# Kissipo Learning for Deep Learning

## Topic 17: Automated Optical Inspection (20min)

Hsueh-Ting Chu

KLDL-W6-T17

# Course Schedule

- W1 - Course Introduction

- W2 - DL Programming Basics(1)

- W3 - DL Programming Basics(2)

- W4 - DL with TensorFlow

- W5 - Midterm

- W6 - DL with PyTorch

- W7 - AOI hands-on project

- W8 - RSD hands-on project

- W9 - NLP hands-on project

- W10 - Final exam

DL: Deep Learning
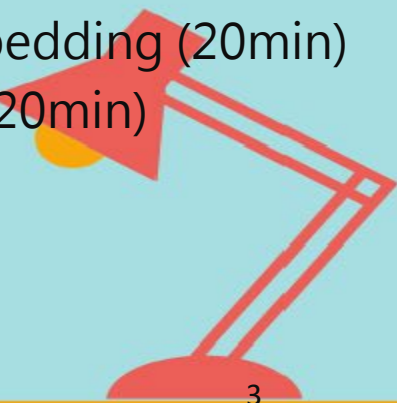AOI: Automated Optical Inspection
RSD: Road Sign Detection
NLP: Natural Language Processing

# Topics

- Topic 01: Introduction to Deep Learning (20min)
- Topic 02: Kissipo Learning for Deep Learning (20min)
- Topic 03: Python quick tutorial (20min)
- Topic 04: Numpy quick tutorial (15min)
- Topic 05: Pandas quick tutorial (15min)
- Topic 06: Scikit-learn quick tutorial (15min)
- Topic 07: OpenCV quick tutorial (15min)
- Topic 08: Image Processing basics (20min)
- Topic 09: Machine Learning basics (20min)
- Topic 10: Deep Learning basics (20min)
- Topic 11: TensorFlow overview (20min)
- Topic 12: CNN with TensorFlow (20min)
- Topic 13: RNN with TensorFlow (20min)

- Topic 14: PyTorch overview (20min)
- Topic 15: CNN with PyTorch (20min)
- Topic 16: RNN with PyTorch (20min)
- Topic 17: Introduction to AOI (20min)
- Topic 18: AOI simple Pipeline (A) (20min)
- Topic 19: AOI simple Pipeline (B) (20min)
- Topic 20: Introduction to Object detection (20min)
- Topic 21: YoloV5 Quick Tutorial (20min)
- Topic 22: Using YoloV5 for RSD (20min)
- Topic 23: Introduction to NLP (20min)
- Topic 24: Introduction to Word Embedding (20min)
- Topic 25: Name prediction project (20min)

# Week 7 Topics

- Topic 17: Introduction to AOI (20min)

- Topic 18: AOI simple Pipeline (A) (20min)

- Topic 19: AOI simple Pipeline (B) (20min)

# AOI machine
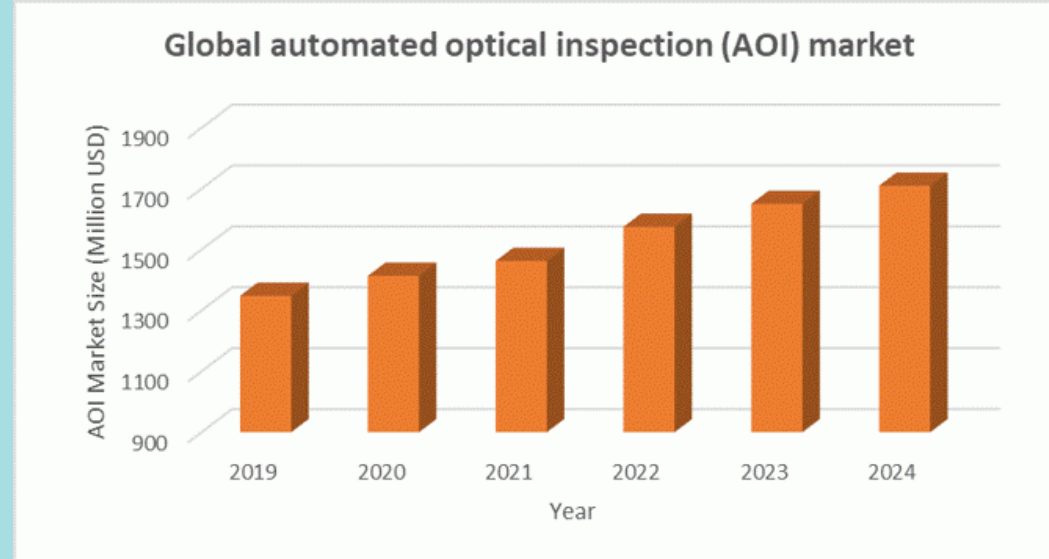


Automated optical inspection machine

Automated optical inspection (AOI) is an automated visual inspection of printed circuit board (PCB) (or LCD, transistor) manufacture where a camera autonomously scans the device under test for any quality defects.

It is commonly used in the manufacturing process because it is a non-contact test method.

https://en.wikipedia.org/wiki/Automated_optical_inspection

# Automated Optical Inspection System Market



Global automated optical inspection (AOI) market

**Global automated optical inspection (AOI) market** was valued to be **1,348 million USD in 2019**. On the other hand, the automated optical inspection (AOI) market size is anticipated to have a growth with **the CAGR of 4.87%** in the coming years to reach **1,709 million USD in 2024**.

https://aoi-spi.com/automated-optical-inspection-market/

# Types of Automated Optical Inspection
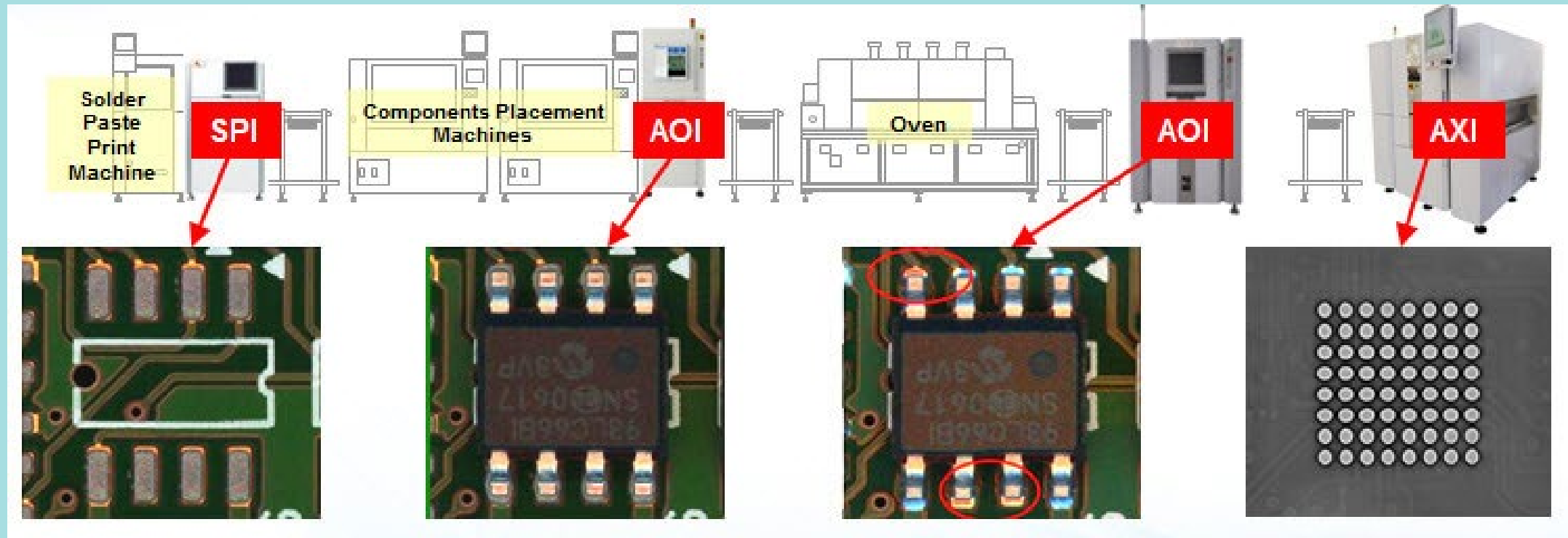


SPI (Solder Paste Inspection)
AOI (Auto Optical Inspection)
AXI (Automatic X-ray Inspection)

# AOI Machine Learning model
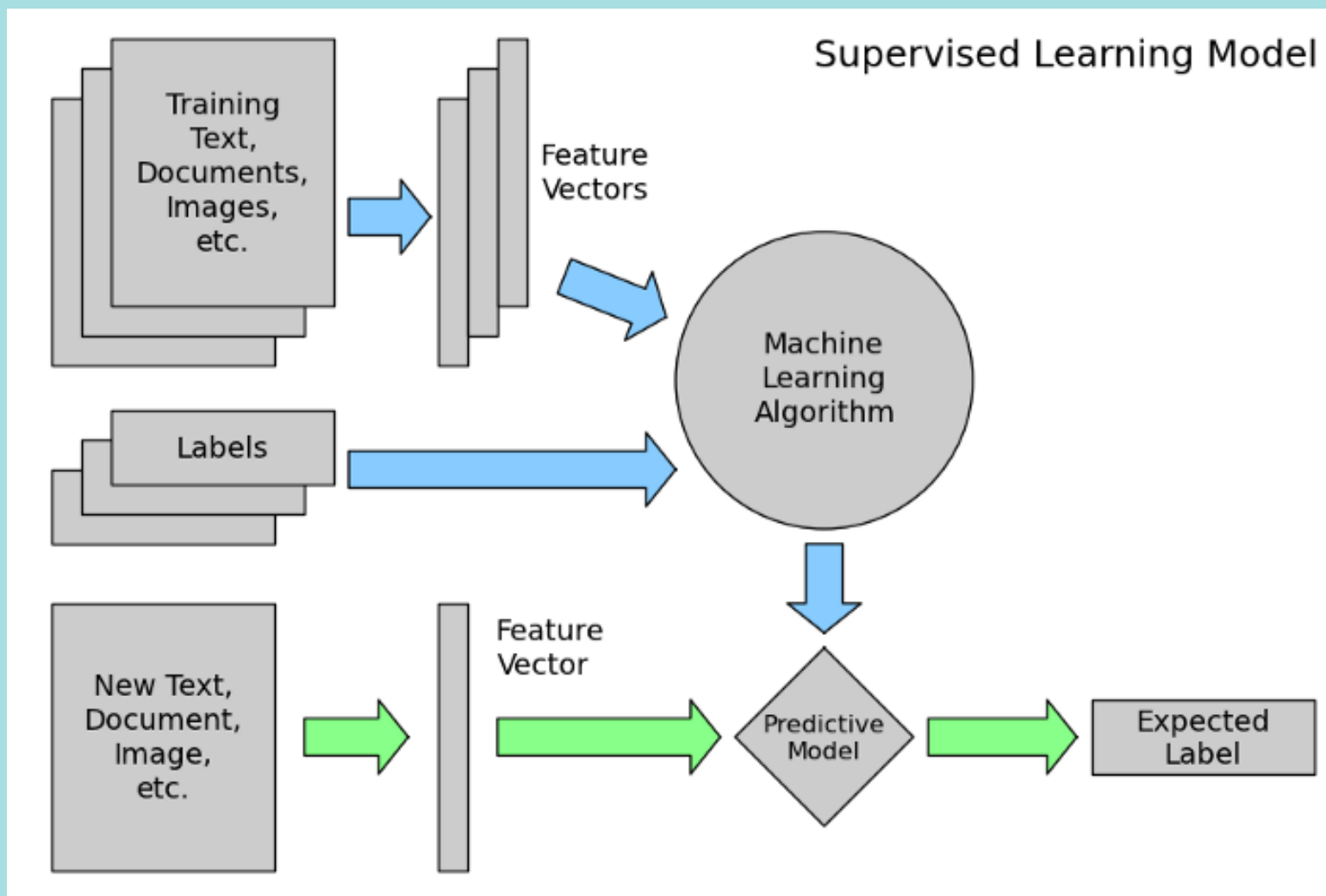
# AOI with Deep Learning models
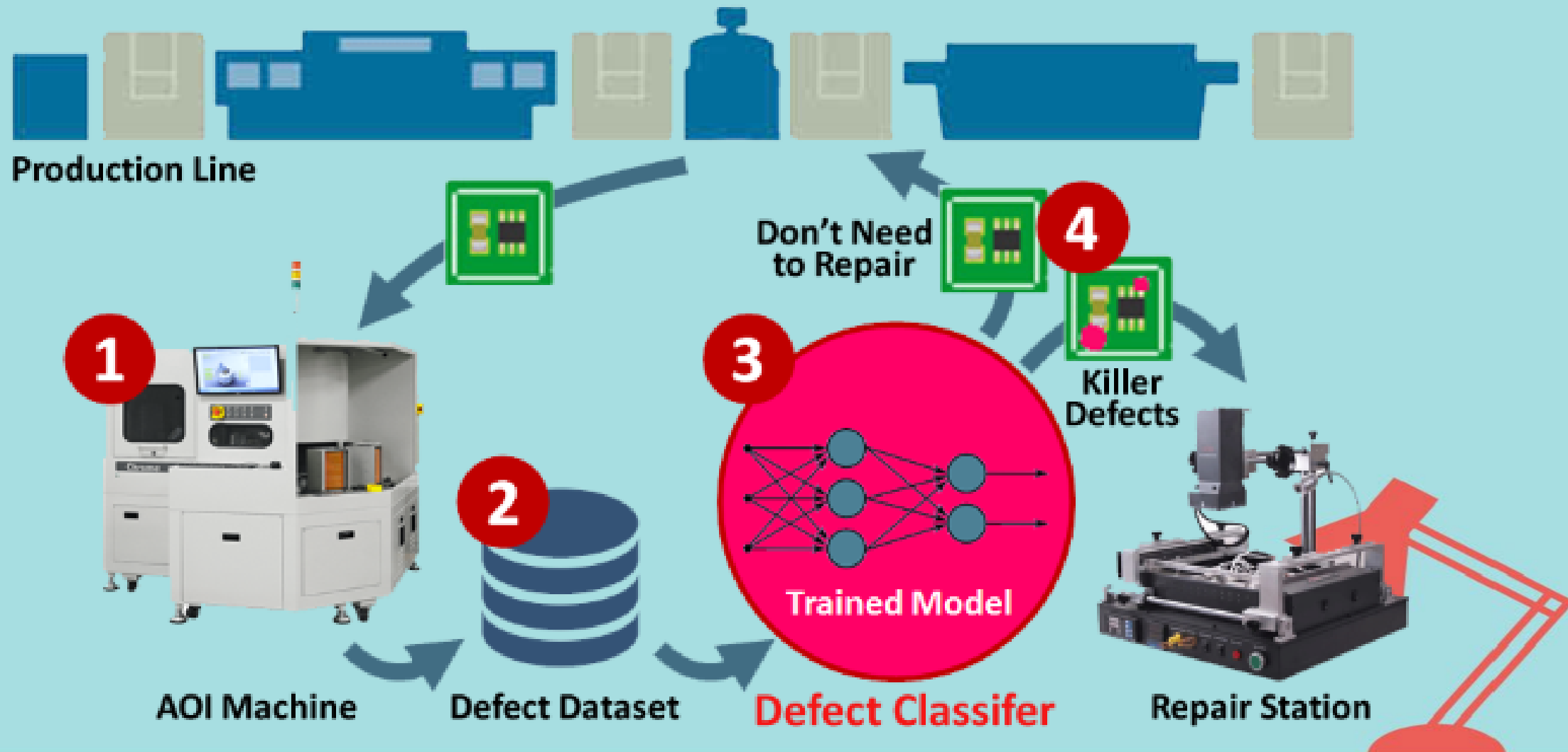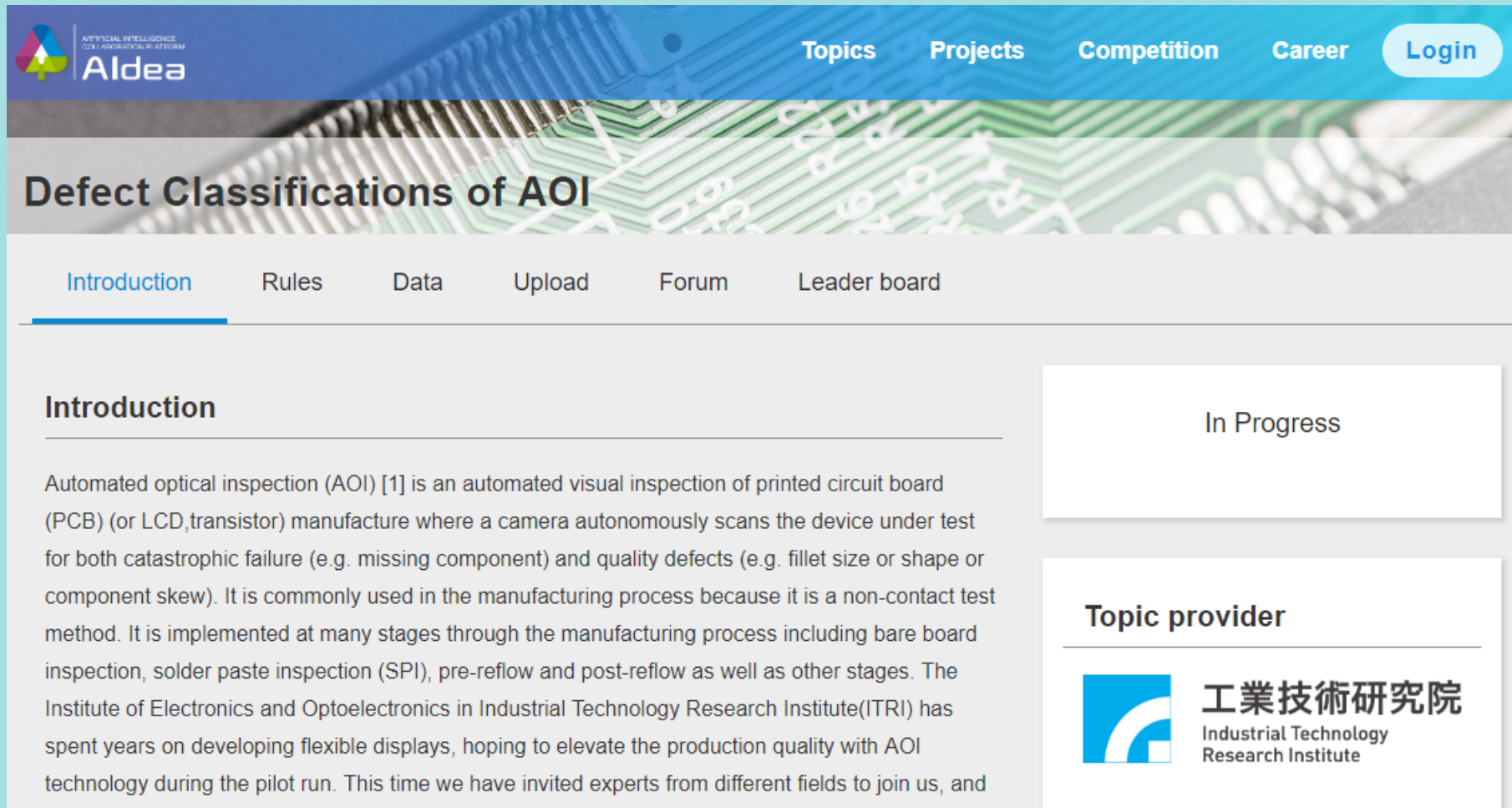
# AOI errors

- Underkill rate: Bad->Good
- Overkill rate:    Good->Bad

- In traditional AOI inspection methods, in order to prevent passing defective objects, parameters are usually set strictly, leading to many overkill situations. Therefore, it is still necessary to have human re-check with traditional methods.

# Open Topic: Defect Classifications of AOI

# Defect Classifications of AOI

# Aidea platform

- Artificial Intelligence Collaboration Platform by ITRI(Industrial Technology Research Institute)

- Solving real AI industrial issues in Taiwan

- Building AI industrial datasets in Taiwan
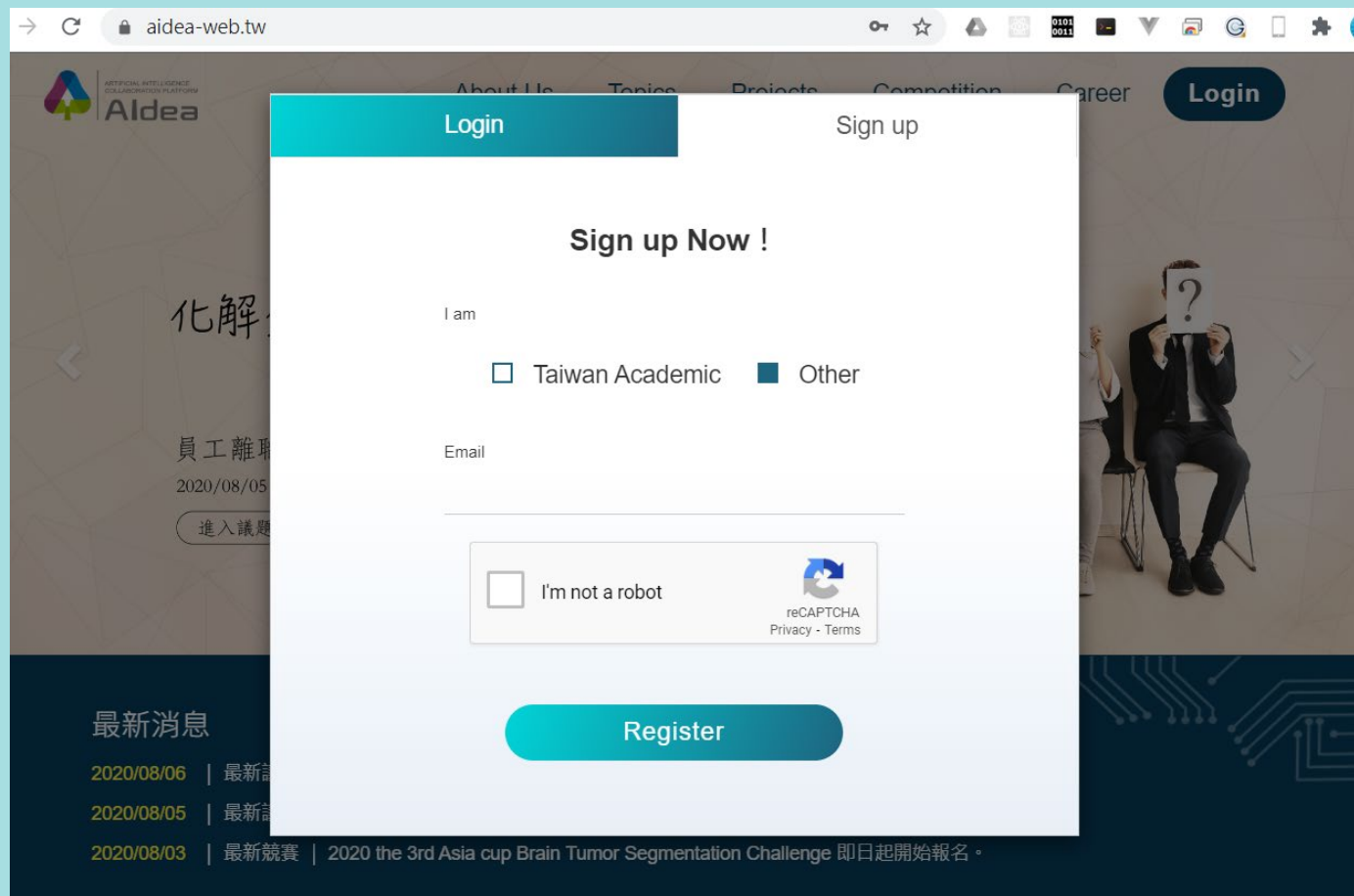
# AOI data discription

There are 6 categories included in image data that the issue offers
 (1 normal category + 5 defect categories)

The download data file (aoi_data.zip) includes:

- train_images: image data for training (PNG format), 2,528 images in total.
- train.csv: includes 2 columns, ID and Label.
  - ID: the image filename
  - Label: defect classification category
    (0: normal, 1: void, 2: horizontal defect, 3: vertical defect, 4: edge defect, 5: particle)
- test_images: image data for testing (PNG format), 10,142 images in total.
- test.csv: includes 2 columns, ID and Label.
  - ID: the image filename
  - Label: Nan

# Prepare to register AIdea projects

# Download the AOI Dataset

https://aidea-web.tw/topic/285ef3be-44eb-43dd-85cc-f0388bf85ea4

# Check the dataset

- aoi.zip→unzip
  - test.csv
  - test_images.zip →unzip
  - train.csv
  - train_images.zip →unzip
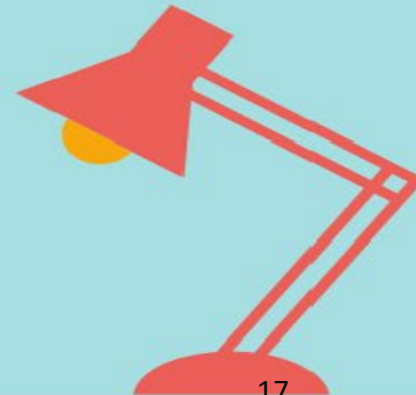
# The folders and files

# The training dataset - train.csv

# Classes of images



0 (normal),　　1 (void),　2 (horizontal defect)

3 (vertical defect),　4 (edge defect),　5 (particle)
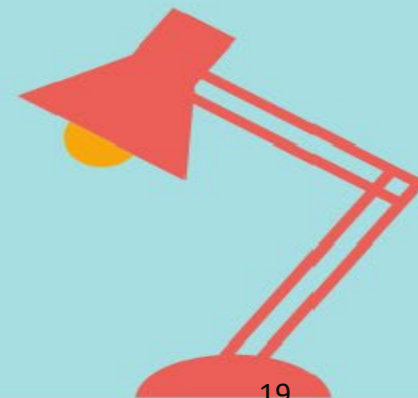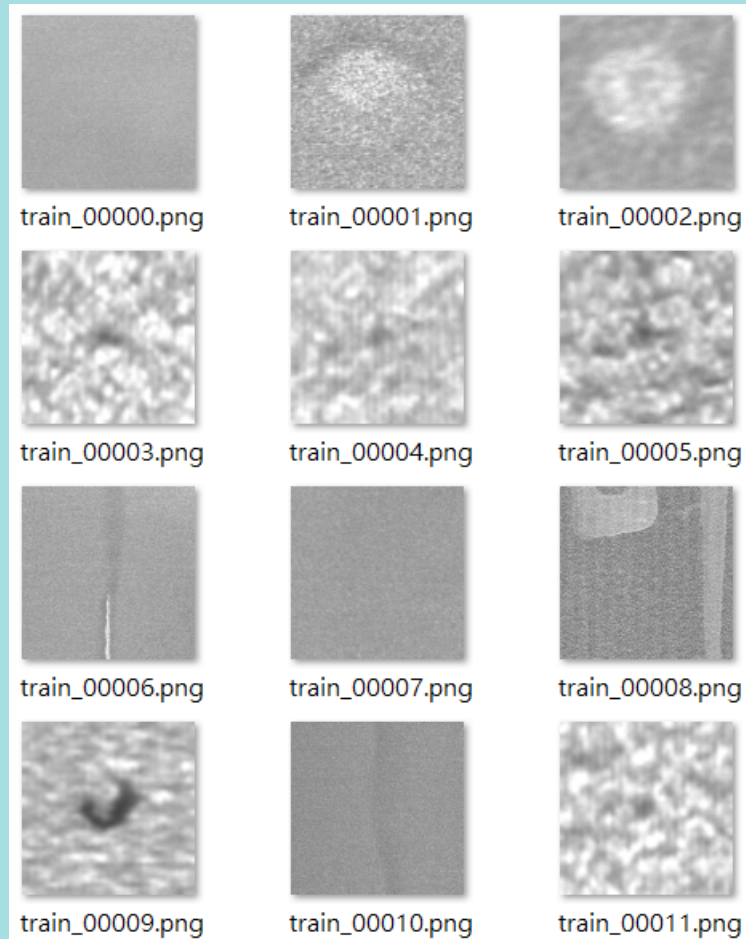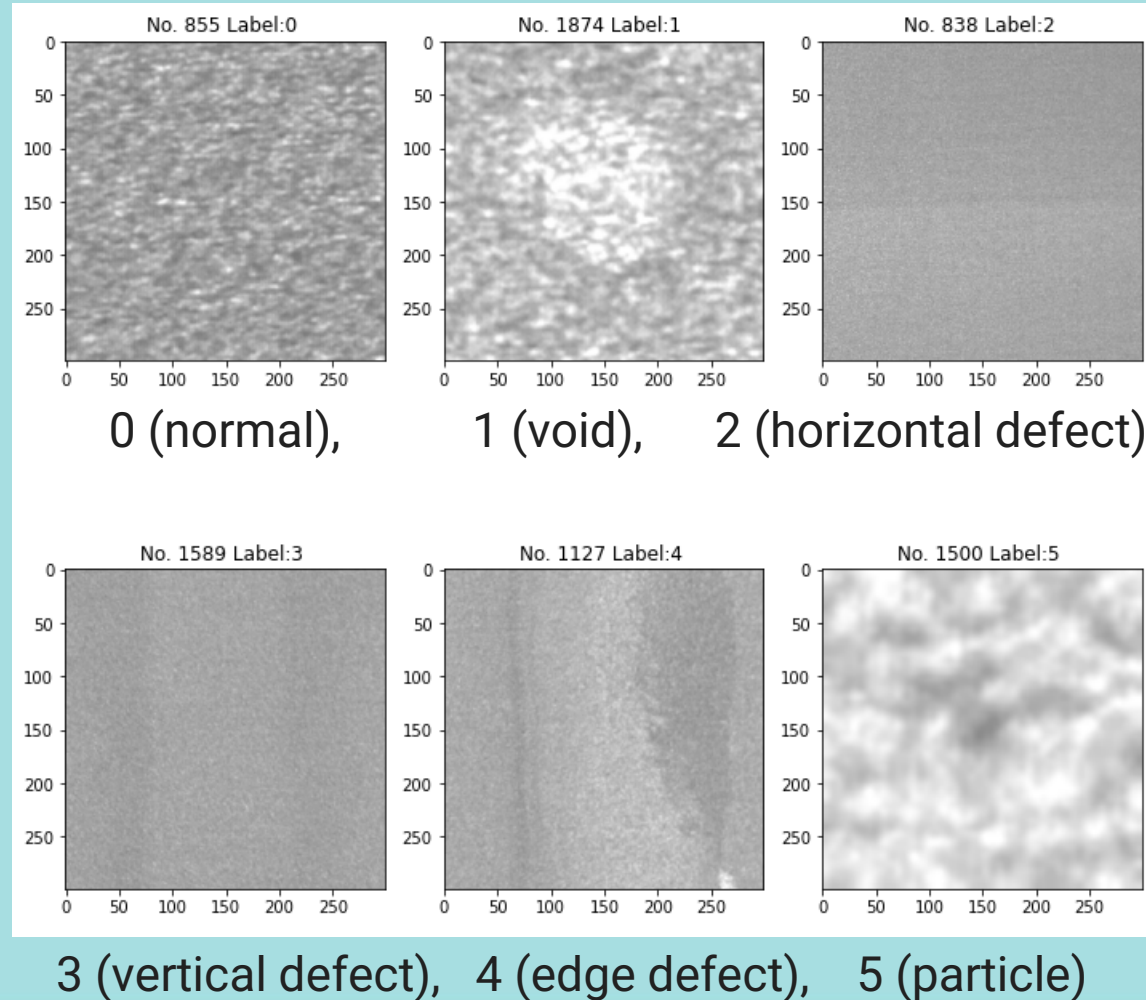
# AIdea Workflow



(A) Input training data

(B) Model training and inference

(C) Output test result
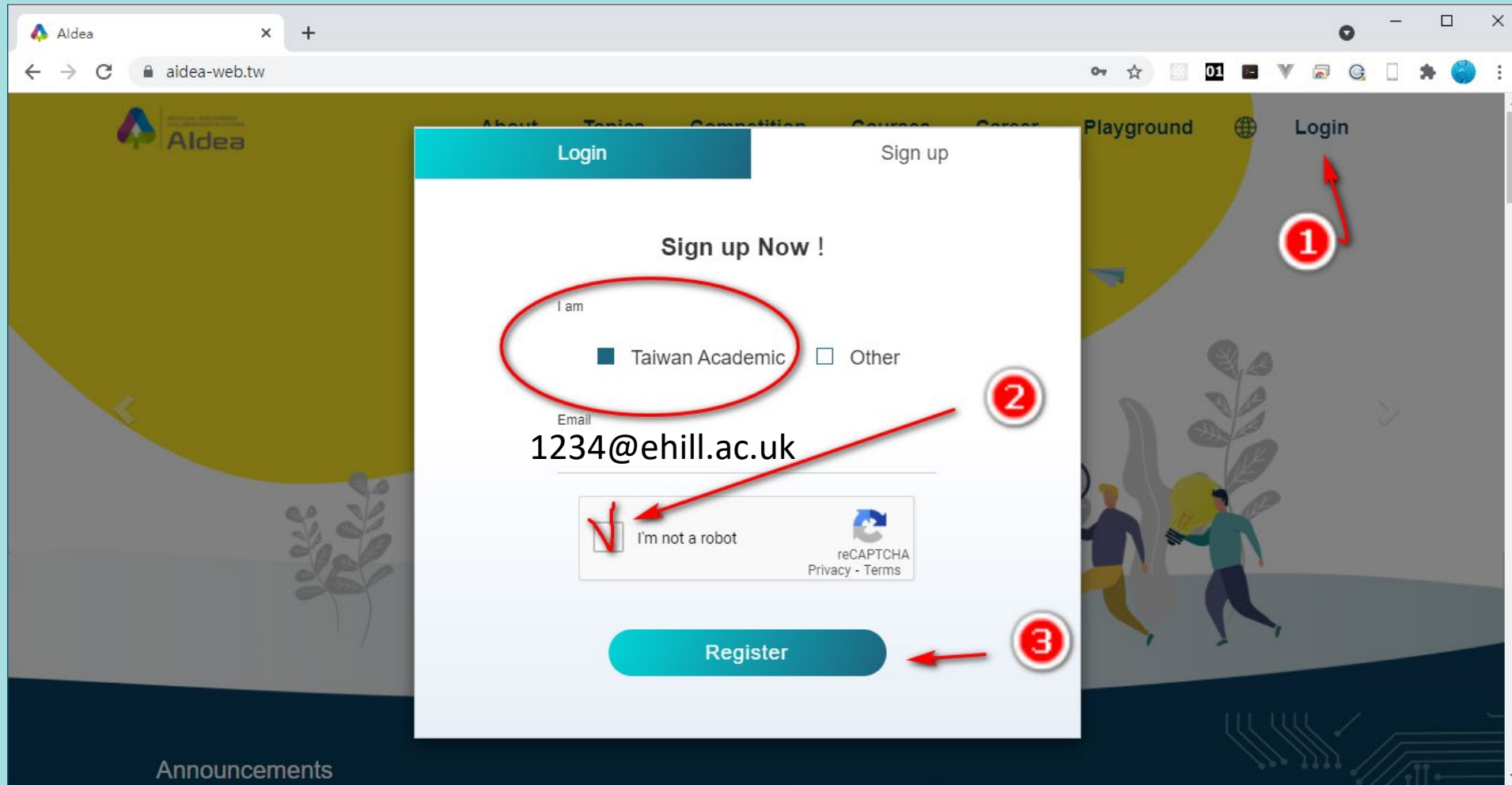
# Register your AIdea account
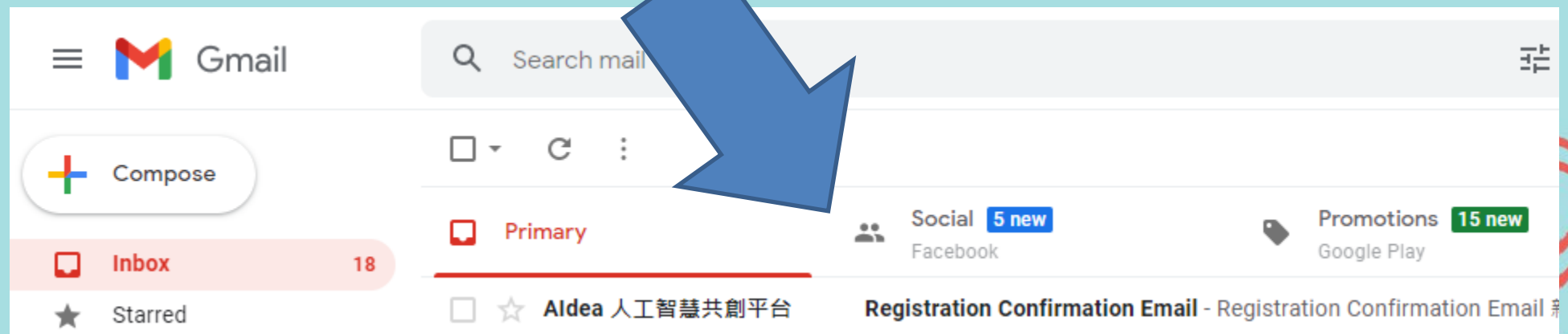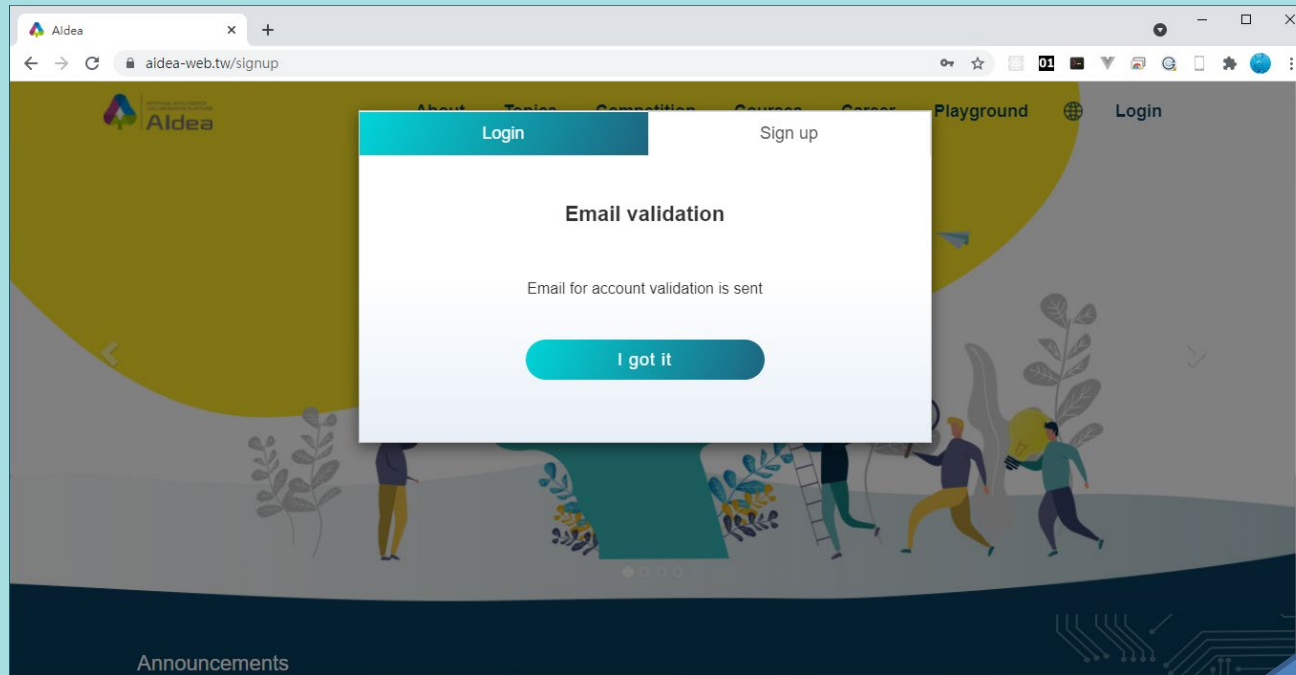
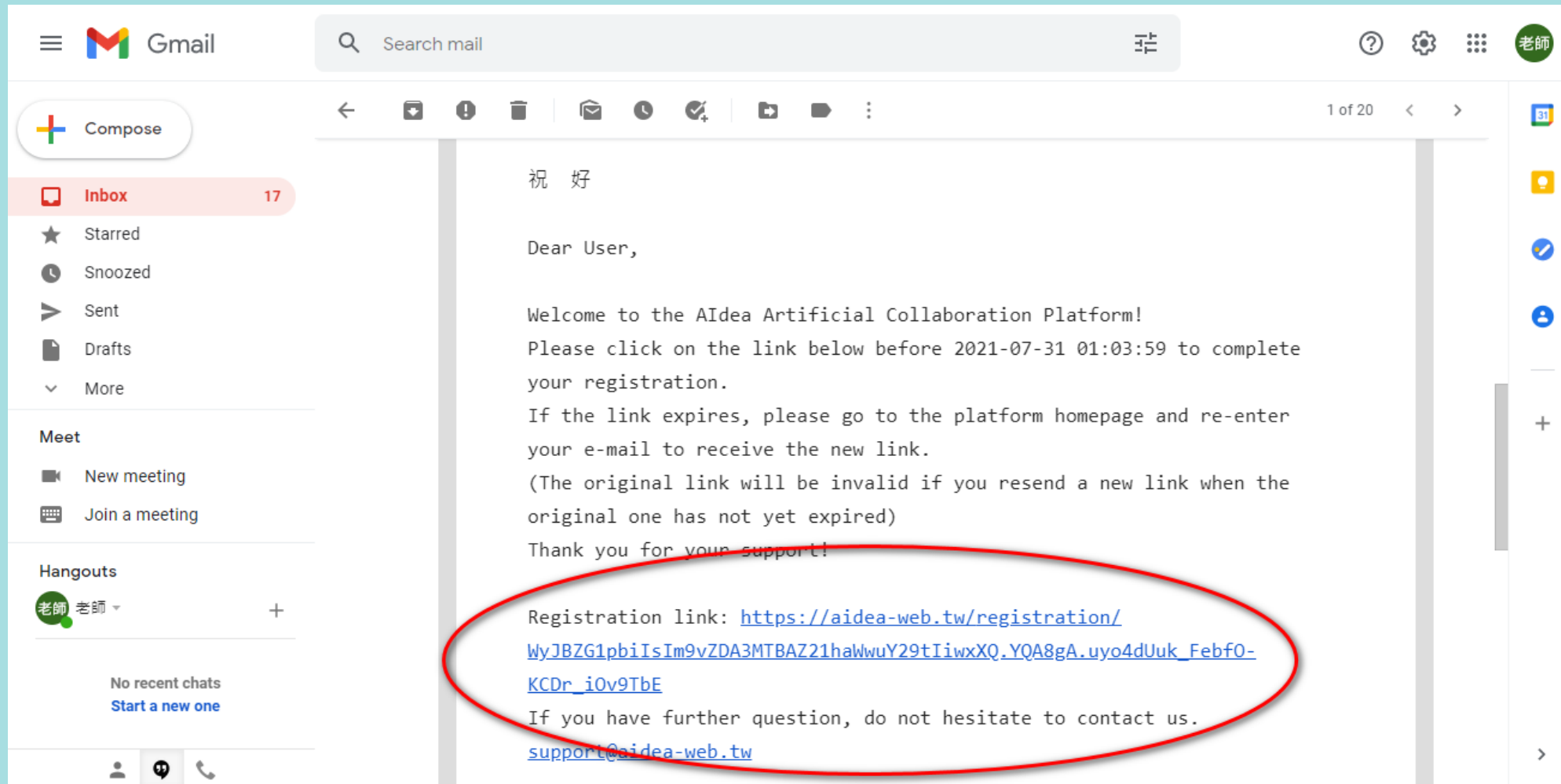# Step 1: Type your email account, and press the Register button



We treat you as foreign students at Asian universities,
so they are also Taiwan's academic.

# Step 2: The system will send you an email

# Step 3: Click the Registration link in the email

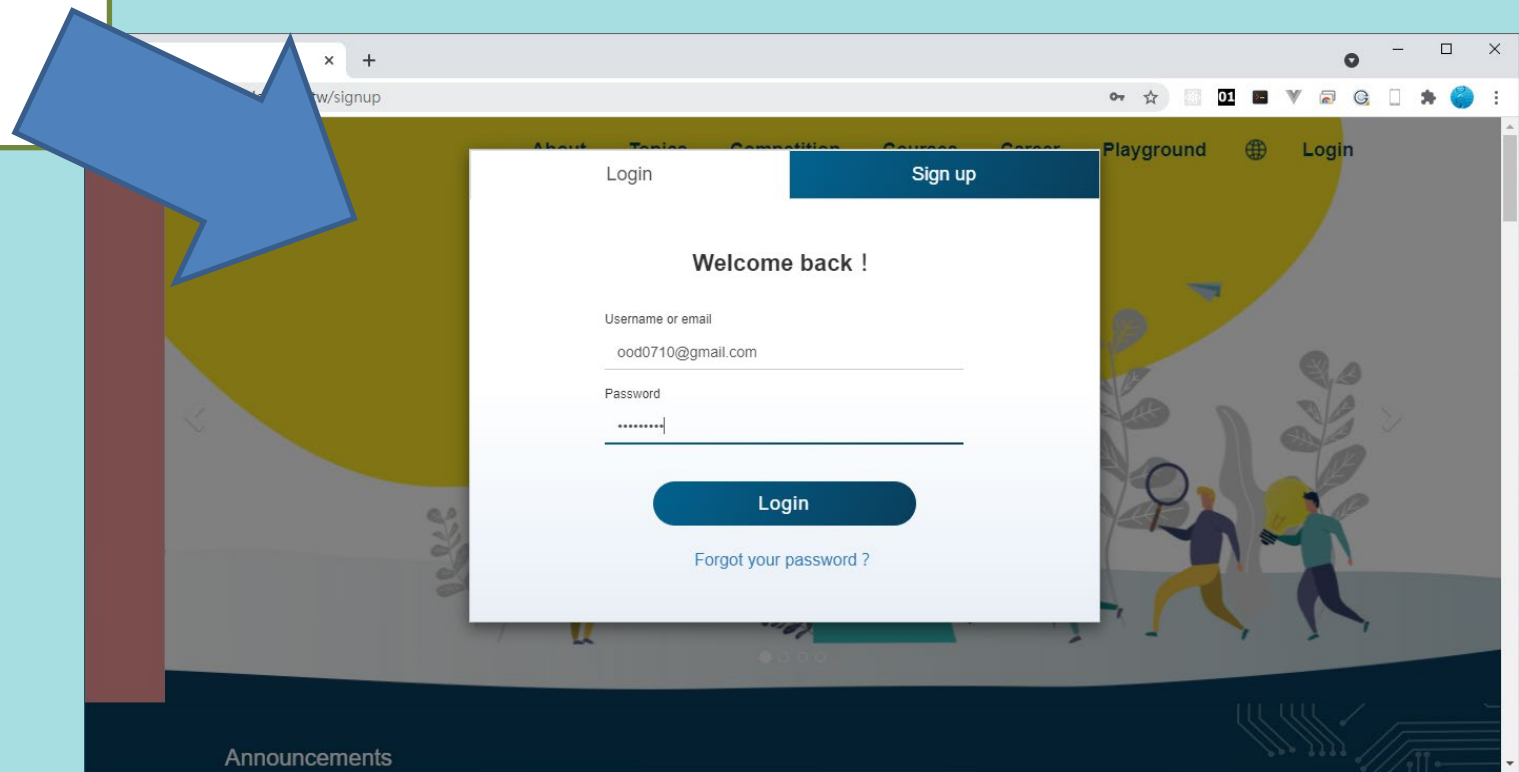# Step 4: Fill the registration form (Chinese)



**Member registration form**
會員註冊
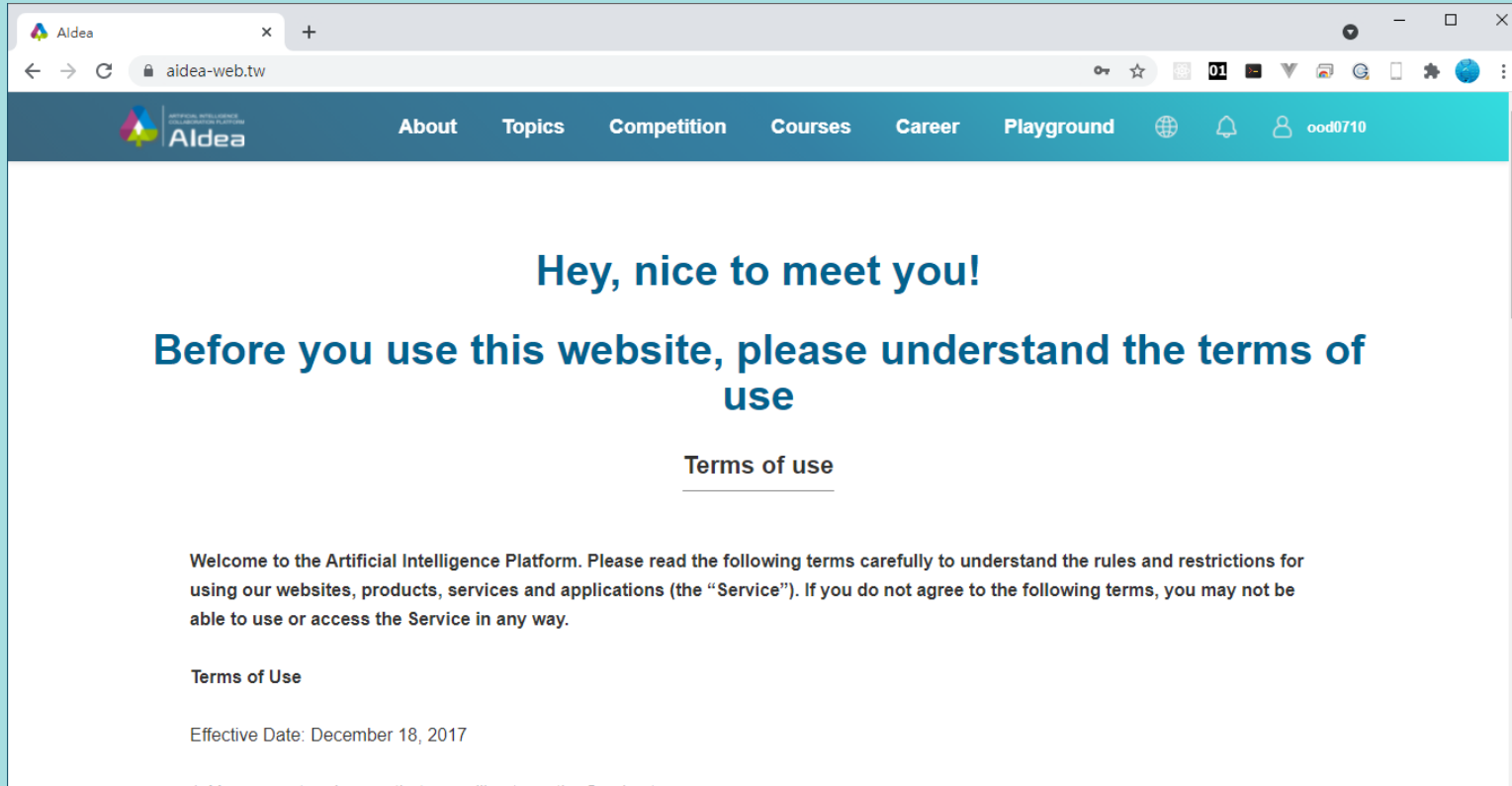
(1) Choose a unique user id
(2) Your name (Last name/First name)
(3) City/School 臺中市/亞洲大學
(4) Department
(5) Phone number
(6) Password
(7) Agree the terms of service and privacy policy
(8) Press the registration(註冊) button

# Step 5: Finish the registration and return to login with your email

# Step 6: Welcome message for AIdea platform



Scroll to the bottom

# Step 7: Send your AIdea account to me via Google Form

**https://shorturl.at/drHVW**



https://docs.google.com/forms/d/e/1FAIpQLSdVyabgsd29bR8ULRlNeyFXthCfJkRiu1rpHtp6JOsiIXjEhA/viewform

# Thanks! Q&A