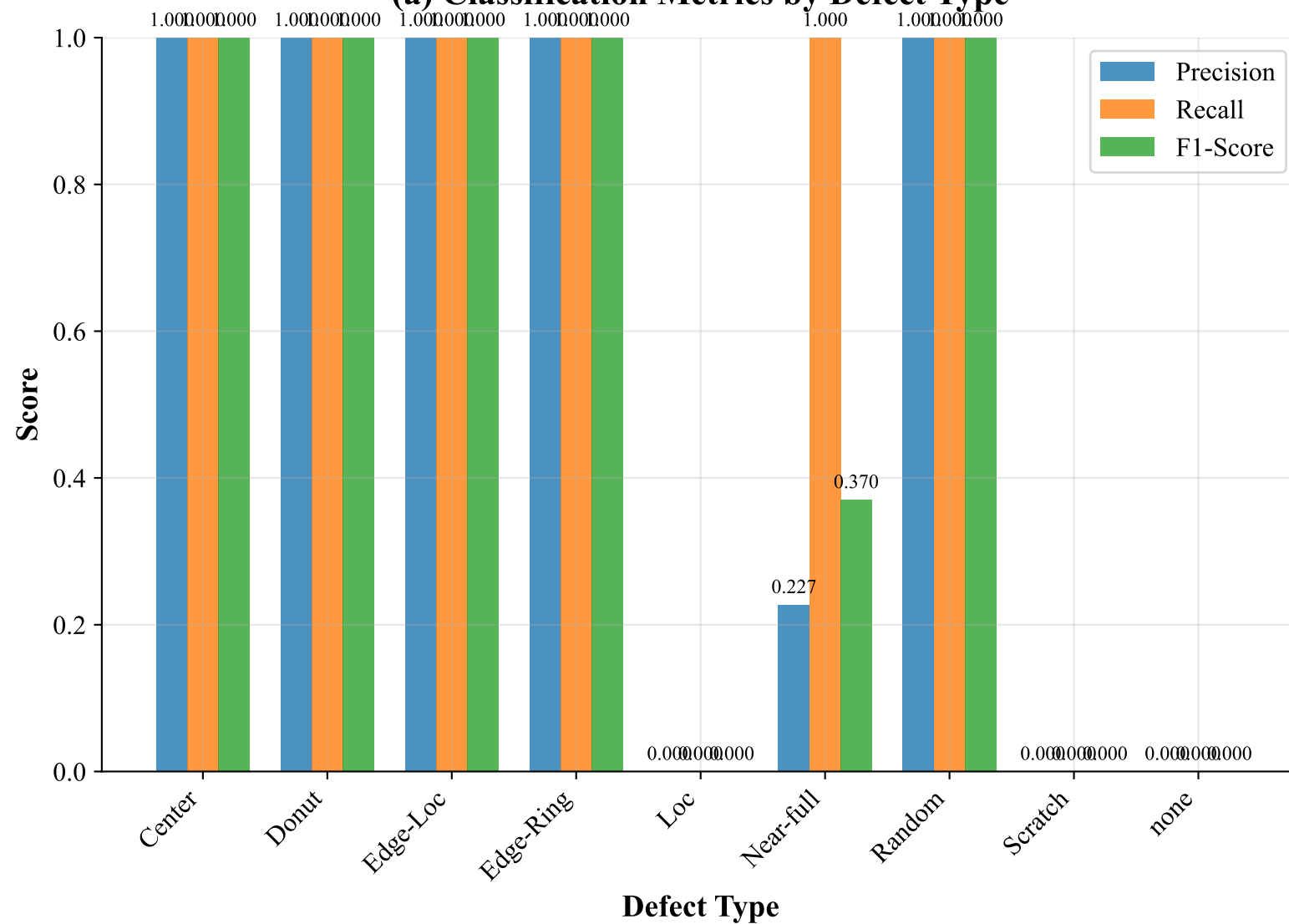
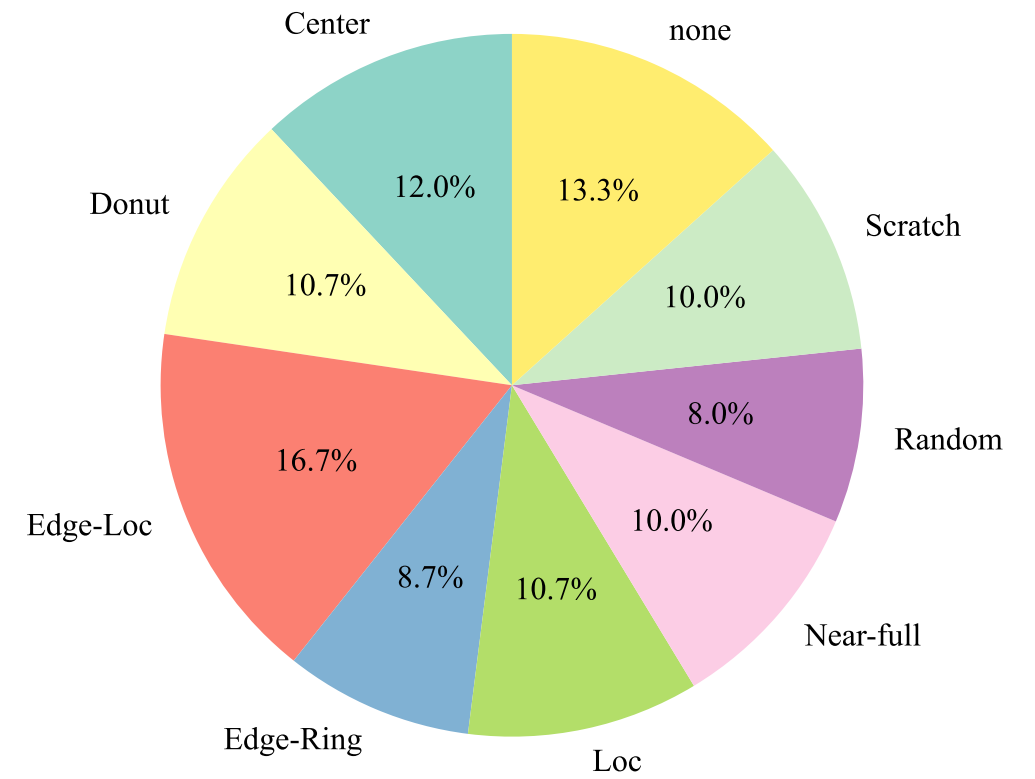


# Comprehensive Performance Analysis - CNN-based Defect Classification

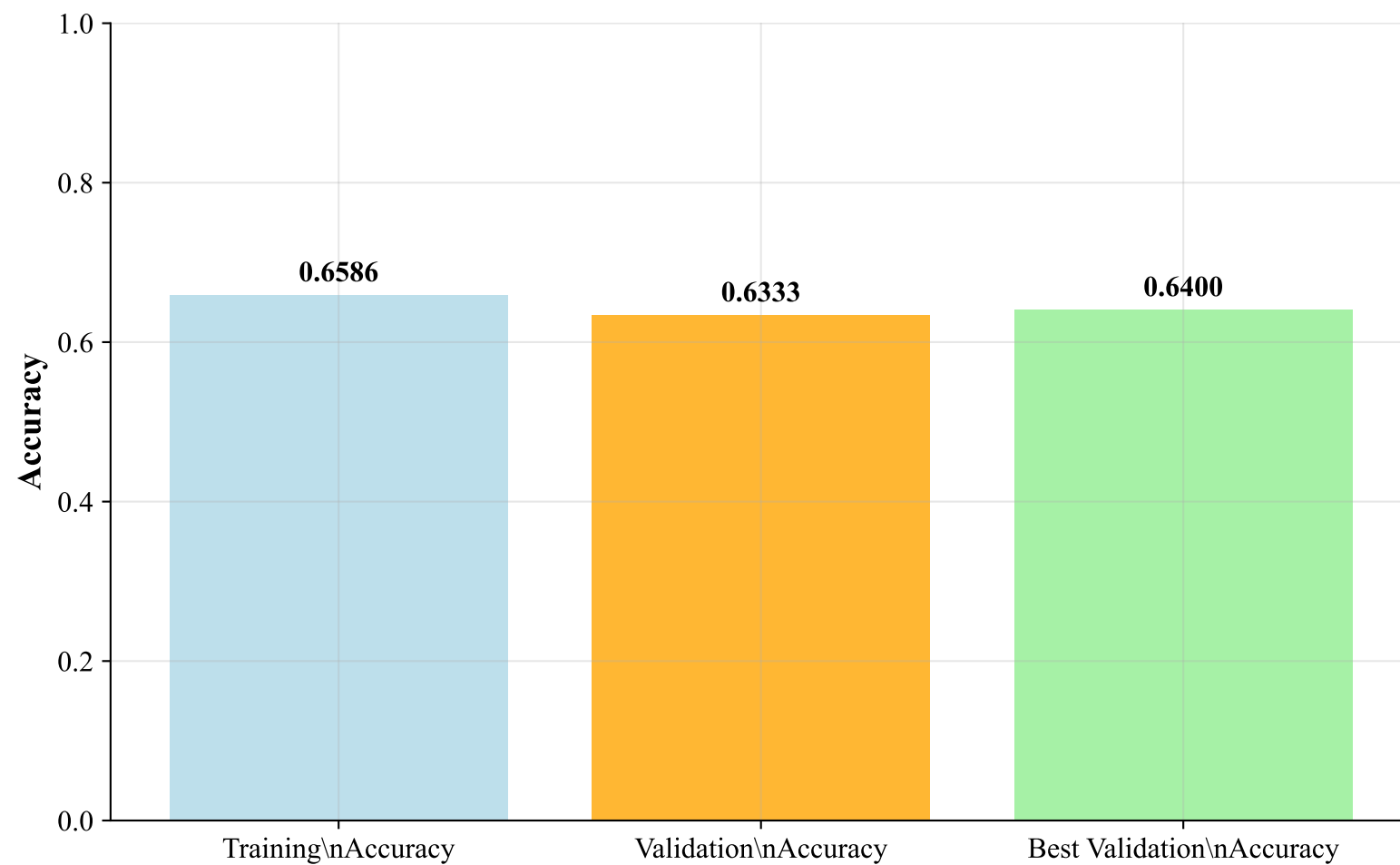
(a) Classification Metrics by Defect Type



(b) Test Set Distribution



(c) Model Training Summary



(d) CNN Architecture

CNN Architecture Summary:

- Input Layer: 64×64×1 (Grayscale Images)
- Conv2D Layer 1: 16 filters, 5×5 kernel
- MaxPooling2D: 4×4 pool size
- Conv2D Layer 2: 32 filters, 3×3 kernel
- MaxPooling2D: 2×2 pool size
- Dense Layer: 64 neurons
- Output Layer: 9 classes (Softmax)

Total Parameters: 79,433  
Optimizer: Adam (lr=0.01)  
Loss Function: Categorical Cross-Entropy