Research Questions and Explanation

Four primary questions drive the study:

Research Questions and Core Questions

1. How can machine learning and deep learning techniques effectively identify food items in images?

Focus on neural network architectures (CNNs) for image classification

Explore training techniques and optimization methods (SGD, Adam, RMSprop)

Evaluate using accuracy, precision, recall, F1-score, and confusion matrices

2. What are the most common food items that need identification?

Analyze dataset distribution to identify frequent food categories

Prioritize training on common items for better generalization

Address class imbalance through data augmentation techniques

3. Which ML/DL techniques work best for food recognition?

CNNs: Extract spatial hierarchies from food images

Transfer Learning: Fine-tune pre-trained models (VGG, ResNet, Inception)

Ensemble Methods: Combine multiple models for improved accuracy

Feature Engineering: Focus on edges, textures, and color patterns

4. What dataset features are critical for accurate identification?

Extract low-level features (edges, textures) and high-level patterns (shapes)

Analyze feature importance using tree-based models and CNN saliency maps

Apply dimensionality reduction (PCA, t-SNE) for model efficiency

Implementation Approach

The research addresses these questions through systematic evaluation of neural network architectures, optimization of training processes, and comprehensive feature analysis to develop an accurate food image classification system.