

[illegible]

A Project on Caltech101 Dataset

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Introduction

Objective

Develop a deep learning model for image classification using a custom CNN (ResNet-18) on the Caltech101 dataset.

Key Tasks

- *Data preprocessing*
- *Model architecture design*
- *Training and evaluation*
- *Performance analysis*

Dataset Overview

Dataset: Caltech101

- 101 object categories + 1 background category.
- Subset used: 10–15 classes, ~1,500 images.

Sample Classes:

- Airplane
- Camera
- Elephant

Split:

- 1 Training
70%
- 2 Validation
20%
- 3 Testing
10%



Data Preprocessing



Transformations

- *Resize to 224x224.*
- *Normalize using ImageNet mean/std.*



Augmentations

- *Random horizontal flip.*
- *Random rotation.*
- *Random resized crop.*

Model Architecture



Base Model

Pretrained ResNet-18.



Key Layers

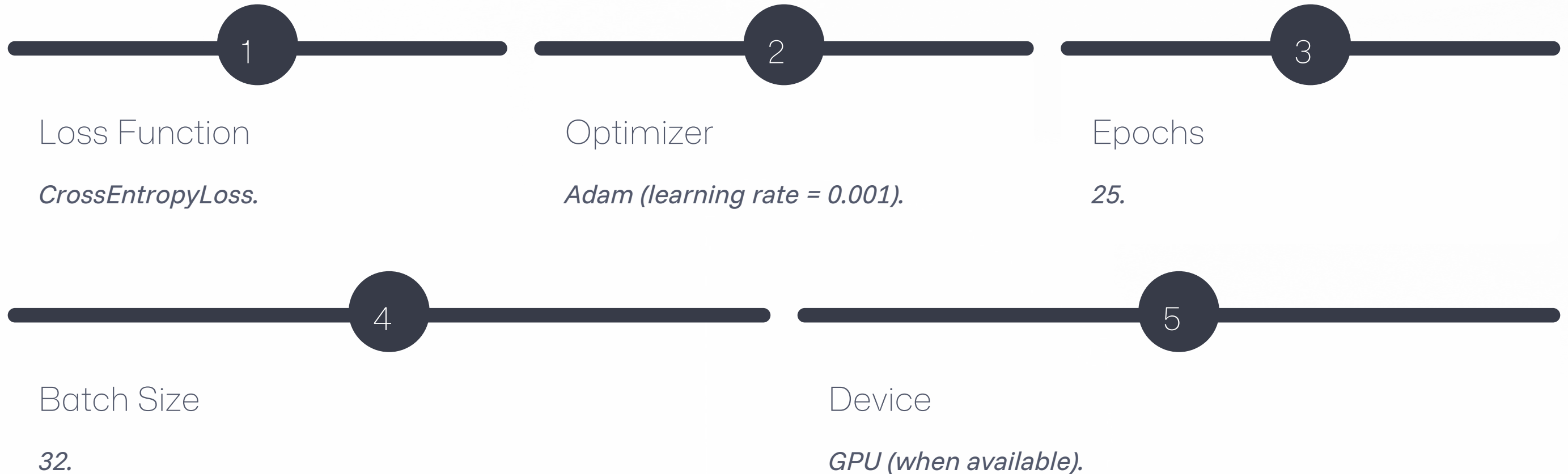
- *Initial 7x7 convolutional layer.*
- *Residual blocks with skip connections.*
- *Modified fully connected layer for 102 classes.*



Activation

Softmax for inference.

Training Setup



Model Evaluation

Metrics

95.48%

Accuracy

- *Precision, Recall, F1-Score.*

Visualization

- *Training loss and accuracy graphs.*
- *Sample predictions with actual vs. predicted labels.*



Key Observations

- 1 High test accuracy (~95.48%).
- 2 Validation accuracy stabilized after ~30 epochs.
- 3 Techniques used to prevent overfitting:
 - *Data augmentation.*
 - *Dropout layers.*

Future Improvements



Use deeper models (ResNet-50, VGG-16).

Conclusion

Successful Implementation

Successful implementation of ResNet-18 on Caltech101.

Demonstrated Effectiveness

Demonstrated effectiveness of deep learning for image classification.

GitHub Link: github.com/hamalnirajan03/deeplearning