REPORT

Assignment no.4 (PART 1)

Objective
To evaluate and compare the classification performance of three deep learning models—VGG-19, ResNet50V2, and InceptionV4—on the CIFAR-10 dataset.

Results

Algorithm	Accuracy
VGG-19	16%
ResNet50V2	10%
InceptionV4	16%

Analysis
The performance differences among the models can be attributed to their architectural design and suitability for certain types of image classification tasks.

1. **VGG-19**:
   VGG-19 is a deep convolutional neural network that consists of 19 layers, using smaller 3x3 filters with deep stacking. While VGG-19 performs well on datasets similar to ImageNet, its limited feature extraction power on smaller images, like CIFAR-10, may result in reduced accuracy. Additionally, VGG-19 lacks some of the optimizations found in newer architectures, which limits its ability to generalize well to different datasets.
2. **ResNet50V2**:
   ResNet50V2 is part of the ResNet family, which introduced residual connections to mitigate the vanishing gradient problem in deep networks. Despite its depth, ResNet50V2 underperformed compared to VGG-19 and InceptionV4, with an accuracy of 10%. The reason might be that ResNet's depth is harder to optimize on a small dataset like CIFAR-10, and residual connections may not offer significant advantages for smaller, simpler images.
3. **InceptionV4**:
   InceptionV4, known for its complex structure combining multiple types of convolutional layers within inception blocks, aims to capture varying feature scales within each block. This design allows InceptionV4 to perform well on datasets with high variance in visual features. The accuracy matched that of VGG-19, likely due to similar complexities in feature extraction.

Conclusion
Both VGG-19 and InceptionV4 reached similar accuracy levels (16%), indicating that a simpler, layered structure (VGG) and a mixed, complex structure (Inception) are equally effective for CIFAR-10. ResNet50V2's lower performance (10%) may suggest that deeper residual connections are not as beneficial for this dataset, which could stem from overfitting or insufficient feature capture given CIFAR-10's resolution and simplicity. Each model's strengths and weaknesses indicate that simpler or moderately deep networks may sometimes yield better results on small datasets like CIFAR-10 compared to very deep architectures designed for larger-scale image tasks.