Auto-PCOS Classification Challenge

Automatic Classification of Poly-cystic Ovary Syndrome in Ultrasound Imaging

Team: AI Avengers

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April 26, 2024

Overview

- Methods
  - Proposed Model
  - Augmentation Method
  - Novelty of the work
  - Additional Details
- Results and Discussion
- Challenges and Future Scope
  - Merits and Demerits of the proposed method
  - Future work
  - Acknowledgment and Suggestions

- Utilized a Modified ResNet architecture with Squeeze-and-Excitation (SE) blocks added to each stage of a standard ResNet model to recalibrate channel-wise features, enhancing the representational capacity of the network.

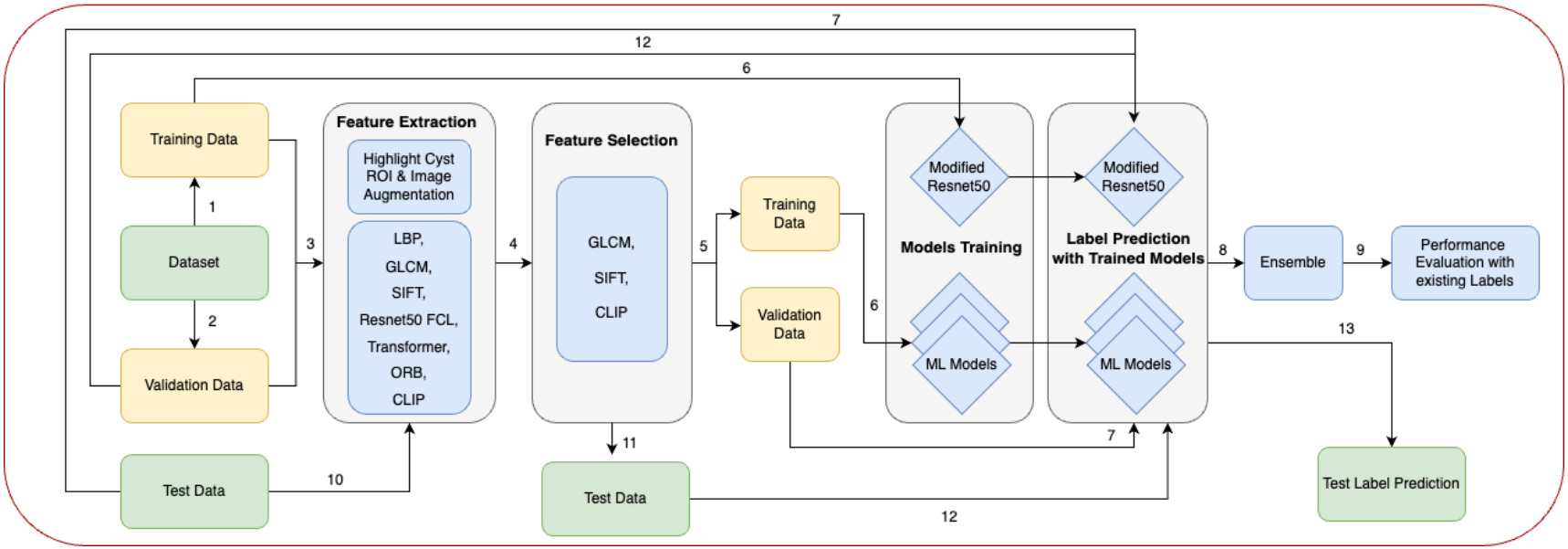

Figure 1: Proposed Method for PCOS Classification

- Image data augmentation includes random horizontal flips, rotations, resizing, and random application of color jitter to improve model robustness and prevent overfitting.

- Dynamic detection and highlighting of the Cyst's (ROI) size.
- Integration of SE blocks into a ResNet architecture for enhanced feature recalibration.
- Enrichment of features by combining DNN fully connected layer features and Spatio-Temporal features like, GLCM, SIFT, CLIP, ORB, LBP and transformer's final layer output.
- Ensemble approach combining deep learning(Modified Resnet50) with multiple machine learning(LGBM, ExtraTreesClassifier, AdaBoost LabelPropagation, LabelSpreading, etc) models to leverage the strengths of both methodologies in prediction.

- Additional techniques include CAM (Class Activation Mapping) for visual explanations, occlusion sensitivity for identifying important image regions, and SHAP values for interpretability.
- Learning Curves:

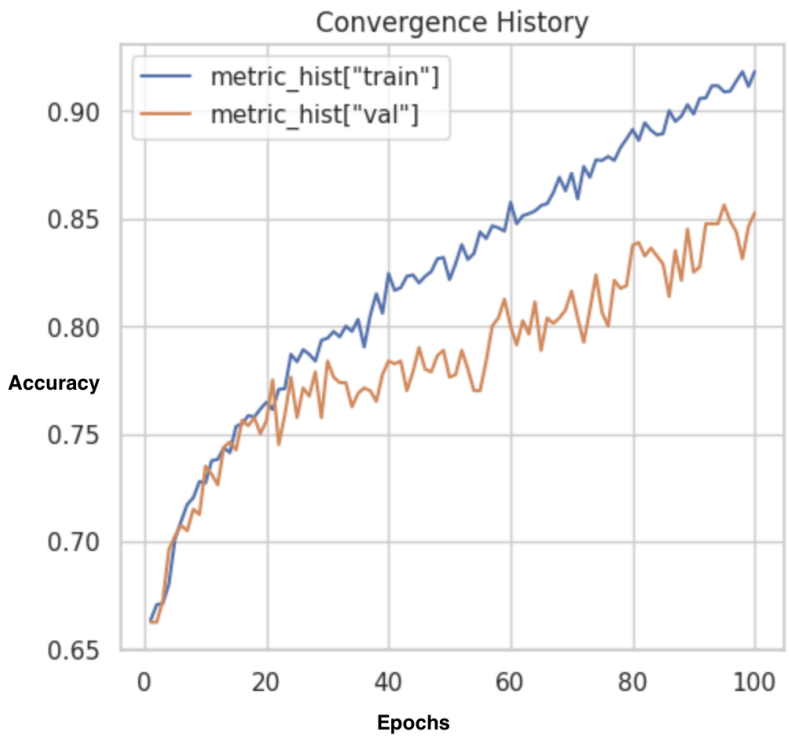

Figure 2: Accuracy Convergence History

- The model's performance was evaluated on a validation dataset consisting of 919 samples, which were classified into two categories: Class 0 (Unhealthy) and Class 1 (Healthy).

	Precision	Recall	F1-Score	Support
Class 0 (Unhealthy)	0.88	0.97	0.93	460
Class 1 (Healthy)	0.97	0.87	0.92	459
Accuracy			0.92	919
Macro Avg	0.93	0.92	0.92	919
Weighted Avg	0.93	0.92	0.92	919

Figure 3: Performance Evaluation

Challenges and Future Scope
Merits and Demerits of the proposed method

- Merits:
  - Improved interpretability with visual explanation methods.
  - Robust performance through ensemble DNN and ML models.
  - Feature enhancement by stacking DNN fully-connected and several spatio-temporal features.
- Demerits:
  - High computational requirements due to multiple image feature extraction and ensemble DNN and multiple ML models.

- Explorating other deep learning architectures such as EfficientNet or VIT(Vision Image Transformers) etc.
- Experimenting with frequency-based feature transformers like FFT transformations.
- Investigating other ensemble techniques (like blending, probability-based, weighted-average) that might further enhance prediction accuracy and robustness.
- Adaptation of the model to multi-class classification, capturing severity of the disease.

Acknowledgments

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Python Implementation
Github Link

https://github.com/musk-singhal/auto-pcos-classification

Thank you for your time.

Please feel free to reach out to us:

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