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A New Machine Learning Method and System For Automated Disease Detection from Chest Radiography Images

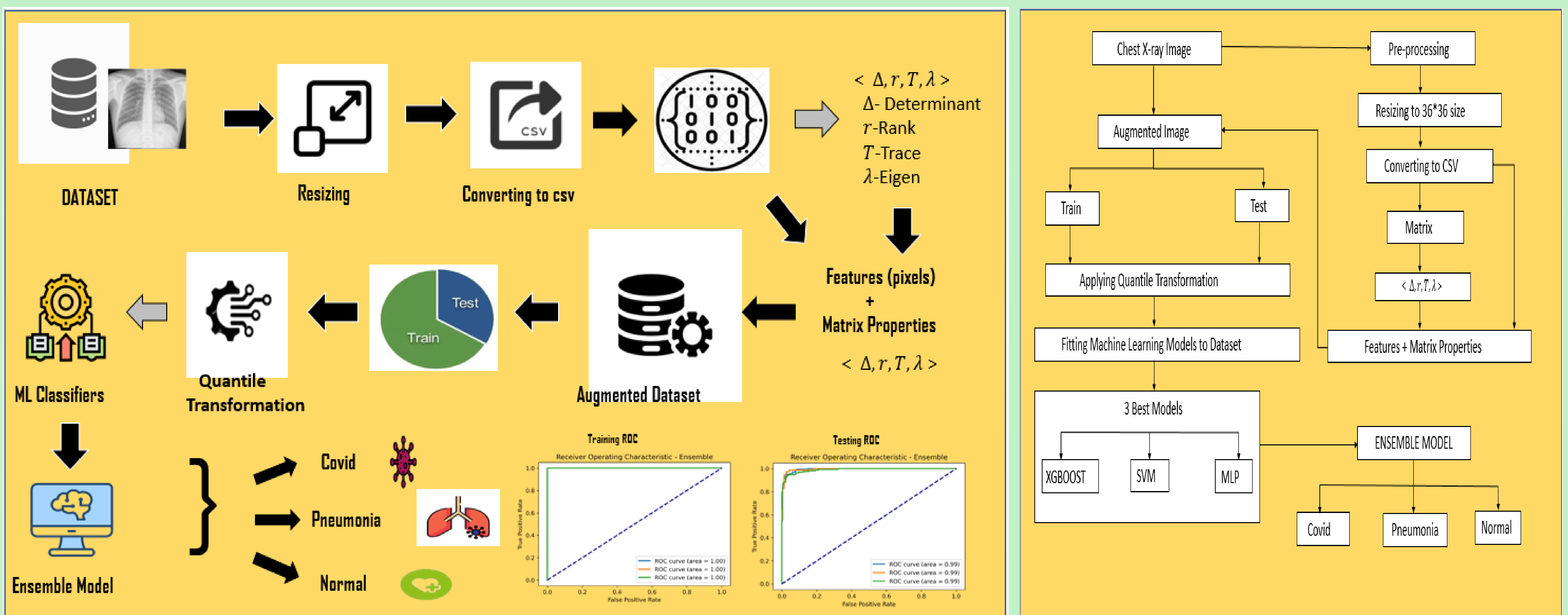


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Problem Statement

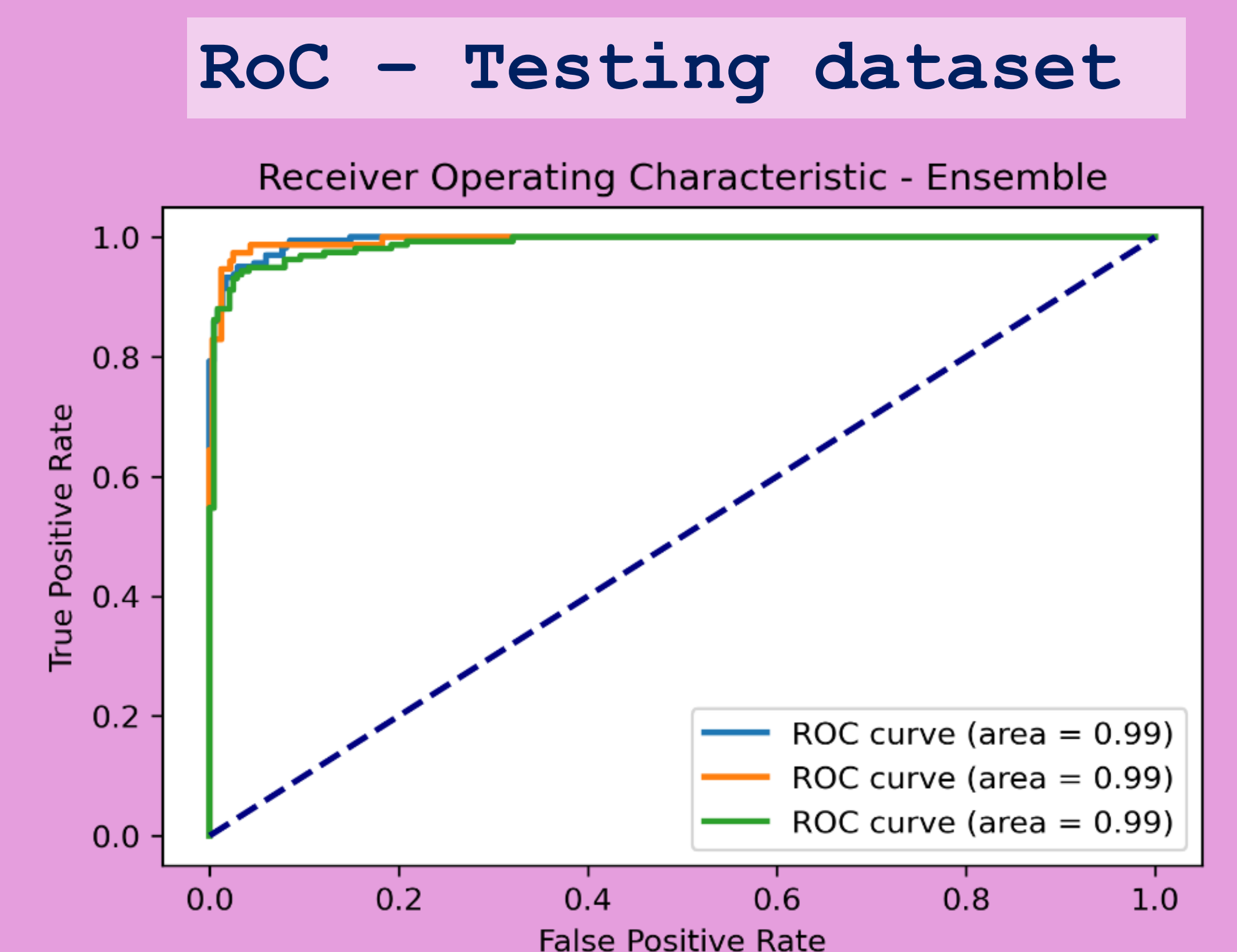
Decisions made by applying machine learning models which are built by leveraging applied linear algebra have strong mathematical basis. The idea is to propose an explainable feature extraction method and an ensemble system to identify near similar medical images by leveraging linear algebra to effectively discriminate between normal, pneumonia and COVID-19 chest radiograph images. Such an explainable medical imaging system that combines machine learning and mathematical basis for accurate disease diagnosis promotes transparency, clear and interpretable diagnostic reports, ultimately assisting healthcare professionals in taking informed decisions.

Method and System



Results

| Existing State-of-the Art Deep Learning Models | | Proposed Ensemble ML System | |
|--|----------|-----------------------------|--------|
| Image Size - 224 x 224 | | Image Size - 36 x 36 | |
| DL Classifiers | Test Acc | Evaluation Metric | Value |
| VGG-16 | 91.22% | Accuracy | 95.23% |
| Xception | 92.98% | Specificity | 97.43% |
| Inception V3 | 93.48% | Sensitivity | 95.73% |
| Choquet Integral WS-1 | 94.23% | Precision | 95.73% |
| Choquet Integral WS-2 | 94.23% | Balanced Accuracy | 96.58% |
| Choquet Integral WS-3 | 93.73% | F-score | 0.9573 |



Novelty

- A new method is proposed for image feature extraction which utilizes and applies matrix linear algebra properties to find similarity between medical images.
- The proposed feature extraction method helps to achieve explainable ML system with better performance by discriminating between normal, pneumonia and COVID-19 chest X-Ray images with 95.23% multi-class accuracy, 95.73% Precision with 96.58% balanced accuracy.