Tutorials

Verification of Multi-Agent Systems against Epistemic Specifications
Alessio Lomuscio, Imperial College London

Autonomous multiagent systems are typically specified by using expressive properties representing, among others, the knowledge of the agents and what they can bring about collectively or on their own in a system. This tutorial will survey some of the current techniques addressing the model checking of multi-agent systems against agent-based specifications. Specifically, the tutorial will cover syntax and semantics for the temporal-epistemic logic CTLK and ATLK, the epistemic variant of alternating time temporal logic. It will also cover ordered-binary decision diagrams and symbolic labeling, parameter synthesis and strategy synthesis in ATLK specifications, verification of systems with an unbounded number of agents, and MCMAS: a model checker for multiagent systems implementing these techniques, as well as the application of the techniques to a range of scenarios including service-oriented computing.

Alessio Lomuscio is a professor in logic for multi-agent systems in the Department of Computing, Imperial College London, where he leads the Verification of Autonomous Systems research group. He currently holds an EPSRC leadership fellowship. He received a PhD in computer science from the University of Birmingham in 1999 and a Laurea in electronic engineering from Politecnico di Milano in 1995. Before joining Imperial he was a lecturer at King's College London and a senior lecturer at University College London. His research interests concern the specification and verification of multiagent systems by means of techniques based on computational logic. In particular he has made theoretical contributions in the area of logic for multiagent systems (including studying the completeness, decidability and complexity of several temporal-epistemic formalisms) and has put forward several symbolic model checking techniques for the verification of agent-based systems. He has applied these techniques to the verification of a range of applications including autonomous underwater vehicles, webservices and security protocols including e-voting.

Dynamic Epistemic Logic and Its Interaction with Knowledge Representation
Lawrence S. Moss, Indiana University

Dynamic epistemic logic (DEL) takes the classical topic epistemic logic and adds features from propositional dynamic logic (PDL). DEL comes to life in the multiagent setting. It allows one to represent epistemic actions in addition to epistemic situations. DEL has been around for about 20 years, and so it has seen a lot of progress. By now, the original topics have been applied, generalized, and adapted in various ways. My primary goal in this tutorial is to present an overview of the area to people at KR 2014. After this, I would like to ask why it is that tools from DEL are not more used in the KR community. Turning things around, I also ask what influence issues from KR and other fields will have on the future of DEL and related frameworks.

Lawrence S. Moss is director of Indiana University's program in pure and applied logic. He is a professor of mathematics, and an adjunct professor of computer science, informatics, linguistics, and philosophy. For a number of years he was the steering committee chair of the North American Summer School in Logic, Language, and Information (NASSLLI).
In order to understand natural language expressions it is usually not enough to know the literal (dictionary) meaning of words used in these expressions and compositional rules of the corresponding language. Much more knowledge is involved here; knowledge, which may have nothing to do with the linguistic competence but is rather related to our general conception of the world. In this tutorial, I will present an overview of the approaches to modeling knowledge-intensive natural language understanding (NLU) in a computational framework, with the main focus on inference-based NLU. I will discuss the types of knowledge required for NLU and the techniques to obtain this knowledge in a machine-readable form. The tutorial will cover lexical-semantic knowledge bases, ontologies (general and domain-specific), and corpora-based resources. Then I will focus on reasoning procedures applicable to NLU and compare two main forms of logical inference: deduction and abduction. In the last part of the tutorial, I will present applications of some of the recent large-scale inference-based NLU systems to such knowledge-intensive tasks as recognizing textual entailment, metaphor interpretation, and narrativization of videos.

Ekaterina Ovchinnikova is a computer scientist (faculty) at the Institute of Information Sciences, University of Southern California. Her research interests include computational natural language understanding, human and automated reasoning, knowledge representation and extraction, scene recognition, and ontologies. Applications she is currently working on include metaphor interpretation, narrativization of videos, textual entailment recognition, and other knowledge intensive natural language understanding tasks. In 2011, Ekaterina earned her PhD degree in cognitive science from the Institute of Cognitive Science, University of Osnabrück (Germany). In her dissertation project, Ekaterina was focusing on inference-based natural language understanding. The main results of this work were published in Integration of World Knowledge for Natural Language Understanding.

Ontology-based data access (OBDA) has recently become a hot research topic in knowledge representation and data management. The basic idea underlying OBDA is to superimpose an ontology (conceptual layer) to a set of data sources (data layer), and use the ontology as a virtual schema for querying the data sources. The ontology and the data sources are connected through declarative mappings that provide the semantic relationship between the two layers. This tutorial will introduce ontology-based data access and will deal with the problem of query answering in OBDA, focusing in particular on the query rewriting approach to query answering. After a brief history of ontology-based data access, the tutorial will overview the most important results obtained in this area. Then, the main query rewriting techniques for OBDA will be presented and compared. The relationship between OBDA and other research topics will also be addressed. The main focus of the tutorial is on ontologies expressed using Description Logics; however, other ontology specification languages, like Datalog+/-, will be considered.

Riccardo Rosati is an associate professor in the Department of Computer, Control, and Management Engineering, Sapienza University of Rome, Italy. His main research interests are in the fields of databases and artificial intelligence, and include knowledge representation, description logics, ontologies, semantic web, databases, and nonmonotonic reasoning. He is the author of more than 150 publications in international journals and conferences. He is a member of the steering committees of the Description Logics workshop, the Nonmonotonic Reasoning workshop, and the International Conference on Web Reasoning and Rule Systems.