Air-Handwriting Detection using Deep learning Neural Network(CNN)

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Abstract— A large number of scholars are working to change how people read, comprehend, and interpret written language. A crucial component of document analysis and recognition is word recognition. In machine learning and pattern recognition, deep learning is a crucial subject. It may be able to handle challenging machine learning issues. The opportunity for next-generation applications is enormous due to the availability of tools that aid with pattern identification. Convolution neural networks generate hierarchical features from CNN training layers through data-driven learning. The machine learning algorithm for handwritten word recognition is presented by this system. The end users will be able to convert handwritten text into digital format with this method. CNN performs best when the input pixels are unprocessed. The system takes in all of the scan images as raw data and processes them further to produce the desired result. The goal of this project is to train a neural network algorithm to recognize patterns in handwritten English letters, interpret those characters as input, and then transform those characters into a prettier version of the original.

Keywords − Machine learning, Deep learning, Convolutional Neural Networks (CNN), Image recognition, etc.

• Introduction

The ability of a machine to read and comprehend handwritten text from a variety of sources, including paper documents, images, touch screen devices, etc., is known as handwriting recognition. Research on handwritten and machine character recognition is just getting started, but it has a lot of uses in offices, banks, and other businesses. The primary goal of this project is to create an expert system for "HCR(English) using Neural Network" that, with the help of artificial convolutional neural networks, can accurately identify a certain character of type format. Artificial Intelligence is a relatively new topic, hence the design elements aren't as well defined as they are in other designs. Data parallelism is implemented via neural computers. The manner that neural computers are operated is entirely distinct from how conventional computers are controlled. When given a certain initial state (data input), neural computers are taught to either categorize the input data into one of the many classes or to have the original data evolve in a way that optimizes a desired attribute.

• Objective

The primary objective of the Air-Handwriting Detection using Deep learning is to develop and implement a touchless interaction that unable user to interact digital device without any physical contact, a user-friendly experience that provide and accessible input method that leverages the familiarity of handwriting and drawing gestures, an enhanced mobility and versatility which offer a versatile input solution that frees users from the constraints of traditional input devices, facilitating interaction in scenarios where physical interfaces are impractical or limiting, such as while on the move or in immersive AR, VR, and MR environments. Gesture recognition that incorporate gesture recognition capabilities to enable users to perform specific gestures for triggering actions or manipulating digital content, leading to innovative and immersive user experiences in domainslike gaming, design, education, and healthcare.

Organization of paper

The organization of the paper is as follows section II gives the related work and limitations and last section concludes the paper with future work followed by references.

• Related Work

Mahmoud M et al. [1], We compared three neural network-based recognition algorithms in this research in order to identify the optimal algorithm taking into account many aspects like accuracy and performance. Additional factors, such the duration of the execution, have also been taken into account. To assess the technique, both standard and random datasets of handwritten numbers have been used..

Parul   Sahare et al [2], We compared three neural network-based recognition algorithms in this research in order to identify the optimal algorithm taking into account many aspects like accuracy and performance. Additional factors, such the duration of the execution, have also been taken into account. To assess the technique, both standard and random datasets of handwritten numbers have been used.

BrijeshwarDesai et al [3], The study suggests utilizing convolutional neural networks to recognize handwritten Devanagari letters optically. Compared to SVMs and ANNs, Convolutional Neural Networks are thought to be more efficient at classifying images.Because Devanagari characters have more intricate structures than Roman characters, working with them is more difficult.

Adeel   Yousaf et al [4], Because neural networks have complementing qualities like accuracy, speed, and robustness, they are frequently utilized for classification in offline HCR systems. Additional HCR algorithms have been suggested by various writers.

Rohan Vaidya[5], Future advances in this system are quite possible. The system is currently unable to recognize handwritten text in cursive. However, we may include support for cursive text recognition in the future. Our system can only now recognize text in the English language. In the future, we can add support for additional languages.

RaniahA[6], This research proposes a retrieving approach that makes use of the new trend in image retrieval searches: the integration of the multimodal information (textual and visual) in the images. To retrieve semantically linked photos, it combines the association rules mining method and clustering, two distinct data mining techniques.

Rohan Vaidya [7], In this paper, we propose a novel deep neural network-based offline handwritten character identification technique. Deep neural network training has become simpler in the modern world due to the abundance of data available and the numerous algorithmic advancements being made. The computer power required these days to train a neural network.

ParulSahare [8], Robust character segmentation and identification techniques are provided in this study for multilingual Indian document images with Latin and Devanagari scripts. These documents typically have mixed text (handwritten and machine printed), poor print quality, local skews, and poor layout organization.   The main segmentation paths in the suggested character segmentation method are derived from the characters' structural characteristics.

### • System Overview and Design
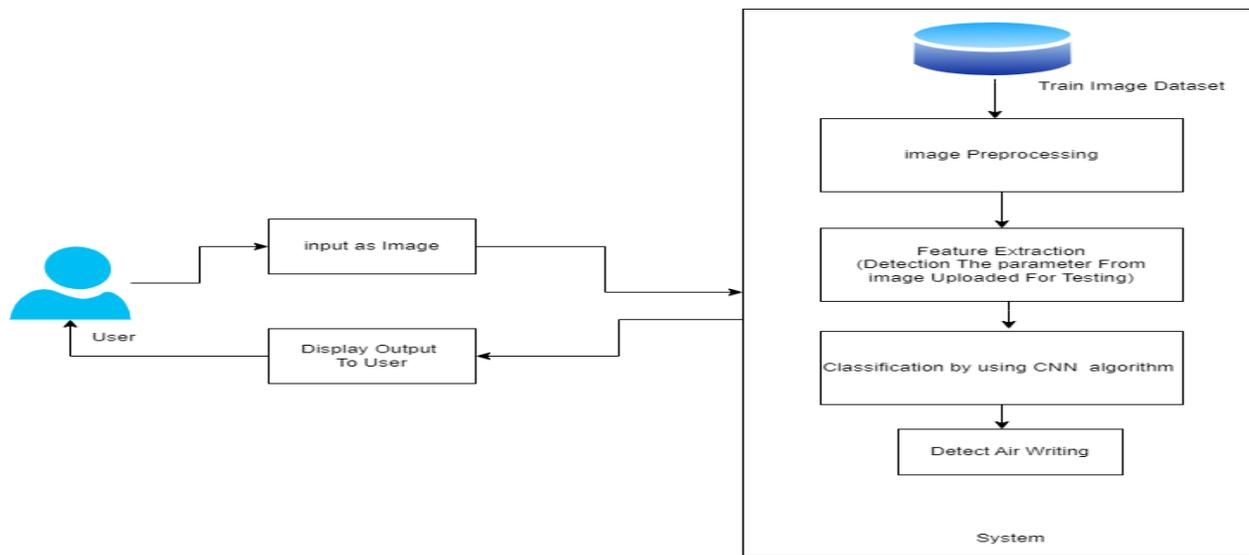
System Architecture

Data Flow Diagram: In DFD diagram we have shown the flow of data in our system in DFD0 we show that base DFD in which circle represent the input as well as output and the rectangle represent our system. In DFD1 we have shown the actual input and actual output of the system, input of our system is text and images and output is rumor detected. Likewise in DFD2 we represent operation of user as well as admin.
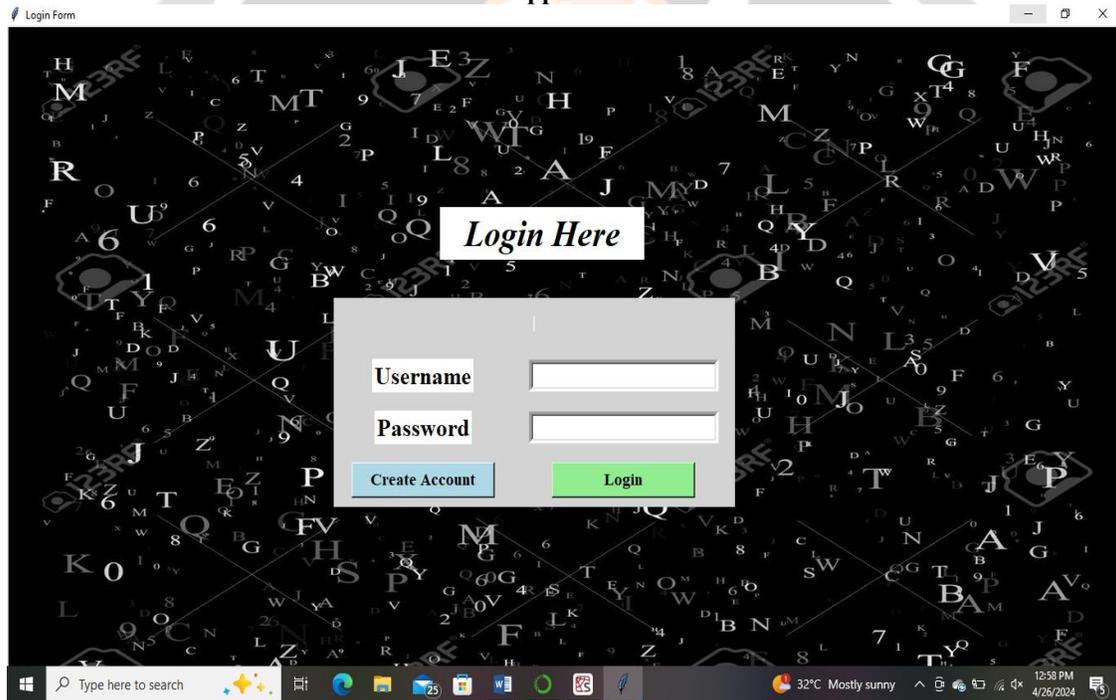

Data Flow(0) diagram
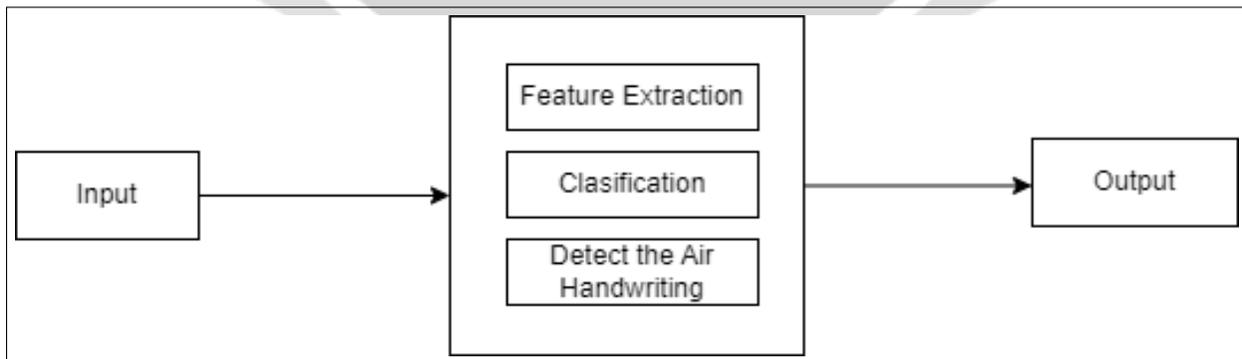
Data Flow(1) diagram
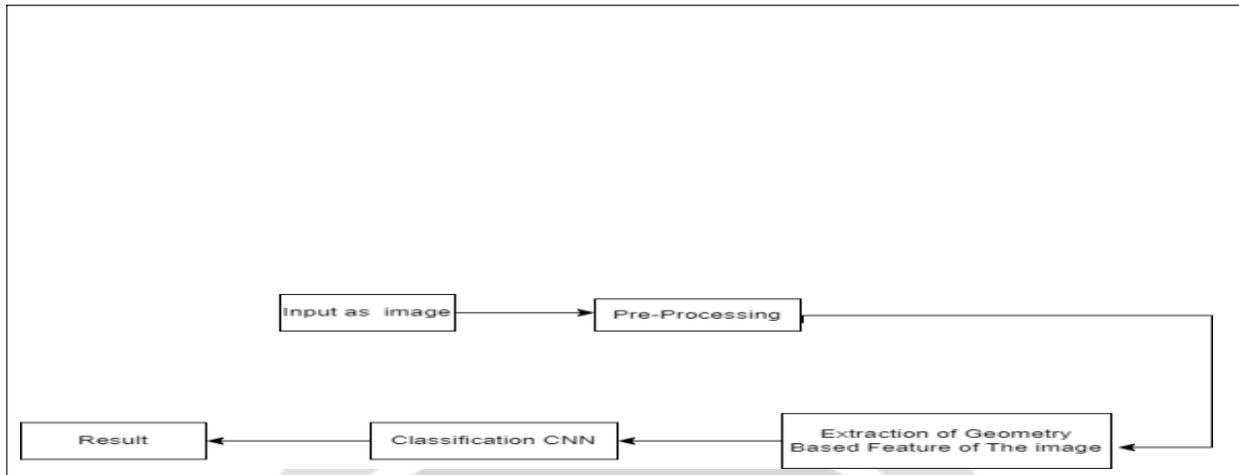

Data Flow (2) Diagram
- **Application Result**

Login page

Master GUI

Master GUI: In master GUI there are 3 applications Shape-App, Alpha- Number App and Air-Writing Frame. If users selects shape application then it will detect the shapes from the list present in application, if user selects number then it will open the alpha-number paint app, if user selects air-writing application then it will be directed to air-frame app.
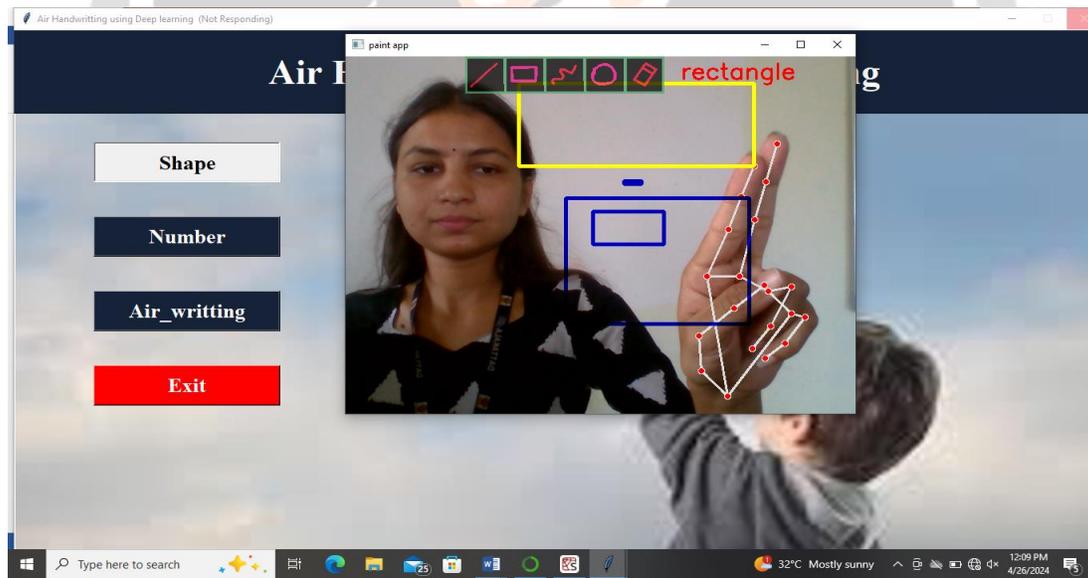

Shape Paint App

Shape Paint App: In Shape Paint App we can select the desired shape from the list given above and system will detect and produce the output. System will take live input from the camera and capture the hand and finger moment accordingly.
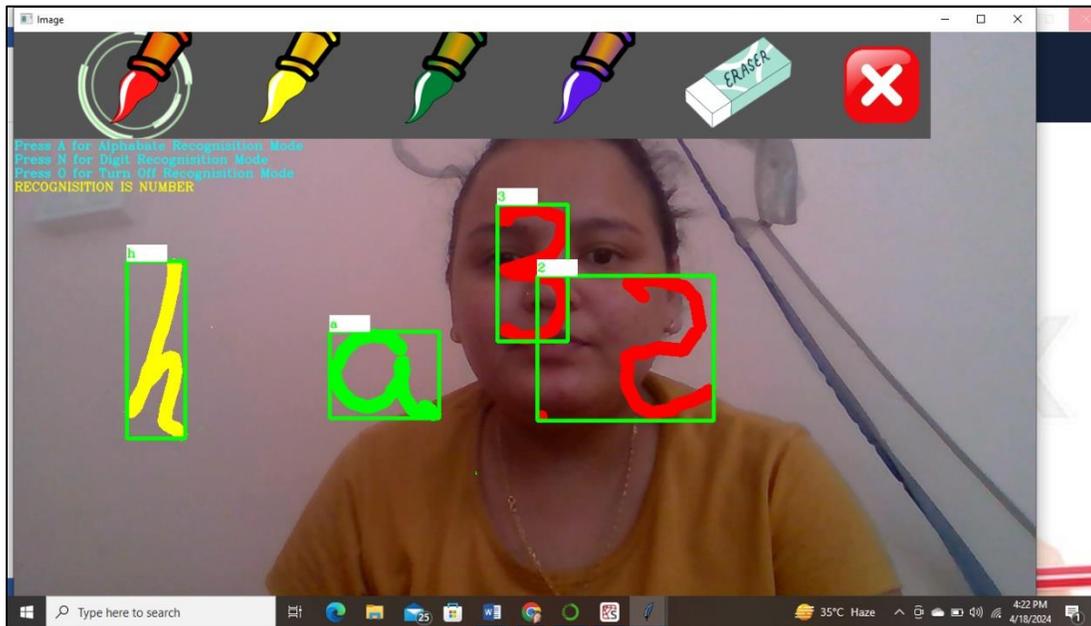
Number-Alpha App

Number-Alpha App: In this page again the camera will detect the live motion of hand, here we can select the desired color from which we can draw alpha or number. If user wants the system to detect alphabets then user have to press A. If the user wants system to detect numbers than user has to press N. User can also erase and clear the screen by selecting on eraser given above. Selection of colors and images will be done over air, user just has to move hand in front of camera and system will detect the motion of users hand and operate accordingly.
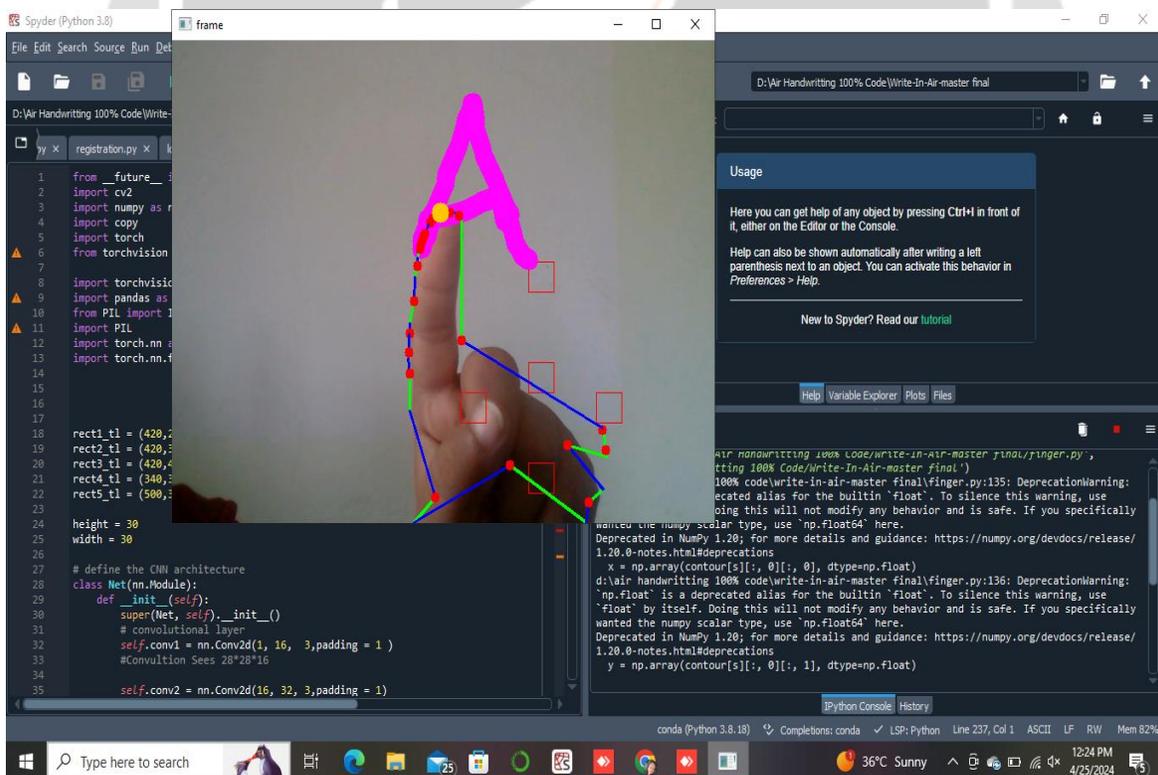
Air-Frame

Air-Frame: In air frame the camera will detect the hand first according to given coordinate then it will take a fingertip motion and user can see whatever he/she is writing over air in the air-frame. To start the detection user has to press A in the keyboard, to draw over air user has to press D in the keyboard and to get the translated output user has to press S. System will translate the letter into Marathi and the output will be shown in the console.

- **Conclusion**

Despite being a branch of computer science, machine learning is not the same as traditional computational methods. Different writing styles are present in many regional languages across the world, and HCR systems may identify these writing styles by utilizing appropriate algorithms and methods. We are studying character recognition in English. It has been discovered that the presence of unusual characters or shapes that are similar across several characters makes it harder to recognize handwritten characters. Scanned image is pre-processed to get a cleaned image and the characters are isolated into individual characters. Preprocessing work is done in which normalization, filtra- tion is performed using processing steps which produce noise free and clean output. Managing our evolution algorithm with proper training, evaluation other step wise process will lead to successful output of system with better efficiency.

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