
DaLí 2020

Dynamic Logic: New Trends And Applications

9 – 10 October 2020

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Dear participants,

Welcome to DaLi 2020. The third edition of the International Workshop on Dynamic Logic: New Trends and Applications, co-organized by the Institute of Computer Science and the Institute of Philosophy of the Czech Academy of Sciences, was supposed to be held in Prague, Czech Republic. Because of the covid pandemic, however, the workshop is held online via Zoom.

Information about Zoom can be found at <https://zoom.us/>. In case you don't have an account, you can set it up yourself there, or contact your university IT support since many universities provide their own Zoom services.

All authors and registered participants will receive Zoom links and passwords via email. If you are not an author of an accepted paper and you would like to attend, send a registration email to sedlar@cs.cas.cz stating your full name and affiliation. We need this information about participants so that we can filter out unwanted attendance.

This booklet contains the workshop schedule and abstracts of all talks. All times in the workshop schedule are Prague time (CEST, i.e. GMT+2).

I would like to wish you, also on behalf of DaLi SC, PC and OC, a pleasant and informative workshop.

Igor Sedlár

Schedule – Friday, 9 October

09:20 – 09:30

Opening

Regular Talks

09:30 – 10:00

Ryo Hatano and Katsuhiko Sano:
Constructive Dynamic Logic of Relation Changers

10:00 – 10:30

Stepan Kuznetsov:
Complexity of Commutative Infinitary Action Logic

10:30 – 11:00

Sebastian Reiche and Christoph Benzmüller:
Public Announcement Logic in HOL

11:15 – 11:45

Yì N. Wáng and Thomas Ágotnes:
A New Completeness Technique for Modal Logics With Intersection

11:45 – 12:15

Anthia Solaki:
Bounded Multi-Agent Reasoning: Actualizing Distributed Knowledge

Invited Talk

13:30 – 14:30

Johan van Benthem:
The Entanglement of Update and Inference

Regular Talks

14:45 – 15:15

Vít Punčochář:
Inquisitive Dynamic Epistemic Logic in a Non-Classical Setting

15:15 – 15:45

Sabine Frittella, Marta Bílková, Ondrej Majer and Sajad Nazari:
Belief Based on Inconsistent Information

15:45 – 16:15

Guillaume Aucher:
Expedition in the Update Universe

16:15 – 16:45

Sonia Marin, Luiz Carlos Pereira, Elaine Pimentel and Emerson Sales:
Ecumenical Modal Logic

Short Talks

17:00 – 17:20

Diana Costa:
A Dynamic Logic with Four-Valued Relations and Propositions

17:20 – 17:40

Daniel Rogozin:
The Finite Representation Property for Representable Residuated Semigroups

17:40 – 18:00

Oleg Grigoriev and Yaroslav Petrukhin:
Basic Modal Congruent and Monotonic Multilattice Logics

Schedule – Saturday, 10 October

Regular Talks

- 09:30 – 10:00 Line van den Berg and Malvin Gattinger:
Dealing with Unreliable Agents in Dynamic Gossip
- 10:00 – 10:30 Fausto Barbero, Katrin Schulz, Sonja Smets,
Fernando R. Velázquez-Quesada and Kaibo Xie:
Thinking about Causation: A Causal Language with Epistemic Operators
- 10:30 – 11:00 Thomas Bolander and Arnaud Lequen:
Parameterized Complexity of Dynamic Belief Updates
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- 11:15 – 11:45 Zuojun Xiong and Thomas Ågotnes:
Arbitrary Propositional Network Announcement Logic
- 11:45 – 12:15 Hans van Ditmarsch, Mo Liu, Louwe B. Kuijer and Igor Sedlár:
Expressivity of some versions of APAL

Invited Talk

- 13:30 – 14:30 Natasha Alechina:
Simultaneous and Sequential Announcements

Regular Talks

- 14:45 – 15:15 Emiliano Lorini and Pengfei Song:
Grounding Awareness on Belief Bases
- 15:15 – 15:45 Gaia Belardinelli and Rasmus K. Rendsvig:
Awareness Logic: A Kripke-Based Rendition of the Heifetz-Meier-Schipper Model
- 15:45 – 16:15 Valentin Cassano, Raul Fervari, Carlos Areces and Pablo Castro:
Default Modal Systems as Algebraic Updates

Short Talks

- 16:30 – 16:50 Zhiguang Zhao:
Sahlqvist Correspondence for Instantial Neighbourhood Logic
- 16:50 – 17:10 Vitor Machado and Mario Benevides:
A Logic for the Study of Evolving Behaviors in Social Networks
- 17:10 – 17:20 Closing

Abstracts

Invited Talks

Natasha Alechina: Simultaneous and Sequential Announcements

Group Announcement Logic (GAL) and Coalition Announcement Logic (CAL) were proposed to study effects of public announcements by groups of agents on knowledge in multiagent systems. Both logics have operators that quantify over such announcements. In GAL, it is possible to say that ‘a group of agents G has a (truthful) announcement such that after this announcement, some property A holds’; for example, A may involve some agents in G gaining additional knowledge, while agents outside G remain ignorant. In CAL, the quantification is over simultaneous announcement by the coalition and anti-coalition: it allows to say that ‘ G has an announcement such that, whatever else the agents outside G announce simultaneously, some property A is guaranteed to hold after the joint announcement’. It has been open for some time whether GAL and CAL are equally expressive. We show that this is not the case: there is a property expressible in GAL that is not expressible in CAL. It is still an open question whether CAL is subsumed by GAL, or whether the two logics have incomparable expressive power. The talk is based on joint work with Tim French, Rustam Galimullin and Hans van Ditmarsch.

Johan van Benthem: The Entanglement of Update and Inference

In solving classical puzzles and tasks, dynamic-epistemic updates triggered by linguistic text cooperate with inferences that can be drawn from that same text. I will discuss this interplay for the case of monotonicity inference (one of the core engines of ‘natural logic’) and its connections with various kinds of update logics, DEL-style or more complex recent systems of graph change. In the process, we will find a large number of technical open problems (including that of a Lyndon Theorem for PAL), but our presentation is also an exploration of the significant role of natural language in scenarios of information flow. (Ref. J. van Benthem and F. Liu, 2020, ‘New Logical Perspectives on Monotonicity’, UvA-Tsinghua Joint Research Center in Logic.)

Regular Talks

Guillaume Aucher: Expedition in the Update Universe

Dynamic epistemic logic (DEL) is a logic dealing with knowledge and belief change based on the concepts of event model and product update. The product update accounts for the way we update our knowledge and beliefs about situations when events occur. However, DEL does not account for the way we update our knowledge and beliefs about events when other events occur. Indeed, events are assumed to occur instantaneously in DEL and this idealization precludes to study this kind of update. We provide a logical analysis of updates without this assumption. It leads us to identify a graph structure for events based on their relative dependence and to introduce a generic product update. The DEL product update is a specific instance of this generic product update. We end the article by proposing a candidate logic which fulfils the principles that we have found out and introduced.

Fausto Barbero, Katrin Schulz, Sonja Smets, Fernando R. Velázquez-Quesada and Kaibo Xie: Thinking About Causation: A Causal Language with Epistemic Operators

In this paper we propose a formal framework for modeling the interaction of causal and (qualitative) epistemic reasoning. To this purpose, we extend the notion of a causal model with a representation of the epistemic state of an agent. On the side of the object language, we add operators to express knowledge and the act of observing new information. We provide a sound and complete axiomatization of the logic, and discuss the relation of this framework to causal team semantics.

Gaia Belardinelli and Rasmus K. Rendsvig: Awareness Logic: A Kripke-based Rendition of the Heifetz-Meier-Schipper Model

Heifetz, Meier & Schipper (HMS) present a lattice model of awareness. The HMS model is syntax-free, which precludes the simple option to rely on formal language to induce lattices, and represents uncertainty and unawareness with one entangled construct, making it difficult to assess the properties of either. Here, we present a model based on a lattice of Kripke models, induced by atom subset inclusion, in which uncertainty and unawareness are separate. We show the models to be equivalent by defining transformations between them which preserve formula satisfaction, and obtain completeness through our and HMS' results.

Line van den Berg and Malvin Gattinger: Dealing with Unreliable Agents in Dynamic Gossip

Gossip describes the spread of information throughout a network of agents. It investigates how agents, each starting with a unique secret, can efficiently make peer-to-peer calls so that ultimately everyone knows all secrets. In Dynamic Gossip, agents share phone numbers in addition to secrets, which allows the network to grow at run-time.

Most gossip protocols assume that all agents are reliable, but this is not given for

many practical applications. We drop this assumption and study Dynamic Gossip with unreliable agents. The aim is then for agents to learn all secrets of the reliable agents and to identify the unreliable agents.

We show that with unreliable agents classic results on Dynamic Gossip no longer hold. Specifically, the Learn New Secrets protocol is no longer characterised by the same class of graphs, so-called sun graphs. In addition, we show that unreliable agents that do not initiate communication are harder to identify than agents that do. This has paradoxical consequences for measures against unreliability, for example to combat the spread of fake news in social networks.

Thomas Bolander and Arnaud Lequen: Parameterized Complexity of Dynamic Belief Updates

Dynamic Belief Update (DBU) is a model checking problem in Dynamic Epistemic Logic (DEL) concerning the effect of applying a number of epistemic actions on an initial epistemic model. It can also be considered as a plan verification problem in epistemic planning. The problem is known to be PSPACE-hard. To better understand the source of complexity of the problem, previous research has investigated the complexity of 128 parameterized versions of the problem with parameters such as number of agents and size of actions. The complexity of many parameter combinations has been determined, but previous research left a few combinations as open problems. In this paper, we solve most of the remaining open problems by proving all of them to be fixed-parameter intractable. Only two parameter combinations are still left as open problem for future research.

Valentin Cassano, Raul Fervari, Carlos Areces and Pablo Castro: Default Modal Systems as Algebraic Updates

Default Logic refers to a family of formalisms designed to carry out non-monotonic reasoning over a monotonic logic (in general, Classical First-Order or Propositional Logic). Traditionally, default logics have been defined and dealt with via syntactic consequence relations. Here, we introduce a family of default logics defined over modal logics. First, we present these default logics syntactically. Then, we elaborate on an algebraic counterpart. We do the latter by extending the notion of a modal algebra to accommodate for the main elements of default logics: defaults and extensions. Our algebraic treatment of default logics concludes with an algebraic completeness result. To our knowledge, our approach is novel, and it lays the groundwork for studying default logics from a dynamic logic perspective.

Hans van Ditmarsch, Mo Liu, Louwe B. Kuiper and Igor Sedlár: Expressivity of some versions of APAL

Arbitrary public announcement logic (APAL) is a logic of change of knowledge with modalities representing quantification over announcements. We present two rather different versions of APAL wherein this quantification is restricted to formulas only con-

taining a subset of all propositional variables: FSAPAL and SCAPAL; and another version quantifying over all announcements implied by or implying a given formula: IPAL. We then determine the relative expressivity of these logics and APAL. The IPAL quantifier provides a novel perspective on substructural implication as dynamic consequence.

Sabine Frittella, Marta Bílková, Ondrej Majer and Sajad Nazari: Belief Based on Inconsistent Information

A recent line of research has developed around logics of belief based on evidence. The approach of Bílková et al. understands belief as based on information confirmed by a reliable source. We propose a finer analysis of how belief can be based on information, where the confirmation comes from multiple possibly conflicting sources and is of a probabilistic nature. We use Belnap–Dunn logic and its probabilistic extensions to account for potentially contradictory information on which belief is grounded. We combine it with an extension of Łukasiewicz logic, or a bilattice logic, within a two-layer modal logical framework to account for belief.

Ryo Hatano and Katsuhiko Sano: Constructive Dynamic Logic of Relation Changers

This paper proposes an intuitionistic generalization of van Benthem and Liu’s dynamic logic of relation changers, where relation changers are dynamic operators which rewrite each agent’s accessibility relation. We employ Nishimura’s Kripke semantics for a constructive propositional dynamic logic to define the semantics of relation changers. A sound and complete axiomatization of the constructive dynamic logic of relation changers is provided. Moreover, we follow Hatano et al.’s approach to provide a different semantics for dynamic logic of relation changers. This alternative semantics leads us to a semantic completeness proof of the axiomatization for the original semantics, which does not require a reduction strategy based on recursion axioms.

Stepan Kuznetsov: Complexity of Commutative Infinitary Action Logic

We consider commutative infinitary action logic, that is, the equational theory of commutative $*$ -continuous action lattices, and show that its derivability problem is Π_1^0 -complete. Thus, we obtain a commutative version of Π_1^0 -completeness for non-commutative infinitary action logic by Buszkowski and Palka (2007). The proof of the upper bound is more or less the same as Palka’s argument. For the lower bound, we encode non-terminating behaviour of two-counter Minsky machines.

Emiliano Lorini and Pengfei Song: Grounding Awareness on Belief Bases

We introduce a multi-agent logic of explicit, implicit belief and awareness with a semantics using belief bases. The novelty of our approach is that an agent’s awareness is not a primitive but is directly computed from the agent’s belief base. We prove soundness and completeness of the logic relative to the belief base semantics. Furthermore, we provide a polynomial embedding of the logic of propositional awareness into it.

Sonia Marin, Luiz Carlos Pereira, Elaine Pimentel and Emerson Sales: Ecumenical Modal Logic

The discussion about how to put together Gentzen’s systems for classical and intuitionistic logic in a single unified system is back in fashion. Indeed, recently Prawitz and others have been discussing the so called ecumenical Systems, where connectives from these logics can co-exist in peace. In Prawitz’ system, the classical logician and the intuitionistic logician would share the universal quantifier, conjunction, negation, and the constant for the absurd, but they would each have their own existential quantifier, disjunction, and implication, with different meanings. Prawitz’ main idea is that these different meanings are given by a semantical framework that can be accepted by both parties. In this work we extend Prawitz’ ecumenical idea to alethic K-modalities.

Vít Punčochář: Inquisitive Dynamic Epistemic Logic in a Non-Classical Setting

This paper studies the operations of public announcement of statements and public utterance of questions in the context of substructural inquisitive epistemic logic. It was shown elsewhere that the logical laws governing the modalities of knowing and entertaining from standard inquisitive epistemic logic generalize smoothly to substructural logics. In this paper we show that the situation is different with the reduction axioms that in the standard setting govern the modality of public announcement/utterance. The standard reduction axioms depend on some features of classical logic that are not preserved in substructural logics. Using an additional auxiliary modality, we show how to overcome this obstacle and formulate an alternative set of reduction axioms for the public announcement/utterance modality that can be used even in the context of our general non-classical setting.

Sebastian Reiche and Christoph Benzmüller: Public Announcement Logic in HOL

A shallow semantical embedding for public announcement logic with relativized common knowledge is presented. This embedding enables the first-time automation of this logic with off-the-shelf theorem provers for classical higher-order logic. It is demonstrated (i) how meta-theoretical studies can be automated this way, and (ii) how non-trivial reasoning in the target logic (public announcement logic), required e.g. to obtain a convincing encoding and automation of the wise men puzzle, can be realized. Key to the presented semantical embedding – in contrast, e.g., to related work on the semantical embedding of normal modal logics – is that evaluation domains are modelled explicitly and treated as additional parameter in the encodings of the constituents of the embedded target logic, while they were previously implicitly shared between meta logic and target logic.

Anthia Solaki: Bounded Multi-Agent Reasoning: Actualizing Distributed Knowledge

The idealizations resulting from the use of Kripke semantics in Epistemic Logic are inherited by formalizations of group epistemic notions. For example, distributed knowl-

edge (DK) is often taken to reflect the potential knowledge of a group: what agents would know if they had unbounded means of communication and deductive ability. However, this does not specify whether/how this potential can be actualized, especially since real people are not unbounded reasoners. Inspired by experiments on group reasoning, we identify two dimensions of actualizing DK: communication and inference. We build a dynamic framework with effortful actions accounting for both, combining impossible-worlds semantics and action models, and we provide a method for extracting a sound and complete axiomatization.

Zuojun Xiong and Thomas Ågotnes: Arbitrary Propositional Network Announcement Logic

Modal logics for reasoning about interaction in social networks is an active area of research. In this paper we introduce modalities for quantifying over possible “tweets”, i.e., simultaneous messages sent to all an agent’s “followers”, into an existing basic framework for reasoning about this type of network events. Modalities that quantify over informational events in general, and over agent announcements in particular, is also an active area in the study of the dynamics of knowledge and belief. We combine these two directions by interpreting such modalities in social networks. We study the resulting logic, and provide a sound and strongly complete (infinitary) axiomatisation.

Yi N. Wang and Thomas Ågotnes: A New Completeness Technique for Modal Logics With Intersection

There has been a significant interest in modal logics with intersection, prominent examples including epistemic and doxastic logics with distributed knowledge, propositional dynamic logic with intersection, and description logics with concept intersection. Completeness proofs for such logics tend to be complicated, in particular on model classes such as S5 used, e.g., in standard epistemic logic, mainly due to the undefinability of intersection of modalities in standard modal logic. A standard proof method for the S5 case uses an “unravelling-folding method” technique to achieve a treelike model to deal with the problem of undefinability. This method, however, is not easily adapted to other logics, due to its reliance on S5 in a number of steps. In this paper we propose a simpler and more general proof technique by building a treelike canonical model directly, which avoids the complications in the processes of unravelling and folding. We demonstrate the technique by showing completeness of the normal modal logics K, D, T, B, S4 and S5 extended with intersection modalities. Furthermore, these tree-like canonical models are compatible with Fischer-Ladner-style closures, and we combine the methods to show the completeness of the mentioned logics further extended with transitive closure of union modalities known from PDL or epistemic logic. Some of these completeness results are new.

Short Talks

Diana Costa: A Dynamic Logic with Four-Valued Relations and Propositions

The basic model for software systems is to consider that the system transits from one state to another depending on the action performed by the environment or by the system itself. It is commonplace to regard transition systems as graphs where vertices correspond to states and (labelled) edges represent transitions between states. States are usually seen as consistent, however a more general notion has been proposed by Belnap and Dunn where in a state formulas can be (only) true, (only) false, both true and false, or neither true nor false. This paper combines the well-known Propositional dynamic logic with hybrid machinery such as nominals and the satisfaction operator in a four-valued semantics. A discussion about the role of negation, especially when in conjunction with modal operators will be provided, which will justify the choice of disregarding the usual duality between \Box and \Diamond .

Oleg Grigoriev and Yaroslav Petrukhin: Basic Modal Congruent and Monotonic Multilattice Logics

In this paper, we present multilattice analogues of the basic congruent and monotonic modal logics as well as their extensions by Gödel's rule. First, we introduce these logics in the form of sequent calculi and prove syntactic embedding theorems. Second, we present these logics algebraically and semantically: via modal multilattices with ultra-multifilters as well as via general and descriptive neighbourhood frames. We show that the categories of modal multilattices and descriptive neighbourhood frames are dually equivalent. Finally, we show that the sequent calculi in question are complete with respect to modal multilattices via Lindenbaum-Tarski algebras.

Vitor Machado and Mario Benevides: A Logic for the Study of Evolving Behaviors in Social Networks

This paper proposes a dynamic logic framework for studying social network dynamics and phenomena. We are particularly interested in modelling scenarios where opposing behaviors clash in a network, and fight for adoption, such as the spreading of fake news. We present a semantic tableau for this logic with soundness results, and also completeness results for a fragment. We also consider the model checking problem, and provide the algorithms and time complexity analysis.

Daniel Rogozin: The Finite Representation Property for Representable Residuated Semigroups

In this paper, we show that the class of representable residuated semigroups, residuated semigroups on binary relations, has the finite representation property. That is, every representable residuated semigroup is isomorphic to some algebra over a finite base. This result gives a positive solution to Problem 19.17 from the monograph by Hirsch and Hodkinson (2002).

Zhiguang Zhao: Sahlqvist Correspondence for Instantial Neighbourhood Logic

In the present paper, we investigate the Sahlqvist-type correspondence theory for instantial neighbourhood logic (INL), which can talk about existential information about the neighbourhoods of a given world and is a mixture between relational semantics and neighbourhood semantics. We have two proofs of the correspondence results, the first proof is obtained by using standard translation and minimal valuation techniques directly, the second proof uses bimodal translation method to reduce the correspondence problem in instantial neighbourhood logic to normal bimodal logics in classical Kripke semantics. We give some remarks and future directions at the end of the paper.