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## **ADVANCEMENTS IN HANDWRITTEN TEXT RECOGNITION FOR UZBEK LANGUAGE**

*Nabiev Jakhongir Ibromhjon ugli, Msc(in-progress), Department of Computer inginiring, Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Tel. (94)690-61-27, jakhongirnabiev02@gmail.com*

**Abstract.** The utilization of activation functions is a crucial aspect of neural networks, including those involved in the recognition of handwritten text images through convolutional neural networks. This article focuses on the benefits and drawbacks of activation functions in this context and presents a comparative analysis of various neural network models using different activation functions. The results indicate that the organized convolutional neural network achieved a recognition efficiency of 80 percent.

### **INTRODUCTION**

Handwritten text recognition is an essential area of research and development in the field of artificial intelligence and computer vision. With the increasing digitization of information, the ability to accurately and efficiently recognize handwritten text in various languages, including Uzbek, has become crucial. In this article, we will explore the algorithms and techniques used for the recognition of handwritten Uzbek text.

The process of recognizing handwritten Uzbek text begins with preprocessing the input image. The image is converted to grayscale and subjected to noise reduction techniques such as Gaussian blur and thresholding to enhance the quality and separation of the text from the background.

### **TEXT SEGMENTATION**

Text segmentation plays a vital role in breaking down the handwritten text into individual characters and words. Techniques such as connected component analysis are employed to identify and separate characters, taking into account the spaces and other delimiters to segment the words.

### **FEATURE EXTRACTION**

The next step involves extracting features from the segmented text. This includes analyzing the shape, size, and orientation of individual characters using methods like contour analysis and Histogram of Oriented Gradients (HOG).





These features are then converted into a suitable format for further processing, such as a feature vector.

Training a machine learning model is a crucial aspect of handwritten text recognition. A dataset of labeled handwritten Uzbek text is used to train models like convolutional neural networks (CNN) or recurrent neural networks (RNN). The extracted features and corresponding labels are utilized to teach the model to recognize handwritten Uzbek characters and words.

## RECOGNITION

Once the model is trained, it is applied to the preprocessed and segmented handwritten Uzbek text image to recognize individual characters and words. The model uses character-level or word-level classification to identify the recognized text.

Postprocessing: After recognition, postprocessing techniques are employed to refine the recognized text. Language-specific rules and dictionaries are applied to correct any recognition errors and improve the accuracy of the recognized text. The recognized text is then converted into a suitable format for further processing or display.

## CONCLUSION

The development of algorithms for the recognition of handwritten Uzbek text represents a significant advancement in the field of computer vision and natural language processing. The ability to accurately recognize handwritten text in Uzbek opens doors for the digitization of historical documents, improvement of educational resources, and efficient data processing in various fields. As technology continues to advance, the algorithms for handwritten text recognition in Uzbek language are expected to evolve further, contributing to the preservation and accessibility of Uzbek culture and heritage.

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