**Computer vs. Human**

Machine

1.Performs precisely defined tasks with speed and accuracy

2.Not gifted with common sense

Human

1.Capable of understanding and reasoning

2.More likely to understand the results and determine what to do next

3.Not gifted with complex computations

**Humanlike Computer**

The ideal hybrid

1.Continue without human intervention when faced with unforeseen situations

2.Possesses or simulate the ability to reason

3.Psychologists and their models may be helpful

**Intelligent Agents**

Agent

1.Device that responds to stimuli from its environment

Sensors: to receive stimuli

Actuators: to react

The goal of artificial intelligence

1.To build agents that behave intelligently

**learning**

Procedural knowledge

1.Learn ‘How’

2.Usually by trial-and-error

3.Punished by poor action, awarded by good action

Declarative knowledge

1.Learn ‘What’

2.Expand ‘facts’ in one’s database of knowledge

**AI Research Approaches**

Performance oriented

1.Researcher tries to maximize the performance of the agents

2.Just do it

Exhaustive search, probabilistic deduction

3.Computer scientists approach



Simulation oriented

1.Researcher tries to understand how the agents produce responses.

2.Wait, let me figure what’s going on first

Heuristic search, classification

3.Psychologists approach

**Levels of Intelligence: Not Really Intelligent**

Weak AI

1. Reflex

Actions are fixed and predetermined

2. Context aware

Actions affected by knowledge of the environment

Context information

Strong AI

3. Goal seeking

Search for a solution

Key: efficient searching

4. Learning

Deduce from experience

Key: identifying majority

**Understanding Images Computer Vision**



Template matching

1.Compare two bitmaps Ex. recognizing well-formed characters

Image processing

1.Consider characters by the common shape Ex. recognizing hand-written characters

Edge enhancement

Region finding

Smoothing

Image analysis

1.Guess what partial, obstructed objects are Ex. recognizing what the image means

**3 steps in language processing**

Syntax analysis

1.Parsing

2.Grammatical role of each word



Semantic analysis

1.What action? The agent of that action? The object of that action?

2.E.g. ‘Marry gave John a car’ = ‘John got a car from Mary’

Contextual analysis

1.E.g. people sometimes say things in a sarcastic way (嘲諷), such “That’s great!’.

**Production Systems**



Capturing common characteristics of reasoning problems

1. Collection of states

Start or initial state

Goal state

2. Collection of productions

Rules or moves

Each production may have preconditions

3. Control system

Production to apply next

**Control System**



Search tree

1.Record of state transitions explored while searching for a goal state

Searching for goal

1.Searches the state graph to find a path from the start node to the goal



Strategies

1.Root: start state

2.Children: states reachable by applying one production

3.Walking up the tree from the goal

**Types of Searches**

Blind

1.Breadth-first search

2.Depth-first search

Heuristics

1.Proximity to goal

**Good Heuristics**

Easier to compute than a complete solution

Provide a reasonable estimate of proximity to a goal

**Neural Networks**

Artificial Neuron

1.Input multiplied by a weighting factor

2.Output

1 if sum of inputs exceeds a threshold value

0 if otherwise.



Network is programmed by adjusting weights using feedback from examples.

**Associative Memory**

Associative memory

1.The retrieval of information relevant to the information at hand

Application of neural network

1.Given a partial pattern

2.Transition themselves to a completed pattern.