

UNIT 1 ARTIFICIAL INTELLIGENCE

Introduction



DISCLAIMER

Some contents in this presentation are retrieved from the following original sources:

1. Washington State University: Artificial Intelligence Course
2. Introduction to Artificial Intelligence by Prof. Bojana Dalbelo Basic and Assoc. Prof. Jan Snajder, University of Zagreb, Faculty of Electrical Engineering and Computing
3. <https://www.educba.com/intelligent-agents/>
4. <https://www.geeksforgeeks.org/artificial-intelligence-a-n-introduction/>

WHY STUDY AI?

Turning theory into working programs forces us to work out the details

AI yields good results for Computer Science

AI yields good results for other fields

Computers make good experimental subjects

Personal motivation: mystery

Artificial Intelligence - Job Profiles

**AI Data
Analyst**

**Big Data
Engineer**

**BI
Developer**

**Data
Scientist**

**ML
Engineer**

**Product
Manager**

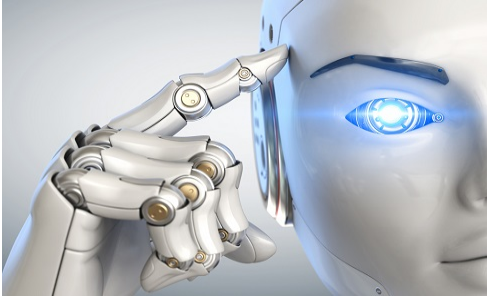
**Research
Scientist**



A survey states that there is a huge possibility that AI is going to create about **58 million jobs by 2022.**

APPLICATIONS OF AI





INTELLIGENT CAPABILITIES

Problem solving: Search, Adversarial search, Optimization

Knowledge management: Knowledge retrieval and extraction,
Knowledge representation, Filtering

Reasoning: Logical reasoning, Uncertain reasoning

Interaction: Human-computer interaction, Real world interaction

COMPONENTS OF INTELLIGENCE

Intelligence is an intangible entity that is composed of:

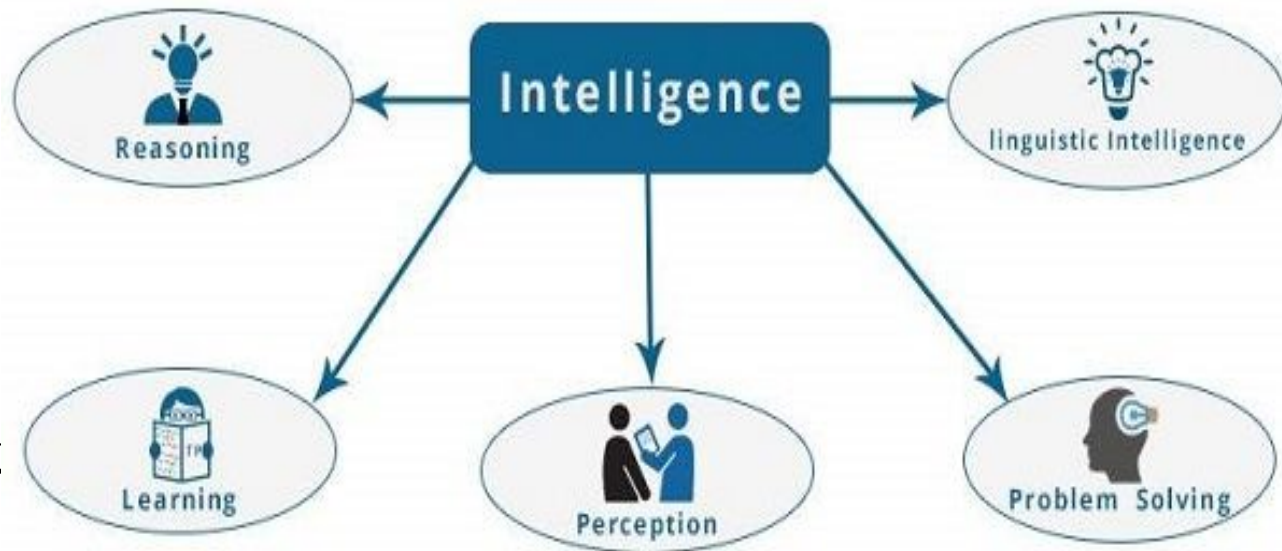
Reasoning

Learning

Problem solving

Perception

Linguistic Intelligence



HISTORY OF AI

S/Z/G/

A.I. TIMELINE

1950

TURING TEST

Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence

1955

A.I. BORN

Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe "the science and engineering of making intelligent machines"

1961

UNIMATE

First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line

1964

ELIZA

Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans

1966

SHAKY

The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I.

WINTER

Many false starts and dead-ends leave A.I. out in the cold

1997

DEEP BLUE

Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov

1998

KISMET

Cynthia Breazeal at MIT introduces Kismet, an emotionally intelligent robot insofar as it detects and responds to people's feelings



1999

AIBO

Sony launches first consumer robot pet dog AIBO (AI robot) with skills and personality that develop over time



2002

ROOMBA

First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes



2011

SIRI

Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S



2011

WATSON

IBM's question answering computer Watson wins first place on popular \$1M prize television quiz show Jeopardy



2014

EUGENE

Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human



2014

ALEXA

Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks



2016

TAY

Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments



2017

ALPHAGO

Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

WHAT IS THE DEFINITION OF AI?

What do you think?

WHAT IS THE DEFINITION OF AI?

Systems that think like humans

Systems that think rationally

Systems that act like humans

Systems that act rationally

Bellman,

1978

“[The automation of] activities that we associate with human thinking, activities such as decision making, problem solving, learning”

WHAT IS THE DEFINITION OF AI?

Haugeland,

1985

“The exciting new effort to make computers think *machines with minds*, in the full and literal sense”

Schalkoff, 1990

“A field of study that seeks to explain and emulate intelligent behavior in terms of computational processes”

WHAT IS THE DEFINITION OF AI?

**Luger & Stubblefield,
1993**

“The branch of computer science that is concerned with the automation of intelligent behavior”

Dean et al., 1995

“A field of study that seeks to explain and emulate intelligent behavior in terms of computational processes”

WHAT IS THE DEFINITION OF AI?

Nilsson, 1998

“Many human mental activities such as writing computer programs, doing mathematics, engaging in common sense reasoning, understanding language, and even driving an automobile, are said to demand intelligence. We might say that [these systems] exhibit artificial intelligence”

**NITI Aayog,
2015**

AI refers to the ability of machines to perform cognitive tasks like thinking, perceiving, learning, problem solving and decision making.

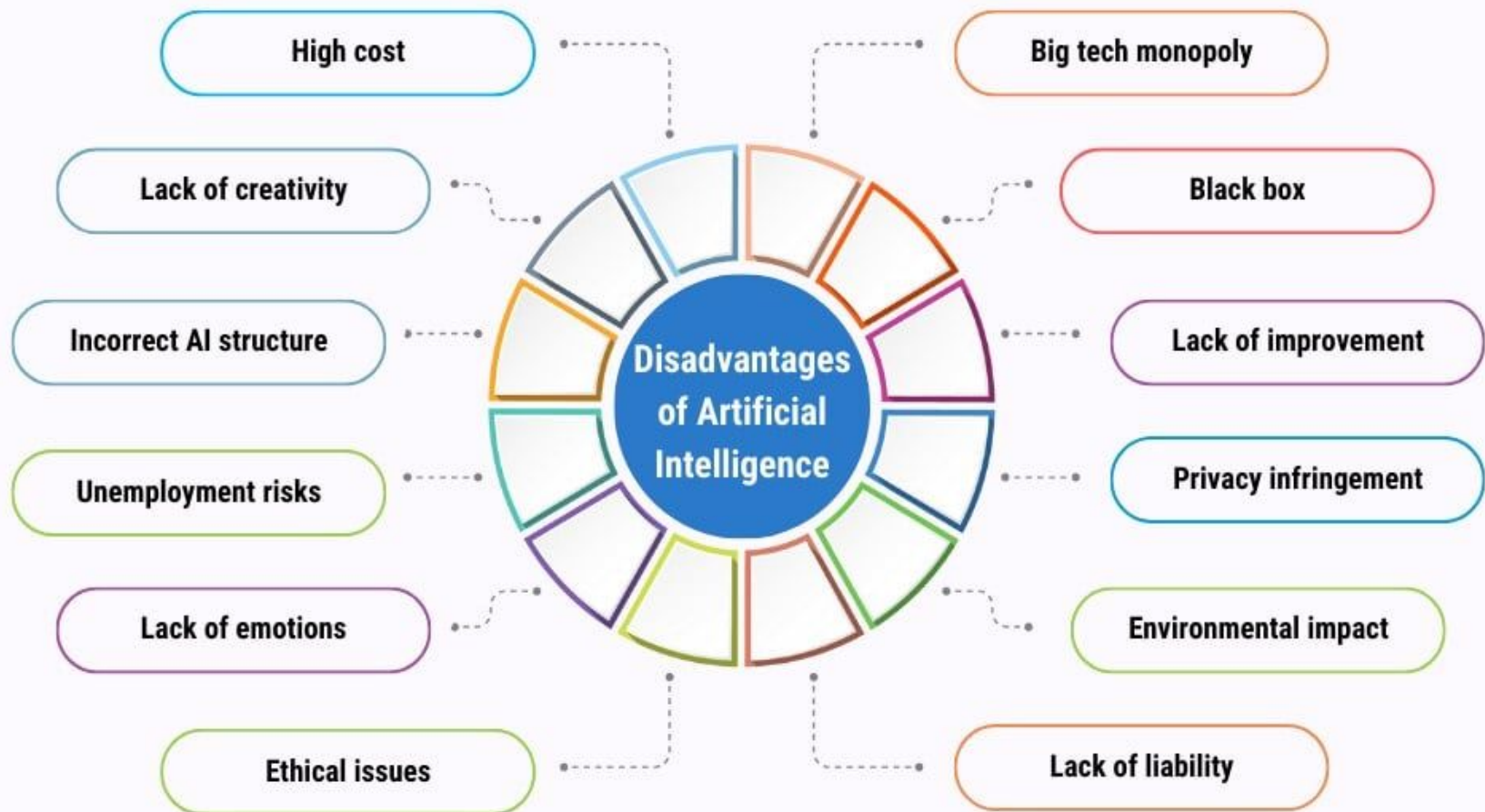
ADVANTAGES OF AI

Advantages of Artificial Intelligence

ANALYTIX LABS



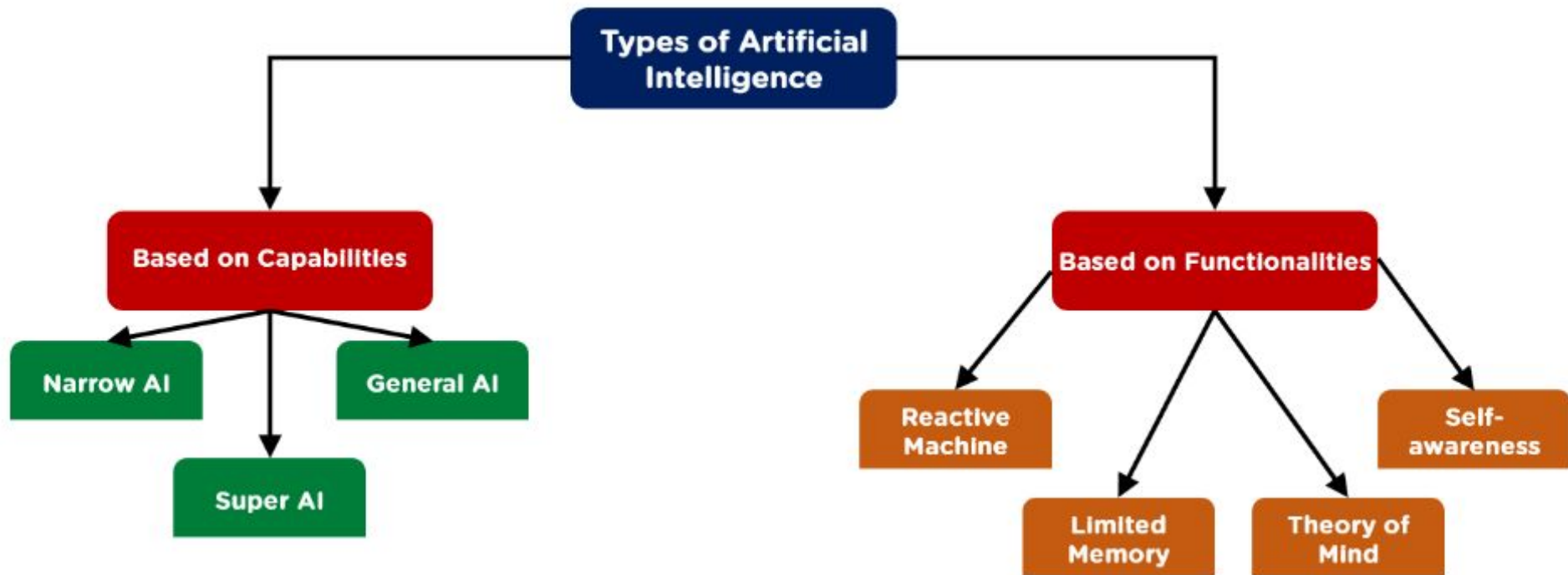
DISADVANTAGES OF AI



GOALS OF AI



TYPES OF AI



BASED ON CAPABILITIES

Types of AI

Weak AI- which has a narrow range of abilities

General AI- which is on par with human capabilities;

Strong AI-which is more capable than a human.

BASED ON FUNCTIONALITIES

Reactive Machines - AI systems that has no memory and are task specific.

Limited Memory - ability to look into the past and improve over time.

Theory of Mind - a term from psychology that describes an individual's capacity for empathy and understanding of others

Self- Awareness- It is hypothetical type of AI that form representations of themselves and perceive their own emotions and menta state.

APPROACH 1: ACTING HUMANLY

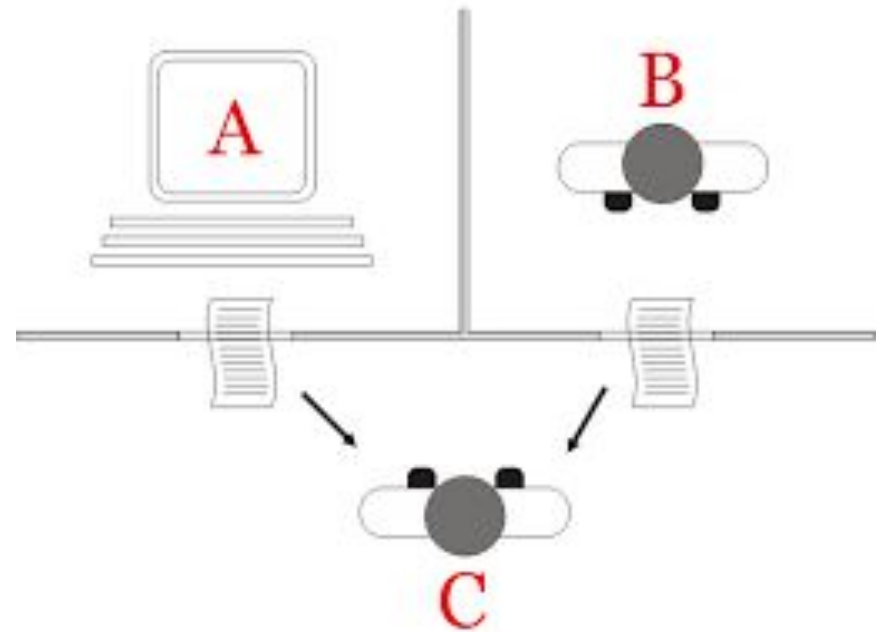
Turing test: ultimate test for acting humanly
Computer and human both interrogated by judge
Computer passes test if judge can't tell the difference

Natural Language Processing: The machine needs this to communicate with the interrogator.

Knowledge Representation: The machine needs to store the information provided before the interrogation.

Reasoning: It's important for the machine to understand how to interpret the information that gets stored..

Machine Learning: This is needed so that the machine can adapt to new conditions in real time.



APPROACH 2: THINKING HUMANLY

Requires knowledge of brain function

What level of abstraction?

How can we validate this

This is the focus of Cognitive Science

APPROACH 3: THINKING RATIONALLY

Aristotle attempted this

What are correct arguments or thought processes?

Provided foundation of much of AI

Not all intelligent behavior controlled by logic

What is our goal? What is the purpose of thinking?

APPROACH 4: ACTING RATIONALLY

Act to achieve goals, given set of beliefs

Rational behavior is doing the “right thing”

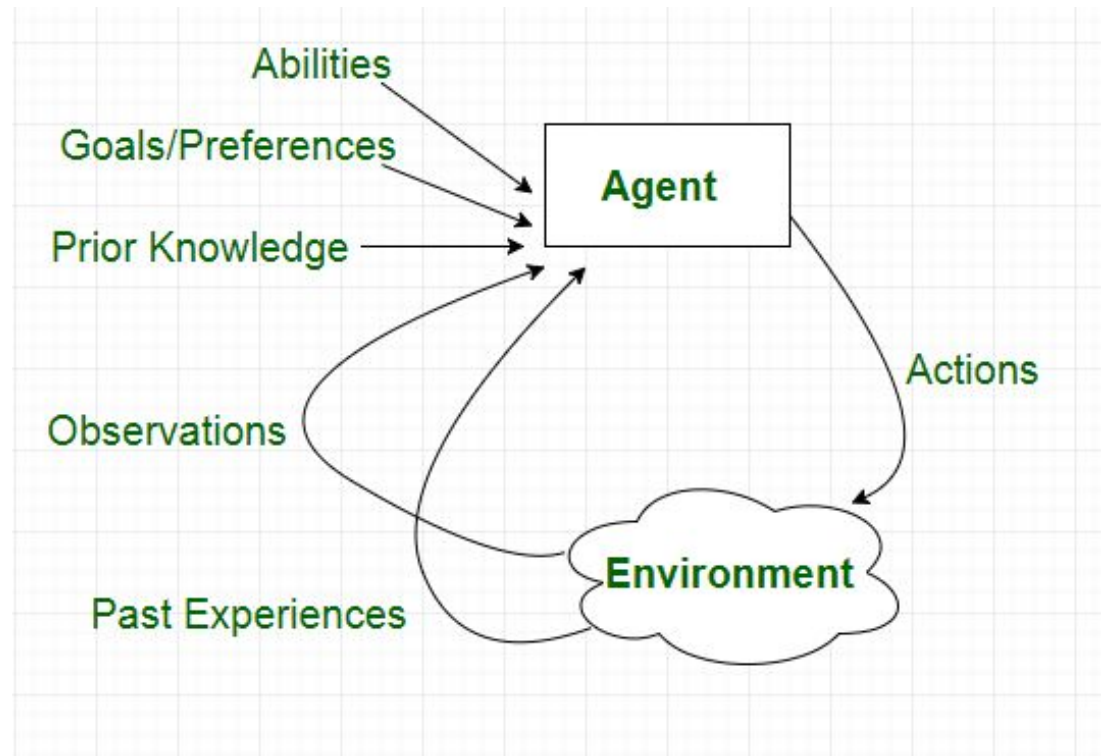
□ Thing which expects to maximize goal achievement

This is approach adopted by Russell & Norvig

RATIONALITY

A rational agent does the **right thing** (what is this?)

A fixed performance measure evaluates the sequence of observed action effects on the environment



Source: <https://www.geeksforgeeks.org/agents-artificial-intelligence/?ref=gcse>

PEAS

Use PEAS to describe task environment

- Performance measure
- Environment
- Actuators
- Sensors

Example: Autonomous driving

- Performance measure: safe, fast, comfortable (maximize profits)
- Environment: roads, other traffic, pedestrians, customers
- Actuators: steering, accelerator, brake, signal, horn
- Sensors: cameras, sonar, speedometer, GPS, odometer, accelerometer, engine sensors



ENVIRONMENT PROPERTIES

Fully observable vs. partially observable

Deterministic vs. stochastic / strategic

Episodic vs. sequential

Static vs. dynamic

Discrete vs. continuous

Single agent vs. multiagent

ENVIRONMENT EXAMPLES



| Environment | Observable | Deterministic | Episodic | Static | Discrete | Agents |
|-----------------------|------------|---------------|----------|--------|----------|--------|
| Chess with a clock | | | | | | |
| Chess without a clock | | | | | | |

ENVIRONMENT EXAMPLES



| Environment | Observable | Deterministic | Episodic | Static | Discrete | Agents |
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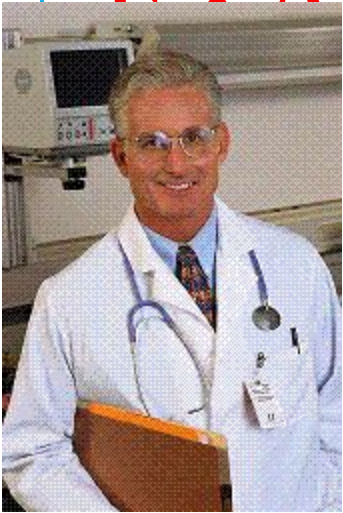
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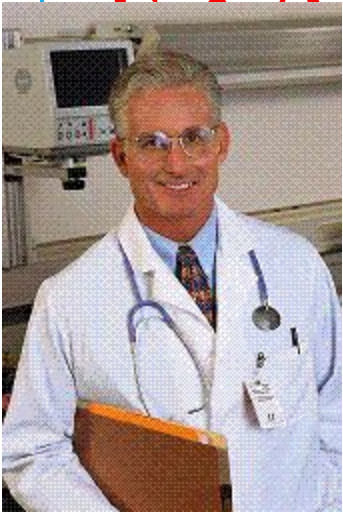
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| Medical diagnosis | | | | | | |

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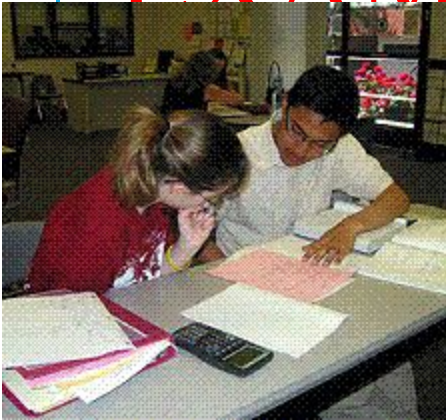
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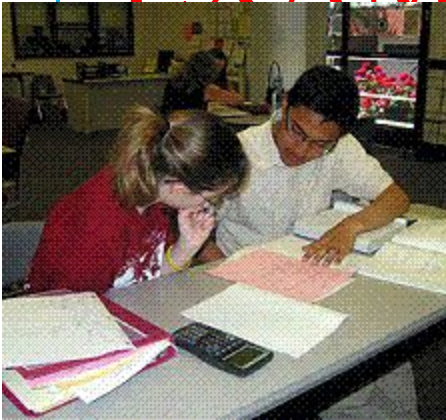
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AGENT TYPES

Types of agents (increasing in generality and ability to handle complex environments)

- Simple reflex agents
- Reflex agents with state
- Goal-based agents
- Utility-based agents
- Learning agent

□ Source:
<https://www.oec.uzh.ch/en/studies/master/it/ai.htm>
1



OTHER EXAMPLE AI SYSTEMS



Knowledge
Representation



Search



Problem
solving



Planning



Machine
learning

Natural language processing

Uncertainty reasoning

Computer Vision

Robotics



THANK YOU !