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Transfer Learning Approach for Handwritten Character Recognition of Meitei Mayek Script Using Deep CNNs

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Abstract

The digitization of low-resource scripts poses a significant challenge including structural uniqueness and limited computational support. This work aims to present an OCR System for the Meitei Mayek script using deep learning techniques, specifically transfer learning with the VGG16 Convolutional Neural Network. It uses a fine-tuned VGG-based convolutional architecture to perform the recognition of characters by modelling the spatial and geometric properties of handwritten symbols.

The system uses a VGG-based convolutional architecture adapted for the Meitei Mayek characters, where convolution layers detect fundamental visual elements such as strokes, curves, intersections, and spatial orientations. Images are passed through successive layers in which low-level features are combined into abstract representations that describe the overall form of each character, while pooling operations reduce sensitivity to minor handwriting variations.

One limitation of the study is the small dataset of handwritten samples, which is addressed through data augmentation using image transformations such as variations in brightness, contrast, noise, and stroke appearance to improve generalization to unseen inputs. Training is guided by gradient-based optimization with gradual adjustment of internal parameters to minimize recognition errors across character classes.

The recognition model is integrated into a simple graphical application that accepts scanned images and camera input for practical and educational purposes. Although the current implementation operates on isolated characters, the underlying design allows future extension to word-level and document-level recognition.

In short, the study demonstrates how convolutional modelling and optimization methods can be applied to the preservation of a low-resource script, contributing both a practical OCR model and a meaningful application of mathematical methods for linguistic preservation.

Keywords: Optical character recognition, Meitei Mayek, convolutional neural network, VGG16, low-resource scripts, handwritten character recognition

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