Experiment NO:- 8.

Aim:- Classifying data using prebrained models/ Transfer learning. Training various popular neural networks (ResNet, VGGNet, Inception V3) on custom dataset.

Theory:-

Transfer learning is a machine learning technique where a model trained on one task is repurposed on a second related task. Instead of training a model from scratch, we start with a model that has already been trained on large dataset (such as ImageNet) and then adapt it to new task with a smaller dataset.

This allows us to take advantage of previously learned features (such as detecting edges, corners, textures, etc), reducing training time and adapting improving performance, especially when the available dataset is limited.

We are applying transfer learning as follows:-

(1) Model Modification
We replaced the final fully connected layer of ResNet18 (orginally designed for 1000 classes) with a new layer that outputs 10 values - one for each digit (0-9) classes.

(2) Freezing layers:-
All the existing layers of ResNet 18 were frozen (ie their parameters were not updated during training) to retain the learned features from ImageNet. Only the newly added final layer was trained on the MNIST data. This approach is called feature extraction, where we reuse the model as a fixed feature extractor.

(3) Training
The modified model was trained on our custom MNIST dataset. Only the final layer weights were updated, resulting in fast convergence and lower computational cost.

(4) Evaluation.

After training, the model was tested on unseen MNIST images. The model achieved ~~gto~~ good classification accuracy, showing that even though MNIST digits are quite different from ImageNet images, the lower-level features learned by the pre-trained model are still useful.

Conclusion:-

Transfer learning allows us to effectively use pre-trained deep learning models for custom tasks. In this practical, we successfully classified handwritten digits using ResNet 18 with only the final layer trained.