

Experiment 3 Production system experiment

1. Experimental Purpose:

- 1) Be familiar with the representation of knowledge
- 2) Master the operating mechanism of the production system
- 3) Basic methods of production system reasoning.

2. Experiment content

Using the learned knowledge, design and program a small animal recognition system, so that this production system can identify the tiger, leopard, zebra, giraffe, ostrich, penguin, and albatross.

Rule base:

- R1: IF The animal has hair THEN The animal is a mammal
- R2: IF The animal has milk THEN The animal is a mammal
- R3: IF The animal has feathers THEN The animal is a bird
- R4: IF The animal can fly AND The animal lays eggs, THEN The animal is a bird
- R5: IF The animal eats meat THEN The animal is a carnivore
- R6: IF The animal has canine teeth AND The animal has claws AND The animal gazes ahead THEN The animal is a carnivore
- R7: IF The animal is a mammal AND The animal has hooves THEN The animal is an ungulate
- R8: IF The animal is a mammal AND The animal is a ruminant THEN The animal is an ungulate
- R9: IF The animal is a mammal AND The animal is a predator AND The animal is tawny AND There are dark spots on its body THEN The animal is the leopard
- R10: IF The animal is a mammal AND The animal is a predator AND The animal is tawny AND There are black stripes on its body THEN The animal is a tiger
- R11: IF The animal is an ungulate AND The animal has a long neck AND The animal has long legs AND There are dark spots on its body THEN The animal is a giraffe
- R 12: IF The animal is an ungulate AND There are black stripes on its body THEN The animal is a zebra
- R13: IF The animal is a bird AND The animal has a long neck AND The animal has long legs AND The animal can't fly AND The animal is black and white THEN The animal is an ostrich
- R14: IF The animal is a bird AND The animal can swim AND The animal can't fly AND The animal is black and white THEN The animal is a penguin

R15: IF The animal is a **bird** AND The animal is good at **flying**
THEN The animal is an **albatross**

Given initial information, your system can recognize which animal it is.
For example, known initial facts are stored in a comprehensive database:
Dark spots, long neck, long legs, milk, hooves
After running, the result is: **giraffe**

3. Experimental process:

- 1) Apply what you have learned, design the production system, build the knowledge base, run the system and obtain the solution.
- 2) For the experiment procedures of the production system, build rule base as shown below.
The system is divided into two parts.

The first part is to initialize the comprehensive database, which is divided into two categories. The first one is the indirect database, that is, the information does not point to the final specific animal. The other one is a direct database, which points to the final specific animal. A two-dimensional list and an one-dimensional list are used to store the key and value. The second part is to add the database and recognize the animal, added when being queried, can effectively expand the database, make the database more flexible and perfect. While the system is running, first complete the information in the indirect database, search the corresponding animal in the direct database, record the information using the dictionary, and check whether a feature appears, the complexity of the query is $O(1)$.

Create an indirect rule base !

Please enter animal properties (space separated, end with 0): hair

Please enter the result: mammal

Please enter animal properties (space separated, end with 0): milk

Please enter the result: mammal

Please enter animal properties (space separated, end with 0): feathers

Please enter the result: bird

Please enter animal properties (space separated, end with 0): fly egg

Please enter the result: bird

Please enter animal properties (space separated, end with 0): meat

Please enter the result: carnivore

Please enter animal properties (space separated, end with 0): teech claws ahead

Please enter the result: carnivore

Please enter animal properties (space separated, end with 0): mammal hooves

Please enter the result: ungulate

Please enter animal properties (space separated, end with 0): 0

The indirect rule base is built !

Fig1 The indirect rule base

Create a direct rule base !

Please enter animal properties (space separated, end with 0): mammal predator tawny darkspots
Please enter the result: leopard
Please enter animal properties (space separated, end with 0): mammal predator tawny blackstripes
Please enter the result: tiger
Please enter animal properties (space separated, end with 0): ungulate longneck longlegs darkspots
Please enter the result: giraffe
Please enter animal properties (space separated, end with 0): ungulate blackstripes
Please enter the result: zebra
Please enter animal properties (space separated, end with 0): bird longneck longlegs cantfly blackandwhite
Please enter the result: ostrich
Please enter animal properties (space separated, end with 0): bird swim cantfly blackandwhite
Please enter the result: penguin
Please enter animal properties (space separated, end with 0): 0

The rule base is established !

Fig2 The direct rule base

1. Add the direct rule library.2. Add the indirect rule library.3. Do animal identification.4. Exit the program!

Please select : 1
Please enter animal properties (space separated, end with 0): bird flying
Please enter the result: albatross
Please enter animal properties (space separated, end with 0): 0

1. Add the direct rule library.2. Add the indirect rule library.3. Do animal identification.4. Exit the program!

Please select : 2
Please enter animal properties (space separated, end with 0): mammal ruminant
Please enter the result: ungulate
Please enter animal properties (space separated, end with 0): 0

1. Add the direct rule library.2. Add the indirect rule library.3. Do animal identification.4. Exit the program!

Please select : 3
Please enter animal properties :(space separated)bird flying
The animal is: albatross

1. Add the direct rule library.2. Add the indirect rule library.3. Do animal identification.4. Exit the program!

Please select : 4

Successful exit procedure !

Fig3 Add information and query

- 3) After understanding how the production rules can be the basis of knowledge representation and production system reasoning, submit your experimental report.