

Einführung in die Computerlinguistik – Endliche Automaten und Transduktoren in Prolog

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Prolog: the basics

- **facts**: state things that are unconditionally true of the domain of interest.

```
human(sokrates).
```

- **rules**: relate facts by logical implications.

```
mortal(X) :- human(X).
```

- **head**: left hand side of a rule
 - **body**: right hand side of a rule
 - **clause**: rule or fact.
 - **predicate**: collection of clauses with identical heads.
- **knowledge base**: set of facts and rules
 - **queries**: make the Prolog inference engine try to deduce a positive answer from the information contained in the knowledge base.

```
?- mortal(sokrates).
```

Prolog: some syntax

- facts: `fact.`
- rules: `head :- body.`
- conjunction: `head :- info1 , info2.`
- atoms start with small letters
- variables start with capital letters

Exercise: `father(X,Y) :- parent(X,Y), male(X).`

Learning material: <http://www.learnprolognow.org/>

lists in Prolog

- Lists are recursive data structures: First, the empty list is a list. Second, a complex term is a list if it consists of two items, the first of which is a term (called **first**), and the second of which is a list (called **rest**).
- `[mary|[john|[alex|[tom|[]]]]]`
- simpler notation: `[mary, john, alex, tom]`
- Exercise: Write a predicate `member/2`.

Algorithms for finite automaton

```
function D-RECOGNIZE (tape, machine) returns accept or reject
index  $\leftarrow$  Beginning of tape
current-state  $\leftarrow$  Initial state of machine
loop
  if End of input has been reached then
    if current-state is an accept state then
      return accept
    else
      return reject
  elseif transition-table [current-state, tape[index]] is empty then
    return reject
  else
    current-state  $\leftarrow$  transition-table [current-state, tape[index]]
    index  $\leftarrow$  index + 1
end
```

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```

```

% Finite state automaton.
fsa(Tape):-
    initial(S),
    fsa(Tape,S).

fsa([],S):- final(S).

fsa([H|T],S):-
    trans_tab(S,H,NS),
    fsa(T,NS).

% FSA transition table:
% trans_tab/3
% trans_tab(State, Input, New State)

trans_tab(1,a,1).
trans_tab(1,b,2).
trans_tab(2,a,2).

initial(1).
final(2).

```

Beispielprogramme (Homepage)

- `fsa.pl` Endlicher Automat, der die Sprache a^*ba^* erkennt. Aufruf mit `fsa(Eingabeliste)`. (Bsp. `fsa([a,b,b,b,a])`).
- `fst.pl` Endlicher Transduktor, der in Wörtern über dem Alphabet $\{a, b\}$ alle a's durch b's und alle b's durch a's ersetzt. Aufruf mit `fst(Eingabeliste,Ausgabeliste)`. (Bsp. `fst([a,b,b],[b,a,a])`, oder `fst(L,[b,a,a])` oder `fst([a,b,b],L)`). Das Programm erlaubt weder ϵ zu schreiben, noch ϵ zu lesen. Nichtdeterministische Transduktoren sind aber möglich. Erweitern Sie den Transduktor zum Beispiel um den Übergang `trans_tab_fst(1,a,c,1)`.
- `fst_2.pl` Endlicher Transduktor von Folie 15 vom 8.12.2009. Aufruf mit `fst(Eingabeliste,Ausgabeliste)`. (Bsp. `fst([f,o,x,?,s,#],L)`). Dieses Programm ist in der Lage auch Transduktoren mit ϵ -Übergängen zu verarbeiten. Versuchen Sie den Transduktor von Folie 16 vom 8.12.2009 zu programmieren. Sie müssen nur die Faktenbasis ändern.