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CP 468 – Artificial Intelligence Spring 2024 – Project Description

This project introduces the students to problem-solving using convolutional neural networks. The students will use existing pre-trained deep convolutional neural network models to solve real-world problems. The project consists of two phases

1- Designing and implementing (from scratch) a deep learning convolutional neural network to solve a real-world problem (classification, regression, or clustering) using TensorFlow and Keras API. The student will propose a simple architecture to train the CNN model using their dataset from phase 1.

2- The students ***MUST*** use the Google TensorFlow API and Gradio with Python to experiment with different pre-trained models and use them to solve a classification/regression/clustering problem and learn about the transfer learning concept.

Students are required to

1- use Google Collaboratory https://colab.research.google.com/

2- Gradio https://www.gradio.app/

Project groups: the students are encouraged to form groups of 4-5 members and work together on this project

Data Source:

The students are encouraged to search for real-world problems with existing data sources.

Deliverables:

1- Each group will upload an "ipython notebook" on the D2L/Github repo to show their implementation. The work must show at least 3 "THREE" working pre-trained models, a link to the data, and a document explaining how to download/configure/train/test the pre-trained models for the given problems. The default implementation will not be accepted. The three models must be used to enhance object recognition accuracy in an Ensemble model.
2- A video showing the output of each model.
3- The students are required to produce a similar video and show the object's class name during the video. For example, suppose a group is working to identify facial expressions. In that case, their video must show people a "public video" with a bounding rectangle on the faces while they are moving around. If a video cannot be obtained, the students can compose a video of the testing images.
4- The output of the Keras model (model that you build from scratch) must be demonstrated in the same manner
5- A summary report must be provided comparing the adapted pre-trained model to the Keras model. The report must show the following sections, title, Abstract, Introduction to the problem, discussion of similar solutions (existing solutions), detailed methodology including data description, results including training curves and quality measures such as TP,TN, AUC, AUROC curve, etc.

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Infrastructure: Google Colab and Gradio

Prerequisite Programming Skills: Sufficient knowledge of Python is required

Deadline for Submission: See course outline.

Example Projects: check the "Course Tools and Learning Materials" section in the course outline"

1. Identify a lionfish
2. Identify environmental sounds from spectrograms (sound images)
3. Find a nucleus in a biomedical pathology image
4. Determine the species of a seedling from an image
5. Invasive Species Monitoring: Identify images of invasive hydrangea
6. Lung cancer detection from CT images
7. Melanoma skin cancer detection
8. Diabetic Retinopathy Detection
9. Facial expression identification
10. Bring your own problem (subject to instructor approval)

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Detailed Deliverables with expected due dates

Item	Due date (by the end of)	40% total
Project Proposal + Teaming up	End of 1st Week	No Marks. A penalty of 10% will apply if late and random groups are formed.
1. CNN from scratch "ipython notebook/Gradio code." With all figs, graphs, and code comments. 2. Video illustrating the results.	FRI – August 2nd	15%
1. Three pre-trained CNN models "ipython notebook/Gradio." With all figs, graphs, and code comments. 2. Video illustrating the results per pre-trained model	FRI – August 2nd	15%
Report explaining the problem, solution, and the results. See the report requirement above.	FRI – August 2nd	10%