

Qualitative Temporal Representation and Reasoning about Points, Intervals and Durations

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Abstract

Recently, an elegant framework called $\mathcal{N}^2\mathcal{TL} [R]$ has been proposed for representing qualitative information about time intervals and durations. $\mathcal{N}^2\mathcal{TL}$ 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 $\mathcal{N}^2\mathcal{TL}$ in two directions: we enrich its expressive power by introducing points and introducing the same computational properties, and we provide it with an automatic theory able to handle qualitative temporal information about points, intervals and durations in a unified framework. This theory is based on general interval axioms 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 $\mathcal{IA}$ 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: $\mathcal{PDN}$ [2] and $\mathcal{APDN}$ [12]. $\mathcal{PDN}$ is a point duration network defined as a structure based by two point algebra networks, separately but not independently, as binary constraints are introduced for relating point and duration information. $\mathcal{APDN}$ extends $\mathcal{PDN}$ 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 disjointness of interval algebras.

The $\mathcal{PIDN}$ 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 $\mathcal{PIDN}$ called $\mathcal{N}^2\mathcal{TV} [3]$ has been proposed. $\mathcal{N}^2\mathcal{TV}$ 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 k is extended to the three relations $\{k^<, k^=, k^>\}$, while other relations such as $\{rc, s, st, d, dt, f, fi\}$ which include implicit information about interval durations, are left unchanged. Thus, 25 basic relations between pairs of intervals are considered. The $\mathcal{N}^2\mathcal{TV}$ network exhibits similar characteristics as the $\mathcal{IA}$ -network concerning tractable subclasses ($\mathcal{C}ommet$ as well as $\mathcal{P}ro-commet$), but the level of local consistency to achieve global consistency is $\mathcal{B}$ -consistency [4].

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research and practice required for advancing the requisite knowledge base and tools and their wider usage Best practices of environmental modeling enables the reader to select appropriate software and gives the reader tools to integrate natural system dynamics with human dimensions

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Handbook of Temporal Reasoning in Artificial Intelligence Michael David Fisher, Dov M. Gabbay, Lluís Vila, 2005-03-01 This collection represents the primary reference work for researchers and students in the area of Temporal Reasoning in Artificial Intelligence Temporal reasoning has a vital role to play in many areas particularly Artificial Intelligence Yet until now there has been no single volume collecting together the breadth of work in this area This collection brings together the leading researchers in a range of relevant areas and provides an coherent description of the breadth of activity concerning temporal reasoning in the field of Artificial Intelligence Key Features Broad range foundations techniques and applications Leading researchers around the world have written the chapters Covers many vital applications Source book for Artificial Intelligence temporal reasoning Approaches provide foundation for many future software systems Broad range foundations techniques and applications Leading researchers around the world have written the chapters Covers many vital applications Source book for Artificial Intelligence temporal reasoning Approaches provide foundation for many future software systems

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algorithms and techniques described in other references **WEBKDD 2002 - Mining Web Data for Discovering Usage Patterns and Profiles** Osmar Zaïane, 2003-10-13 This book constitutes the thoroughly refereed post proceedings of the 4th International Workshop on Mining Web Data WEBKDD 2002 held in Edmonton Canada in July 2002 The 10 revised full papers presented together with a detailed preface went through two rounds of reviewing and improvement and were selected from 23 submissions The papers are organized in topical sections on categorization of users and usage prediction and recommendation and evaluation of algorithms

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