



## Decision Making in Dynamic Information Environments

Tiago Oliveira<sup>1</sup>, Jose Carlos Montoya<sup>2</sup>, Paulo Novais<sup>3</sup> and Ken Satoh<sup>4</sup>

<sup>1</sup>University of Minho, ALGORITMI research centre  
Braga, Portugal  
toliveira@di.uminho.pt

<sup>2</sup>University Carlos III of Madrid, Roboticslab  
Madrid, Spain  
josecarlos.castillo@uc3m.es

<sup>3</sup>University of Minho, ALGORITMI research centre  
pjon@di.uminho.pt

<sup>4</sup>National Institute of Informatics  
Tokyo, Japan  
ksatoh@nii.ac.jp

**Abstract** If there is no knowledge about the state of the world, getting the appropriate response to an event becomes impossible. Situations of uncertainty are common in the most varied environments and have the potential to impair or even stop the decision-making process. Thus, reaching an outcome in such situations requires the development of decision frameworks that account for missing, contradictory or uncertain information.

**Keywords:** Decision Making, Incomplete Information, Uncertainty, Knowledge Representation.

### 1 Introduction

Decision making has always been the main focus of Artificial Intelligence (AI). Given a problem, the point is to endow machines with the ability to achieve the best possible solution, in a manner similar to that of a human being [1]. There are many challenges in trying to achieve such a feat, from the appropriate way to structure the problem in a machine-readable format to the formal definition of a best solution. As such, AI can be seen as the science of knowledge representation and reasoning. Uncertainty is an element typically present in real world problems, the very same problems that AI tries to address. It poses particular obstacles to both representation and reasoning, usually related with how expressive a model is with regards to uncertainty and how its corresponding inference mechanism handles this uncertainty in order to produce a solution [5]. This brings forth the need for systems with non-standard inference capabilities, that are not only able to produce different results but also able to say more about these results, the process that led to them and how well they fit the problem for which they provide a solution [3].

The field of uncertainty representation is extremely wide, with a variety of proposed techniques that differ greatly in the type of inputs they require and the sort of statements they produce. The clearest separation one may draw between these techniques is related with the vocabulary they use. A system for inference may represent uncertainty in a numerical way (which comprises methods mostly derived from

probability theory) or, alternatively, resort to symbolic representations (as extensions of classical logic) [6]. However, there is no one-size-fits-all method, in the sense that the environment, which comprises the set of parameters that characterize a problem, plays a central role in the selection of the best fitting technique. The environment can be prone to situations of uncertainty such as missing information or conflicting information, caused by miscommunication or the inability to recognize states of the world [4]. If there is no knowledge about the state of the world, it becomes harder to generate an appropriate response to a problem. Moreover, in situations which demand a negotiated outcome, negotiation is impaired by missing information or uncertainty. An example is when the parts have different views on a problem, which, depending on the assumed view, leads to different results [2]. Another possibility is that the environment features ever-changing states of information, meaning that the assumed truth value of premises supporting the results may be constantly changing, thus requiring the constant re-computation of solutions.

This special issue on Decision Making in Dynamic Information Environments aims to provide an insight into different techniques used for handling uncertainty and the specific requirements of the settings in which they are applied. The selected contributions come from varied fields such as Logic Programming, Argumentation, or Ambient Intelligence, to name a few.

## 2 Contributions of this Issue

The paper “How the ability to analyse tendencies influences decision satisfaction”, authored by Carneiro et al., proposes a model and an algorithm that will allow an agent to analyse tendencies regarding the number of supporters for each alternative in a problem.

The paper “Energy planning under uncertain decision-making environment: An evidential reasoning approach to prioritize renewable energy sources”, authored by Sellak et al., describes an approach to manage the expanding complexities and uncertainties in the prioritization of renewable energy sources.

The paper “Tracking Users Mobility at Public Transportation”, authored by Baeta et al., proposes a new approach to estimating the number of passengers in a public transportation and predicting the users’ routes.

The paper “A Knowledge Representation and Reasoning System for Multimodal Neuroimaging Studies”, authored by Coelho et al., presents a system for neuroimaging analysis supported by case-based reasoning.

The paper “A Review on Intelligent Monitoring and Activity Interpretation”, authored by Montoya et al., presents a review on various monitoring and activity interpretation frameworks found in the literature.

The paper “Rational versus Intuitive Outcomes of Reasoning with Preferences. Argumentation Perspective”, authored by Cyras K., studies how several formalisms of argumentation with preferences model human intuition behind a particular common-sense reasoning problem.

The paper “An Orientation Method with Prediction and Anticipation Features”, authored by Ramos et al., presents an orientation system with prediction features that help anticipate the path followed by the users.

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