

Future Works

Future improvements include better class balance, attention mechanisms, ensemble techniques, and real-world deployment.

The initiative achieved its main goals; however, it found some areas for improvement.

Data Augmentation and Balancing:

Class imbalance hampered all models, especially the RNN and LSTM. To balance the dataset, future studies should include advanced data augmentation and synthetic data synthesis. To balance datasets, oversampling, undersampling, and generative adversarial networks (GANs) may increase model performance.

Refinement of model designs may increase performance. Deeper architectures or ensemble approaches may improve CNN model outcomes. Attention processes may help RNN and LSTM models focus on essential characteristics, boosting accuracy and recall.

Hyperparameter Optimisation:

Bayesian optimisation or grid search could find the best hyperparameters for each model, enhancing performance.

Evaluation Metrics:

Adding AUC-ROC and Precision-Recall curves to accuracy, precision, recall, and F1-score may help assess model performance, especially for imbalanced datasets.

Beyond model building, further effort may involve implementing models in real-world applications. This could involve establishing a simple image upload and classification interface, integrating with mobile apps, or scaling on cloud systems.

Transfer Learning:

VGG16 was a pre-trained model, however exploring other pre-trained models like ResNet, Inception, or EfficientNet may yield new insights and increase classification performance.

In conclusion, the study met its goals and identified various research and development topics. Future study in these topics will improve current models and advance picture classification and machine learning.