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Intelligent Classification OF ENDOSCOPIC IMAGES USING DEEP LEARNING

Introduction

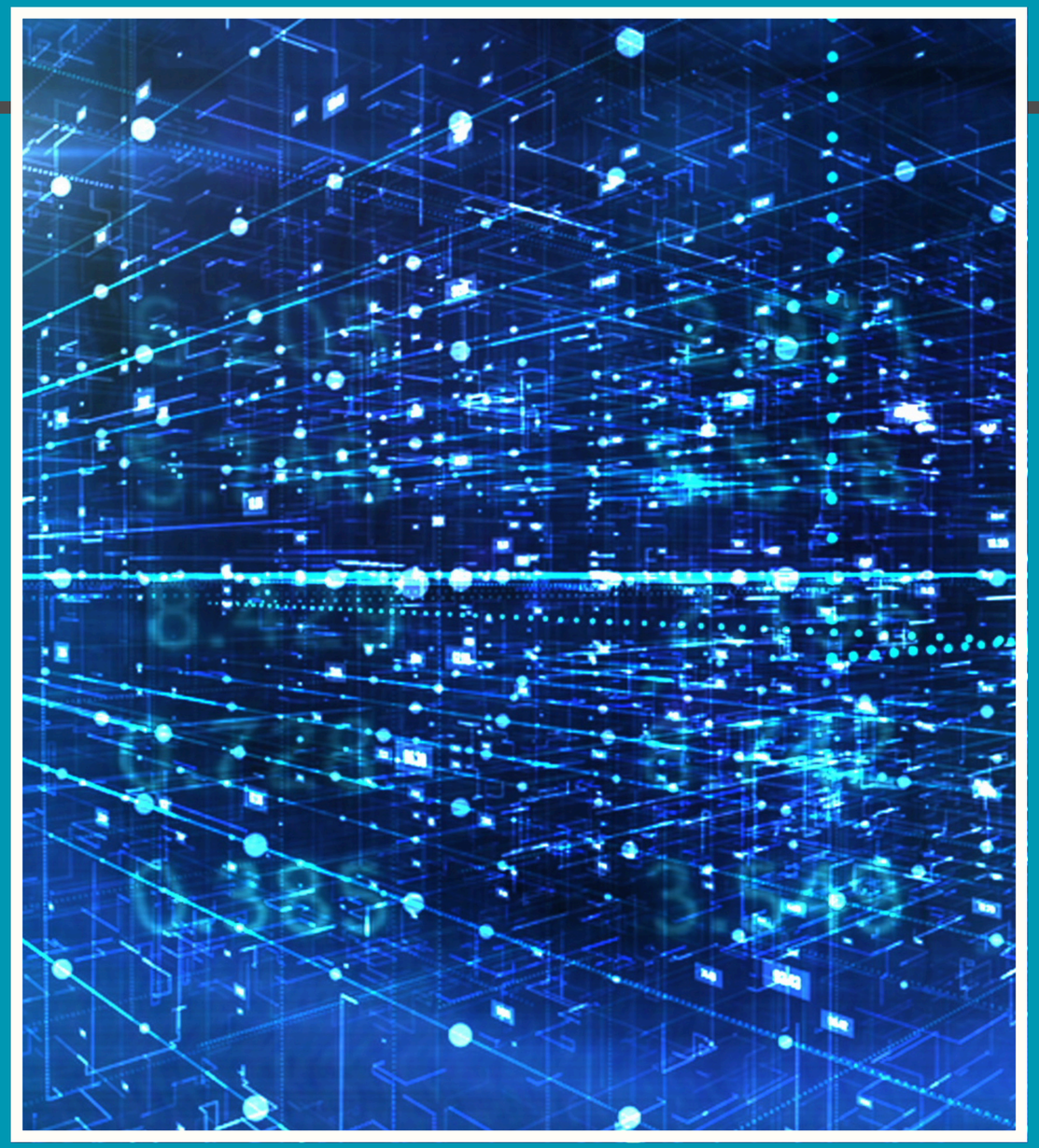
Automatic analysis of medical images is a major challenge in artificial intelligence.
Gastrointestinal diseases affect millions, and early, accurate diagnosis is essential.
This project develops an intelligent system to classify endoscopic images using CNNs and explainable AI techniques.

01 Dataset

DATASET

8 classes

- Real clinical RGB images
- Stratified split: 80% training, 20% validation
- Challenges: lighting variation, anatomical differences, variable quality and color

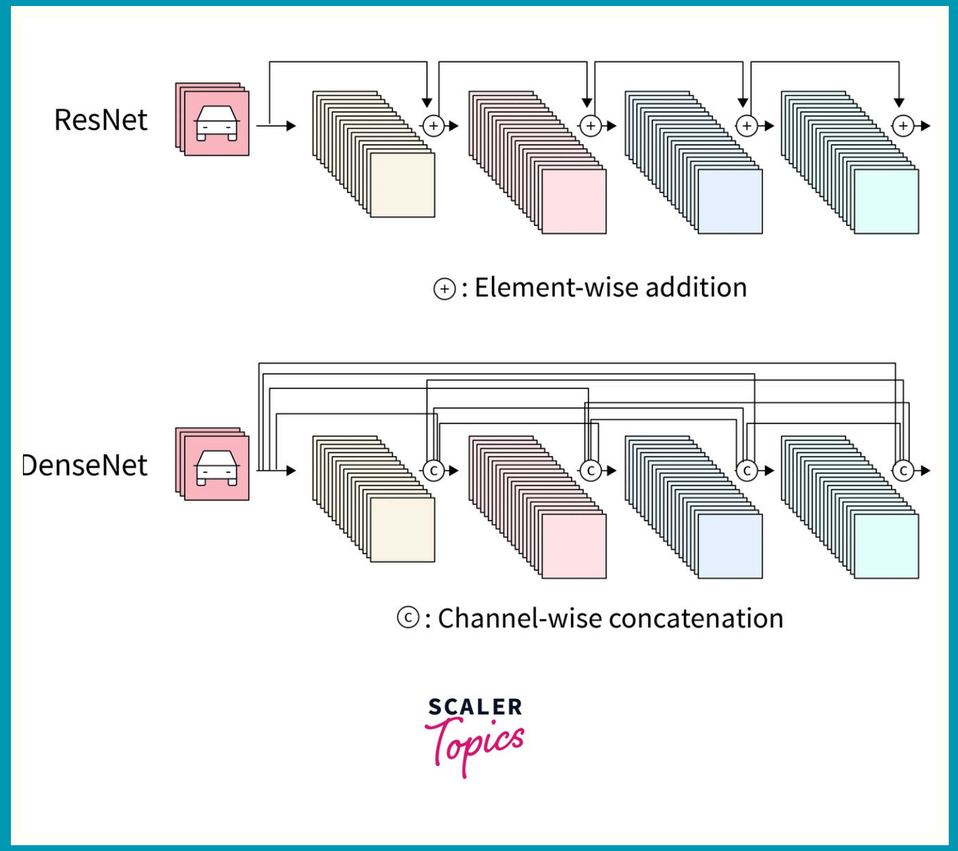


02 Preprocessing

PREPROCESSING

- CLAHE applied to the L channel (LAB color space) for local contrast enhancement
- Data augmentations with Albumentations:
  - Horizontal flip
  - Brightness/contrast adjustment
  - Normalization

Improves robustness to real-world imaging conditions.



MODELS

01 ResNet18

- Fast and lightweight
- Classic residual architecture

02 DenseNet121

- Densely connected layers
- Better feature reuse and gradient flow

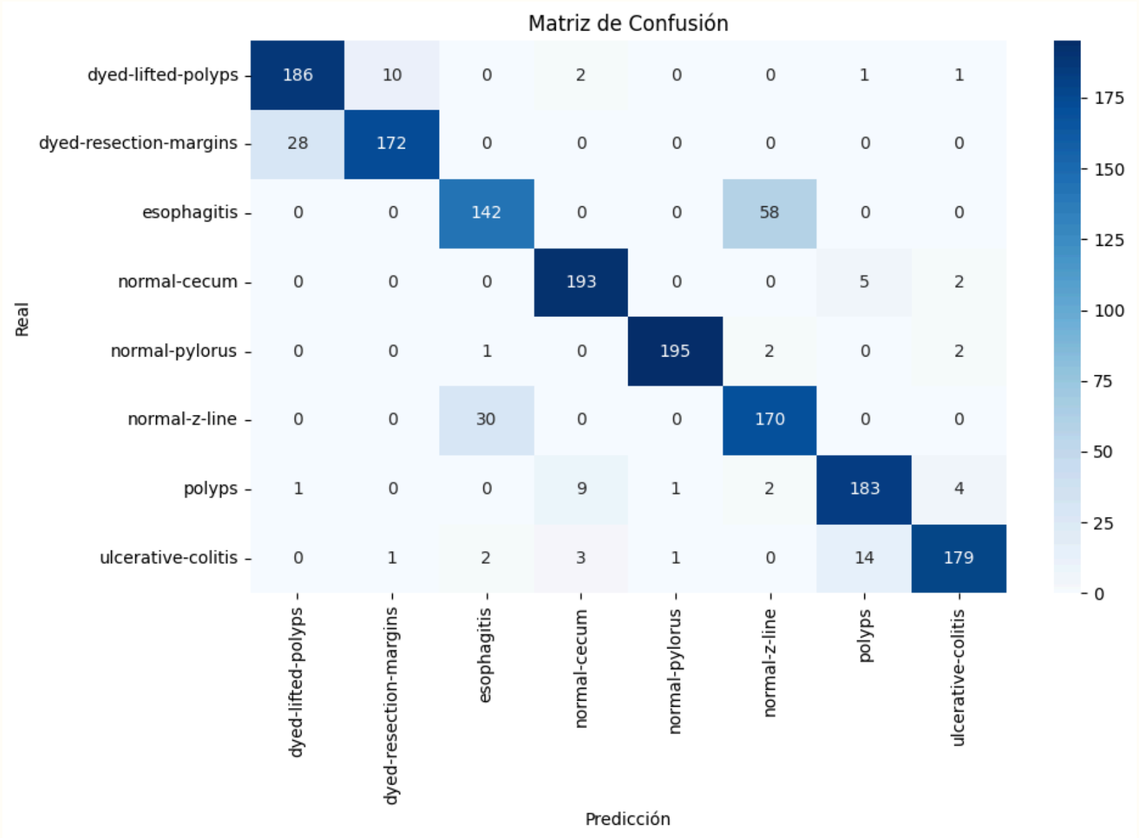
Training setup:

- Optimizer: Adam
- Loss: CrossEntropy
- Epochs: 20
- Learning rate: 0.001, Batch size: 32

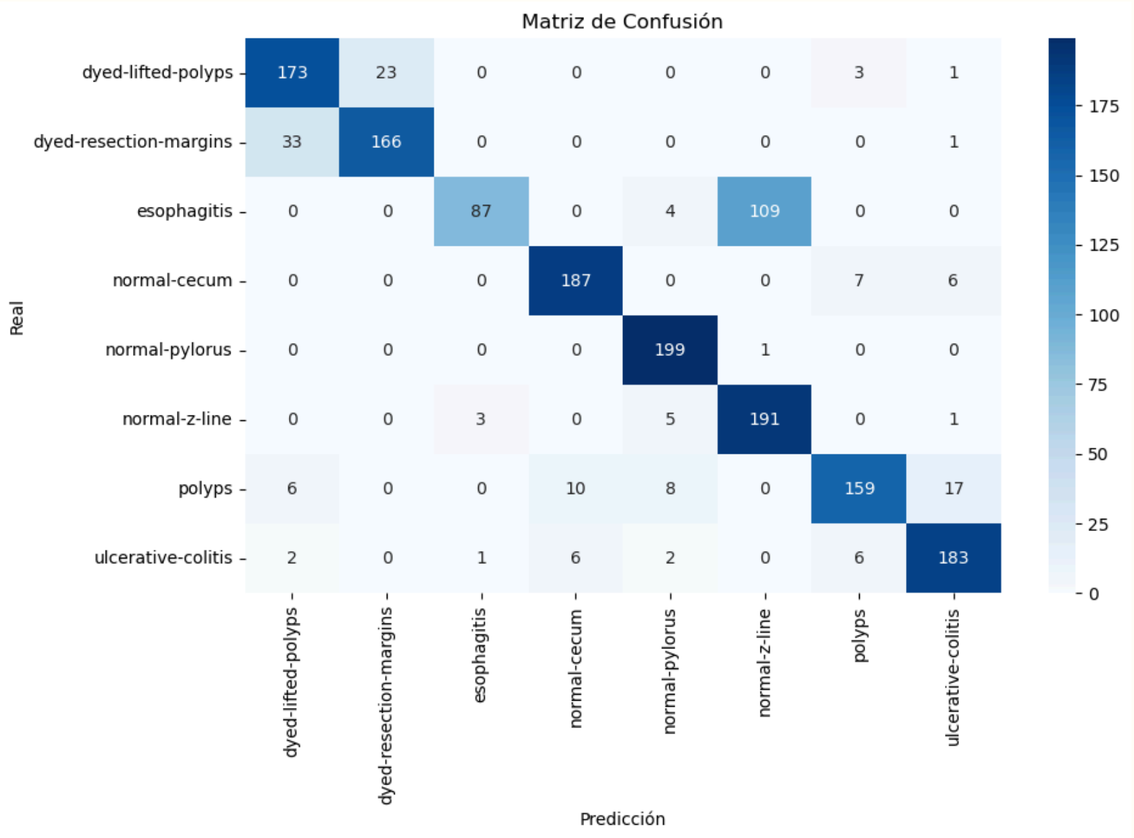
03 Performance

Metric	ResNet18	DenseNet121
Accuracy	84,06%	**88,75%**
Macro F1	0,8341	**0,8876**
Hardest Class	Esophagitis (F1: 0.60)	Esophagitis (F1: **0.76**)

Confusion Matrices



DenseNet121

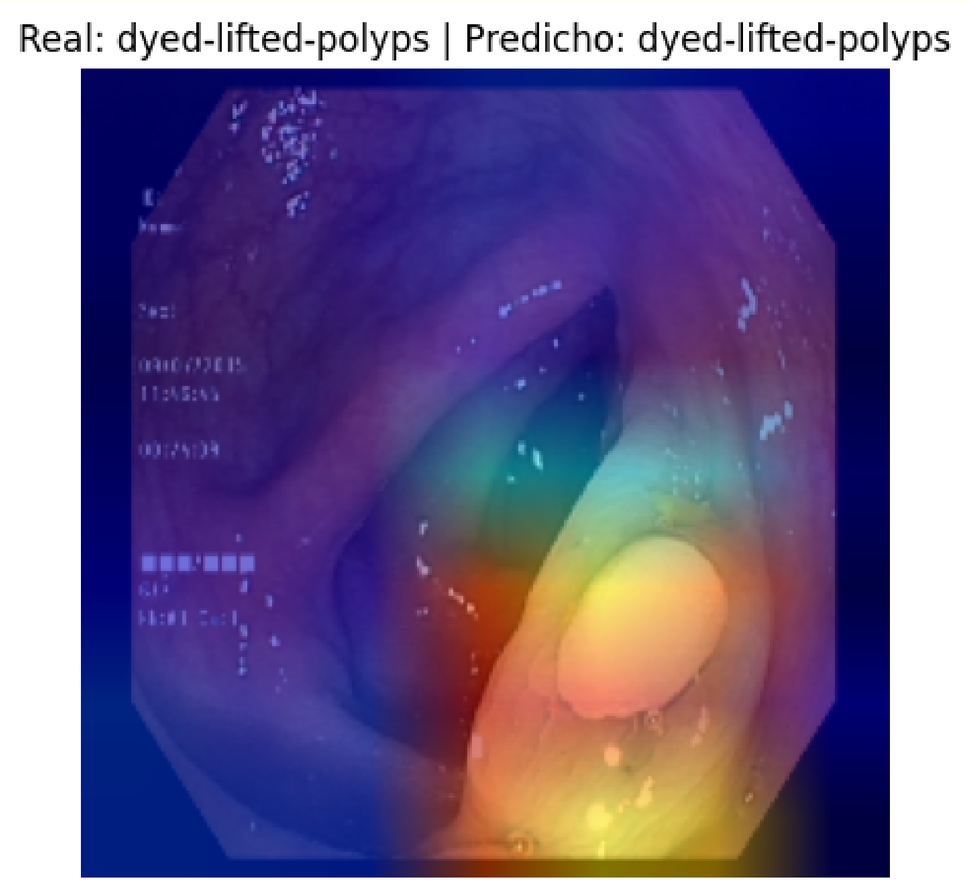


ResNet18

Grad-CAM Visualization

Grad-CAM was used to highlight areas influencing model predictions.
Key insights:

- **Focused on clinically relevant regions (e.g., polyp boundaries, inflammation)**
- **Confirms that models learn medically meaningful features**
- **Increases interpretability and trust**



04 Conclusion

Conclusion

- DenseNet121 outperformed ResNet18 (88.75% vs. 84.06%)
- Grad-CAM confirms medically valid attention
- Promising tool for clinical decision support
- Contributes to trustworthy, explainable medical AI systems

Thank
YOU