Chapter 12

Case Technology for Psycho–Diagnostic System Generation

ABSTRACT

The automated workstation (AWS) for psychologists and physiologists must be an instrument that allows adaptive programming applied psycho-diagnostic expert systems (APDS). For this goal, the AWS must contain toolkits for 1) the automated specification of adaptive psycho-diagnostic systems (APDS) directed by an expert; 2) the adaptation of these systems to changeable conditions of their functioning. We propose an automated technology for creating APDS, the main peculiarity of which consists in using machine learning methods to choose, validate, define and redefine the main constructive elements of psycho-diagnostic testing and decision making procedures utilized in the developed psycho-diagnostic systems.

INTRODUCTION

Machine learning and knowledge acquisition from experts have distinct capabilities that appear to complement one another. The integration of these approaches can both improve the accuracy of system’s knowledge and reduce the time of APDS development. The expert systems created by means of the integrated approach possess higher accuracy than those created only by knowledge elicitation from experts without using machine learning methods.

We describe a software, called GENINTESE (GENERATOR + INTERPRETER of EXPERT SYSTEMS), realizing an integrated CASE – technology (Naidenova et al., 1996a; Naidenova et al., 1996b) for expert system rapidly prototyping, creating and evolution.

DOI: 10.4018/978-1-60566-810-9.ch012
We consider both the statistical and logical (symbolic) methods of machine learning, so our approach encompasses the automated knowledge acquisition methods for a wide range of knowledge types.

The GENINTES is oriented to creating psycho-diagnostic systems. But it can be applied for creating diagnostic systems in medicine too. The GENINTES (the first version) has been realized in Visual Basic 6.0 on PC for XP operation system.

A TECHNOLOGY FOR FAST PROTOTYPING COMPLETELY DEFINED PSYCHO-DIAGNOSTIC EXPERT SYSTEMS

The development of psycho-diagnostic expert systems (PDSs) is a very complicated and time consuming process, as these systems include not only the diagnostic testing procedures but the knowledge required to interpret the results of testing.

In this chapter, a CASE - technology is proposed for constructing and developing computer PDS that allows automating two tightly interrelated processes:

- Knowledge acquisition;
- Design of PDS.

The psycho-diagnostic is based on the methods of psychometric psychology. This science treats mental states as concepts which, on the one hand, determine the different aspects of human behavior and reasoning and, on the other hand, they are determined themselves through independent personal characteristics. For example, the quality of scholar children works depends on their intelligence measured by the diagnostic test consisted of different tasks requiring intellectual capability and including specially constructed questions. The investigations have shown that such important features of personality as introversion - extraversion, agreeableness, conscientiousness, quality of intellect and emotional stability are main factors reflected in performance on tests of personality (Kimble, 1994).

The traditional technique of creating PDS assumes that a new PDS is elaborated for every special application of psycho-diagnostic testing. This approach has the following disadvantages:

- An expert provides every new PDS with both specific and well known domain knowledge;
- Knowledge used in an isolate PDS is fragmented, partial; it is difficult to compare it with knowledge contained in the other PDSs. For this reason, common practice of PDS’s application does not influence essentially on the theoretical models in psycho-diagnostic;
- As a rule, different PDSs use different models of knowledge and different programming environments;
- The development of PDSs is rather expensive and time-consuming.

The CASE-technology assumes that the accent of designing PDS is moved from the narrow goal of programming a final product to the goal of analyzing psychological test as a structural unit of knowledge. At the first plan the following questions are advanced:

- What knowledge in principle allows constructing psycho-diagnostic test (DT)? How this knowledge is generated and what is its syntactic structure?
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