REDES BAYESIANAS TEMPORALES: APLICACIONES MÉDICAS E INDUSTRIALES[1]

by
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Thesis
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Abstract

The main goal of this thesis is the development of a system that models the evolution of a nasopharyngeal cancer. This system assists the oncologists of a radiation oncology department in the specification of the extension reached by nasopharyngeal cancer in a patient, before the application of therapy.

In part I we describe the general framework for knowledge modeling that we have adopted. Due to the nature of the processes taking place in this medical domain, we decided to use Bayesian networks with an explicit representation of time as our final representation and reasoning method for cancer spread modeling.

In part II, firstly we examine the different present types of Bayesian networks for temporal reasoning and analize their advantages and drawbacks. Next we formalize a new method called *network of probabilistic events in discrete time* (NPEDT), which is appropriate for modeling uncertain causal mechanisms and their associated temporal events. As a remarkable characteristic of this new method, we point out that new models of temporal causal interaction for a family of nodes in the network can be used. These models, called *temporal noisy gates*, represent an extension for temporal processes of traditional probabilistic canonical models. We apply a new algorithm that allows conditional probabilities for a family of nodes interacting through a temporal noisy gate to be factorized. By using this factorization, probabilistic inference in NPEDTs can be considerably improved.

In part III we present NasoNet, a system that applies the new method for temporal reasoning with Bayesian networks described in part II to the domain of nasopharyngeal cancer. We demonstrate the general scope of NPEDTs by applying them to an industrial domain: the diagnosis and prediction of faults occurring in the steam generator of a fossil power plant.

We conclude with a summary of the main results obtained and our research interests for the future.

[1] *Bayesian Networks for Temporal Reasoning: Medical and Industrial Applications*