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Article Title: Handwriting Recognition Using Artificial Intelligence with Neural Network

Handwriting Recognition Using Artificial Intelligence with Neural Network

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ABSTRACT

Handwriting character recognition has grown in popularity as a study topic as a result of the rising use of digital technology to store and transmit information in all industries and practically all daily activities. Despite the continued importance of handwriting, individuals still need handwriting copies that can be electronically transmitted and preserved. The ability of a computer to recognise and comprehend legible handwriting input from sources such as touch screens, images, paper documents, and other sources is known as handwriting character recogning. Considering that every person has a unique handwriting style, handwriting characters are nonetheless difficult. The purpose of this essay is to describe the creation of a system for reading handwritten notes from students and lecturers. The creation is built on an artificial neural network, a branch of artificial intelligence research.

1 Introduction

Due to their usefulness in several daily activities, character recognition and handwriting digits have grown in significance in today's digital environment. The fact that several recognition systems have been created or put forth for use in various industries where great categorization efficiency is required in recent years is evidence of this. People can complete more complex jobs that would otherwise take a long time and be expensive with the aid of systems that recognise handwriting letters, characters, and numerals. The automated systems used by banks to handle bank checks are a good example. Without computerised cheque processing technology, the bank would have to hire a large number of staff members who might not be as productive as the computerised system. Biological neural networks, which enable people and animals to learn and model non-linear and complicated interactions, can serve as inspiration for handwriting recognition systems [1, 2]. That implies that they could be created using an artificial neural network [4]. People can distinguish between various handwriting objects, including numbers, letters, and characters, thanks to the human brain [5]. Humans can choose

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to read handwriting letters and digits in different ways because they are biassed [8]. On the other hand, impartial computer systems can complete extremely difficult jobs that could demand a lot of time and effort from people to complete in the same way. It is important to comprehend how human beings read underwriting [10].

2 Piliminary

2.1 Artificial Intelligence

There is a case to be made that computer systems interpreting handwritten characters, numbers, and words is an imitation of humans. It may be said that such a system uses artificial intelligence to read handwriting from photographs or any other source of handwriting [11]. Artificial intelligence is the term used to describe intelligence displayed by machines [13]. Computers or other devices that may simulate "cognitive" processes connected to the human mind are referred to by this term. With the aid of artificial intelligence, a machine can carry out tasks that a human can do [12, 20], learn from experience, and adapt to new data (inputs). Deep learning, neuron networks, and machine learning are subfields in artificial intelligence. B. Computer Learning The focus on learning from a set of data in psychology and biology serves as an inspiration for machine learning technologies. The fundamental premise is that through studying data, machines may learn how to carry out specific jobs [21].

2.2 Machine learning

The model is given training data that is unique to the domain of the given problem and the resolution for each individual instance of the problem. In this manner, the model picks up new skills through learning [14]. The machine learning model utilised in the handwriting recognition system is simply demonstrated in Figure. 1. The model uses learning data to identify a given digit from a handwritten digit in an image.

2.3 Artificial Neural Network (ANN)

Artificial Neural Network (ANN) is a term used to describe a computing paradigm or system that processes information and is modelled after the biological neural networks that make up the human brain [18]. Although the systems do not exactly match real neural systems, they are made to process information similarly to how the human and animal brains do [27]. The networks are made up of numerous linked neurons that cooperate to accomplish certain objectives . ANNs learn from examples in a manner similar to how humans do. As a result, an ANN can be trained to perform a specific task, like character recognition or data classification. The system must be conFigureured to a connection as part of the learning process [24]. A network of numerous straightforward processors, each with a tiny amount of local memory, makes up an artificial neural network [39]. The processors (units) are connected via unidirectional communication channels, and they can only access local input and data from those links.

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3 Design and Architecture

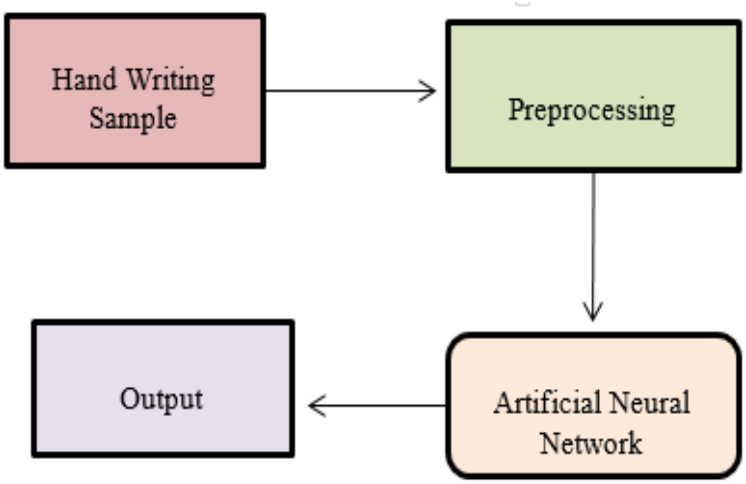

Figure 1: *Architecture and Design*

The layout and architecture of the proposed neural network-based handwritten character recognition system. As depicted in Figure. 1, the proposed system consists of input pre-processing, ANN, and output portions.

3.1 Neural Network Architecture

As previously said, neural network architectures are the most effective foundation for HRS systems. Consequently, it is important to comprehend the neural network architecture. The components that join to form a network utilised for handwriting recognition are referred to as the neural network architecture. Neural networks are loosely inspired by how the human brain functions. It is based on the concept of how human brain neurons transmit signals as they process input into an output [16]. A network is made up of layers, which range from the ones in charge of accepting input to the layer in charge of producing values. There is a hidden layer between the output and input level layers that does the majority of processing. From the input photos of handwriting, multiple neural network designs can be used to produce various outcomes. The reason for this is that different architectures are based on various parameters, data, and training times. Figure. 2 provides a good illustration of the architecture needed to identify handwriting in photos. While "Y" denotes the output, "X" displays the input.

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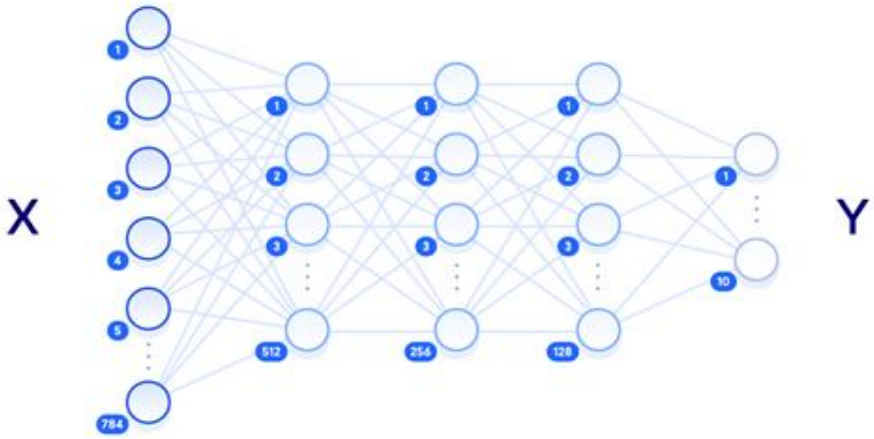

Figure 2*: Neurel Network Architecture*

4 Methodology

The current OCR system will consist of four phases. The phases are preprocessing, segmentation, feature extraction, and recognition

4.1 Preprocessing

Noise is first removed during preprocessing, after which skewing is evaluated. Preprocessing is necessary to create data that optical character recognition systems can easily process. Pre-processing is mostly used to reduce background noise, highlight the area of interest in the image, and create a distinct separation between the foreground and background.

4.2 Segmentation

The most important step in character recognition techniques, according to some, is segmentation. Only during the testing stage are photos segmented. By comparing all points to the typical distance between segmentation points in the incomplete image, it verifies that no erroneous points were included. In order to make an image's representation simpler and easier to analyse, segmentation is done. The recognition rate of the script is thus positively impacted.

4.3 Feature Extraction

The height of the character, the number of horizontal lines, the widths of the character, the number of circles, the pixels, the positions of various elements, and the number of vertically oriented arcs, to name a few, are some of the attributes used to define the features of the image at this phase.

4.4 Recognition

The neural network is employed in this stage to categorise and identify the characters in the image. Multiplayer perception (MLP) and Korhonen's Self-Organizing Map are the neural networks that optical character recognition systems employ the most.

5 Conclusion

The primary goal of this research was to create a system for classifying and identifying handwriting characters and numerals. In today's digital age, it is crucial to be able to recognise characters and numbers, particularly in organisations that work with handwritten papers that require computer systems to analyse. Preprocessing, segmentation, feature extraction, and recognition were the stages of handwriting recognition. Character recognition in other languages can be added to the current research's findings. Using the current research's machine learning models, books, newspapers, handwritten notes, and newspapers can be converted into digital text format.

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