Reasoning about Time in CBR

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Preface

The workshop is dedicated to time in case-based reasoning and how time is dealt with in all aspects of it. The literature on case-based reasoning (CBR) that takes time into account is broad. Still, there are aspects that have not been given much consideration. Reasoning about time drives the complexity of AI systems, but with the increasing amount of streaming and event-based data, this complexity has to be dealt with, also in CBR. The aim is to refocus the CBR community's attention to temporal reasoning, as the focus has moved away lately even though the number of temporal CBR applications is increasing. Several open problems exist in temporal CBR, and these contain among others temporal revise and CBR on data streams.

Three previous workshops on applying case-based reasoning to temporal data have been organized at ICCBR. This workshop is a continuation - in spirit - to the workshops on applying CBR to time-series prediction that was organized in 2003 and 2004, and it is a direct descendant of the RATIC 2014 workshop.

The workshop received eight submissions from which six papers with a broad range of topics were selected for publication. In *Diagnosing Root Causes and Generating Graphical Explanations by Integrating Temporal Causal Reasoning and CBR*, Nikpour et al. present a hybrid system combining Bayesian networks with case-based reasoning in order to diagnose root causes of failures in the domain of oil well drilling. The Bayesian network utilizes temporal information together with the causal relation sequence in order to filter out irrelevant parts of the causal relations sequence that is above some threshold.

Duarte et al. utilize temporal information to compare career trajectories of scholarly researchers in *Case-based comparison of career trajectories*. When comparing the career trajectories of researchers that are in different parts of their career, it is important to measure the relative and not the absolute volume of accomplishment, and for this a standard normalization technique is proposed.

A system that supports astronauts in conducting complex procedures by combining intelligent tutoring and augmented reality is presented by Borck et al. in *Exploiting Time Series Data for Task Prediction and Diagnosis in an Intelligent Guidance System*. The idea is to detect the task the astronaut is performing and recognize and diagnose mistakes during execution. In order to achieve this case-based prediction is performed using a case feature containing sequences of image features that changes over time.

Ihle describes a system that forecasts the electricity consumption of a container terminal in *Case Representation and Adaptation for Short-Term Load Forecasting at a Container Terminal*. In order to forecast the electricity consumption for every quarter of the next day, case-based prediction is conducted based on previous electricity usage and the logistics operation plan for the next day. An approach that uses the top three matching cases compares favorably with the current state of the art, which is an approach that utilizes information from the last week. The method takes holidays and weather conditions into account as well.

Szczepanski et al. investigate challenges related to comparing activity streams from patients suffering from low back pain in *Challenges for the Similarity-Based Comparison of Human Physical Activities Using Time Series Data*. The main challenges discussed are related to 1) developing a suitable abstraction for wristband activity streams, 2) identifying an adequate similarity metric for such activity streams and 3) account for missing data in the comparison. Solutions discussed include reducing the dimensionality of the time-series streams for different activities and using domain knowledge into the similarity metrics.

In *Evaluating the Distribution Potential for the Intelligent Monitoring of Business Process Workflows using Case-based Reasoning*, Agorgianitis et al. evaluate the potential for distributed business process workflow monitoring and management using the CBR paradigm. Although the paper is not specifically on temporal reasoning, business workflows share many of the characteristics of temporal CBR as tasks are ordered in time and, thus, many of the methods utilized are shared. This paper discusses shared issues between business workflows and temporal CBR, as both the complexity of comparisons requiring distributed execution and similarity comparison utilizing graph similarity metrics are examples of such characteristics.

The goal for this workshop is to emphasize the need for the CBR community to investigate problems related to temporal reasoning, as we firmly believe that reasoning about time is a central challenge in CBR and that it deserves more attention from the broader community. The papers published in this workshop proceeding show that temporal case-based reasoning still has a broad set of challenges that need further investigation in a variety of domains. We look forward to see final results of these initial developments in future ICCBR conferences.

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