**Department of Artificial Intelligence**

**College of Computer and Cyber Sciences**

**Introduction to Deep Learning**

***Pre-trained Models for Image Classification***

1. **Learning Objectives**

By the end of this lab, students will:

* Learn what is a pre-trained model.
* Be able to use a pre-trained AlexNet model for image classification.

1. **Explanation of Key Concepts**

* **Pre-trained Models:**

Pre-trained models are deep learning models that have been trained on large datasets to accomplish a specific task. These models learn general patterns, features, and representations from vast amounts of data, allowing them to be reused for various applications without needing to be trained from scratch.

* **Image Classification:**

Image classification is a core task in computer vision that focuses on automatically analyzing and identifying the content of an image. It involves assigning a predefined category or label to an image based on its visual features. This process helps machines recognize and differentiate between various objects, scenes, or patterns within images.

* **Torchvision:**

Torchvision is a Python library that is part of the PyTorch ecosystem. It provides tools for working with image data, making it easier to develop deep learning models for computer vision tasks.

* **ImageNet:**

ImageNet is a large-scale visual database designed for use in visual object recognition research. It contains millions of labeled images, organized into thousands of categories, making it a crucial resource for training, and evaluating deep learning models in the field of computer vision.

Key Features of ImageNet:

Size: Over 14 million images (around 1.2 million for training and 50,000 for testing).

Image Format: Images are varied in size but typically resized to 256x256 pixels, in RGB format.

Labels: Over 21,000 classes, with 1,000 object categories.

* **AlexNet:**

AlexNet is a deep convolutional neural network (CNN) that was trained on the ImageNet dataset. By learning from millions of images across 1,000 different categories, AlexNet became highly effective at identifying and classifying objects.

1. **Activities**

* **Exercise 1: Using** **AlexNet for Image Classification.**

In this exercise, we will use the pre-trained AlexNet model for image classification on ImageNet dataset. You will load the model, preprocess images, perform predictions, and evaluate model performance.

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| # Code provided in the notebook |

Screenshot of the result:

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1. **Tasks**

* **Task 1:**

In this task, you will modify the code from Exercise 1 to use ResNet instead of AlexNet. Then, write a paragraph explaining the results you got after using it (Using ChatGPT or any other Chatbot is completely prohibited).

Submit your jupyter notebook & Add a screenshot of the result:

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**After testing both pre-trained models, AlexNet and ResNet-101, I observed a significant improvement in prediction performance, with ResNet-101 generally outperforming AlexNet.**

**When evaluating an image of a cat, both models predicted the same top label, and the second and third predictions were also similar, though their order varied. Interestingly, beyond the top prediction, AlexNet tended to perform better overall.**

1. **References**

[learnopencv/Image-classification-pre-trained-models/Image\_Classification\_using\_pre\_trained\_models.ipynb at master · spmallick/learnopencv](https://github.com/spmallick/learnopencv/blob/master/Image-classification-pre-trained-models/Image_Classification_using_pre_trained_models.ipynb)

[Pre Trained Models for Image Classification - PyTorch](https://learnopencv.com/pytorch-for-beginners-image-classification-using-pre-trained-models/)

[Understanding AlexNet | LearnOpenCV #](https://learnopencv.com/understanding-alexnet/)

[Transfer Learning for Computer Vision Tutorial — PyTorch Tutorials 2.6.0+cu124 documentation](https://pytorch.org/tutorials/beginner/transfer_learning_tutorial.html)

[imagenet\_classes.txt](https://gist.github.com/ageitgey/4e1342c10a71981d0b491e1b8227328b)

[Image net classes + labels](https://gist.github.com/aaronpolhamus/964a4411c0906315deb9f4a3723aac57)

[What Is a Pretrained AI Model? | NVIDIA Blog](https://blogs.nvidia.com/blog/what-is-a-pretrained-ai-model/)

[What is Image Classification? - GeeksforGeeks](https://www.geeksforgeeks.org/what-is-image-classification/)

[torchvision — Torchvision 0.21 documentation](https://pytorch.org/vision/stable/index.html)

[ImageNet](https://www.image-net.org/)