PrologPF: Adding functions to Prolog

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Abstract

PrologPF is a language that combines the logic programming of Prolog with the functional reduction of the language ML. The syntax has been pragmatically designed to provide a consistent combined style that would be familiar to both Prolog and ML programmers. Declared functions can be called naturally from within Prolog clauses, i.e. a function reference can appear as the functor of a compound term resulting in functional reduction of that term. Prolog relations can be called with one-solution semantics as the condition in functional if-then-else statements. Unification is used consistently for argument matching in both relations and functions, and unifications from the functional if-then-else condition are propagated into the then and else statements. Higher-order functional programming and lazy reduction of functions are supported. The implementation is designed as an extension of Prolog, and has been shown to support all of the ML programming exercises in an undergraduate CS course. The PrologPF approach to blending functional and logic programming combines the declarative nature of both paradigms while replacing deterministic relations with declarative function definitions and reducing the need for Prolog's extra-logical cut.

I. Introduction

Prolog code tends to be a mix of relations and functions although the limited syntax requires the functions to be expressed using the relational head-normal form.

For example, a factorial function in Prolog will typically be written

```
fact(0,1).
fact(N,F) :-
    N > 0,
    M is N - 1,
    fact(M,FM),
    F is N * FM.
```

Note this relation is deterministic and requires the first argument to be instantiated to a number without those details being clearly expressed. More problematically, the implementation of functions as relations encourages the use of *cut*, as in

```
fact(0,1) :- !.
fact(N,F) :-
    M is N - 1,
    fact(M,FM),
    F is N * FM.
```

The extra-logical behaviour of *cut* destroys the declarative nature of Prolog code and in this case silently introduces non-terminating behaviour when the first argument is a negative number.

II. Method

In PrologPF, the factorial function can be defined as below.

```
fun fact(1) = 1;
    fact(N) = N * fact(N-1).
```

This style of the function definition has familiarity to both Prolog's alternate head terms for typical relation declarations and the alternate argument matching cases in Standard ML.

As PrologPF has special treatment for if-then-else in function definitions, the factorial function can equally be written using this style.

*A thank you or further information

```
fun fact(N) = if (N=1)
              then 1
              else N * fact(N-1).
```

Function references can occur naturally in place of Prolog terms, for example

```
% fact_list(+L,?FL) succeeds if FL is
% a list of factorials from numbers L.
fact_list([],[]).
fact_list([H|T],[fact(H)|FT])
    :- fact_list(T,FT).
```

In PrologPF, the operator @ is used to express functional application, i.e.

```
fact(5)
```

where fact has been declared as a function using the fun operator, is equivalent to

```
fact @ [5]
```

III. Methods

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- Curabitur feugiat
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Text requiring further explanation[1].

Table 1: *Example table*

Name		
First name	Last Name	Grade
John	Doe	7.5
Richard	Miles	2

IV. Results

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[1] Example footnote

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V. Discussion

i. Subsection One

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ii. Subsection Two

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References

[Figueredo and Wolf, 2009] Figueredo, A. J. and Wolf, P. S. A. (2009). Assortative pairing and life history strategy - a cross-cultural study. *Human Nature*, 20:317–330.