

COS40007 Design project

COS40007 students are expected to undertake a design project on a focused topic of AI for Engineering. Students will get a lot of example sample data to work with on their projects. Students are also encouraged to collect similar data by their own if available. This document contains a summary description of each project. More detailed description related to the project topics will be covered in Week 4 and Week 5 Seminar.

A. Grouping Rules

- A group needs to be formed to complete the design project
- The group should contain 4-5 students.
- The group must be formed within same studio session. Formation of group between students of multiple studio session will be not allowed unless there is a special consideration. If you have changed your studio session to a different one you are registered please inform this to your tutor so you can attend in the group of studio session you generally attend
- Group are expected to produce the following outcome
 - project brief
 - data labelling
 - data exploration and data pre-processing
 - training and validation of machine learning/deep learning models
 - evaluation of machine learning/deep learning models
 - an AI demonstrator of final selected model
 - project presentation
 - a final report

B. Rubric, Report and Project Progress

- A rubric for the design project will be available around mid-semester
- An outline of final report will be available after mid-semester
- Part of studio session after mid-semester will be utilised to review and discuss design project progress

C. Project Topics

- The topics capture the overall project goals to solve AI problem in Engineering, but do not define specification like portfolio tasks on how the project should be undertaken.
- You should apply your knowledge and skills you acquired in this unit to complete your project
- Project groups are expected to study on the topic and come up with a project brief and project plan
- Project groups have their own freedom to choose technology components

D. Project Themes

Project Group are expected to select from one of the following topics for a given theme. Please submit your group members name, Student numbers, studio session and your choice of 3 project theme in this [google form](#) by 26 August 12 PM. You will be assigned in one of your selected projects. Please note that, the first preference will not be guaranteed. We will distribute the project such a way that each studio session can have all 5 projects.

Theme 1: Smart City / Civil and construction engineering

AI areas: Deep Learning, Machine Learning, Object classification, Anomaly detection

Format of Data: Roadside Images of city

Topic: Detecting roadside asset issues identifying objects causing the issues using roadside image data.

Description: Using image data obtained from on board cameras on vehicles, detect issues of roadside assets, such as damaged road signs, dumped rubbish etc. The project group will get some exiting image data, however, will need to label it. They are also encouraged to collect own data from online or by taking photos of their own.

Key Question to Answer

1. What roadside issue is detected by your model (e.g. damaged road sign, dumped rubbish)
2. What is the type of the detected issues (for damaged sign is it bent, cracked or graffiti etc.; for dumped rubbish, what sort of rubbish (e.g., mattresses, couch, char table, toy etc.)

Input and Output of final AI model

Input: an image file

Output:

1. Identified issues along with confidence score
2. Identified objects/ detects along with confidence score

Theme 2: Electronics Engineering / Biomedical Engineering

AI areas: Machine Learning, Activity Recognition, Feature Engineering, Predictive analytics

Format of Data: Raw motion data from sensors

Topic: Detecting Worker's activity along with knife sharpness using body worn sensors to understand worker's productivity and safety in manufacturing plant.

Description: Using motion data obtained from body worn sensors in different body position, detect worker's activity such as cutting, slicing along with knife sharpness quality. The project group will get existing data but need to label by themselves.

Key Question to Answer

1. What activity is detected by your model (e.g., cutting, slicing, idle)
2. What is the quality of the knife (blunt, medium, sharp) and predict when to sharpen the knife

Input and Output of final AI model

Input: raw sensor data of 1 minute

Output:

1. Identified worker's activity
2. Identified knife sharpness and recommendation for next state of the sharpness

Theme 3: Product manufacturing / Mechanical Engineering

AI areas: Machine Learning, Prescriptive analytics

Format of Data: Machine sensors and machine settings data during production run of product

Topic: Recommend machine settings values that can lead desired product consistency during production process.

Description: Using machine sensors and machine settings data during production run of manufacturing vegemite develop ML models which can recommend machine settings value to get desired product quality during production. You will also need to detect anomalies (production downtime) during production run. The project group will get existing data however need to label the data by themselves.

Key Question to Answer

1. What are the recommend values of machine settings during production process for different class of product quality
2. What anomalies can occur in production process for which a production run can fail

Input and Output of final AI model

Input: current machine sensor and machine settings

Output:

1. Recommended machine settings values to get desired product quality

2. Detected anomalies that can happen with current settings

Theme 4: Structural Engineering / Chemical Engineering

AI areas: Deep Learning, Defect detections

Format of Data: Images containing structural defects

Topic: Structural defects detection

Description: Using image data of structural defects (such as corrosion in bridge, crack in solar panel) identify defects and classify them. The project group will get some exiting image data, however will need to label it. They are also encouraged to collect own data from online or by taking photos of their own.

Key Question to Answer

1. Is there any structural defect detected by your model
2. What type of defect it is (e.g.: corrosion, crack)

Input and Output of final AI model

Input: An image file

Output:

1. Detection of object containing defect along with confidence score
2. Identified type of defects along with confidence score

Theme 5: Electrical Engineering / Telecom Engineering

AI areas: Machine Learning, Clustering, Predictive analytics

Format of Data: 5G network performance data in CSV format

Topic: Grouping of zone based on 5G network performance and prediction of 5G network performance

Description: Using 5G network performance data (such as throughput, Latency) identify geographical zone (from longitude and latitude) with different performance level. Also predict network performance of zone using time-series data. The project group will get some existing network performance data.

Key Question to Answer

1. How many groups can be categorised using 5G network performance and their location. What are the key properties of each group
2. Prediction value for a given network performance data

Input and Output of final AI model

Input: 5g network performance values

Output:

1. The group and zone the data belongs to
2. The prediction of network performance for the next period