EE4052 Task 3: Project Abstract

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Project Title: Aircraft Identification and Classification.

Project Areas: Computer vision, Object recognition, and image classification.

Description: Identification and classification of aircraft from images with high accuracy is a critical activity in various domains, including air traffic control, defense, and aerospace research. The goal of the project is to develop a deep learning-based model to identify and classify aircraft from images. The problem statement regards distinguishing different kinds of aircraft through computer vision techniques. Conventional approaches, including hand-designed feature extraction and traditional machine learning techniques, suffer from limited feature representation and scalability. Recent developments in convolutional neural networks (CNNs) and attention models, achieve remarkable gains in accuracy and efficiency.

This project will contrast and compare some of the most well-known deep learning architectures like AlexNet [1], ResNet [2], EfficientNet [3], and attention-based models like Vision Transformers for aircraft classification with the objective of determining the best approach for this problem. The project will also examine how data augmentation, transfer learning, and fine-tuning techniques assist in model accuracy.

The deliverables expected from this work are a constructed model that can classify aircraft into various categories with high precision, an assessment of the model's performance against standard measures such as accuracy, precision, recall, and F1-score, and a comparison of classical and contemporary classification methods. A visual overview of the model architectures and performance comparisons will also be offered to illustrate significant findings.

Resources required:

Dataset: A good quality dataset of images depicting diverse types of aircraft, derived from publicly available datasets like FGVC-Aircraft.

Computational Resources: Access to high-performance GPUs for training models (e.g., NVIDIA A100, V100, or cloud platforms like Google Colab Pro, AWS, or Azure).

Toolsets: TensorFlow, PyTorch, OpenCV, and other relevant deep learning toolsets for preprocessing of images, training of the model, and assessment.

Other Requirements: Libraries for benchmarking model performance, a visualization library for result interpretation (e.g., Matplotlib, Seaborn), and a version control system like GitHub for development collaboration.

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References

[1] Alex, 2012. https://proceedings.neurips.cc/paper_files/paper/2012/file/c399862d3b9d6b76c8436e924a68c45b-Paper.pdf.

[2] K. He, 2015.https://arxiv.org/pdf/1512.03385.

[3] Q. V. L. Mingxing Tan, 2019. https://arxiv.org/pdf/1905.11946.