Requirements for Successful Verification in Practice

S. Spreeuwenberg, R. Gerrits

LibRT
Postbus 90359
1006 BJ AMSTERDAM, The Netherlands
info@LibRT.com

Abstract

Many large scale companies use knowledge-based systems (KBS) to support their decision making processes. The quality of the decisions made depend on the quality of the underlying knowledge. It has been stated many times that verification techniques can be used to improve decision making and the quality of the knowledge rules in a knowledge based system. Furthermore, verification is seen as one of the key issues in system certification. After a short introduction to the current state of the art of knowledge verification this paper describes a verification technique used in a commercial development environment for knowledge intensive applications: VALENS. We will describe the experiences with VALENS in some recently finished experiments. Based on these results and an overview of the literature we will discuss the discrepancies between verification in practice and verification in theoretical / scientific situations. This leads us to an overview of the requirements for successful verification in practice. Obeying these requirements will increase the return on investment for knowledge based systems.

Introduction

Verification establishes the logical correctness of a KB i.e. the rules in a KB are checked to see if they are logical consistent, non-circular, complete, not redundant and not obsolete (the taxonomy of anomalies from A. Preece [4] is followed except that the term contradiction is used instead of ambivalance). Verification should not be confused with validation techniques, as stated by Gonzales[18] in an excellent overview of the controversy between scientists in defining these terms.
Validation tries to establish the correctness of a system with respect to its use in a particular domain and environment. In short the software community agrees that validation is interpreted as "building the right product", verification as "building the product right". It has been argued that the latter is a pre-requisite and sub-task of the former (Laurent[5]).
Until recently commercial development environments did not offer verification techniques despite the fact that the scientific world has stated the importance and offered solutions for this issue. In short they stated that verification techniques are important when:
KB components are embedded within safety critical or business critical applications (Ed P. Andert Jr, [1]).
When people without a background in system programming or system analysis define and maintain the knowledge in a KBS, the support of a V&V tool helps them to cope with the complexity. (Spreeuwenberg [2])
In all the main phases of the knowledge engineering life cycle, V&V is an important aspect when it comes to delivering a high quality KBS. (Anca Vermesan [3])
It has been concluded that "a uniform set of definitions should encourage developers to begin to think seriously about the need to perform formal V&V on their intelligent systems, and will also provide the foundation for researchers to develop tools that will be usable by others" (Gonzales and Barr, 2000).
In this article we will describe the implementation of verification techniques in a commercial development environment for knowledge based systems. The result of this work is implemented in a 'general' verification component called VALENS. This component is 'general' in the sense that you can integrate it in a development environment or case tool. Once we implemented this tool we have found some more reasons that make V&V a commodity in the mainstream software development industry. After discussion of the state of the art of verification research, the VALENS tool and our experiences with VALENS, we will transform these findings into requirements for applying verification techniques. Our final goal is to improve the quality of knowledge based systems and optimally support experts by formalizing their knowledge.

Overview of verification research

In the beginning of the ’90s, different universities devoted much attention to V&V of KBS. There were some tools developed to verify rule bases of which Preece [6] has given an overview and comparison. An even more extensive overview comes from Plant [7] who lists 35 V&V tools built in the period 1985–1995. Most of the systems where developed at a university and it is hard to find out what the current status of those systems is.