

Artificial Intelligence

Context

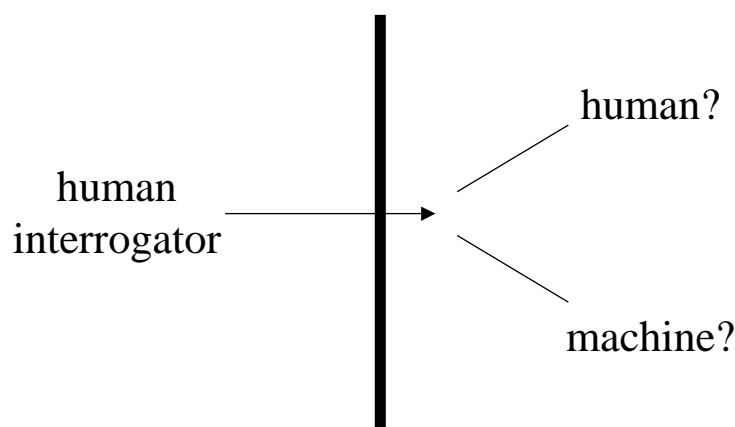
- ❑ Algorithms
- ❑ Virtual machines
- ❑ High-level languages
- ❑ Software-engineering practices and tools
- ❑ Applications: word processing, taxation, air-ticket reservation, control of power-systems
- ❑ How about more human-like tasks?
 - Are we ready to implement systems to “think” independently?
 - Can intelligence be encoded as an algorithm?

Setting

- Goal of AI researchers
 - More user-friendly, versatile and robust systems
 - Simulating intelligence
 - Imparting intelligence to machines
 - Machines with autonomous behaviour
- What is intelligence?
 - External observable behaviour
 - Internal characteristic
- Are humans intelligent machines with complex programs?

Turing Test

- Can human interrogator behind a wall tell the difference between human and machine?



Eliza Psychiatrist

- ❑ Seemingly human, but without understanding
- ❑ Implement via pattern matching of clever rules
- ❑ Understanding involves interpretation of information in light of knowledge already acquired

Men are all alike
IN WHAT WAY?

They're always bugging us about something or other
CAN YOU THINK OF A SPECIFIC EXAMPLE?

Well, my boyfriend made me come here
YOUR BOYFRIEND MADE YOU COME HERE

He says I'm depressed most of the time
I'M SORRY TO HEAR YOU ARE DEPRESSED

It's true, I am unhappy
DO YOU THINK COMING HERE WILL HELP YOU NOT TO BE UNHAPPY?

I need some help, that much seems certain

WHAT WOULD IT MEAN TO YOU IF YOU GOT SOME HELP?

Perhaps I could learn to get along with my mother
TELL ME MORE ABOUT YOUR FAMILY

My mother takes care of me

WHO ELSE IN YOUR FAMILY TAKES CARE OF YOU?

My father

YOUR FATHER?

You are like my father in some ways

WHAT RESEMBLANCE DO YOU SEE?

You are not very aggressive, but I think you don't want me to notice that
WHAT MAKES YOU THINK I AM NOT VERY AGGRESSIVE?

You don't argue with me

WHY DO YOU THINK I DON'T ARGUE WITH YOU?

You are afraid of me

DOES IT PLEASE YOU TO BELIEVE I AM AFRAID OF YOU?

My father is afraid of everybody

WHAT ELSE COMES TO MIND WHEN YOU THINK OF YOUR FATHER?

Bullies

DOES THAT HAVE ANYTHING TO DO WITH THE FACT THAT YOUR BOYFRIEND MADE YOU COME HERE?

Eliza rules

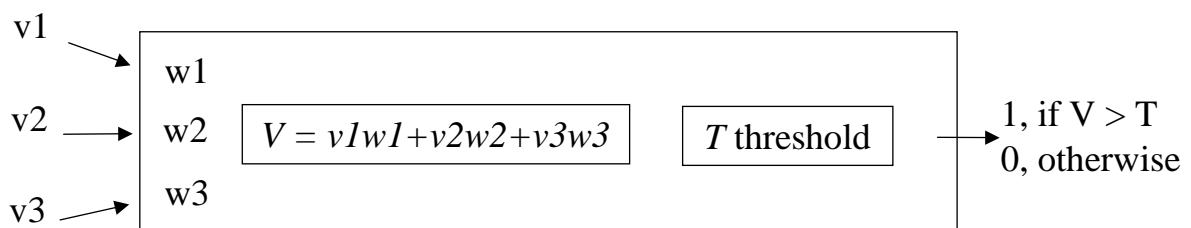
- ❑ Keywords: I, YOU, MOTHER, HATE ..etc
- ❑ Response:
AAA You are BBB ==> I am (inversion BBB)
inversion: ME/YOU, MY/YOUR
- ❑ Templates:
T1: What makes you think XXX
T2: Tell me more about XXX
T3: Does it please you to believe XXX
- ❑ Encouragement to engage:
“You don't seem very talkative today”

Types of Task

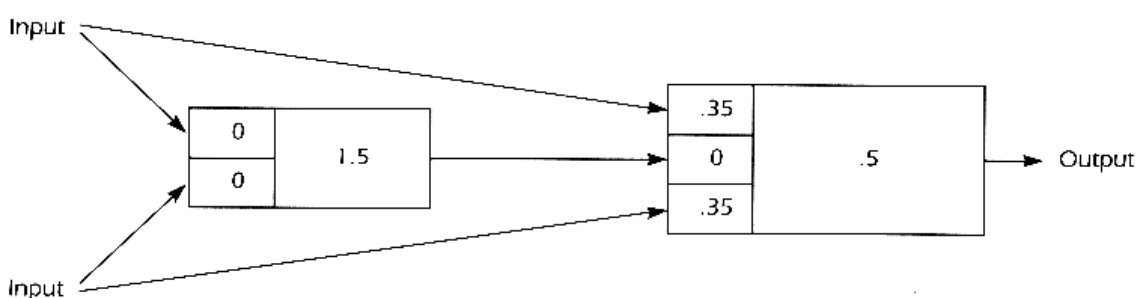
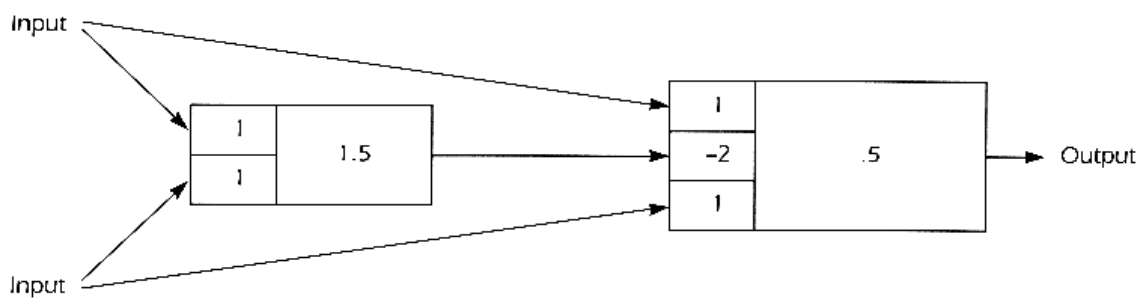
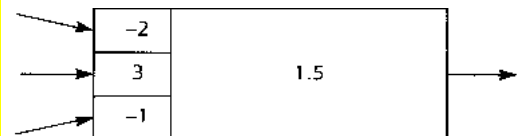
- ❑ Computational
 - Adding prices of grocery items
 - Managing payroll or inventory
 - Trajectory adjustments for missiles
- ❑ Recognition
 - Speech understanding
 - Face/profile recognition
- ❑ Reasoning
 - Things to bring on holiday
 - Disaster recovery planning

Pattern Recognition

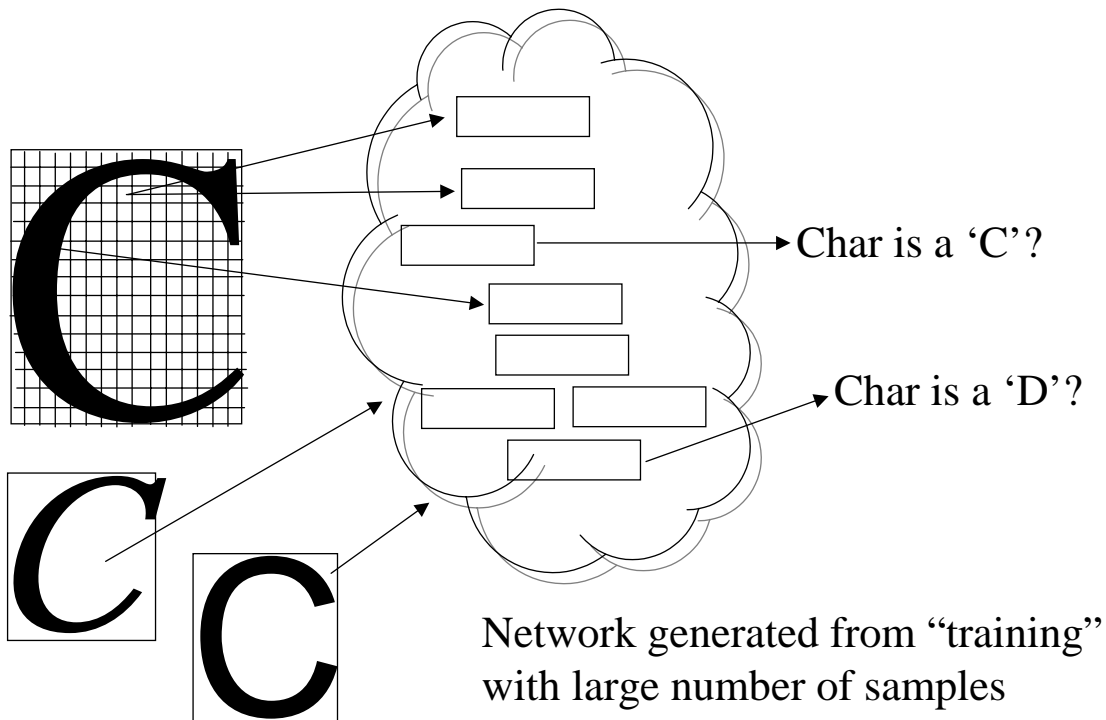
- Large pattern database
- Inaccurate samples
- Neural networks constructed from many simple processing units



Example Networks



Character Recognition

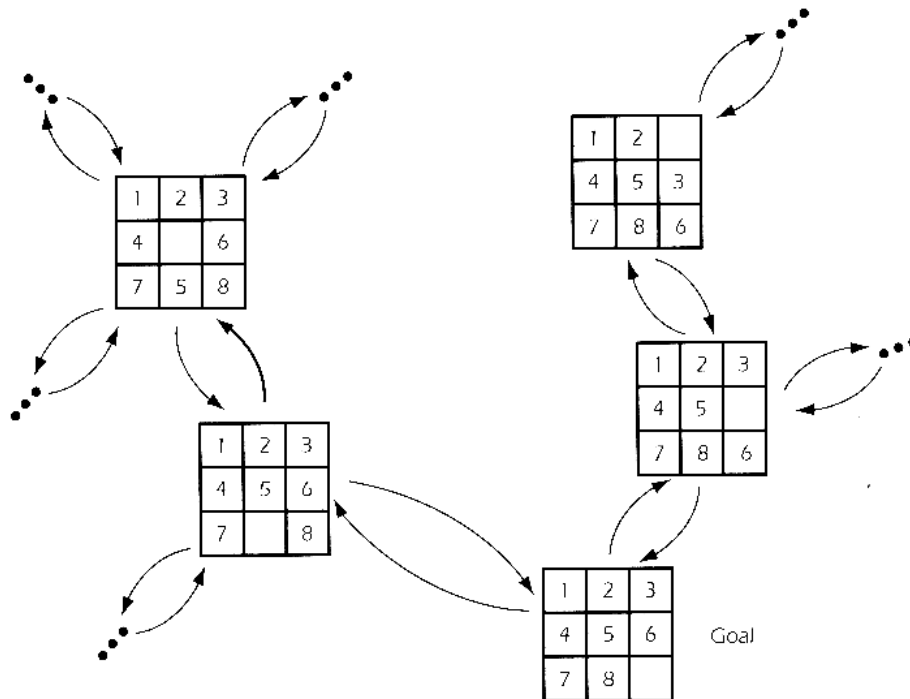


Solving a Puzzle

- Involves
 - planning
 - learning from past experience
- Simulated by
 - searching a state graph
- state graph could be very big
- solution is found by searching for goal in state graph
- can we be guided in making productive search?

1	3	5
4	2	
7	8	6

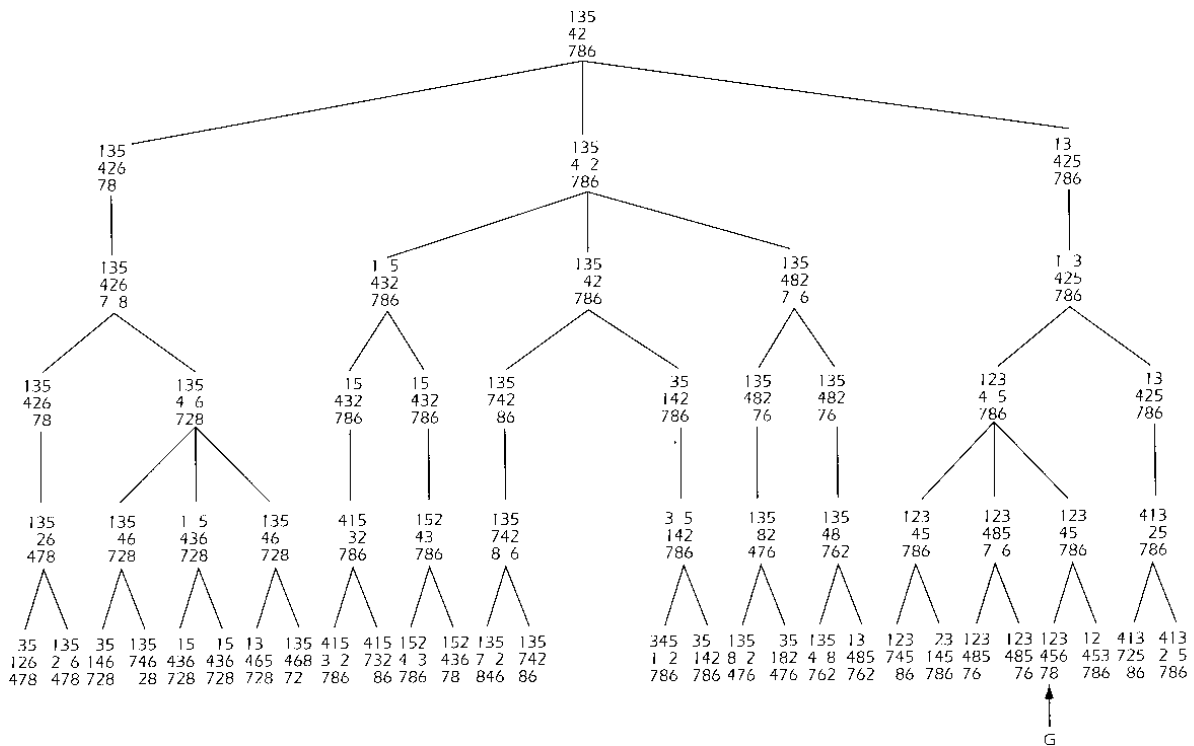
State Graph



Searching

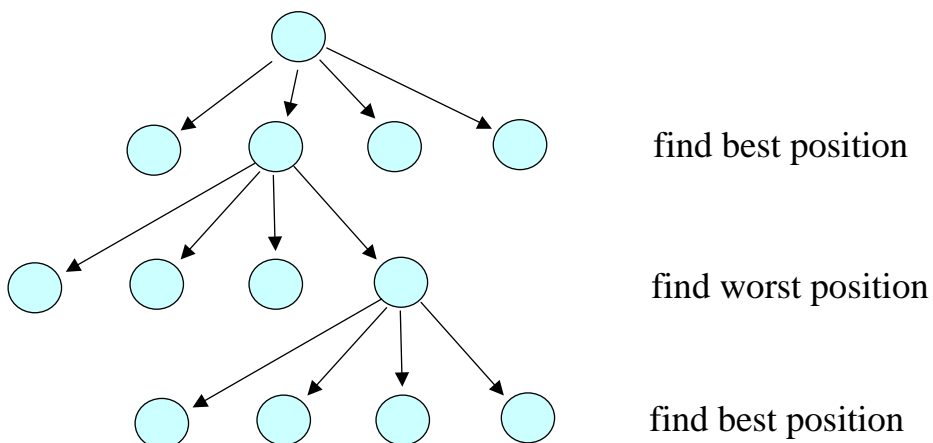
- ❑ start with initial state
- ❑ state graph is extending during search
- ❑ searching remembers where we came from
 - does not make futile loops
- ❑ searching be improved by some evaluation function
- ❑ evaluation function might need to “peek ahead”

Search Tree



Game Playing

- like a puzzle but complicated by opponent
 - opponent undoes effort of player
 - evaluation function must be reversed



Logical inference

Knowledge encoded as a set of rules:

`parent(x,y) if father(x,y).`

x is the parent of y if x is the father of y

`parent(x,y) if mother(x,y).`

x is the parent of y if x is the mother of y

`grandparent(x,y) if parent(x,z) and
parent(z,y).`

x is the grandparent of y if x is the parent of z and z
is the parent of y

Logical inference

`ancestor(x,y) if parent(x,y).`

`ancestor(x,y) if parent(x,z) and
ancestor(z,y).`

Knowledge base:

`father(andrew, tom).`

`mother(jane, tom).`

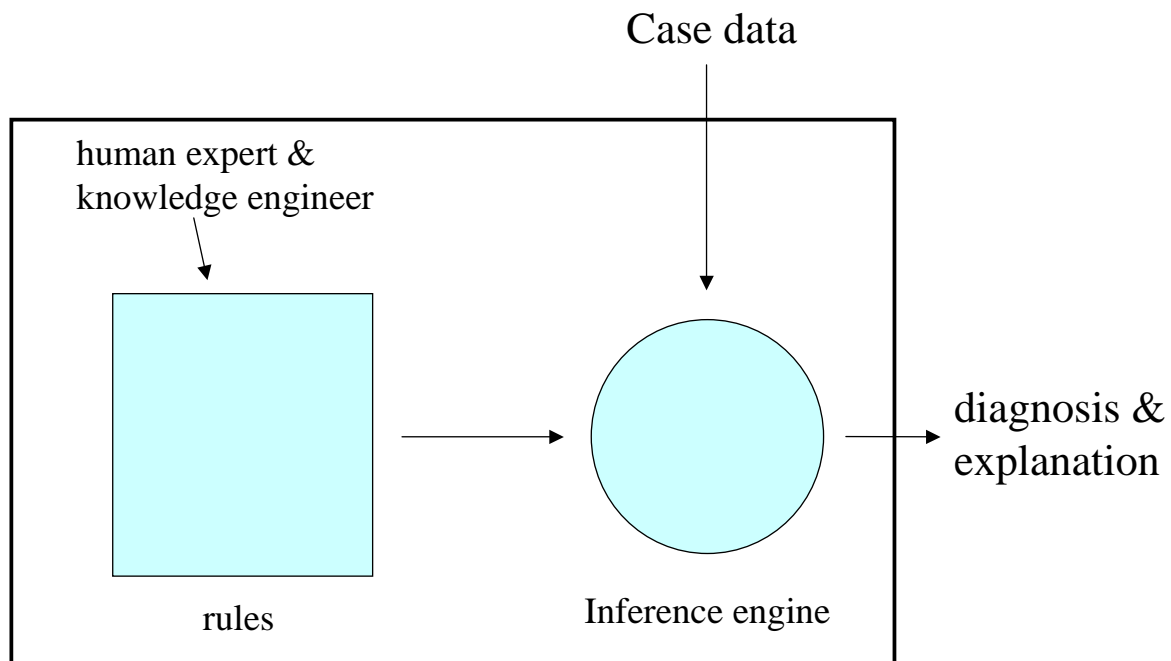
`father(tom, john).`

Queries:

?`ancestor(jane, tom)` Is jane an ancestor of tom?

?`ancestor(X, john)` Who are ancestors of john?

Expert System



Sample Rules

1. IF engine_getting_petrol & engine_turns_over
THEN problem_with_spark_plugs
2. IF NOT engine_turns_over & NOT lights_come_on
THEN problem_with_battery
3. IF NOT engine_turns_over & lights_come_on
THEN problem_with_starter
4. IF petrol_in_fuel_tank
THEN engine_getting_petrol

Summary

- ❑ casting real problems for current computer solutions
 - still computational
 - evaluation functions
 - weights and thresholds
 - rules
- ❑ move from fixed algorithms to non-deterministic information centred processing
- ❑ fixed engines still built from Von Neumann computers