

KEBN-DN
Knowledge Engineering with Bayesian Networks and Decision Networks

Bayesian Decision Networks have been developed in multiple ways for different domains. This variety stems from the different types of information available about the domain (for example, data versus expert knowledge), differences in the methods applied to the domain information, and the preferences or expertise of the knowledge engineer building the BDN. However, current methodologies for KEBN are not comprehensive. Although they suggest the evolving prototype spiral model as the life cycle for the development of the BN and provide different levels of guidance with regard to some of the BDNs' components, none provides comprehensive guidance on how to integrate knowledge engineering for all components and how to combine knowledge from different sources and different methods. Given the different methods available, the question then arises: what process should be followed when building a BDN for a new domain application?

We present our methodology for Knowledge Engineering Bayesian Networks and Bayesian Decision Networks (KEBN-DN). The methodology is structured, and is based on three levels of abstraction:

- Level 1:** The highest level divides the KEBN-DN process into four main stages, one for each aspect of the BND: BN structure, probability parameters, BDN structure and utilities. All stages consist of two common sub-processes, construction/estimation and evaluation.
- Level 2:** In the middle level we identify the main steps that are common to all sub-processes and provide a general structure.
- Level 3:** In the lowest level of abstraction we provide a detailed workflow for each sub-process within each stage, identifying the applicable information and methods.

The methodology is iterative and descriptive (rather than prescriptive). At level 1, the stages and sub-processes may be undertaken in any order. Similarly, in level 2, there are many possible interactions between the main steps of the sub-processes. In level 3 we show the versatility of the methodology in combining methods. The characteristics of our methodology, namely its structure and its iterative and descriptive nature allow complete flexibility at each level of abstraction and interactions between the activities that make up a particular KEBN-DN workflow.