitive functioning. Sudheendra Hangal (Stanford University) presented the applications of long-term personal digital archives, introducing the Stanford MUSE project. Yotam Heineberg (Stanford University) introduced the Stanford CCARE (the center for compassion and altruism research and education) project by presenting the online tracking of people's values and behaviors for compassion behavioral activation. Yukiko Shiki (Kansai University) finally introduced the concept of Zone (flow) in sports science, and presented the collective views of the workings and significance of experiences in the Zone from the standpoint of Kansei.

Fifteen technical papers were presented over the course of the two and a half days. Presentation topics included the mobile health application for diabetes patients; Twitter usage analyses for fitness self-reporting; pervasive self-tracking of physical activities with mobile phone; web-based visualization of influenza surveillance; self-tracking of cognitive performance; meditation training and neurofeedback using a consumer EEG device; mindfulness into persuasive technologies; interfaces for nutrigenomics and nutrigenetics; sleep stage detection; age-based sleep stage estimation; individual care plan for a good sleep; personal genome analyses; knowledge sharing among patients, doctors, and researchers; DIY citizen science genetics; self-tracking case studies for chronic illness; and brain structure and individual differences in social behaviors.

The symposium was successful in inspiring new ideas from diverse fields of participants. Overall, the participants found the symposium engaging and constructive, and they expressed the desire to continue this initiative in further events. We expect that the further continuous events followed by this symposium will present important interdisciplinary challenges for guiding future advances in the AI community.

Takashi Kido and Keiki Takadama served as cochairs of this symposium. The papers of the symposium were published as AAAI Press Technical Report SS-05-12.

Wisdom of the Crowd

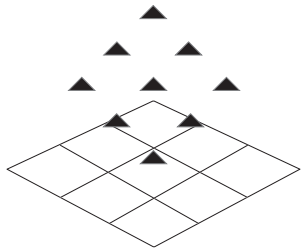
The Wisdom of the Crowd symposium brought together researchers exploring crowdsourcing and applying crowdsourcing to a number of domains. The goal of this symposium was to share experiences and best practices, transferring knowledge between disciplines.

Crowdsourcing is becoming a popular way to get work done. The Internet facilitates access to large and distributed workforces, allowing researchers and employers to reach a wide audience, complete tasks quickly, or have a person always on call. The introduction of Amazon's Mechanical Turk, crowdsourcing providers such as CrowdFlower, and the use of games for data collection have accelerated growth in the space.

As in many new fields, however, a good deal of the academic work thus far has been fragmented and published in various application domains such as robotics, computer vision, natural language processing, and AI. This symposium brought together researchers using and improving crowdsourcing in these domains to share knowledge and best practices. Participants from both academe and industry applied crowdsourcing to AI, machine learning, computer vision, robotics, natural language processing, translation, semantically linking data, and tracking epidemics.

A number of different approaches to crowdsourcing were presented. Many of the participants used the Amazon Mechanical Turk market for micro tasks. Other approaches included recruiting volunteers who participated out of goodwill or for social standing such as in Wikipedia or open source programming communities. Finally, a more structured search for a crowd could be conducted through professional crowdsourcing providers.

Of course, obtaining a crowd is only the first step. A project also needs to obtain the right crowd who will be qualified for the task and work hard and honestly. Discussions emerged around the questions of how to filter and motivate the crowd to get good results. Techniques and requirements differed by task; for example, running a human-computer interaction study requires a large and diverse crowd, while getting work done quickly simply requires rapid turnover regardless of the crowd's makeup. Gold tasks with known answers



2013 Spring Symposium Series Call for Participation

AAAI presents the 2013 Spring Symposium Series, to be held Monday – Wednesday, March 25–27, 2013, at Stanford University. The eight symposia will be as follows:

Analyzing Microtext

Eduard Hovy (USC Information Sciences Institute), Vita Markman (Disney Interactive Media Group), Craig Martell (Naval Postgraduate School), David Uthus (National Research Council and Naval Research Laboratory)

Creativity and (Early) Cognitive Development: A Perspective from Artificial Creativity, Developmental AI and Robotics

Georgi Stojanov (The American University of Paris), Bipin Indurkhya, chair (International Institute of Technology, Hyderabad and AGH University of Science and Technology)

Data Driven Wellness: From Self-Tracking to Behavior Change

Takashi Kido (Riken Genesis Co, Ltd, Japan)

Designing Intelligent Robots: Reintegrating AI

George Konidaris (Massachusetts Institute of Technology)

Lifelong Machine Learning

Eric Eaton (Bryn Mawr College)

Shikakeology: Designing Triggers for Behavior Change

Naohiro Matsumura (Osaka University), Renate Fruchter (Stanford University)

Trust and Autonomous Systems

Don Sofge (Naval Research Laboratory), Geert-Jan Kruijff (German Research Center for AI – DFKI), William F. Lawless (Paine College)

Weakly Supervised Learning from Multimedia

Rahul Sukthankar (Google Research)

For additional information, and links to the supplementary websites for each symposium, please see www.aaai.org/Symposia/Spring/ sss13.php. Submissions for the symposia are due on October 5, 2012. Notification of acceptance will be given by November 2, 2012. Material to be included in the technical reports of the symposium must be received by January 18, 2013. Registration information will be available by December 15, 2012. Please contact AAAI at sss13@aaai.org with any questions.

were often used to identify good workers. Interesting tasks, tasks that made the workers feel good about themselves, or game-based tasks were often performed well. In some cases, if the work did not explicitly require a diverse crowd, the crowd was narrowed to a small set of reliable workers.

An interesting discussion arose around the ethics of crowdsourcing, including the pros and cons of paying a small amount per task versus accumulating free work through games or volunteers. A positive aspect of crowdsourcing is the potential for bringing work and training to underserved areas around the world.

This symposium allowed participants from an array of fields to meet and discuss the many faces of crowdsourcing. It was cochaired by Caroline Pantofaru, Sonia Chernova, and Alexander Sorokin. The papers of the symposium were published as AAAI Press Technical Report SS-12-06.

Harith Alani is a senior lecturer at the Knowledge Media Institute, the Open University, UK.

Bo An is a postdoctoral research associate in the Department of Computer Science at the University of Southern California.

Manish Jain is a Ph.D. student in the Department of Computer Science at the University of Southern California.

Takashi Kido is a research manager of Rikengenesis in Japan. He had been a visiting researcher of Stanford University.

George Konidaris is a postdoctoral associate at MIT CSAIL.

William Lawless is a professor of mathematics and psychology at Paine College in Augusta, Georgia.

David Martin is a software development manager on the Siri team at Apple.

Caroline Pantofaru is a research scientist at Willow Garage, Inc.

Donald Sofge is a computer scientist with the Naval Research Laboratory in Washington, D.C.

Keiki Takadama is a professor of the University of Electro-Communications in Japan.

Milind Tambe is a professor in the Department of Computer Science at the University of Southern California.

Tomas Vitvar is an associate professor at the Czech Technical University in Prague and a senior technical architect at Oracle.