Prolog

Hamidreza Shafaei

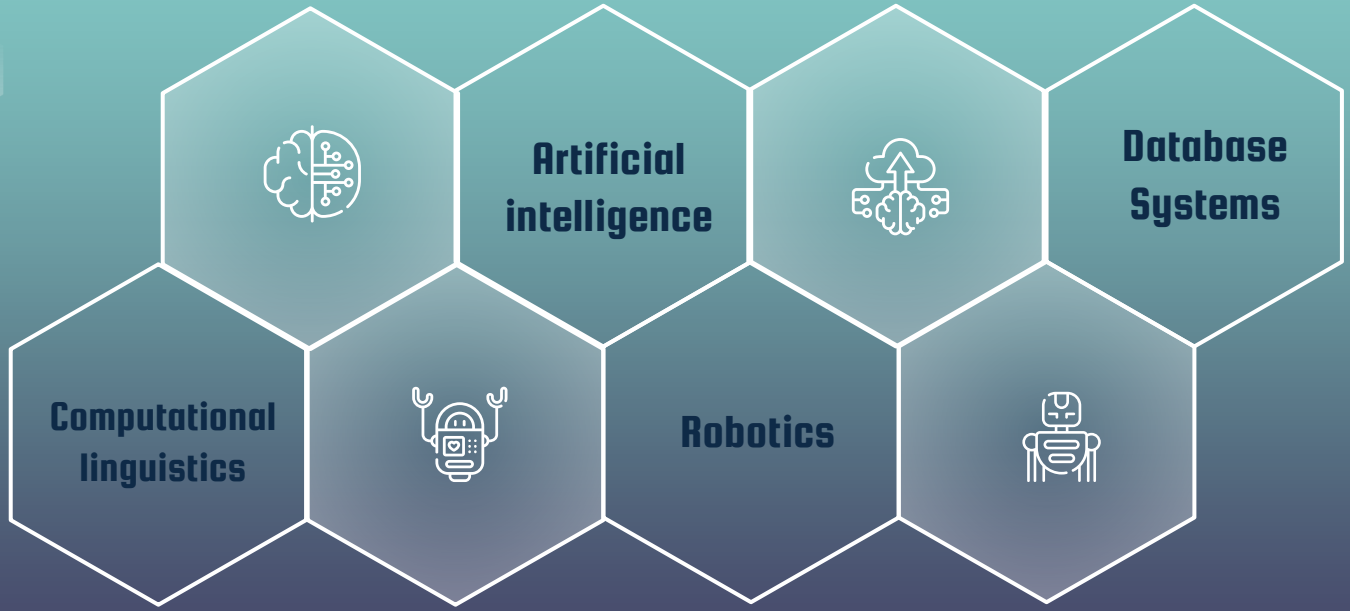
?- Contents.

?- Introduction.

What's Prolog?

- Prolog is a language that is useful for doing symbolic and logic-based computation.
- It's declarative: very different from imperative style programming like Java, C++, Python,...
- A program is partly like a database but much more powerful since we can also have general rules to enter new facts!

?- Application domain.



?- A little History.

Programming logic

- The programming language, Prolog, was born of a project aimed not at producing a programming language but at processing natural languages .
- The project gave rise to a preliminary version of Prolog at the end of 1971 and a more definitive version at the end of 1972.

The birth of Prolog
Alain Colmerauer and Philippe Roussel

```
User
   Cats kill mice.
   Tom is a cat who does not like mice who eat cheese.
   Jerry is a mouse who eats cheese.
   Max is not a mouse.
   What does Tom do?
Computer
   Tom does not like mice who eat cheese.
   Tom kills mice.
User
   Who is a cat?
Computer
   Tom.
User
   What does Jerry eat?
Computer
   Cheese.
User
   Who does not like mice who eat cheese?
Computer
   Tom.
User
   What does Tom eat?
Computer
   What cats who do not like mice who eat cheese eat.
```

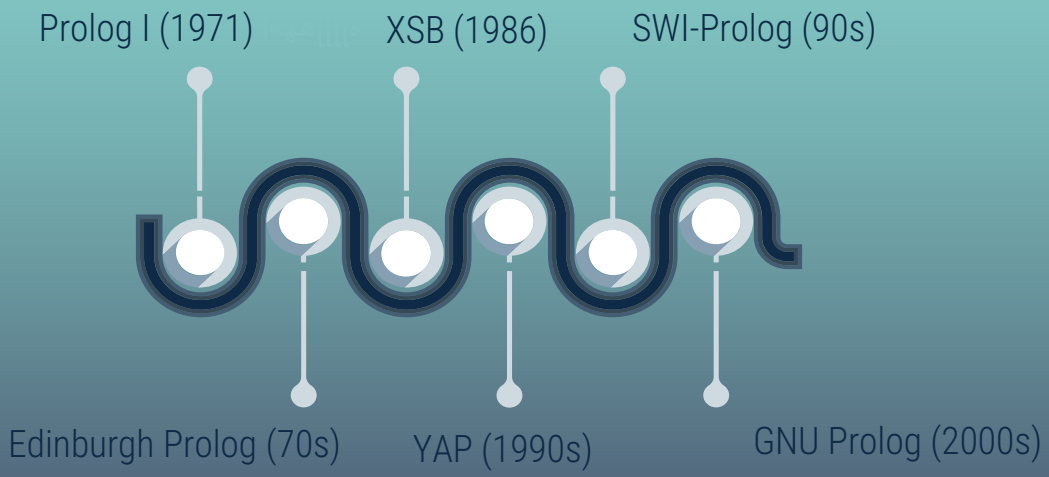

?- A little History.

Continuation

The birth of Prolog

Alain Colmerauer and Philippe Roussel

?- Environment frameworks.



?- Standardization in Prolog.

ISO Prolog

This is the official international standard for the Prolog language

Edinburgh Prolog

This was the first widely used Prolog system, developed at the University of Edinburgh in the 1970s

SWI-Prolog

This is a widely used open-source implementation of Prolog that adheres closely to the ISO Prolog standard

?- Language paradigm.

Prolog is a logic programming language that follows a declarative programming paradigm. These logical statements are called clauses, and they follow a specific pattern in Prolog :

?- Language paradigm.

Continuation

- Fact: A fact is a statement that defines a relationship between objects or predicates : `father(john, bob).`
- Rule: A rule is a statement that defines a logical relationship between objects or predicates : `ancestor(X,Y) :- parent(X,Y).`
- Query: A query is a statement that asks a question to the Prolog interpreter : `?- parent(X, john).`
- Variables: Variables in Prolog start with an uppercase letter or an underscore : `ancestor(X,Y) :- parent(X,Y).` , `X` and `Y` are variables.

?- Subprogram.

- Predicates: In Prolog, sub-programs are called predicates. A predicate is a logical statement or a goal that can be queried by the Prolog interpreter to determine if it is true or false. . For example:

```
factorial(0, 1).
factorial(N, Result) :-
N > 0,
N1 is N - 1,
factorial(N1, Result1),
Result is N * Result1.
```

```
?- factorial(5, X).
X = 120.
```

?-Data Objects.

Primitive Data Types

Constants :

Identifiers

sequences of letters, digits, or underscore "_" that start with lower

Numbers

Integer and real

Strings

Strings enclosed in single quotes

?-Data Objects.

Continuation

Primitive Data Types

Variables

Sequence of letters digits or underscore that start with an upper case letter or the underscore.

?-Data Objects. → Continuation

Structured Data Types

A list is represented as [A , B , C , ...] . The notation [A|B] is used to indicate A as the head of the list and B as the tail of the list :

```
?- X=[A|B] , X=[1,2,3,4].
```

```
A = 1 ,
B = [ 2,3,4 ] ,
X = [ 1,2,3,4 ]
```

?-Subjugation in prolog.

LBT

Late binding : Implementation - low speed and efficiency - high flexibility

?- Implementation method.

Interpreter

An interpreter executes Prolog programs directly by interpreting each statement or clause

Compiler

A compiler translates the Prolog program into machine code or an intermediate representation before execution

?-sequence control.

all the rules are local . rules are stored in the order of being entered in the database in a query such as :
Q1 , Q2 , ... , Qn

For example :

```
animal(Fred)  :-elephant(Fred).
ant_eater(Fred).
```

```
ant_eater(Fred).
animal(Fred)  :-elephant(Fred).
```

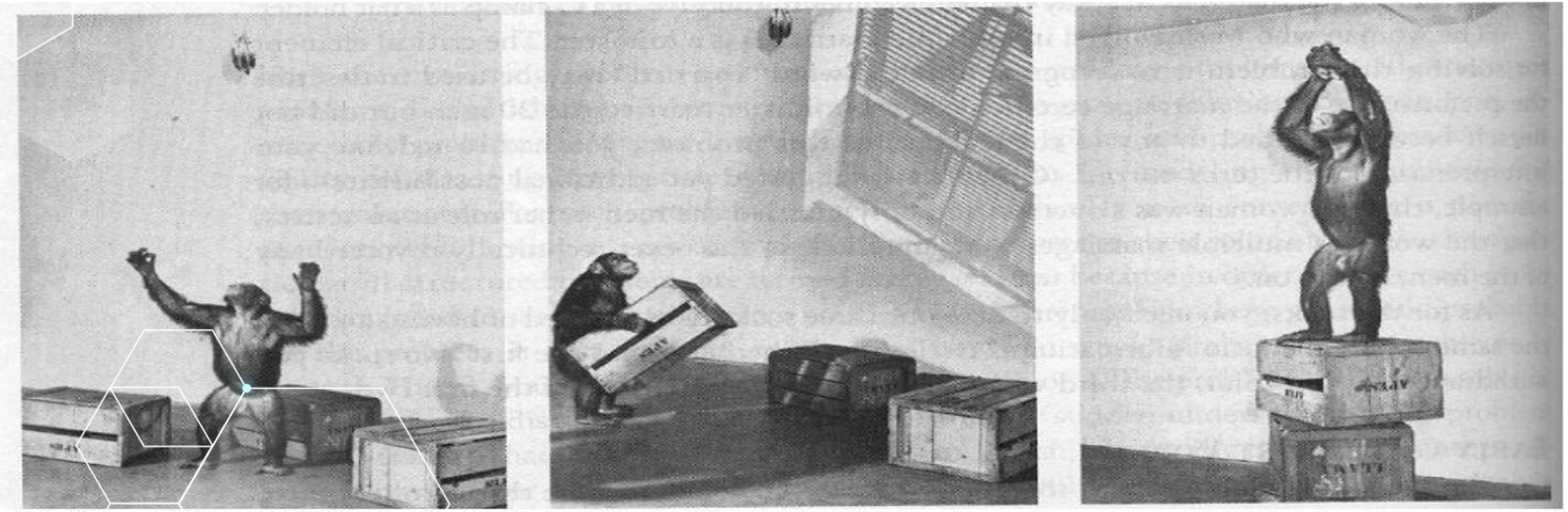
?-Testing and Debugging.

Execution trace features

You can turn on trace mode by entering:

```
trace.
```

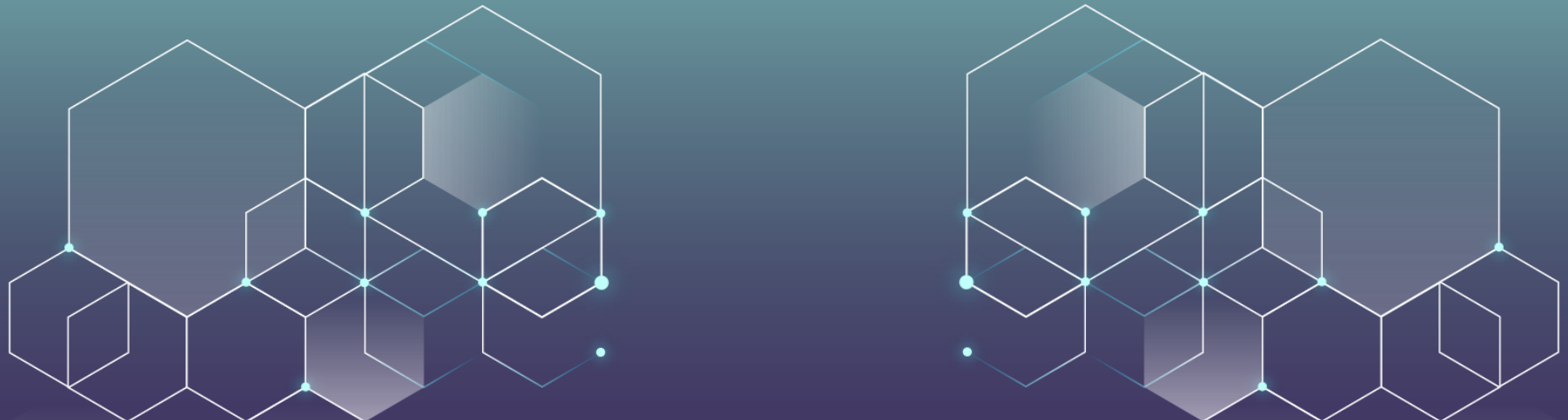
Kohler (1945): monkey and banana problem.



Kohler observed that chimpanzees appeared to have an insight into the problem before solving it

?-Implementing a sample code.

```
['Monkey-Banana.pl']. or consult(Monkey-Banana).
```



PREMIUM RESOURCES

- The birth of Prolog - Alain Colmerauer and Philippe Roussel
- PrologTutorial1 - Hojjat Ghaderi and Fahiem Bacchus, University of Toronto
- The Art of Prolog - Leon Sterling Ehud Shapiro with a foreword by David H. D. Warren
- Programming languages design and implementation

THANKS

Do you have any questions?

hamidreshtime@gmail.com

https://github.com/hamidresh/Prolog_presentation

University of Mohaghegh Ardabili
Dr.S.Najar

Date: 23 May 2023