

# Research on CNN Neural Networks and Application in Image Classification Problems

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**Abstract:** This study investigates Convolutional Neural Networks (CNNs) and their application to image classification tasks. CNNs represent a class of deep learning models specifically designed to process grid-like data, such as images, by leveraging convolutional layers to automatically extract hierarchical features. The research systematically examines the fundamental architecture of CNNs, including convolutional, pooling, and fully connected layers, alongside key training techniques such as backpropagation and regularization. To evaluate performance, the study implements and tests several CNN architectures on benchmark image datasets, analyzing metrics such as accuracy, precision, and computational efficiency. Experimental results demonstrate that CNNs significantly outperform traditional machine learning methods in classifying complex visual data, achieving high accuracy while maintaining robustness to variations in lighting, scale, and orientation. The findings confirm the effectiveness of CNNs for real-world image recognition applications, though challenges related to overfitting and computational cost are also discussed. This work contributes to the understanding of deep learning techniques and provides a practical framework for deploying CNNs in automated image classification systems.

**Keywords:** CNN, image classification, neural network, application