

Chapter 49

Case-Based Reasoning and Some Typical Applications

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ABSTRACT

Case-Based Reasoning (CBR) arose out of research into cognitive science, most prominently that of Roger Schank and his students at Yale University, during the period 1977–1993. CBR may be defined as a model of reasoning that incorporates problem solving, understanding, and learning, and integrates all of them with memory processes. It focuses on the human problem solving approach such as how people learn new skills and generates solutions about new situations based on their past experience. Similar mechanisms to humans who intelligently adapt their experience for learning, CBR replicates the processes by considering experiences as a set of old cases and problems to be solved as new cases. To arrive at the conclusions, it uses four types of processes, which are retrieve, reuse, revise, and retain. These processes involve some basic tasks such as clustering and classification of cases, case selection and generation, case indexing and learning, measuring case similarity, case retrieval and inference, reasoning, rule adaptation, and mining to generate the solutions. This chapter provides the basic idea of case-based reasoning and a few typical applications. The chapter, which is unique in character, will be useful to researchers in computer science, electrical engineering, system science, and information technology. Researchers and practitioners in industry and R&D laboratories working in such fields as system design, control, pattern recognition, data mining, vision, and machine intelligence will benefit.

INTRODUCTION

Case-based Reasoning (CBR) is a recent approach to problem solving and learning that has got a lot of attention over the last few years. The basic idea had been first introduced in the US and then

underlying theories have spread to other countries. It is a recent approach of Artificial Intelligence (AI) to solve problem and learning. In CBR, new problems are often similar to previously encountered problems and the current solution is mostly based on past solution.

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Sometime it called a methodology which can solve a new problem remembering previous experience. It consists of four stages; Case Retrieve, Case reuse, Case revise and Case retain. It is a problem solving paradigm which is different from other AI approaches. CBR is able to utilize the specific knowledge of previously experience and contain problem as cases. A new problem is solved by finding a similar past case and reusing it in the new problem situations. Now-a-days CBR field is developing rapidly. It is used in many areas like diagnoses, pattern recognition, planning and troubles shooting.

BACKGROUND AND MOTIVATION

What is case-based reasoning? Basically: To solve a new problem by remembering a previous similar situation and by reusing information and knowledge of that situation. Let us illustrate this by looking at some typical problem solving situations which is described in A. Aamodt, E. Plaza (1994).

- A physician - after having examined a particular patient in his office - gets a reminding to a Patient that he treated two weeks ago. Assuming that the reminding was caused by a similarity of important symptoms (and not the patient's hair-color, say), the physician uses the diagnosis and treatment of the previous patient to determine the disease and treatment for the patient in front of him.
- A drilling engineer, who have experienced two dramatic blow out situations, is quickly reminded of one of these situations (or both) when the combination of critical measurements matches those of a blow out case. In particular, he may get a reminding to a mistake he made during a previous blow-out, and use this to avoid repeating the error once again.

- A financial consultant working on a difficult credit decision task uses a reminding to a previous case, which involved a company in similar trouble as the current one, to recommend that the loan application should be refused.

The first CBR workshops were organized in 1988, 1989, and 1991 by the U.S. Defence Advanced Research Projects Agency (DARPA). Which is formally marked the birth of the discipline of case-based reasoning. In 1993, the first European workshop on case-based reasoning (EWCBR, 1993) was held in Kaiserslautern, Germany. That was a great success, and that attracted more than 120 delegates and over 80 papers. Since then, many international workshops and conferences on CBR have been held in different parts of the world.

Now a day some of the Organizations such as IBM, VISA International, Volkswagen, British Airways, and NASA have already made use of CBR in applications such as customer support, quality assurance, aircraft maintenance, process planning, and decision support, and many more applications.

SOME INTERESTING APPLICATIONS OF CBR

- **Case-Based Problem Solving:** The case based on previous experience is that it can be used for future problems solving, and can be referred to as a past case, stored case or retained case. Case-Based Reasoning terminology usually presents case on the problem situation. Case-Based reasoning is most successful techniques for software development. This technique is rapidly making practical usage outside AI community.
- **Learning in CBR:** Learning in CBR happens as a natural sequel to problem solving. When a new problem is successfully

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