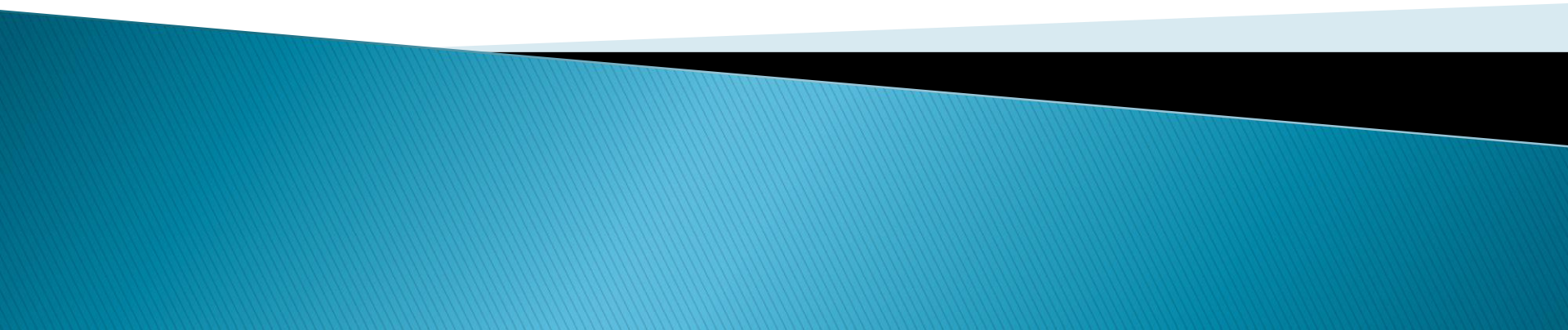
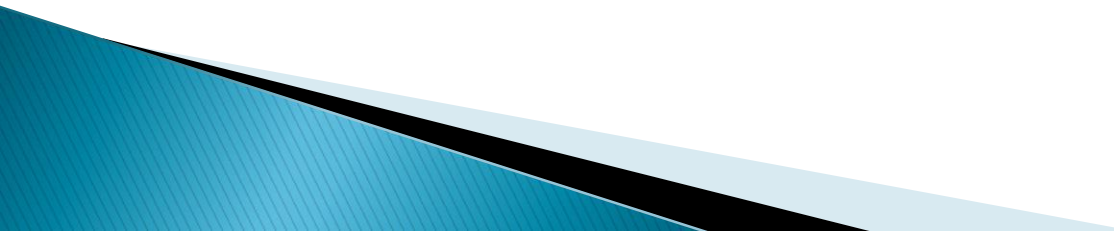


Artificial Intelligence

Lecture 1

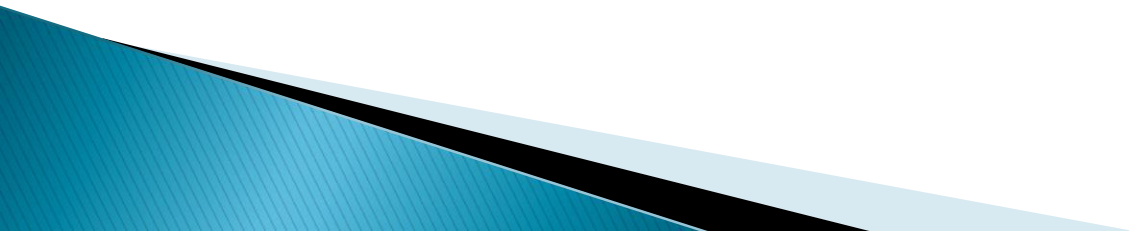


Administrative details

- ▶ Text: Artificial Intelligence: A Modern Approach (3rd edition), Stuart Russell and Peter Norvig
 - ▶ Lecturer: Derrick Peh
 - ▶ Email : dckpeh001@mymail.sim.edu.sg
 - ▶ Lecture timings: Thursday 8.30am to 11.30am
- 

Introduction

What do you think is
artificial intelligence?



Introduction

Thinking Humanly	Thinking Rationally
Acting Humanly	Acting Rationally

- What is the difference between acting and thinking?

Behavior

- What is the difference between Human and Rationally?

Thought processes and reasoning

Introduction

[ref:C3310 Study guide]

▶ Thinking Humanly

- ' ... effort to make computers think ... ' (Haugeland, 1985)
- '[The automation of] activities that we associate with human thinking ...' (Bellman, 1978)
- **The cognitive modeling approach**
 - Can we “copy and paste” a human mind into a machine?

Introduction

[ref:C3310 Study guide]

▶ Thinking Rationally

- 'The study of mental faculties through the use of computer models.' (Charniak and McDermott, 1985)
- 'The study of the computations that make it possible to perceive, reason, and act.' (Winston, 1992)
- **The “laws of thought” approach**
 - All modules are boring. C3310 is a module. C3310 is boring?

Introduction

[ref:C3310 Study guide]

▶ Acting Rationally

- ' ... the study of the design of intelligence agents.'
(Poole et al., 1998)
- ' ... intelligence behaviour in artifacts.' (Nilsson, 1998)
- **The rational agent approach**
 - **To achieve the best (expected) outcome**

Introduction

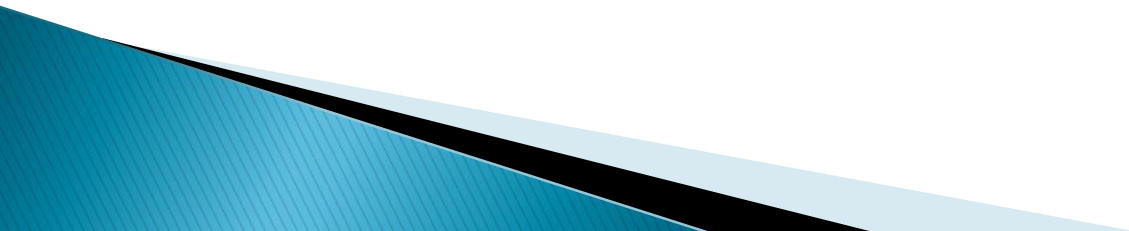
[ref:C3310 Study guide]

▶ Acting Humanly

- '... creating machines that perform functions that require intelligence when performed by people.' (Kurzweil, 1990)'
- ... how to make computers do things at which, at the moment, people are better.' (Rich and Knight, 1991)
- **The Turing Test approach**

Introduction

What do you think is
artificial intelligence?



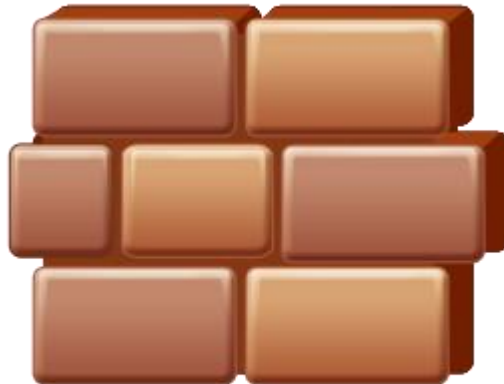
Goal of AI

- ▶ To understand and replicate human thought processes through computational modelling
 - Moved to *Cognitive Science*
- ▶ Alan Turing's famous 'Turing test' for intelligence
 - a program is judged **intelligent** if its **behaviour** cannot be differentiated from that of a human.

Cognitive Science: Inter-disciplinary field (AI, psychology, linguistics, philosophy, anthropology) that tries to form computational theories of human cognition

Turing's Test

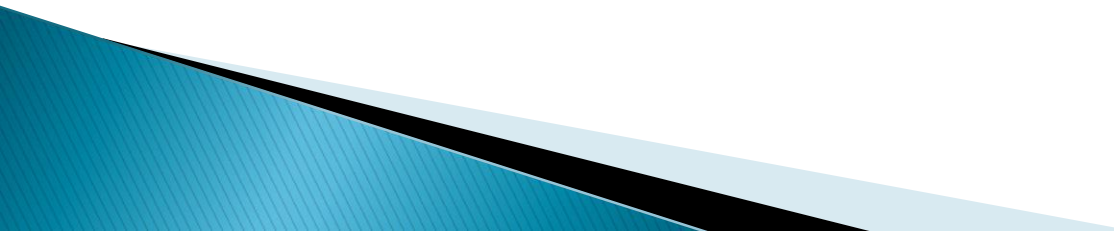
- ▶ Acting humanly: If the human cannot tell whether the responses from the other side of a wall are coming from a human or computer, then the computer is intelligent.



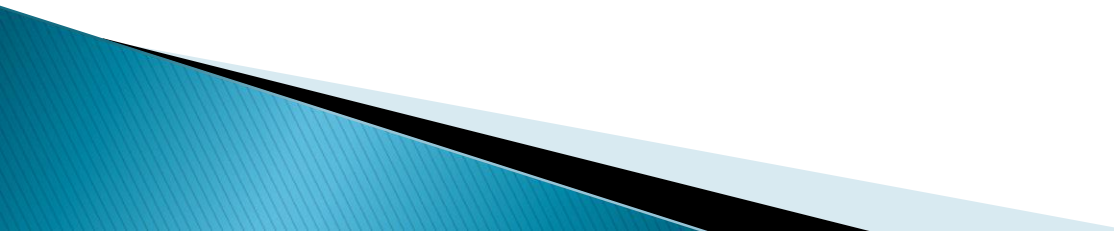
Current State of AI

- ▶ Most modern AI programs are instead designed to **act rationally**
 - Take the best possible action given their goals, knowledge and Constraints

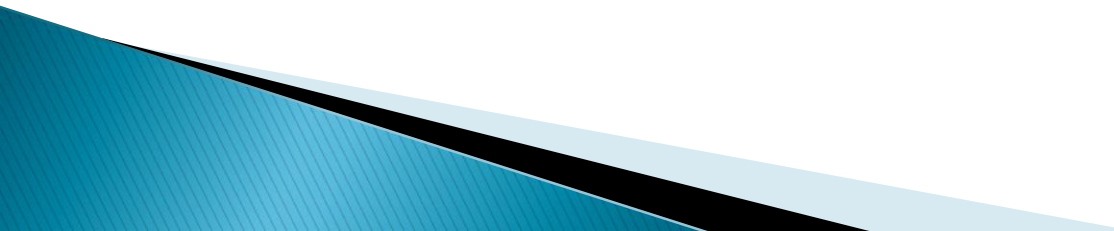
Current State of AI

- ▶ Why design to act rationally?
 1. It provides a concrete, objective measure against which performance can be judged and understood
 2. Not required to model poorly understood areas of human's odd habit /unusual feature
 3. Able to build systems that may be useful in situations in which humans do not always behave rationally
- 

Subfields of Artificial Intelligence

- ▶ The major subfields of Artificial Intelligence
 1. Problem solving
 2. Knowledge representation and reasoning
 3. Planning
 4. Learning
 5. Vision
 6. Natural language
- 

Subfields of Artificial Intelligence – Problem solving

- ▶ An agent is given a problem setting and a goal and must determine how to realize that goal
 - ▶ Example
 - Chess
 - Sudoku
 - Tower of Hanoi
 - ▶ Find a sequence of operations to produce the expected output from the initial input
- 

Subfields of Artificial Intelligence – Knowledge representation and reasoning studies

- ▶ How an agent can represent knowledge it has about the environment
- ▶ Uses it to derive further knowledge,
- ▶ Either using
 - a logic-based representation (when the knowledge is certain) or
 - a probabilistic representation
- ▶ Example
 - Self driving cars
 - Perception → **Knowledge representation** → reasoning
→ Planning → Execution

Knowledge representation and reasoning

- ▶ AI agents deal with knowledge (data)
 - Facts (believe & observe knowledge)
 - Procedures (how to process knowledge)
 - Meaning (relate & define knowledge)
- ▶ Right representation is crucial
 - Wrong choice can lead to project failure
- ▶ Examples
 - First order theorem proving... first order logic
 - Inductive logic programming... logic programs
 - Neural networks learning... neural networks

Subfields of Artificial Intelligence – Planning

- ▶ An agent is given knowledge of an environment and
- ▶ formulates a plan for interacting with it to achieve its goals.
- ▶ What is planning?
 - A collection of actions for performing some task
 - Example: assembling your new IKEA cupboard.
 - Programs are available to help humans formulate plans.
 - But it is difficult to generate plans automatically.
- ▶ Example
 - Self driving cars
 - Perception -> Knowledge representation -> reasoning -> Planning -> Execution

Subfields of Artificial Intelligence – Learning

- ▶ An agent improves its performance through experience.
 - ability to distinguish between categories of objects (supervised learning),
 - learning structure from raw data (unsupervised learning),
 - learning to maximise reward (or minimise cost) in an environment (reinforcement learning)

Subfields of Artificial Intelligence – Learning

- ▶ Learning denotes changes in a system that will enable the system to do the same task more efficiently next time.
 - Example: email spam detection system
 - Trained on email messages to learn to distinguish between spam and non-spam messages
 - After learning, it can be used to classify new email messages into spam and non-spam folders

Subfields of Artificial Intelligence – Vision

- ▶ Computer Vision is the science and technology of obtaining models, meaning and control information from visual data
- ▶ An agent interprets or processes raw visual images
 - How about videos?
 - Acquiring, analysing, processing and understanding images and videos
 - The Robocup tournament and ASIMO are examples of Artificial Intelligence using Computer Vision to its greatest extent.



Subfields of Artificial Intelligence – Natural language Processing

- ▶ Branch of computer science focused on developing systems that allow computers to communicate with people using everyday language
- ▶ An agent must process input in a natural language (e.g. English), or generate it.
 - Example: Siri
 - Challenges involving natural language understanding
 - How to enable computers to derive meaning from human or natural language input
 - Can music be a natural language?

Reading advice and Resources[ref:C3310 Study guide]

- ▶ Read all chapters as indicated in the essential reading at the beginning of each chapter in the study guide

Prescribed text : Artificial Intelligence: A Modern Approach (3rd edition), Stuart Russell and Peter Norvig

- ▶ Please refer to the Computing VLE for other resources, including past examination papers and **Examiner's reports** for this subject, which should be used as an aid to your learning.

About the subject guide[ref:C3310 Study guide]

- ▶ This subject guide is not a subject text.
 - ▶ It sets out a sequence of study for the topics in the subject, and provides a high-level overview of them.
 - ▶ It also provides guidance for further reading.
 - ▶ It is **not** a definitive statement of the material in the subject, nor does it cover the material at the same level of depth as the unit.
 - ▶ Students should be prepared to be examined on any topic which can reasonably be seen to lie within the remit of the syllabus, whether or not it is specifically mentioned in the subject guide.
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