**REPORT- ASSIGNMENT – 4**

**Basic CNN Model**

Epoch 10:

v\_num=10

val\_loss=2.060

val\_accuracy=0.562

train\_loss=0.041

train\_accuracy=0.996

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| **Test metric** | **DataLoader 0** |
| test\_accuracy | 0.5628025531768799 |
| test\_loss | 1.4256922006607056 |

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Description automatically generated with medium confidence

**RestNet18 Model**

Epoch 8:

v\_num=11

val\_loss=1.870

val\_accuracy=0.617

train\_loss=0.164

train\_accuracy=0.945

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| **Test metric** | **DataLoader 0** |
| test\_accuracy | 0.5551592111587524 |
| test\_loss | 1.501777172088623 |

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Description automatically generated with medium confidence**

**Regularized Model**

Epoch 9:

v\_num=12

val\_loss=1.700

val\_accuracy=0.550

train\_loss=0.447

train\_accuracy=0.845

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| **Test metric** | **DataLoader 0** |
| test\_accuracy | 0.5429299473762512 |
| test\_loss | 1.4538490772247314 |

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**Transfer Learning**

Epoch 6:

v\_num=15

val\_loss=1.220

val\_accuracy=0.732

train\_loss=0.130

train\_accuracy=0.956

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| **Test metric** | **DataLoader 0** |
| test\_accuracy | 0.7666242122650146 |
| test\_loss | 0.769429624080658 |

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Epoch 7:

v\_num=16

val\_loss=1.710

val\_accuracy=0.595

train\_loss=0.228

train\_accuracy=0.921

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| **Test metric** | **DataLoader 0** |
| test\_accuracy | 0.5299363136291504 |
| test\_loss | 1.4233157634735107 |

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**Model Description: Transfer Learning with ResNet-18**

Overview: The implemented model leverages the architecture of ResNet-18, a deep convolutional neural network (CNN) known for its ability to train very deep networks using residual learning. ResNet-18 is selected for its efficiency and effectiveness in feature extraction from images, especially when pre-trained on large datasets like ImageNet.

**Transfer Learning and Fine-Tuning:**

* **Pretrained Weights:** The model is initialized with weights pre-trained on ImageNet, providing a strong starting point for feature extraction.
* **Fine-Tuning:** The final fully connected layer is customized for the specific task, and the entire model is fine-tuned on the target dataset.

**Training Procedure:**

* **Loss Function:** Cross-entropy loss is used for classification tasks, optimizing the model's parameters to correctly predict class labels.
* **Optimizer:** Adam optimizer with a learning rate of 1e-3 is used, balancing speed and stability during training.
* **Evaluation Metrics:** Accuracy is used to monitor the model's performance on the validation set.
* **Early Stopping:** Training stops if the validation loss does not improve for a specified number of epochs (earlyStoppingPatience), preventing overfitting and unnecessary training time.
* **Model Checkpointing:** The best model based on validation loss is saved during training, ensuring that the best-performing weights are retained.

**Conclusion:**

This model harnesses the power of ResNet-18 and transfer learning to efficiently classify images with a high degree of accuracy. The use of residual connections allows for deeper network architecture without degradation in performance, while fine-tuning ensures that the model adapts to the specific dataset and task at hand. This combination of techniques makes the model robust and capable of achieving high performance even with relatively small datasets.