Abstract

This paper presents a debugger for Prolog 'PROEDIT2'. In order to express the complex execution mechanism of Prolog, a new execution model for Prolog 'BPM' is also proposed. PROEDIT2 shows the execution of Prolog in BPM notation.

1 INTRODUCTION

Since Prolog has a complex execution mechanism, a useful Prolog debugger must provide clear views of the execution process of Prolog. In this paper, in order to grasp the complex execution mechanism of Prolog, we propose a visual computation model BPM (Box and Plane Model) that clarifies the semantics of backtracking and cut operator in a visual way. Based on BPM, we have developed a visual debugger for Prolog PROEDIT2, which shows the execution of Prolog programs in BPM notation. PROEDIT2 first executes a goal and then displays the wider image of the execution in 2-dimensional way. This allows the user to get the global image of the execution of his program and find a shortcut to the bug.

In the following sections, we explain the details of BPM and PROEDIT2. In section 2, we discuss the complex features of Prolog execution upon which we have to concentrate, and then give an outline of a solution for these problems through BPM. Next, the definition of BPM is given, and its expressive power is shown using examples. Section 3 discusses the problems of other debuggers, introduces a Prolog debugger PROEDIT2, and shows how these problems are solved in PROEDIT2. The usage of PROEDIT2 is also presented.

2 BPM (BOX AND PLANE MODEL)

In this section, the important features of the execution model BPM are discussed, the symbols of BPM are presented, a real meaning is given for each symbol, and the expressive power of BPM is explained using some examples.
2.1 The features of BPM

The most popular execution model on which the usual debuggers are based is the box model (See Clocksin and Mellish 1981). Our model BPM is made through modifying and enhancing this box model. Therefore, before introducing BPM, we want to describe the merits and defects of the box model.

The box model gives a good representation of control flows through a given subgoal. In the box model, each goal or subgoal is represented by a box. The flow of control in and out of the boxes is represented by arrows which are named call, exit, redo and fail.

But this box model has problems. Since the box model restricts attention to one goal and represents it by a box, it cannot express the backtracking mechanism clearly. In other words, since each call of a predicate results in a change of variable binding, having only one box per predicate does not adequately represent the execution of the program. It is necessary to represent the relationship between each goal, so that the effect of changes over time should be clarified. Another problem of the box model is that it also cannot represent the scope and effect of the cut operator clearly. To be able to represent a cut operator's behavior, the box model needs to be modified and enhanced.

In order to represent these procedural aspects, such as backtracking mechanism and cut operator's behavior, the new computation model BPM is created out of the box model through modifying and enhancing it. BPM uses the same kind of symbols, boxes and arrows as the box model. But let's look at how it solves each of the problems. On the backtracking mechanism problem, the weak point of the box model is that its only interest is control flows of one subgoal. In our model BPM, the unit of interest is clauses which define the same predicate. Then this model shows the flow of control between subgoals in a clause by using 2-dimensional representation. It connects boxes corresponding to subgoals in clauses by arrows and represents control flows between boxes. These boxes are contained in a ‘plane’ that was introduced to express the internal control flow of an upper level box. With this ‘plane’, we can clearly catch the scope of the cut operator and its return place clearly in BPM.

2.2 Symbols

box There are two kinds of boxes. One is the head-box, and the other is the goal-box. A head-box is a rectangle of dotted lines. A goal-box is a rectangle of thin lines.

plane The plane contains boxes. It is a rectangle drawn by bold lines.

arrows There four different arrows, each of which has two names.

These symbols are shown in Fig. 1.