

Comparison of CNN-18 and ResNet-18 on MNIST

This experiment presents a comparative study of a CNN-18 model trained from scratch and a ResNet-18 model pretrained on ImageNet under two different settings: frozen and fine-tuned. All models were evaluated on the MNIST dataset using identical training, validation, and testing splits to ensure a fair and unbiased comparison.

Experimental Results

Model	Test Accuracy	Test Loss
CNN-18 (Scratch)	0.9770	0.0833
ResNet-18 (Pretrained Frozen)	0.6166	1.1598
ResNet-18 (Pretrained Fine-Tuned)	0.9110	0.2855

The CNN-18 model trained from scratch achieved the highest accuracy, indicating that learning domain-specific features directly from MNIST is highly effective. The pretrained ResNet-18 with frozen layers performed poorly due to domain mismatch, demonstrating the effect of negative transfer. Fine-tuning the higher layers of ResNet-18 significantly improved performance by allowing adaptation to the target domain.

Conclusion

This study highlights that pretrained models are not universally superior. Their success depends on the similarity between source and target domains and the extent of fine-tuning applied. Proper adaptation is essential to fully benefit from pretrained deep learning models.