Topics by Max Kanovich

1. Formal methods in the traditional AI planning but with quantitative time constraints.

The aim is to develop an efficient and comprehensive logical tool for a typical AI problem of making a plan of the actions to be performed by a robot so that it could get into a final situation, if it started with a certain initial situation.

A particular focus is on planning under uncertainty caused by actions with non-deterministic effects and actions that may have quantitatively delayed effects in continuous time.

The ultimate goal is to show that for many planning problems - that are known to be a considerable obstruction to computer-aided planners, our systems lead to a dramatic contraction of the search space from exponential to polynomial in size.

1. Formal methods in the traditional AI planning but with quantitative time constraints.

- Max Kanovich and Jacqueline Vauzeilles. Linear logic as a tool for planning under temporal uncertainty. Theoretical Computer Science, 412, 2011, pp.2072-2092
- Max Kanovich and Jacqueline Vauzeilles. Strong planning under uncertainty in domains with numerous but identical elements (a generic approach). Theoretical Computer Science, 379 (2007) pp.84-119.

2. Formal verification of software. Effective logical formalisms for resource- and memory-sensitive reasoning

The aim is to develop efficient and comprehensive logical systems and programming tools capable of handling important properties of real-time dynamic systems such as safety, liveness, schedulability, surviveness, simulation, monitoring, etc.

As an effective language for reasoning about heap memory models, we use the formalism of Hoare triples based on separation logic.

Besides the intrinsic technical/theoretical interest of its principles, such as the frame rule and abduction, local reasoning and compositionality, separation logic provides new insights which could be of use in practical applications of logic to program analysis.

2. Formal verification of software.
Effective logical formalisms for resource- and memory-sensitive reasoning

- Reynolds, J. C. 2002. Separation logic: A logic for shared mutable data structures. In Proceedings of LICS-17. IEEE Computer Society, 55–74.
- N.Gorogiannis, M.Kanovich, and P.O'Hearn. The Complexity of Abduction for Separated Heap Abstractions. The 18th International Static Analysis Symposium (SAS 2011), Sept 14-16, Venice, Italy
- James Brotherston and Max Kanovich. Undecidability of Propositional Separation Logic and Its Neighbours. J. ACM 61(2): 14 (2014), 43 pages.

3. Formal systems for assured information sharing within collaborative systems and security protocols with quantitative time constraints.

The aim is to develop efficient and comprehensive logical systems and programming tools to enable multiple parties to share information and at the same time enforce confidentiality, privacy, trust, release, dissemination, data quality and provenance policies.

The formal systems should be capable of handling important properties of real-time collaborative systems such as safety, liveness, schedulability, surviveness, simulation, monitoring, etc.

The aim is to develop efficient logical systems capable of handling security protocols in software, distributed systems, and concurrent systems.

3. Formal systems for assured information sharing within collaborative systems and security protocols with quantitative time constraints.

- Max Kanovich, T.Ban Kirigin, V.Nigam, A.Scedrov, and C.Talcott. Discrete vs Dense Times in the Verification of Cyber-Physical Security Protocols. 4th Conference on Principles of Security and Trust (POST 2015) ETAPS 2015: 11-18 April 2015, London, UK
- Max Kanovich, T.Ban Kirigin, V.Nigam, and A.Scedrov. Bounded Memory Protocols. Computer Languages, Systems and Structures, 40 (2014), 137-154.
- Max Kanovich, T.Ban Kirigin, V.Nigam, and A.Scedrov. Bounded memory Dolev-Yao adversaries in collaborative systems. Information and Computation, 238 (2014) 233-261.

4. Formal systems in computational linguistics.

The aim of this research is to develop comprehensive and efficient logical formalisms capable of handling syntactical and semantical properties of a natural language.

5. Model Checking.

In particular, the aim is to develop efficient and comprehensive logical systems and programming tools for the systems with user-defined inductive predicates (such as lists, trees, etc.) as used in program verification.

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