

TASK BRIEF

What is AI for engineering systems: a literature review and presentation

Submission details:

Type:	Recorded presentation and small-group discussion.
Length:	10-minute presentation and 10-minute small-group discussion.
Weighting:	14% of the overall subject grade.
Due Date:	During the workshop class of semester week 4 (i.e., Mon 14 August 4:15-6:15pm).
Instructions:	<ul style="list-style-type: none"> • You must be physically present during your workshop session to complete the assessment. • After the workshop session you are required to upload to LMS your: recorded presentation, recorded small-group discussion and the presentation slides.

The following learning outcomes are demonstrated through this assessment activity:

- **ILO5)** Communicate and collaborate on AI and decision-making projects through formats such as: technical reports, presentations, and informational videos, and reflection.
- **ILO6)** Review and compare the variety of definitions, applications, and safety implications of AI for engineering systems.

PURPOSE STATEMENT

The terminology Artificial Intelligence was introduced in the 1950s and in recent years it has developed into a “buzz” word that sees very broad usage across media, marketing, and publications from virtually all scientific disciplines. As this subject is focused on AI for Robotics, the purpose of this assignment is to **explore the literature and implications of AI for Robotics and more broadly AI for Engineering Systems**.

The terminology *Engineering Systems*, for this assignment, refers to a system:

- Designed and built by a combination of the engineering disciplines and sub-disciplines, i.e., Civil, Mechanical, Electrical, Chemical, Biomedical, Aerospace, Aeronautical, Materials, Petrochemical, Nuclear, Environmental, Mechatronics, Electronics, Computer, Software Engineering.
- That has a physical real-world embodiment, i.e., not a purely software system.
- That has negative consequences on the health and safety of humans when it “goes wrong”.
 - The phrase “**go wrong**” can be interpreted in a broad sense, from spectacular failure -to- minor inefficiency -and- everything inbetween (and tangential).

To give a flavour for the intended scope of *Engineering Systems*, some examples are:

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| • Jointed robots | • Batteries |
| • Autonomous cars | • Skyscrapers |
| • Airplanes | • HVAC (Heating, Ventilation, and Air. Conditioning) systems of large buildings |
| • Cargo ships | • The electricity power grid |
| • Water treatment plants | • Steam turbines |
| • Pharmaceutical production lines | • Motor controllers and inverters |
| • The backbone network of the public internet | • Many, many, many more ... |
| • Oil and gas wells (offshore and onshore) | |
| • Nuclear power plants | |

Take a second to think about what can happen when any of these systems “go wrong”.

TASK DESCRIPTION

SUMMARY:

Your task is to deliver a 10-minute presentation on the topic of AI for Engineering Systems (see the purpose statement above for the working definition of an Engineering System). Immediately following the delivery of your presentation, you are required to guide a 10-minute small-group discussion on the topic you presented. The contents of your presentation should be based on a literature review about the usage and implications of AI for Engineering Systems.

DETAILS:

The following is **an example** of how you could approach this task:

- Choose a specific Engineering System to focus on.
- Search literature for how AI is generally used for your chosen Engineering System.
- Search literature for a **deeper dive** into some details for your chosen Engineering System, **for example**, you could focus on one or more of the following:
 - Details of an incident where the AI algorithm being used caused things to “go wrong” for your chosen engineering system.
 - Cutting-edge research and current research trends for applying specific AI methods to your chosen Engineering System, **for example**:
 - * Highly cited publications in the past 3 years.
 - * Closely related topics appearing across many publications in the past 3 years.
 - * Publications in the past 18 months from “big name” academics in that discipline.
 - * Open research questions and future directions appearing across multiple recent publications.
- Prepare a 10-minute presentation that includes the following:
 - **Briefly present (approx. 2 mins) the chosen Engineering System** using block diagrams to describe the overall system and to introduce/motivate the AI aspects of the system.
 - **Present a deeper dive (approx. 8 mins) in the details that you investigated, for example**:
 - * For safety implications and incidents, this could include:
 - **Discuss** safety implications and verification procedures for AI usage in that particular engineering system.
 - **Discuss** an example when something went “wrong”, including details of how the incident was resolved and what has happened/changed since.
 - * For cutting-edge research and research trends, this could include:
 - **Discuss** the state-of-the-art for research of AI for that particular Engineering System, including details of what new possibilities such research has enabled.
 - **Discuss** open research questions of AI for that particular Engineering System, including any topic that you may wish to pursue as part of the final project for this subject.
 - **Conclude** your presentation by posing discussion questions and/or conundrums and/or and/or ethical dilemmas and/or provocative statements, with the goal to use these for driving the 10-minutes of small-group discussion that immediately follows your presentation.

NOTE:

You are **NOT required** to follow the approach detailed above. If you feel any concern that an alternative approach you wish to follow is not matched to the expectations of this task (see the marking rubric below for details), then discuss your intended approach with the teaching team.

PRESENTATION LOGISTICS

- During the workshop session on **Monday 14 August**, we will divide the class into groups of 4-6 students.
- In your groups:
 - You take turns at delivering your presentation. The range of **acceptable presentation duration is 8-12 minutes**.
 - After each presentation:
 - * **the presenter has the responsibility** to lead the group in a 10-minute discussion about the topic that was presented.
 - * **the audience has the responsibility** to meaningfully participate in the discussion as guided by the presenter.
 - **You must record both** your presentation and the subsequent small-group discussion to your personal device (or to the device of another member of your group).
 - An external web-cam and tripod will be provided to each group to assist with getting a nice perspective for the recording.
- After the workshop session you must upload to LMS the recording of your presentation and the subsequent small-group discussion that you guided.
- This recording will be viewed and graded by the teaching team. Additionally, the recording is valuable for you to later reflect on aspects of your presentation.
- **You are responsible for ensuring the recording works**, hence perform a test before presentation day, and double check the recording during the workshop session.

CRITERIA GUIDANCE

- Each of us has a different prior knowledge and perspective on the topics explored by this assessment. Use this assignment as **an opportunity** to broaden your perspective based on literature and to share that with others through your presentation and guided discussion.
- A goal of the **cutting-edge research and research trends** option is that you may uncover a research question that you can pursue in the final project of this subject, or perhaps that you can take with you to other research endeavors.
- You can use **any mixture of presentation format** that is appropriate, i.e., something different for purely talking through PowerPoint slides for 10 minutes. **For example:**
 - For parts of your presentation you could show full screen video content that you obtain from some source and you narrate the video, possibly pausing at appropriate points to explain the details of that scene.
 - Some blank (or mostly blank) slides that you draw on as you present.
 - Alternating between presentation and discussion for your 20-minute window.
- Your framing of the autonomous decision making algorithms that you describe **should be more** precise than the generic “AI” labelling. **For example**, the following two articles provide useful terminology and context:
 - Michael Jordan’s opinion piece titled [“AI - the revolution hasn’t happen yet”](#) (published April 2018)
 - Russel & Norvig’s introduction to AI in Chapter 1 of their textbook [Artificial Intelligence: A Modern Approach](#) (4th edition published 2021) (you are able to access an online version of the textbook [through the UniMelb library](#)).
- Additionally, the **deeper dive** aspect of the presentation is expected to go **deeper than just** a labelling of algorithms used (i.e., deeper than just the labelling PID, MPC, DQN, SAC, etc.). You are expected to **dive deeper into** parameters selection, engineering design trade-offs, and system operation as appropriate to the topic that you are presenting in-depth.
 - For the example of reviewing recent research papers, a deeper dive **could include details and interpretations** of theorems and/or numerical examples from the paper, i.e., **more than** just the “generic description” from the abstract or conclusion.

- Expectations for citations/reference given in your presentation material:
 - Citations/reference within the presentation slides are **NOT** required to adhere to any particular citation style and hence can be adjusted to suit the style of the slide. All citations/references **MUST** be hyperlinked to where the material can be accessed.
 - You **MUST** include one slide (or multiple if required) at the end of the presentation slide-deck that collects together all the references used, presented in a citation style of your choosing, and each one with a hyperlink to where the cited material can be accessed.

USAGE OF GENERATIVE AI TOOLS

- You are allowed to use ChatGPT (or similar) to assist with finding literature for you to read.
- You should fact check anything that ChatGPT “says”. It is a widely acknowledged and demonstrated fact that ChatGPT can provide false and make-believe details, and fake references.
- References within your presentation that are non-existent or unreasonable will reduce your overall grade for this assignment.
- As per university policy, and hence as per the integrity that employers expect in their graduate employees, if ChatGPT (or similar) has generated something that you submit, then this should be appropriately referenced. For example:
 - If you use ChatGPT (or similar) to prepare a script for all, or part of, your presentation, then this **MUST** be clearly stated on your presentation slides.
 - If text and/or images on the presentation slides were generated by ChatGPT or DALL.E or similar, then this **MUST** be clearly stated on the slides.

MARKING RUBRIC

10% of the overall subject marks are awarded for the quality of your recorded presentation and its contents according to the following rubric criteria:

Criteria	Weighting	Aspects assessed by each criterion
Literature review quality	80%	<ul style="list-style-type: none"> • Clarity and technical preciseness for the overview provided of the chosen Engineering System. • Depth of literature review for the details of a deeper dive (for example: safety implications and an incident for the chosen Engineering System; or interpretation of cutting-edge research details for the chosen Engineering System).
Presentation quality	20%	<ul style="list-style-type: none"> • Clarity of information communicated. • The degree to which the presentation material supports and enhances the information communicated verbally, and vice versa. • Quality of referencing within the slide-deck

4% of the overall subject marks are awarded for the manner in which **you, as the discussion leader**, facilitate and guide the small-group discussion. **You are expected** to do some of the following to actively drive the small-group discussion:

- Prompts on you presentation material that kick-off lively and meaningful discussions.
- You, as the discussion leader, bring the group back “on track” if the conversation diverges to meaningless or tangential topics.
- If the group goes silent, then you provide additional discussion prompts that probe the group.
- You, as the discussion leader, actively invite quieter group members to contribute.
- You, as the discussion leader, are open to alternative points of view.
- You, as the discussion leader, provide clear explanations for your position, and additional technical details as appropriate.