Qualitative Temporal Representation and Reasoning about Points, Intervals and Durations

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Abstract

Recently, an elegant framework called $\mathcal{IA}^{dur}$ [8] has been proposed for representing qualitative information about time intervals and durations. $\mathcal{IA}^{dur}$ is a single network, therefore it avoids typical problems of bi-networks, and in addition it has interesting computational properties. In this paper, we extend $\mathcal{IA}^{dur}$ in two directions: we enrich its expressive power introducing points and maintaining the same computational properties, and we provide it with an axiomatic theory able to handle qualitative temporal information about points, intervals and durations in a unified framework. This theory is based on general interval entities and two relations: general meets and not longer than.

1. Introduction

In many domains, it is more important to consider the relative information concerning the durations of two temporal intervals instead of considering the absolute knowledge about a single interval. If durations are taken as distances between endpoints of intervals then qualitative constraints as "the duration of the interval I is shorter than the duration of the interval J" cannot be represented in a binary constraint network since they concern four points. This problem is usually overcome encoding duration information in a network orthogonal to the interval relationship network, but this strategy presents some limits. In the IA framework [1] it does not guarantee the total consistency

of the network [7]. In the same line, there are other bi-network based works proposed for representing information about durations. PDN [7] and APDN [12]. PDN is a point-duration network defined as a structure composed by two point algebra networks separately but not independently, as ternary constraints are introduced for relating point and duration information. APDN extends PDN where only qualitative information is considered, by representing both qualitative and quantitative information about point events. Like other point-based approaches, they do not handle the disjointedness of interval algebra.

The PIDN framework [9] considers a single network able to handle both qualitative and quantitative temporal information about points, intervals and durations, but its high expressive power is achieved at the price of its computational properties.

Recently, an elegant subframework of PIDN called $\mathcal{IA}^{dur}$ [8] has been proposed. $\mathcal{IA}^{dur}$ represents only qualitative information about time intervals and durations and it has interesting computational properties. The set of interval relations considered is an extension of 13 Allen's relations [1] integrated with qualitative information about durations $\{<, =, >\}$. For example, the relation b is extended to the three relations $\{b^<, b^=, b^>\}$, while other relations such as $\{m, s, si, d, di, f, fi\}$ which include implicit information about interval durations, are left unchanged. Thus 25 basic relations between pairs of intervals are considered. The $\mathcal{IA}^{dur}$ network exhibits similar characteristics as the IA-network concerning tractable subclasses (Convex as well as Pre-convex). But the level of local consistency to achieve global consistency is 4-consistency in-

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Multiagent Systems in Hakodate Japan and ECAI 2006 the 17th European Conference on Artificial Intelligence in Riva del Garda Italy *Johan van Benthem on Logic and Information Dynamics* Alexandru Baltag,Sonja Smets,2014-08-27 This book illustrates the program of Logical Informational Dynamics Rational agents exploit the information available in the world in delicate ways adopt a wide range of epistemic attitudes and in that process constantly change the world itself Logical Informational Dynamics is about logical systems putting such activities at center stage focusing on the events by which we acquire information and change attitudes Its contributions show many current logics of information and change at work often in multi agent settings where social behavior is essential and often stressing Johan van Benthem s pioneering work in establishing this program However this is not a Festschrift but a rich tapestry for a field with a wealth of strands of its own The reader will see the state of the art in such topics as information update belief change preference learning over time and strategic interaction in games Moreover no tight boundary has been enforced and some chapters add more general mathematical or philosophical foundations or links to current trends in computer science The theme of this book lies at the interface of many disciplines Logic is the main methodology but the various chapters cross easily between mathematics computer science philosophy linguistics cognitive and social sciences while also ranging from pure theory to empirical work Accordingly the authors of this book represent a wide variety of original thinkers from different research communities And their interconnected themes challenge at the same time how we think of logic philosophy and computation Thus very much in line with van Benthem s work over many decades the volume shows how all these disciplines form a natural unity in the perspective of dynamic logicians broadly conceived exploring their new themes today And at the same time in doing so it offers a broader conception of logic with a certain grandeur moving its horizons beyond the traditional study of consequence relations **Clinical Knowledge Management** Rajeev K. Bali,2005-01-01 This book establishes a convergence in thinking between knowledge management and knowledge engineering healthcare applications Provided by publisher Agents and Artificial Intelligence Béatrice Duval,Jaap van den Herik,Stephane Loiseau,Joaquim Filipe,2015-09-24 This book constitutes the thoroughly refereed post conference proceedings of the 6th International Conference on Agents and Artificial Intelligence ICAART 2014 held in Angers France in March 2014 The 21 revised full papers presented together with one invited paper were carefully reviewed and selected from 225 submissions The papers are organized in two topical sections on agents and on artificial intelligence *Adaptive Semantics Visualization* Kawa Nazemi,2016-03-22 This book introduces a novel approach for intelligent visualizations that adapts the different visual variables and data processing to human s behavior and given tasks Thereby a number of new algorithms and methods are introduced to satisfy the human need of information and knowledge and enable a usable and attractive way of information acquisition Each method and algorithm is illustrated in a replicable way to enable the reproduction of the entire SemaVis system or parts of it The introduced evaluation is scientifically well designed and performed with more than enough participants to validate the benefits of the methods Beside

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Enterprise, Business-Process and Information Systems Modeling Han van der Aa,Dominik Bork,Henderik A. Proper,Rainer Schmidt,2023-05-30 This book contains the refereed proceedings of two long running events held along with the CAiSE conference relating to the areas of enterprise business process and information systems modeling the 24th International Conference on Business Process Modeling Development and Support BPMDS 2023 and the 28th International Conference on Exploring Modeling Methods for Systems Analysis and Development EMMSAD 2023 The conferences were taking place in Zaragoza Spain during June 12 13 2023 For BPMDS 9 full papers and 2 short papers were carefully reviewed and selected for publication from a total of 26 submissions for EMMSAD 9 full papers and 3 short papers were accepted from 26 submissions after thorough reviews The BPMDS papers deal with a broad range of theoretical and applications based research in business process modeling development and support EMMSAD focusses on modeling methods for systems analysis and development

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