

Project and Online Lesson Overview

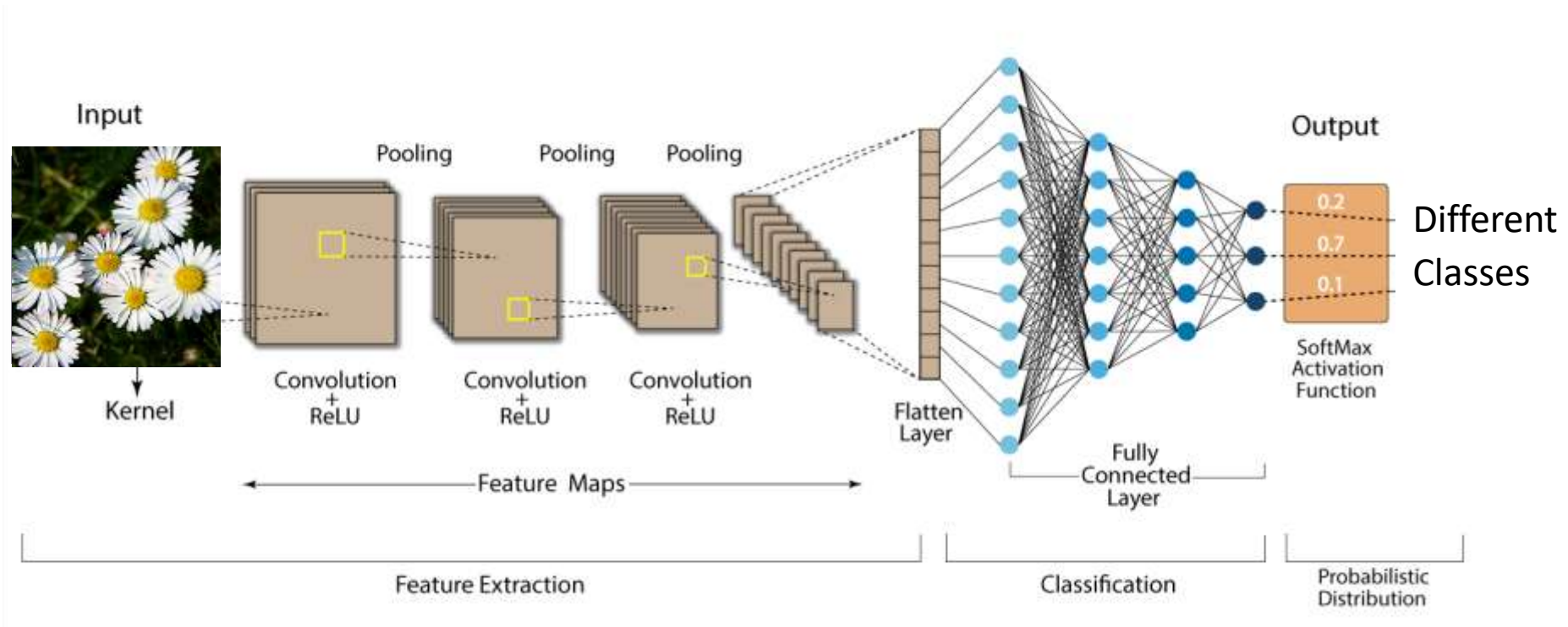
ENEL 525: Machine Learning For Engineers

Electrical and Software Engineering Department

Fall 2023

Project Overview

- Image classification based on Deep Neural Network (Convolutional Neural Network).





Project Overview

- Discuss with Dr. Leung if any student is interested in using their own datasets/application – one is provided in next slide.
- Students should work individually to complete this project.
- Report:
 - Due December 18 Midnight.
 - Format details will be provided in a template on D2L (Intro, Approach, Result/Discussion).
 - A copy of your final code should be provided as a .py file.

Flower Image Dataset for Image Classification

- Use deep learning to recognize different vegetable species.



Daisy



Dandelion



Rose



Sunflower

Sample of 4 images from the 5 different classes.

Link to download the dataset: <https://www.kaggle.com/datasets/alxmamaev/flowers-recognition/>

Motivation

- Illustrates the diversity and complexity of natural patterns, ideal for image recognition tasks.
- Offers a rich dataset for training algorithms to distinguish intricate features.
- Encourages the development of robust models capable of handling real-world variability.
- Provides a colorful, engaging visual context for machine learning demonstrations.
- Serves as a stepping stone to more complex image classification challenges.

Dataset Insights

- This dataset contains 4242 images of flowers.
- The data collection is based on the data flicr, google images, yandex images.
You can use this dataset to recognize plants from the photo.
- The flowers that are chosen for the experimentation are divided into five classes: chamomile, tulip, rose, sunflower, dandelion.
- For each class there are about 800 photos. Photos are about 320x240 pixels and in *.jpg format. Photos are not reduced to a single size, they have different proportions!

You can split the dataset into 70% for training, 15% for validation, and 15% for testing purpose.

Project Directions

- Project:
 - Implement deep learning techniques for advanced image classification.
 - Focus on the identification and recognition of various flower species.
 - Utilize convolutional neural networks (CNNs) to process and learn from floral image data.
 - Explore the intricacies of feature extraction in high-resolution flower imagery.
 - Aim to achieve high accuracy in distinguishing between different floral categories.

Additional Works:

- Build your own test cases (10 images): Take some pictures with your camera and read it, see how well your model does!
 - Why do you think your model is not classifying? What can you do to improve it?

Project Directions

- You can choose to take a subset of the dataset to save some computational power (Make sure the number of images in each class is equal for better results).
- The way you process the images is up to you.
- Lessons will show you “standard” variants of procedures to handle these images and “standard” CNN models.
- Feel free to incorporate your ideas or existing techniques:
 - Vary the number of samples in any case, what happens?
 - Transfer learning: Use a pre-trained model while replacing the classifier and see how well the model performs.

Lessons

- Seamless progression to final project.
- Learning goals:
 - Mastering Python for data analytics tasks.
 - Data preparation and visualization for machine learning input.
 - Building machine learning models with frameworks like TensorFlow
 - Assessing model efficacy.
 - Gaining practical insights and applied techniques.

Lesson Format

- Three video recorded lessons focusing on ML in python:
 - Each lesson consists of around two 35-45 minutes videos and supplementary codes/contents.
- Lessons' content as follows:
 - Lesson 1:
 - Part 1: Introduction to Python (installation, numpy, code reading).
 - Part 2: Data Visualization (pre-processing, manipulating, visualization)
 - Lesson 2:
 - Part 1: Image Processing (Pandas, OpenCV library).
 - Part 2: Data Classification (Tensorflow library).
 - Lesson 3: Image Classification using Deep learning.
 - Part 1: Convolutional Neural Networks (CNN).
 - Part 2: Building a CNN Network using Tensorflow.

How Does This Tie to the Project?

- Some codes are re-usable for the final project and future work.
- In Lesson 1 you'll learn how to:
 - Install python, work with numpy and other fundamental libraries.
 - Visualize the data and build a perceptron.
- In Lesson 2 you'll learn how to:
 - Read "RGB" images and pre-process them.
 - Perform classification on datapoints and samples from different applications.
- In Lesson 3 you'll learn:
 - The different building blocks of a CNN Network.
 - How to put it all together and train an image classifier using deep learning and Tensorflow.

Schedule of Lessons

- Video UPLOAD schedule on D2L:
 - Lesson 1 :November 17
 - Lesson 2: November 24
 - Lesson 3: December 01



Exercises Due

- Exercises due schedule:
 - Exercise 1 from Lesson 1: Due (Nov 24).
 - Exercise 2 from Lesson 2: Due (Dec 01).
 - Exercise 3 from Lesson 3: Due (Dec 08).
 - Final Report: Due (Dec 18)
- Notes:
 - Exercises are fairly straight-forward completion, upload code, screenshots of output and other requested details to D2L (A dropbox folder will be provided to you).
 - A separate document that illustrates the details of each exercise will also be provided.