

## COS40007 Artificial Intelligence for Engineering

### Week 5 Studio Activities

<b>ILO</b>	Understand Deep Learning using Tensorflow and Kears.
<b>Aim</b>	<ul style="list-style-type: none"> <li>Learn what is CNN (Convolutional Neural Network)</li> <li>Learn how to label object image data using labelling tool</li> <li>Learn how to train a CNN model using labelled data and use it for classification and Object detection</li> </ul>
<b>Resources</b>	<p>Books:</p> <ol style="list-style-type: none"> <li>Prosise, Jeff. Applied machine learning and AI for engineers. " O'Reilly Media, Inc.", 2022.</li> <li>Raschka, Sebastian, Yuxi Hayden Liu, and Vahid Mirjalili. Machine Learning with PyTorch and Scikit-Learn: Develop machine learning and deep learning models with Python. Packt Publishing Ltd, 2022.</li> </ol> <p>Web Resources:</p> <ol style="list-style-type: none"> <li><a href="https://www.geeksforgeeks.org/convolutional-neural-network-cnn-in-machine-learning/">https://www.geeksforgeeks.org/convolutional-neural-network-cnn-in-machine-learning/</a></li> <li><a href="https://github.com/labelmeai/labelme">https://github.com/labelmeai/labelme</a></li> <li><a href="https://www.geeksforgeeks.org/residual-networks-resnet-deep-learning/">https://www.geeksforgeeks.org/residual-networks-resnet-deep-learning/</a></li> </ol>
<b>Requirements for to be marked as complete</b>	Demonstrate the data you labelled to your tutor to access your data labelling quality.

Note: It is recommended that, students use Google CoLab or other free GPU computing environment to complete activities 2-4 of this studio.

### Studio Activity 1: Class labelling

In this studio activity we will learn how we can generate ground truth information by labelling our desired class though annotation. We will learn how to annotate image data at

- 1) Image level so your classification algorithm will classify the entire image
- 2) Object level so your classification algorithm will identify your targeted object (e.g., car, people) in the image file

## Rust dataset

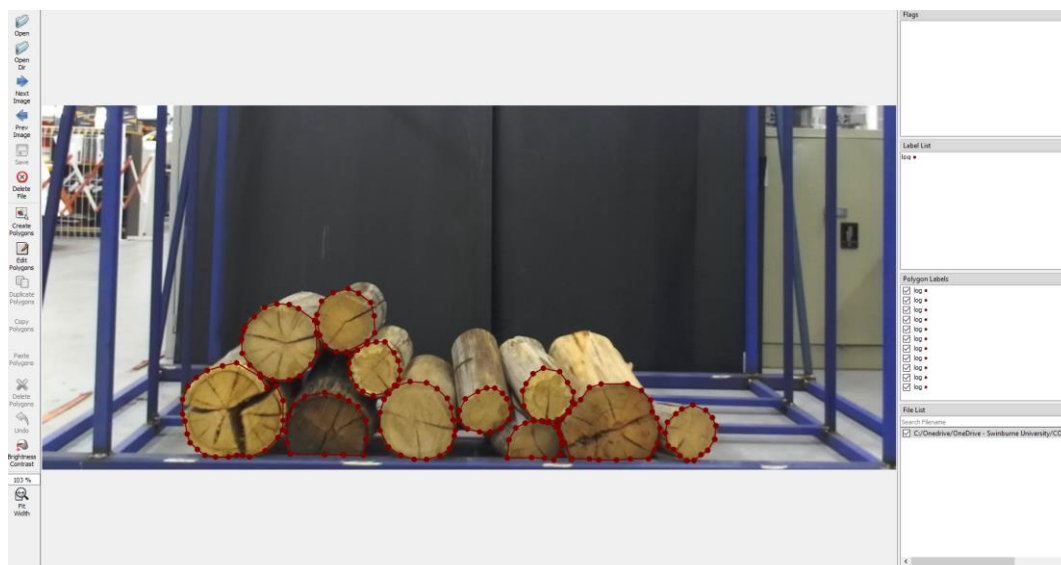
- The objective of our image classification problem is to identify whether the structural asset image contains rust (corrosion) or no rust.
- The image dataset of this is located here: [Corrosion-dataset](#) however data are not labelled (rust/ no rust)
- Some example labelling or annotation of rust and no-rust is provided here: [Corrosion](#)
- Based on the example labels you are required to label (or alternatively it is called as annotation) the data located in [not labelled](#).
- Randomly take 10 images from [not labelled](#) and label them by placing them in 2 folder 'rust' or 'no rust'.

## Log dataset

As part of your studio 1 activity you supposed to installed labelme on your machine. It is a python-based image annotation tool. More details are [here](#).

The image dataset for wooden log is located in [log-images](#). A sample labelme annotation can be found in [log-labelled](#). You can copy this folder to your local machine.

- To open the labelme GUI, from your command line type labelme.
- Now open the folder [log-labelled](#) from labelme (using open dir). You should able to see the annotation of wooden log for one image and how it is done using polygonal annotation



- Now you will need to perform similar annotation task of wooden logs for the images located in [log-images](#).
- Randomly pick 5 images and annotate all the logs in those 5 images using polygonal annotation. Take help from your tutor if you are unsure how you can annotate.

### **Studio Activity 2:** Develop your custom CNN for image classification

Follow this [tutorial](#) to understand how you can develop your own CNN model to train a test dataset. For this dataset minst dataset is used. Try to create and run this code on your own environment.

### **Studio Activity 3:** Transfer Learning with RestNet for image classification

Follow this [tutorial](#) to understand how you can use a pre-trained model to train with your own data and build a deep learning mode. For this dataset cat and dog images are used for classification. Try to create and run this code on your own environment.

### **Studio Activity 4:** Recursive CNN for object detection

Follow this [tutorial](#) to understand how you can use a CNN for object recognition using a pretrained recursive CNN model. For this dataset kangaroo images are used as target object. Try to create and run this code on your own environment.

### **Next Steps:**

In this studio you have learned how to label image data and how you can use different deep neural network for image classification and object recognition. In the portfolio assessment task you will use the type of data that we labelled in this studio to develop CNN for image classification (in our case rust and no rust for image classification and wooden logs for object recognition) Please follow the spec of portfolio task. The assessment Task for Week 5 now can be attempted and submitted via Canvas