

Princess Nora University
Faculty of Computer & Information Systems



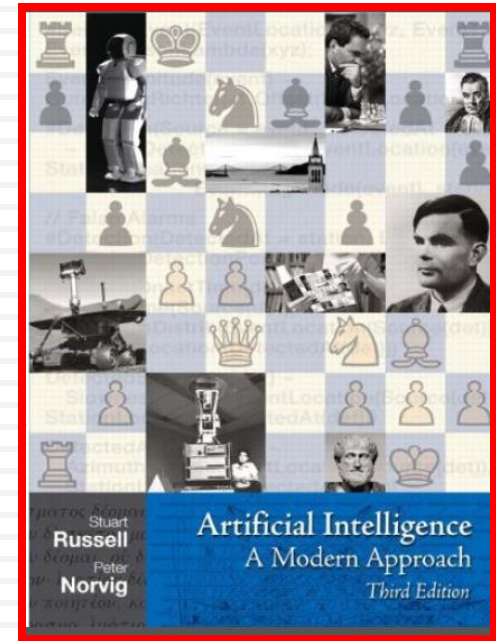
ARTIFICIAL INTELLIGENCE

(CS 370D)

Computer Science
Department



جامعة الأميرة نورة بنت عبد الرحمن
Princess Nora Bint Abdul Rahman University



(CHAPTER-1) INTRODUCTION



Chapter 1: Introduction

3

1. What is AI ?
2. Applied Areas of AI.
3. What's involved in Intelligence?



Dr. Abeer Mahmoud
(course coordinator)



OBJECTIVES:

4

- *explain* why we consider **artificial intelligence (AI)** to be a **subject most worthy of study**,
- *decide* what exactly AI,





Why Would You Study Artificial Intelligence? (1)

➤ Artificial intelligence **impact on society** is growing

rapidly: ex

- ✓ in speech and language technology,
- ✓ in diagnosis,
- ✓ in vision and authentication systems,
- ✓ in information retrieval and data-mining





Why Would You Study Artificial Intelligence? (2)

- knowledge is power
- Due to the rapidly expanding role of AI in our current and future society, there is an urgent need for academically trained people with the variety of backgrounds who are familiar with the fundamentals of AI, aware of its reasonable expectations, and have practical experience in solving AI problems





Roots of artificial intelligence (1)

7

□ **PHILOSOPHY** (428 b.c. -present)

- ❖ Can **formal rules** be used to draw **valid conclusions**?
- ❖ Where does **knowledge** come from?
- ❖ How does **knowledge lead to action**?

□ **MATHEMATICS** (c. 800 -present)

- What are the **formal rules** to draw **valid conclusions**? (**formal logic**)
- What can be **computed**? (**algorithms**)
- How do we **reason** with uncertain information? (**probability theory, fuzzy sets**, etc.)



Dr. Albert
(course coordinator)



Roots of artificial intelligence (2)

8

- **ECONOMICS** (1776 -present)

- ❖ How should we make decisions so as to maximize payoff?

- **NEUROSCIENCE** (1861 -present)

- ❖ How do human brains process information? (neural networks)

- **PSYCHOLOGY** (1879 -present)

- How do humans and animals think and act? (behaviorism, cognitive psychology, cognitive science)





Roots of artificial intelligence (3)

9

- **COMPUTER ENGINEERING** (1940 -present)
 - ❖ How can we build an efficient computer?
- **CONTROL THEORY AND CYBERNETICS** (1948 -present)
 - ❖ How can artifacts (man made objects) operate under their own control? (**automatic**)
- **LINGUISTICS** (1957 -present)
 - ❖ How does language relate to thought?
 - ❖ (natural language processing, knowledge representation)



Basic Questions

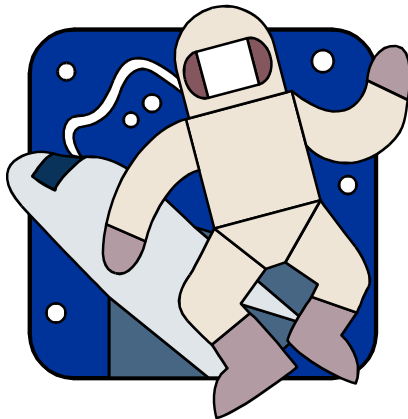
Q. What is intelligence?

Intelligence is the computational part of the ability to achieve goals in the world.

Varying kinds and degrees of intelligence occur in people, many animals and some machines.

Q. What's involved in Intelligence? (1)

Reasoning	الاستنتاج	Inference	الاستدلال
Perception	الادراك	Learning	التعلم
Knowledge-Based	تعتمد علي المعرفة	Problem Solving	حل المشاكل
Non-algorithmic	لا يوجد خطوات للحل		





Q. What's involved in Intelligence? (2)

- **Ability to interact with the real world**
 - to perceive, understand, and act
 - e.g., speech recognition and understanding and synthesis
 - e.g., image understanding
 - e.g., ability to take actions, have an effect

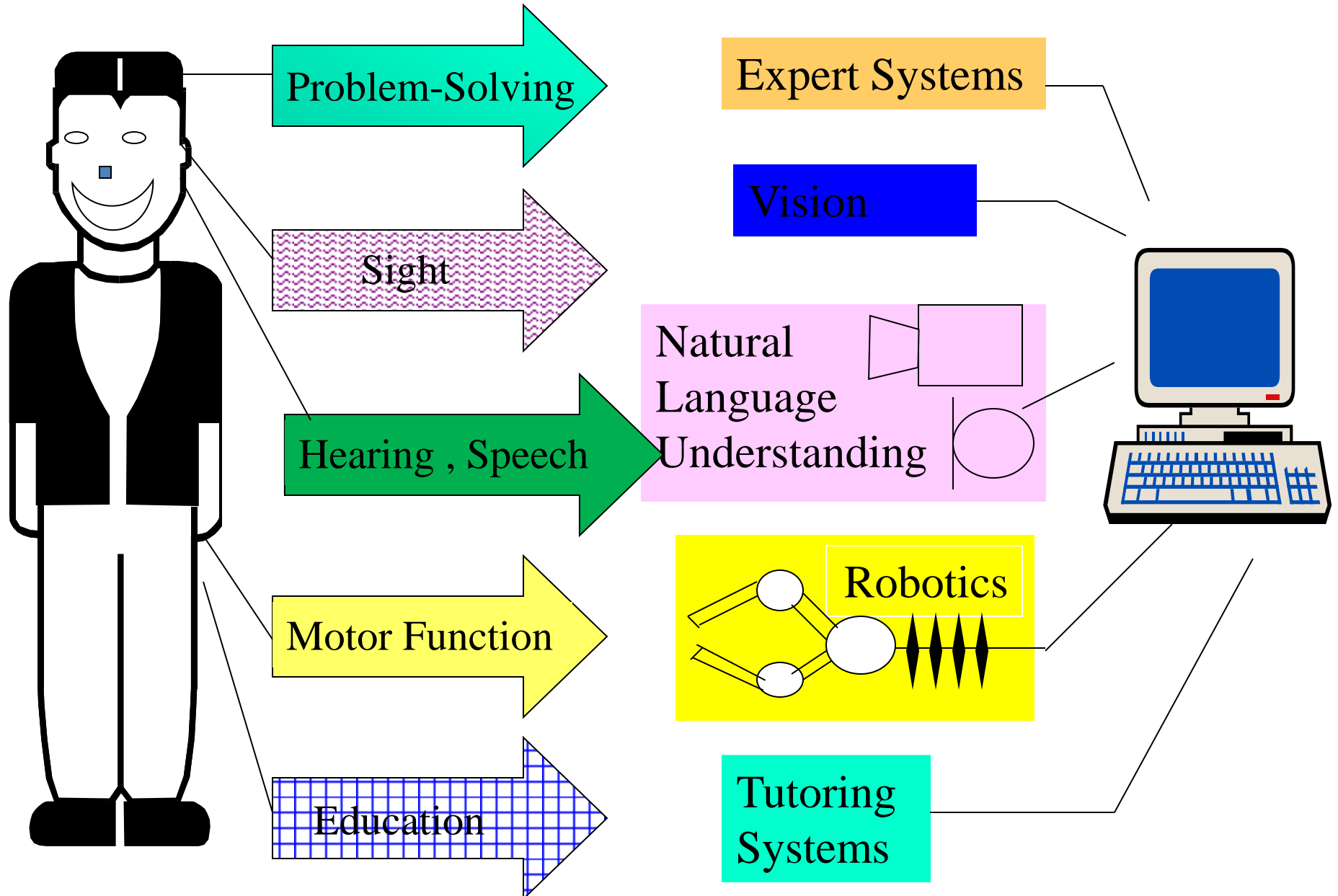
- **Reasoning and Planning**
 - modeling the external world, given input
 - solving new problems, planning, and making decisions
 - ability to deal with unexpected problems, uncertainties

- **Learning and Adaptation**
 - we are continuously learning and adapting
 - our internal models are always being “updated”
 - e.g., a baby learning to categorize and recognize animals



Q. What is artificial intelligence definition?

Artificial Intelligence models human behavior





Q. What is artificial intelligence definition? -1

16

- To day we still don't have an **unambiguous** and **comprehensive** definition of artificial intelligence

✓ definition(1) :

AI is that **branch of science** which makes machines **perform tasks** which would **require intelligence** when performed by humans (Marvin Minsky)

✓ definition(2) :

is the study of the **formal properties of problems** and **problem-solving methods**, with the aim of equipping computers with problem-solving **capabilities** that are **comparable** to those of **a human being**

Dr. Abeer Mahmoud
(course coordinator)





Actually definitions of artificial intelligence can be grouped in main categories:

Logically or based on reason

Systems that think like humans	Systems that think rationally
<p>The existing new effort to make computers think ... <u>machines with minds</u>, in the full and literal sense (Haugeland, 1985)</p> <p>The automation of activities that we associate with <u>human thinking</u>, activities such as decision-making, problem solving, learning... (Bellman, 1978)</p>	<p>The study of <u>mental faculties</u> through the use of computational models (Charniak and McDermont, 1985)</p> <p>The study of the <u>computations</u> that make it possible to perceive, reason, and act (Winston, 1992)</p>
Systems that act like humans	Systems that act rationally
<p>The art of <u>creating machines</u> that <u>perform functions</u> that require intelligence when performed by people (Kurzweil, 1990)</p> <p>The study of how to make <u>computers do things</u> at which, at the moment, people are better (Rich and Knight, 1991)</p>	<p><u>Computational intelligence</u> is the study of the design of <u>intelligent agents</u> (Poole et. al., 1998)</p> <p>Artificial Intelligence ... is concerned with <u>intelligent behavior</u> in artifacts (Nilsson, 1998)</p>





The previously mentioned categories of definitions can be considered along 2 dimensions:

18

Definitions related to thinking processes and reasoning

Systems that think like humans	Systems that think rationally
Systems that act like humans	Systems that act rationally

Definitions related to behavior

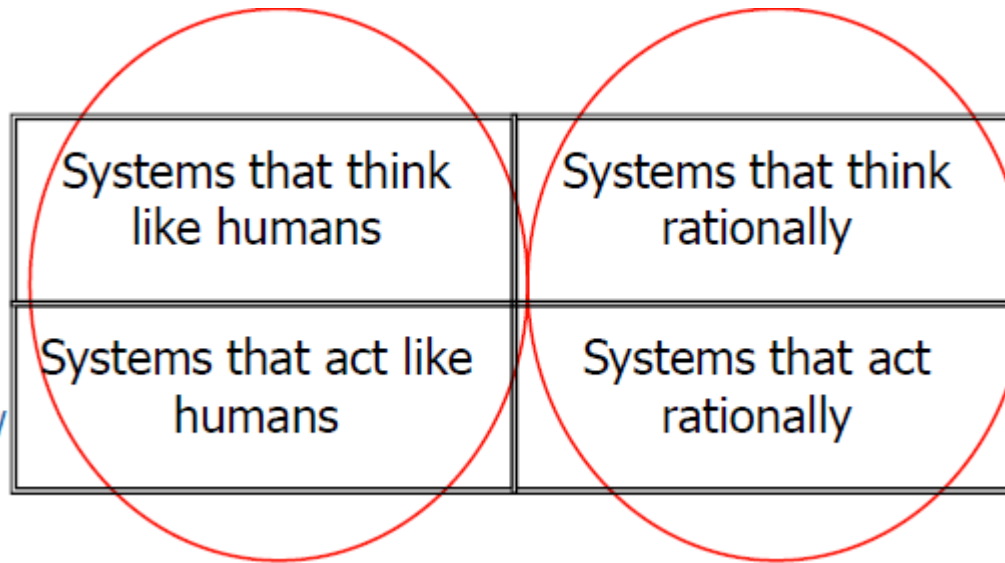




□ The other dimensions can be the following:

19

Definitions that evaluate a success of an intelligent artificial system in terms of human action/operation/performance



Definitions that evaluate a success of an intelligent artificial system in terms of an ideal intelligence called rationality





SYSTEMS THAT THINK LIKE HUMANS

20

- If we want to develop a **computer that thinks** like humans we need to know **how people think**
- **Cognitive science** integrates **computational models** developed in the area of artificial intelligence with **techniques from psychology** in order to simulate about how the human mental mind works





SYSTEMS THAT THINK RATIONALLY

21

□ This approach is related to logics, that is ,**logical rules** make the mental mind of humans

□ *For example,*

if we know that All people have ahead and Alexis one of people,

Then we can conclude that Alex has ahead





SYSTEMS THAT ACT LIKE HUMANS

22

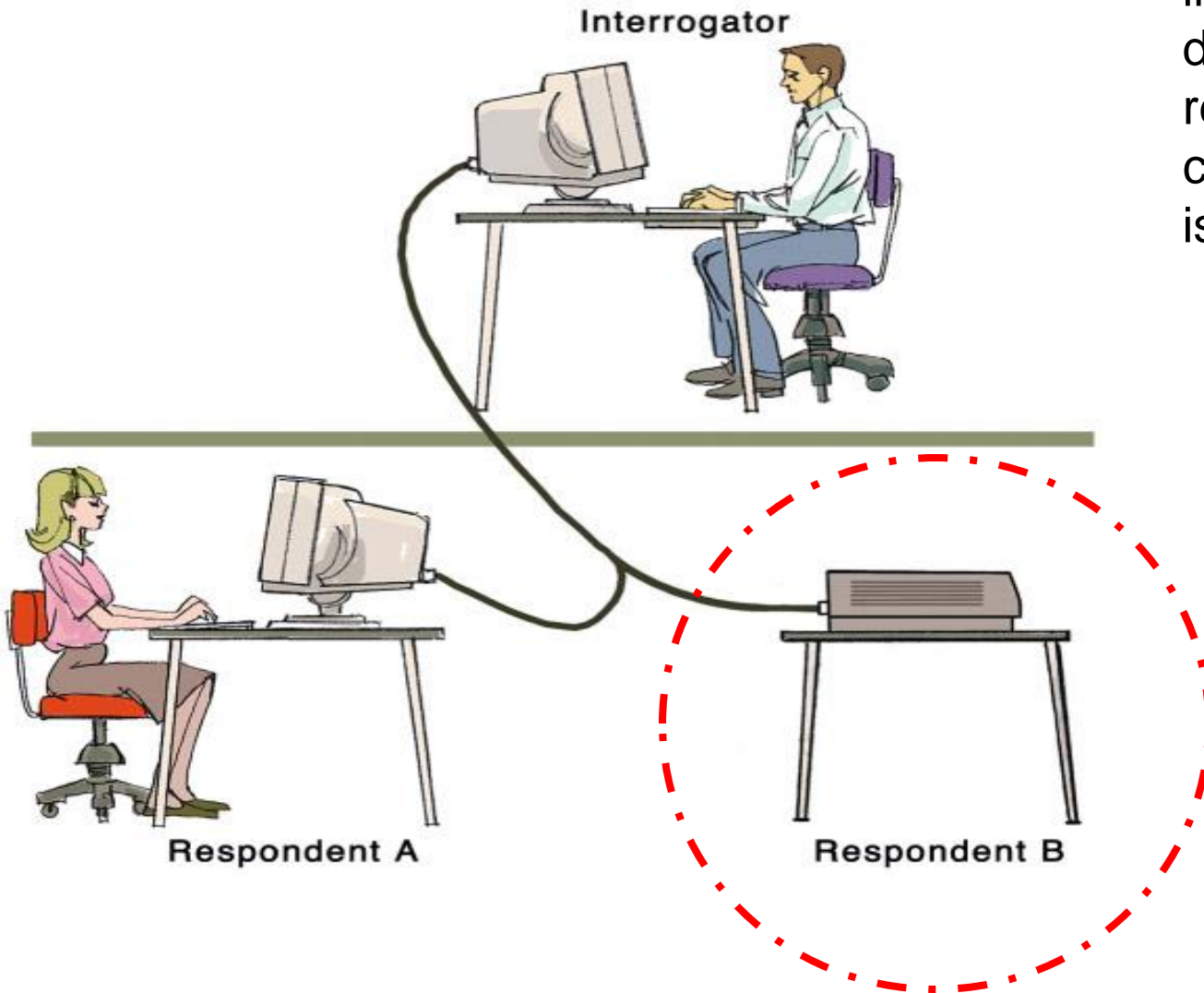
- In this approach computer capabilities are compared with human capabilities

- For this purpose a special **test of intelligent behavior** is defined. The test is called the **Turing test**

- The idea of the test is the following. There are 3 rooms.
 - ▣ In the first one there is an artificial intelligence,
 - ▣ in the second room-a person or natural intelligence,
 - ▣ and in the third room there is a tester.
 - ▣ The tester asks questions to both intelligences.
 - ▣ If it is impossible to determine which answers were given by the person and which ones by the machine, than the machine has intelligence



In a Turing test, the interrogator must determine which respondent is the computer and which is the human





SYSTEMS THAT ACT LIKE HUMANS (cont..)

24

□ To pass the Turing test the **computer** must have the following **capabilities**:

1. **Natural language processing**
2. **Knowledge representation**
3. **Automated reasoning**
4. **Machine learning**

• However ,the Turing test excludes direct physical contact between the machine and the tester. The so called **the Total Turing test** brings forward two more requirements:

1. computer vision in order to perceive objects, and
2. Robotics in order to move objects





SYSTEMS THAT ACT RATIONALLY

25

- A **rational agent** is one that acts so as to achieve the best outcome or, when there is uncertainty, the best expected outcome

- **Rational behavior** : doing the right thing
- The right thing which is expected to maximize goal achievement given the available information





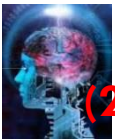
Research directions of artificial intelligence

26

Today there are 2 main research directions in artificial intelligence:

(1) BIONICS: approaches that have focus on humans and based on empirical knowledge acquired during different experiments

Systems that think like humans	Systems that think rationally
Systems that act like humans	Systems that act rationally



(2) PRAGMATIC DEVELOPMENT OF COMPUTER PROGRAMS: approaches based on rationality and combining mathematics and computer engineering



Dr. Abeer Mahmoud
(course coordinator)

Research directions of artificial intelligence

There are two main lines of research.

- One is biological, based on the idea that since humans are intelligent, AI should study humans and **imitate** their **psychology** or **physiology**.
- The other is phenomenal, based on studying and formalizing common sense facts about the world and the problems that the world presents to the achievement of goals.

Some real applications



Applied Areas of AI

29



- Game playing
- Speech and language processing
- Expert reasoning
- Planning and scheduling
- Vision
- Robotics



Siri



Voice Control

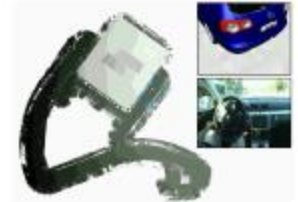
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Autonomous Intelligent Systems

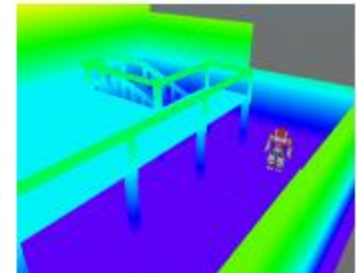
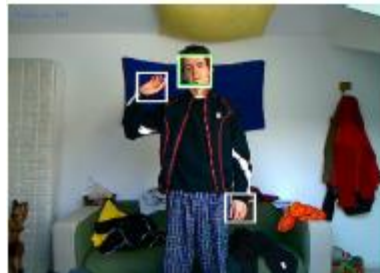
- Mobile robots
- Flying vehicles
- Adaptive techniques and learning
- Multi-robot systems
- Applications of mobile robots
- Interaction and Web interfaces





Humanoid Robots

- Resource-constrained systems
- Perception, state estimation
- 3D environment modeling
- Path planning and navigation in cluttered environments
- Natural human-robot interaction
- Human motion analysis
- Imitation of human motions





Social Robotics

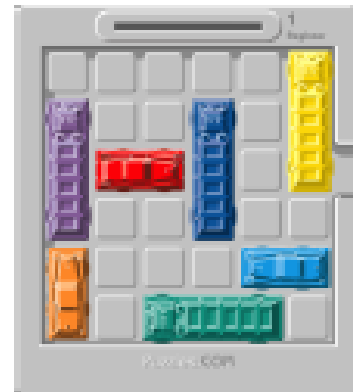
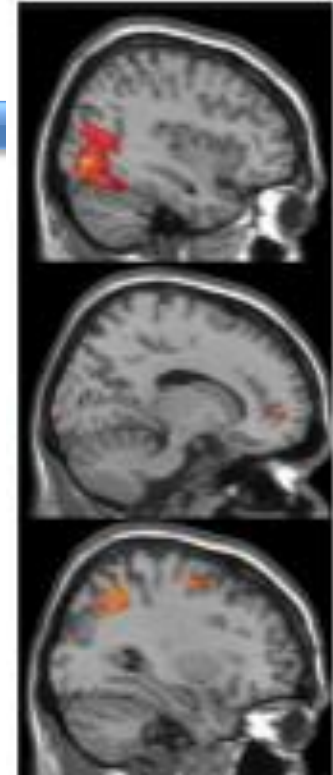
- Towards socially compatible robots
- Social learning, learning by observation
- People detection and track
- Motion planning
- Robot navigation
- Spatio-temporal models of human
- social behavior
- Human-robot interaction
- "Free robots from their social isolation"



Cognitive (الوعى)



- Cognitive models of human thinking, reasoning, and planning
- Qualitative Reasoning and imprecise knowledge
- Cognitive complexity analysis
- Behavioural and fMRI experiments
- Systems that solve IQ-test problems
- "Build systems that reason and plan like humans"





Diagnosing Diseases

- **Environment**
 - ▣ Patient information
 - ▣ Results of tests
- **Actions**
 - ▣ Choosing diseases
 - ▣ Choosing treatments
- **Doing the right thing**
 - ▣ Eliminating disease





Thank you



**End of
Chapter 1**

