# Enhancing Colon Polyp Detection Using Deep Learning

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## Introduction

Colon polyps are small growths on the inner lining of the colon, with some types (e.g., adenomatous polyps) posing a significant risk of developing into colorectal cancer (CRC) if left undetected. Despite colonoscopy being the gold standard for diagnosis, challenges such as variability in endoscopist expertise, missed small/flat lesions, and patient discomfort during the procedure hinder early detection.

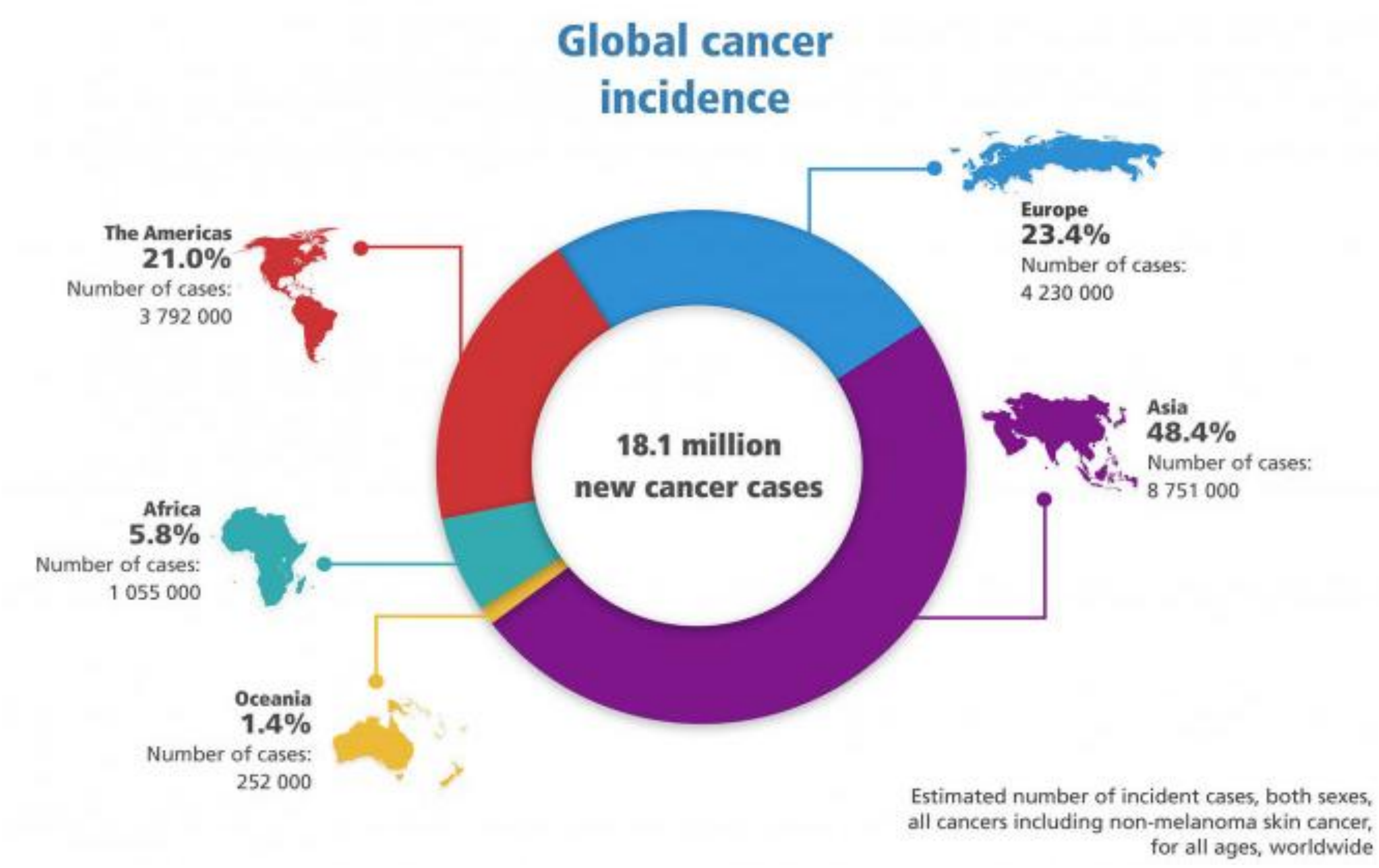


Figure 1: Global Cancer Statistics

Globally, CRC accounts for over 930,000 deaths annually, with cases projected to rise by 63% by 2040. This research aims to leverage deep learning to enhance polyp detection accuracy, reduce diagnostic delays and democratize access to high-quality screening. By integrating temporal analysis and advanced post-learning strategies, our AI-driven approach seeks to improve clinical outcomes and support real-time decision-making during colonoscopies.

## Dataset

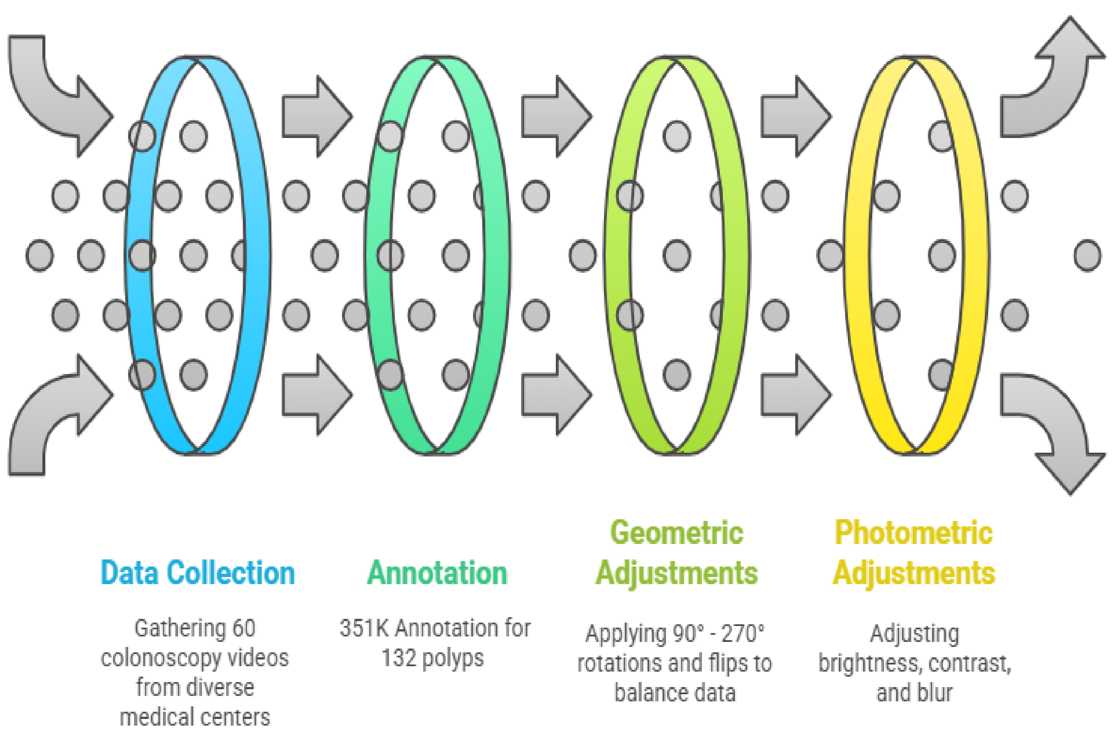


Figure 1: Real-Colon Dataset

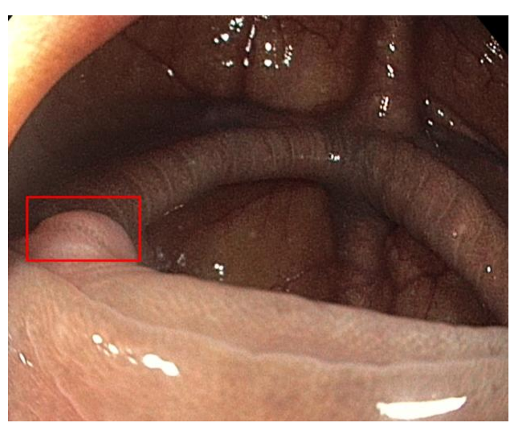

Figure 2: A frame from Real-Colon Dataset Showing polyp

## Methods

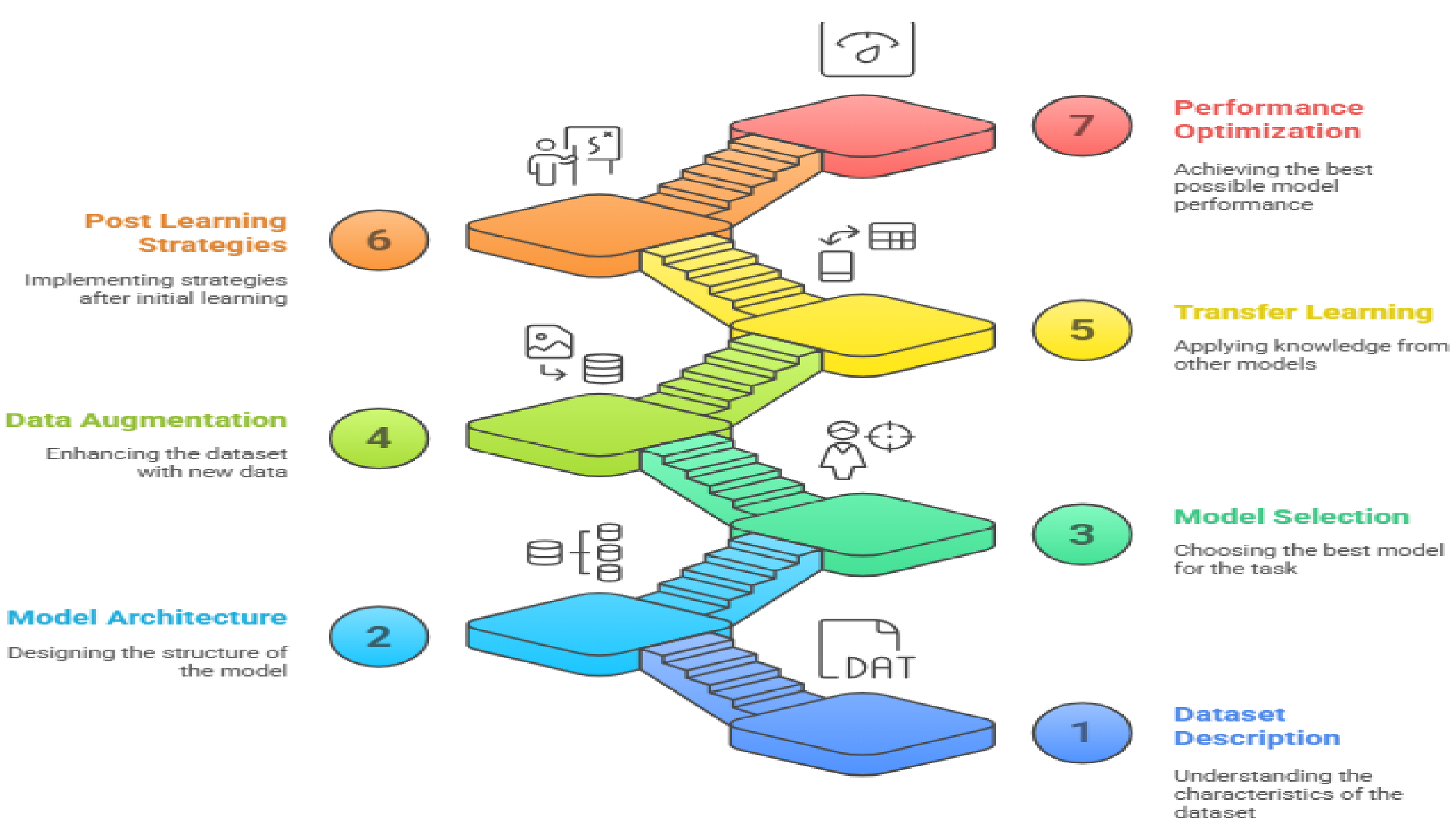


Figure 3: Steps involved in this methodology

**Model Architecture :** We employ a Faster R-CNN framework with a ResNet-FPN backbone to extract features from colonoscopy images.

**Training and Refinement Strategy :** The model's accuracy and generalization are enhanced through a multi-stage training process:

**Transfer Learning:** The model is initialized with weights pre-trained on large datasets (ImageNet, MS COCO) and then fine-tuned on our specific polyp dataset.

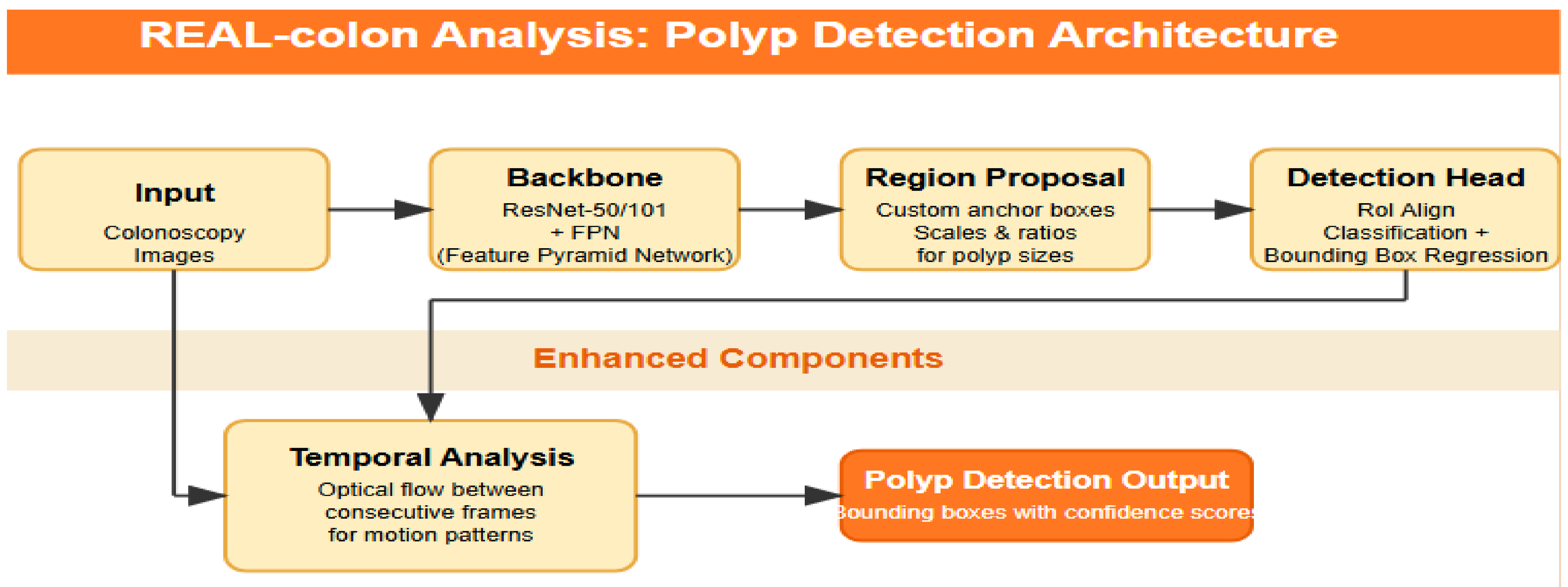


Figure 5: Colon Polyp Detection architecture

**Data Augmentation:** We apply extensive geometric and photometric augmentations to simulate realistic colonoscopy variations and prevent overfitting.

**Post-Learning Refinement:** To minimize errors, the model is re-trained on high-confidence **false positives** (polyp mimics) and fine-tuned offline using reliably detected polyps.

## Expected Outcomes

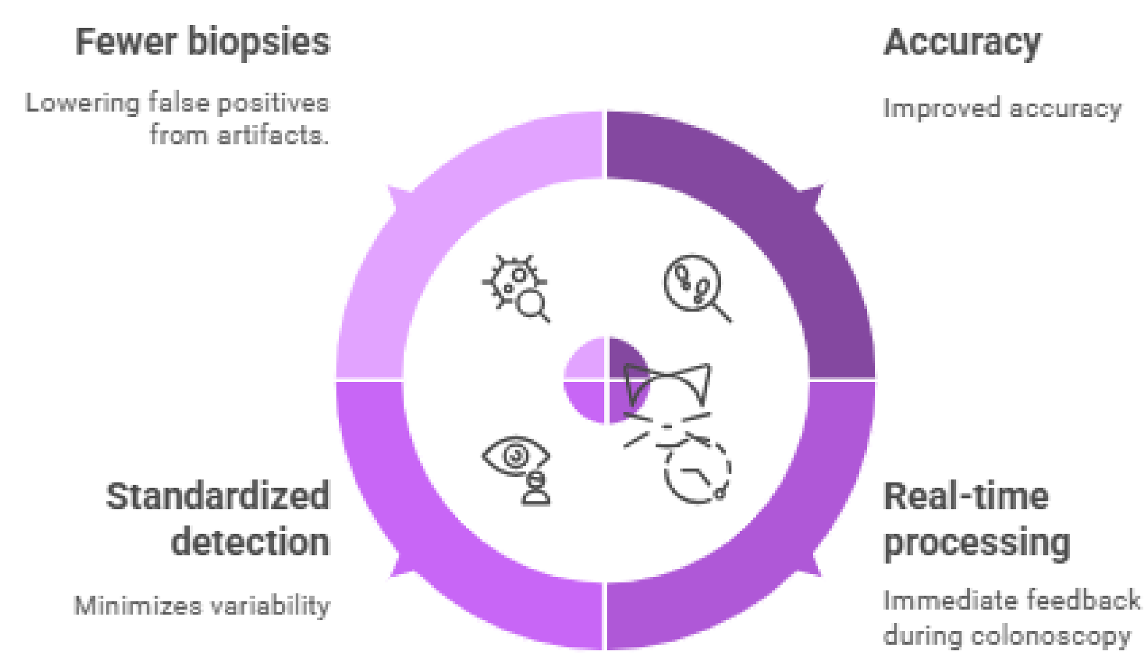


Figure 6: Expected Outcome from our research

## Future Work

Future directions include expanding the model's capabilities to predict polyp malignancy risk using morphological features and integrating it into Clinical Decision Support Systems (CDSS) for real-time diagnostics. Collaborations to incorporate larger datasets (e.g., HyperKvasir) will improve generalizability across diverse populations. Additionally, we plan to explore semi-supervised learning to reduce annotation dependency and deploy the model in resource-limited settings via lightweight, edge-compatible versions.

## References

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