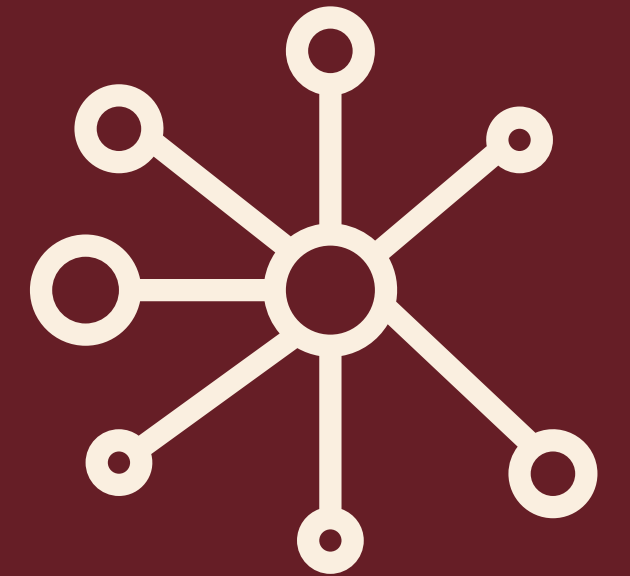


CLASSIFICATION OF ENDOSCOPIC IMAGES



MOBILENETV2 + PREPROCESSING

DATASET

- 3,000 images (1,000 per class)
- Kvasir dataset
- Split:
 - 70% Training
 - 15% Validation
 - 15% Test
- Deduplication using **perceptual hashing** to avoid leakage

Final distribution per class

Each class contained approximately:

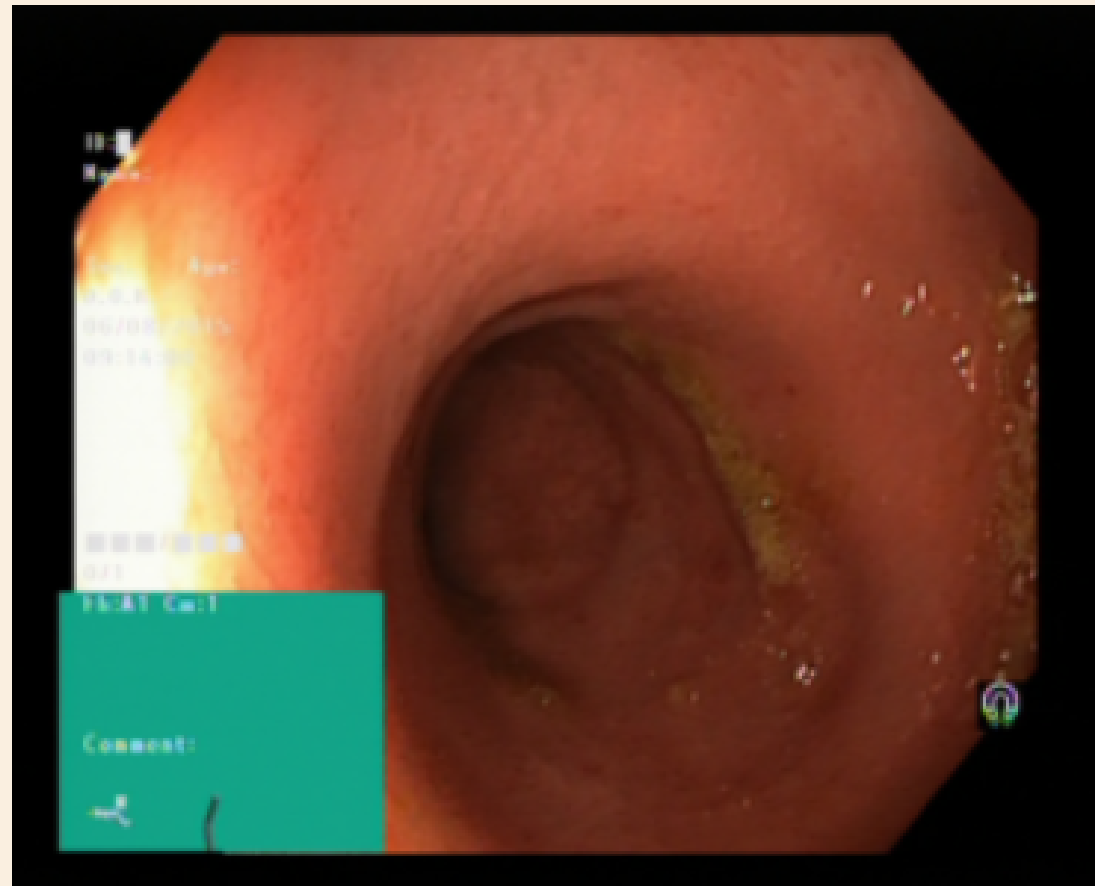
- 700 training images
- 150 validation images
- 150 test images



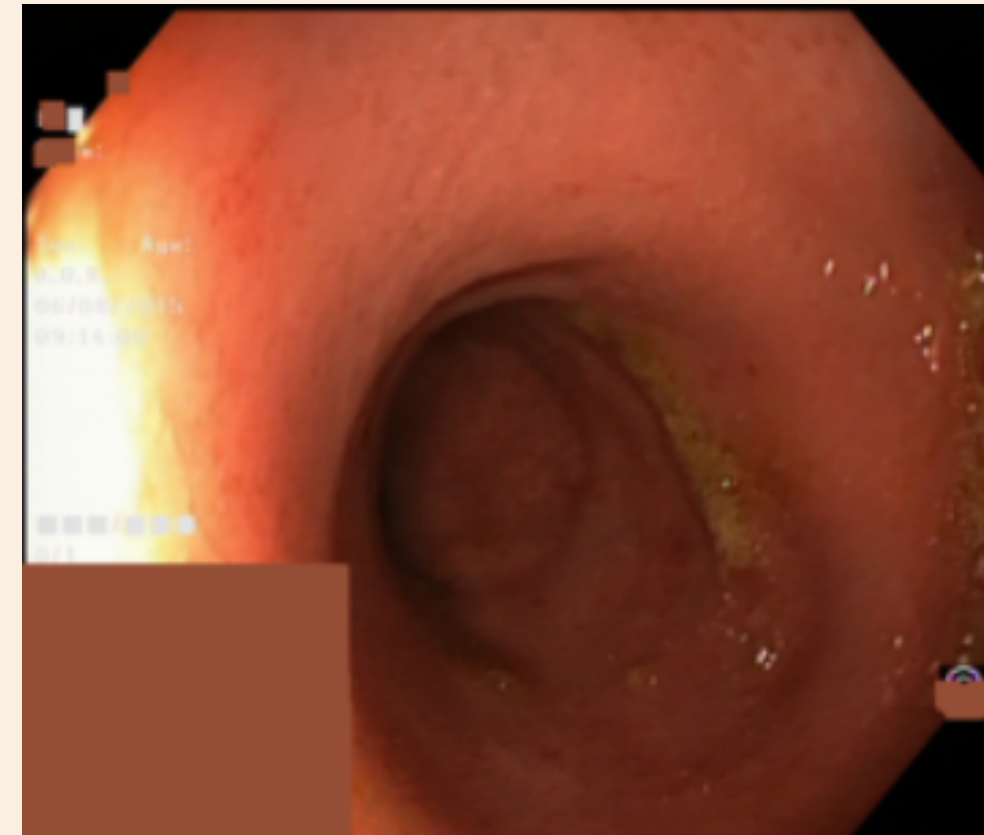
PREPROCESSING AND AUGMENTATIONS

PREPROCESSING

- **Removed** ScopeGuide green box and some text replacing it with the mean color of the image
- **Cropped** bright field of view
- **Resized** to 224×224 pixels



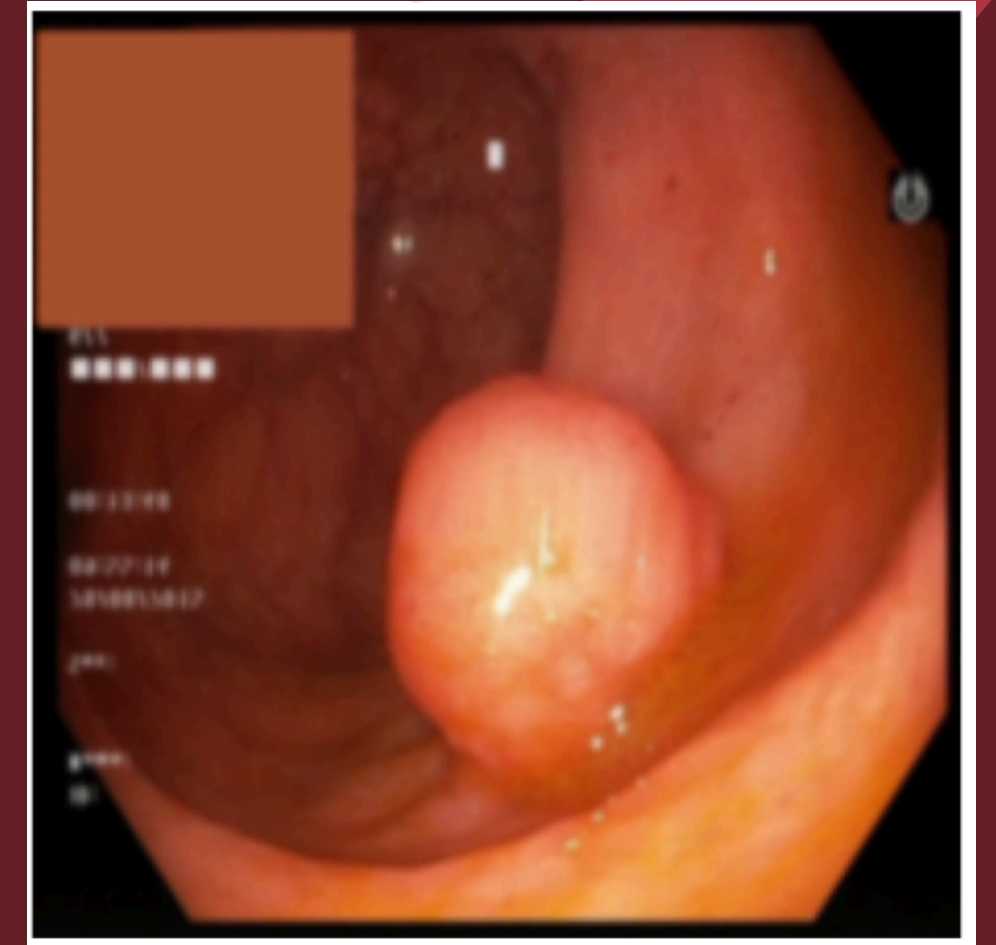
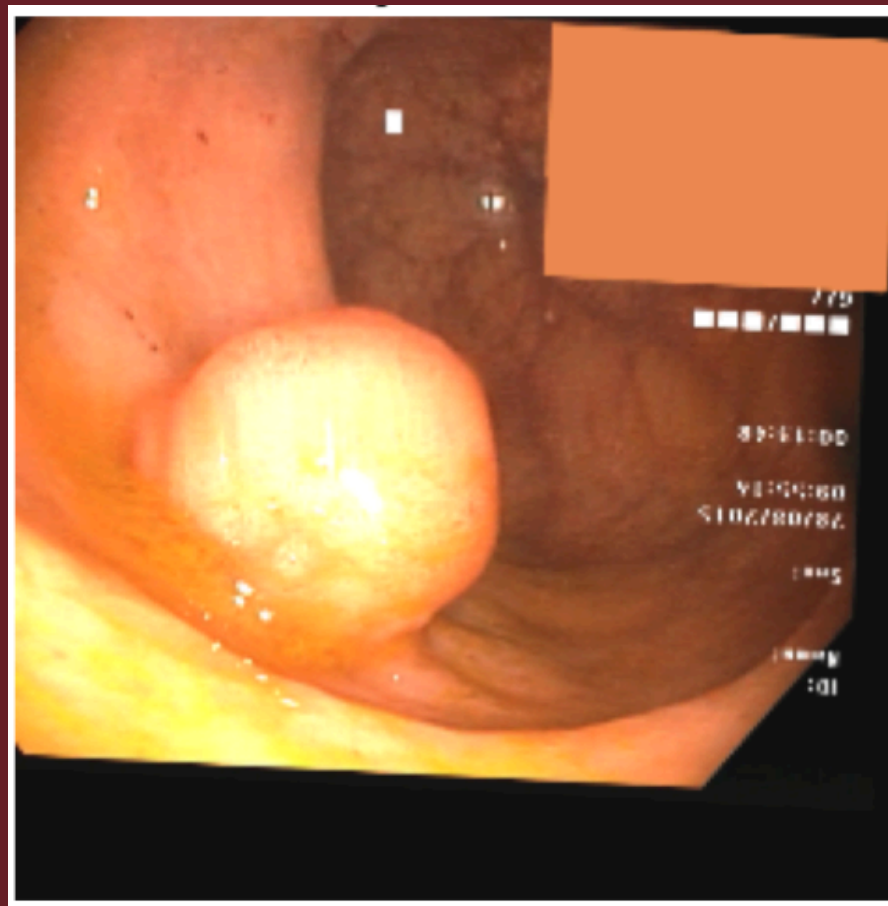
Before



After

AUGMENTATION

- Random rotations and flips
- Shift, scale, rotate $\pm 15^\circ$
- Brightness/contrast adjustments
- Gaussian blur
- Gamma correction



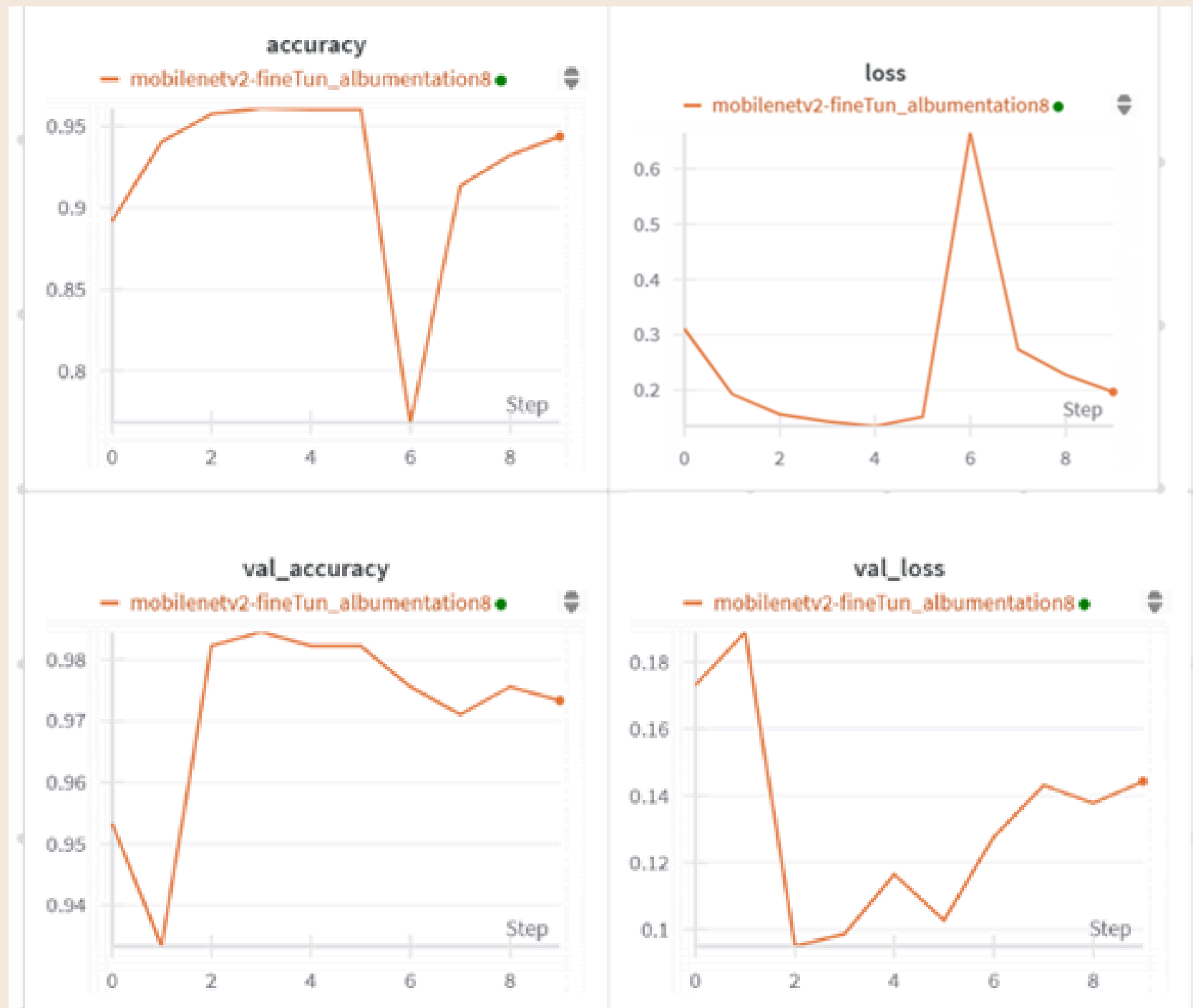
Albumentations library was used to apply advanced data augmentations. These transformations increase dataset diversity and help the model generalize better.

WHY MOBILENETV2?

Model Overview

- ★ MobileNetV2 is a lightweight convolutional neural network pretrained on ImageNet.
- ★ It uses depthwise separable convolutions to reduce the number of parameters while maintaining high accuracy.
- ★ Includes residual connections that help gradient flow during training.
- ★ Why it works well:
 - Pretrained weights capture general features (edges, textures).
 - Fine-tuning adapts these features to medical endoscopic images.
 - Small parameter size reduces overfitting on limited datasets.
 - Data augmentation improves generalization to unseen cases.

TRAINING DETAILS



- Batch size: 32
- Optimizer: Adam
- MobileNetV2 (pretrained on ImageNet)
- Dropout (0.3)
- Loss function: Categorical cross-entropy
- Callbacks:
 - Early stopping with patience of 3 epochs
 - TensorBoard logging
 - WandB tracking

Training Summary:

- Stage 1 (Frozen): Ran 6 epochs, best weights restored from epoch 3.
- Stage 2 (Fine-tuning): Ran 4 epochs, best weights restored from epoch 1 (lowest val loss).
- Final model combined these epochs for optimal performance (>97% val accuracy).

TRAINING DETAILS

```
Epoch 1/10
66/66 ————— 178s 3s/step - accuracy: 0.8129 - loss: 0.4762 - val_accuracy: 0.9533 - val_loss: 0.1730
Epoch 2/10
66/66 ————— 222s 3s/step - accuracy: 0.9376 - loss: 0.1987 - val_accuracy: 0.9333 - val_loss: 0.1888
Epoch 3/10
66/66 ————— 226s 3s/step - accuracy: 0.9604 - loss: 0.1692 - val_accuracy: 0.9822 - val_loss: 0.0950
Epoch 4/10
66/66 ————— 273s 4s/step - accuracy: 0.9579 - loss: 0.1475 - val_accuracy: 0.9844 - val_loss: 0.0987
Epoch 5/10
66/66 ————— 242s 4s/step - accuracy: 0.9619 - loss: 0.1352 - val_accuracy: 0.9822 - val_loss: 0.1164
Epoch 6/10
66/66 ————— 238s 4s/step - accuracy: 0.9629 - loss: 0.1484 - val_accuracy: 0.9822 - val_loss: 0.1027
Epoch 6: early stopping
Restoring model weights from the end of the best epoch: 3.
Epoch 1/20
66/66 ————— 656s 9s/step - accuracy: 0.6873 - loss: 0.9376 - val_accuracy: 0.9756 - val_loss: 0.1277
Epoch 2/20
66/66 ————— 733s 11s/step - accuracy: 0.9127 - loss: 0.2774 - val_accuracy: 0.9711 - val_loss: 0.1431
Epoch 3/20
66/66 ————— 257s 4s/step - accuracy: 0.9252 - loss: 0.2354 - val_accuracy: 0.9756 - val_loss: 0.1378
Epoch 4/20
66/66 ————— 248s 4s/step - accuracy: 0.9382 - loss: 0.2157 - val_accuracy: 0.9733 - val_loss: 0.1442
Epoch 4: early stopping
Restoring model weights from the end of the best epoch: 1.
```

Early stopping monitored validation loss. Training stopped when validation loss stopped improving to prevent overfitting.

MODEL RESULTS

RESULTS TABLES



Global Metrics %

Metric	Value
Accuracy	94.89
Precision (macro)	95.07
Recall (macro)	94.89
F1 Score (macro)	94.87

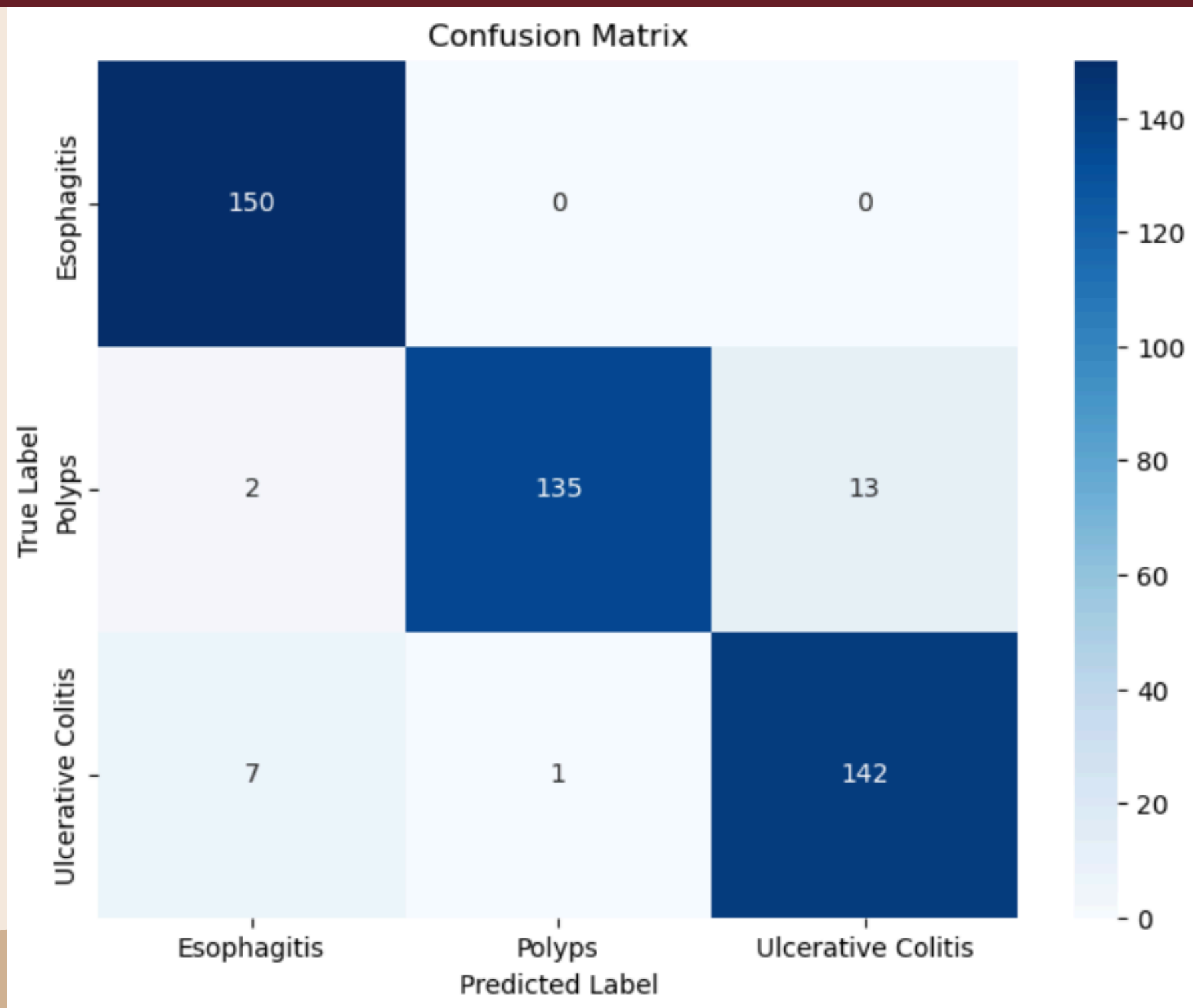
Per Clase Metrics %

Class	Precision	Recall	F1 Score	Specificity
Esophagitis	94.34	100.00	97.09	97.00
Polyps	99.26	90.00	94.41	99.67
Ulcerative Colitis	91.61	94.67	93.11	95.67

Test Loss: 0.2026

CONFUSION MATRIX

V



Class	TP	FP	FN	TN
Esophagitis	150	9	0	291
Polyps	135	1	15	299
Ulcerative Colitis	142	13	8	287

CONCLUSIONS

A decorative dashed line in a reddish-pink color starts in the top right corner and curves downwards and to the left, ending near the top of the slide.

- The model achieved high overall accuracy (94.89%) and strong class-wise performance.
- Preprocessing steps, including removal of the green scope guide and cropping, improved the robustness of predictions by preventing the model from relying on background artifacts.
- Recall for esophagitis reached 100%, indicating excellent sensitivity for this class.
- Slightly lower recall for polyps (90%) suggests that additional data augmentation or preprocessing could further improve results.
- The combination of transfer learning, fine-tuning, and advanced augmentations proved effective for medical image classification.



¡GRACIAS!

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