

Research on deep learning techniques for recognizing mathematical symbols to support the digital conversion of scientific and technical documents

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Abstract: This study investigates deep learning techniques for recognizing mathematical symbols to support the digitization of scientific and technical documents. The automatic conversion of printed mathematical expressions into machine-readable formats remains a significant challenge due to the complex two-dimensional structure and diverse notation of mathematical symbols. We propose a novel approach based on convolutional neural networks (CNNs) and recurrent neural networks (RNNs) to detect and classify mathematical symbols from scanned document images. The model is trained on a comprehensive dataset of scientific literature, incorporating both isolated symbols and full expressions. Experimental results demonstrate that our method achieves high accuracy in symbol recognition, significantly outperforming traditional optical character recognition (OCR) systems for mathematical content. Furthermore, the integration of attention mechanisms improves the handling of overlapping and densely packed symbols. This research contributes to the efficient digitization of technical archives, enabling full-text search, editing, and knowledge extraction from legacy scientific documents. The proposed framework offers a practical solution for large-scale conversion of mathematical content in academic and engineering fields.

Keywords: deep learning, mathematical symbol recognition, document digitization, scientific document processing