The Librarian from Alexandria

Font Classification for Ancient Manuscripts

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Project Overview

CNN Model

CNN model to recognize 11 ancient manuscript fonts

Dataset

Started with 1,200 images, expanded to 8,000

Challenges

Data challenges: class imbalance, inconsistent formats, varying quality

Goal

Goal: accurate classification despite limited training data

Data Preparation

Preprocessing

RGB conversion, resizing to 224×224, normalization

Augmentation

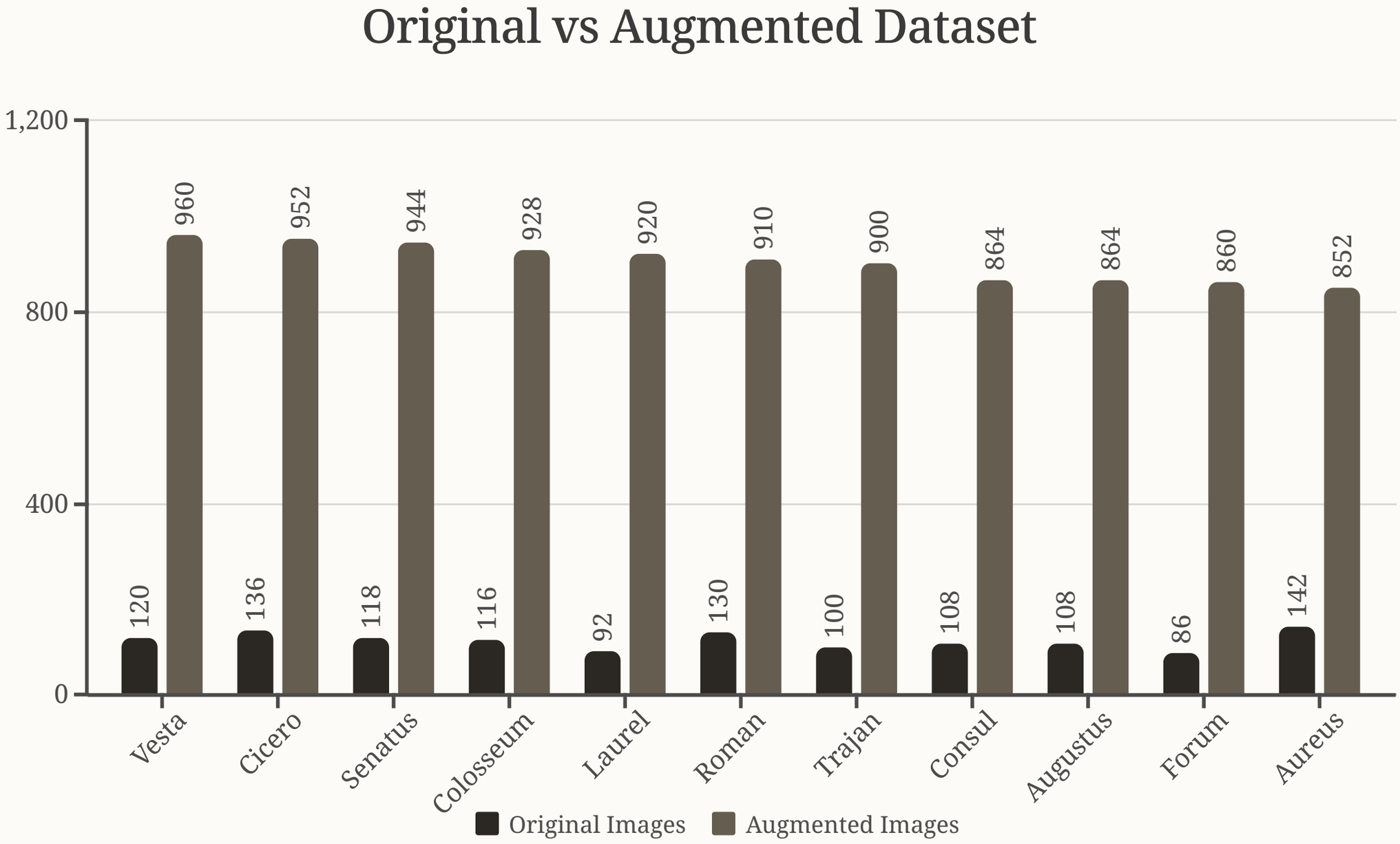
Rotation, brightness/contrast adjustments, blur, sharpening

Dataset Expansion

Expanded dataset from 1,200 to 8,000 images

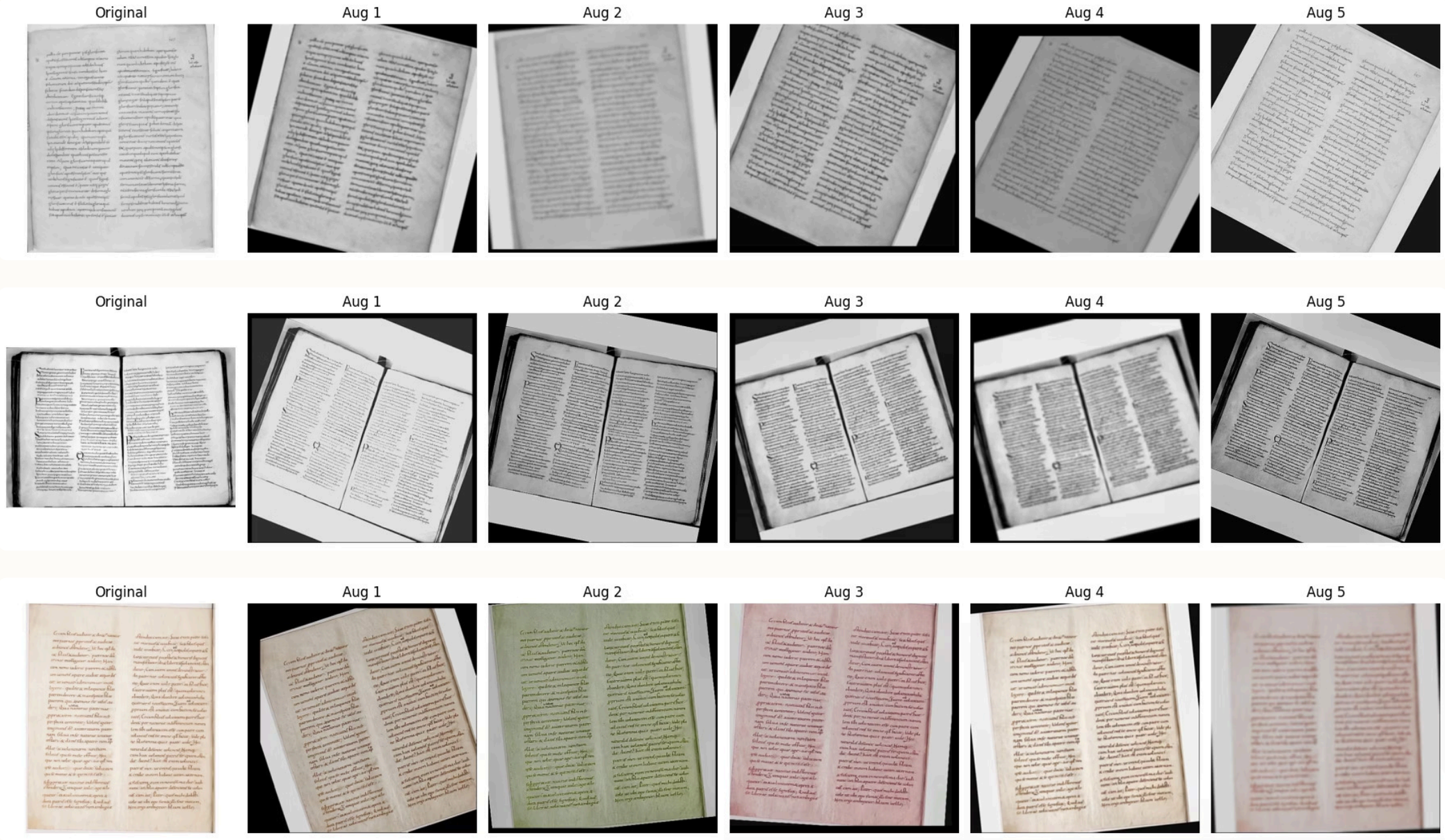
Class Balancing

Balanced classes at ~850 samples each

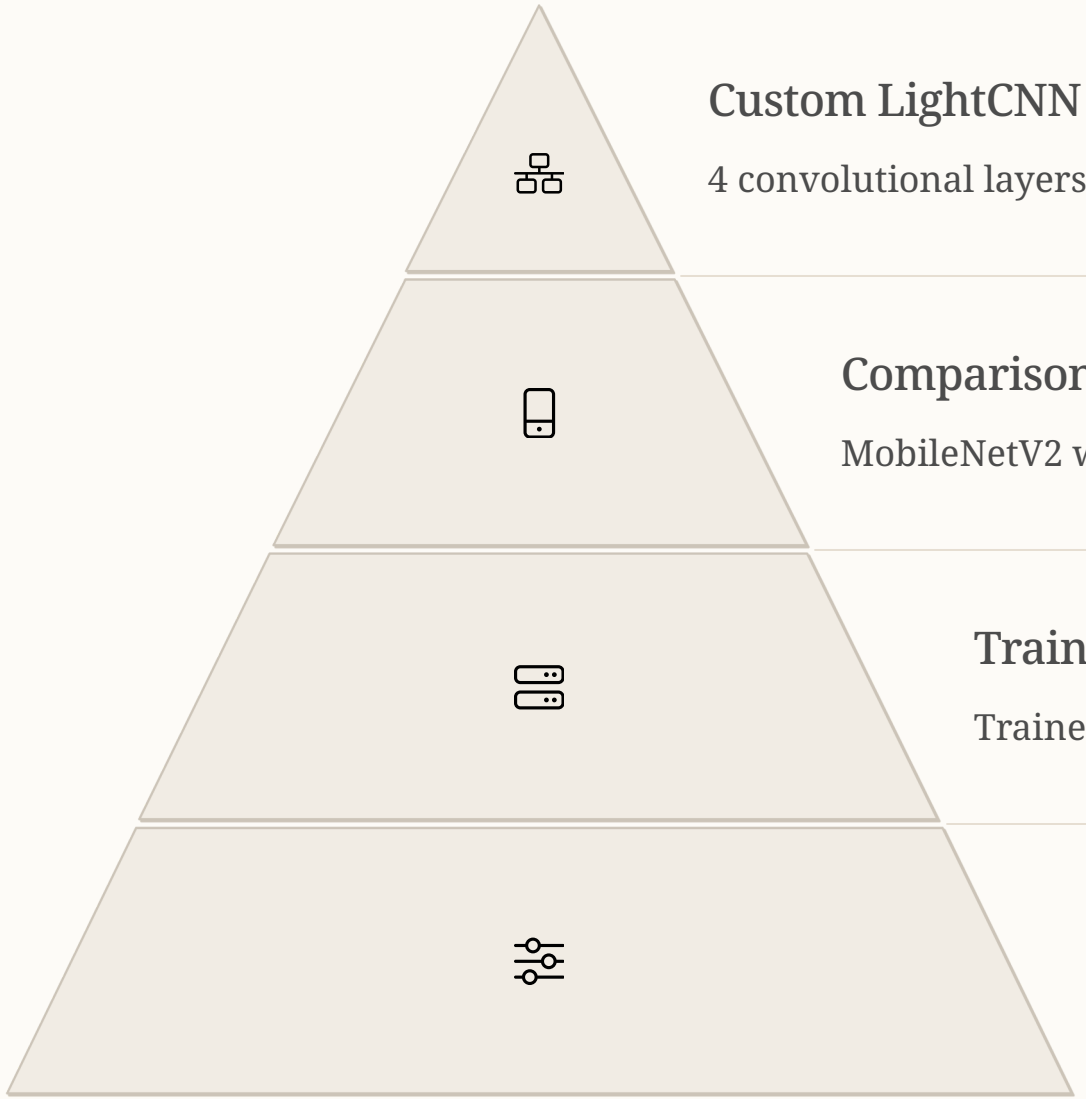


The chart shows a 7.93x multiplication factor. Initially underrepresented classes received more augmentation, creating balanced training data across all font types.

Data Augmentation Samples



Model Architecture



Custom LightCNN

4 convolutional layers, dropout for preventing overfitting

Comparison Baseline

MobileNetV2 with transfer learning

Training Environment

Trained with PyTorch on AMD GPU with 32GB RAM

Optimization

Optimized parameters with Optuna, implemented early stopping

Experimental Design

Dataset Splitting

Stratified dataset splitting for balanced evaluation

Evaluation Metrics

Metrics: accuracy, precision, recall, F1-score, confusion matrix

Research Goals

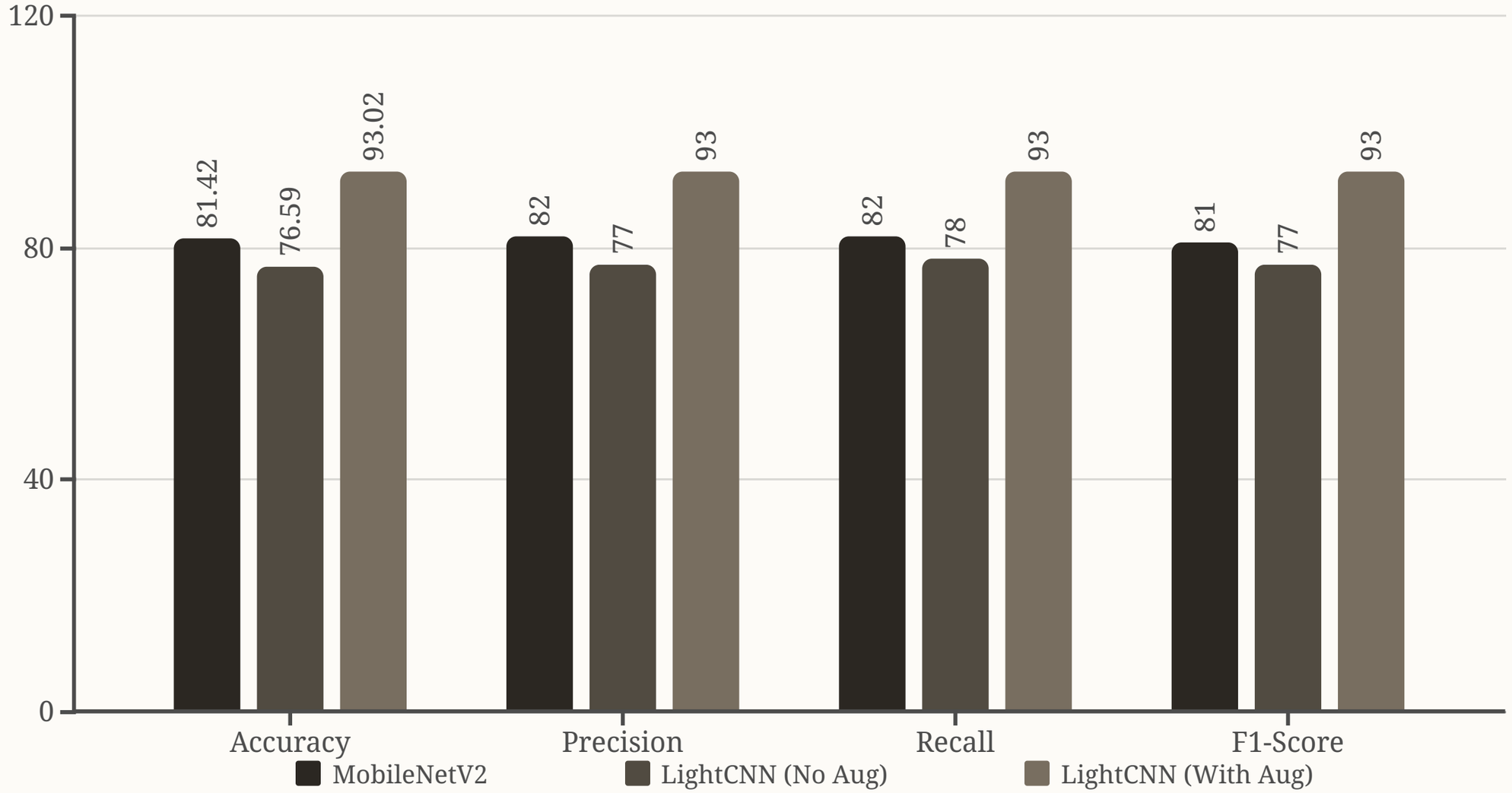
Goals: evaluate CNN effectiveness, impact of augmentation, architecture comparison

Performance Focus

Focus on realistic performance to avoid overfitting

Results: Model Performance Comparison

The chart shows performance metrics across three models. LightCNN with augmentations dramatically outperformed both alternatives.



Data augmentation provided +16.4% accuracy improvement over the baseline LightCNN and +11.6% over MobileNetV2.

Key Takeaways

Better Architecture

Task-specific CNN outperformed MobileNetV2

Augmentation Impact

Data augmentation crucial for performance

Effective Preprocessing

Effective preprocessing enabled strong results despite limited data

Limitations & Future Work

Dataset Limitations

Limited original dataset size

Hardware Constraints

Hardware constraints affected training efficiency

Advanced Augmentation

Potential for more advanced augmentation techniques

Hardware Optimization

Room for optimization with better hardware

Thank You!