International Journal for Modern Trends in Science and Technology
Volume 10, Issue 03, pages 173-177.
ISSN: 2455-3778 online
Available online at: http://www.ijmtst.com/vol10issue03.html
DOI: https://doi.org/10.46501/IJMTST1003026

Matrices to Manuscripts: MATLAB's Dual Recognition Capabilities for Images and Handwritten Characters

Dr. Arvind S[1], Dr. Devika SV[2], R. Jagadeesh Chandra Prasad[2]

[1]Department of CSE, Hyderabad Institute of Technology and Management, Hyderabad, India
[2]Department of ECE, Hyderabad Institute of Technology and Management, Hyderabad, India

To Cite this Article
Dr. Arvind S, Dr. Devika SV, R. Jagadeesh Chandra Prasad, Matrices to Manuscripts: MATLAB's Dual Recognition Capabilities for Images and Handwritten Characters, International Journal for Modern Trends in Science and Technology, 2024, 10(03), pages. 173-177.https://doi.org/10.46501/IJMTST1003026

Article Info
Received: 02 February 2024; Accepted: 26 February 2024; Published: 03 March 2024.

ABSTRACT

This research elucidates a strategic approach to attain Image and Handwritten Character Recognition with an accuracy surpassing 90%. Despite the extensive exploration of Image Recognition (IR) and Handwritten Character Recognition (HWCR), achieving high accuracy remains a persistent challenge. Centered within the dynamic realm of image processing, this study underscores the selection of image and handwritten character recognition as an intriguing investigative focus.The methodology for handwritten character recognition involves the comprehensive scanning of input from diverse sources, ranging from images and documents to real-time devices like tablets, tabloids, and digitizers. Subsequent to this scanning process, the acquired input undergoes translation into digital text. The paper not only details this recognition method but also disseminates findings from image recognition research. The findings showcase a spectrum of image processing steps meticulously employed to enhance accuracy in the overarching pursuit of advancing recognition capabilities.

Keywords: Handwritten recognition, image recognition, image processing, offline character recognition

1. INTRODUCTION

Handwritten recognition has piqued the researcher's interest in the current scenario. The development of devices such as smart phones and digital computers that could successfully reinterpret and digitise the data entered increased the demand for handwritten recognition. The data is entered either by scanning the image as in the offline system or by entering the image on the screen of devices such as the digitizer using an electronic pen as in the online system. In either case, the image of the input is scanned and sent to the subsequent stages for processing and recognition. Writing Handwriting is defined as a person's distinctive writing style. With the invention of the printing press and the modern typewriter, the world was opened up for formatted documents, piquing people's interest in reading and writing. Matrix matching is the process of comparing an image to a stored glyph pixel by pixel; it is also referred to as "pattern matching," "pattern recognition," or "image correlation." This is dependent on the input glyph being properly isolated from the rest of the image, as well as the stored glyph being in a

similar font and scale. This technique works best with typewritten text and fails when confronted with new fonts. This is the technique that the early physical photocell-based OCR used quite directly.

2. PROCESSING STEPS OF HWCR

This section discusses the basic HWCR processing steps depicted in Fig. 1. As previously discussed, pre-processing and segmentation are used to obtain each clean character. These extracted characters are fed into the feature extraction phase, which is followed by the classification phase for recognition.

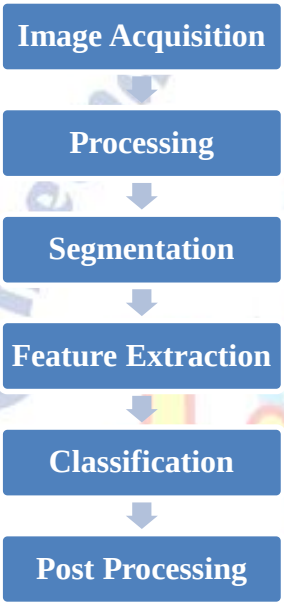

Fig 1. Processing steps

3. IMAGE ACQUISTION

The input image is provided to the recognition system during the image acquisition stage. The given input can be in an image format such as JPEG, BMT, or scanned image, digital camera, or any other suitable digital input device, or it can be drawn on the user interface canvas.

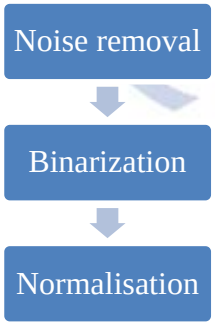

Fig 2: Image Acquisition Steps

4. PREPROCESSING

It's a crucial step in character recognition. The subsequent steps, such as segmentation, feature extraction, and classification, are dependent on the pre-processing step. Binarization, noise removal, and skeletonization were all performed in this paper. First, the image is binarized, and noise is reduced by filling holes smaller than 30 pixels in size. Following that, we used the skeletonization method proposed in [14]. After pre- processing, we have a clean image with only character pixels. A pool of connected components present in an image document can be obtained by segmenting it. Line, word, and character segmentation are different types of segmentation that are performed in the order listed.

1. Noise Removal: Noise removal is a technique used to remove unwanted or undesired patterns. A technique called Uniform and no uniform filtering is to be used.

2. **Binarization**: In this step, all typed characters are converted into grayscale images. After translating the grayscale image into the binary matrix, each character image must be captured vertically.

3. Normalization: This is the process of converting image data into the required standard form. Sizing and skewing normalizations are the most common. Size transforms the image into a predefined fixed size. While skew is used during scanning when the text deviates from the baseline, and for this skewing and detections and their applications

5. SEGMENTATION :

1) Segmentation of lines: To accomplish this, we must obtain the positions of pixels that are to the rightmost, leftmost, topmost, and bottommost. This allows us to crop the image into a rectangular bounding box. From the resulting image, we must track row by row until we reach a row with no character pixels. Crop the image up to this point, which is the intended segmented line, and keep the rest of the image. Crop the retained image to obtain a rectangular image format as previously proposed, and then proceed to acquire

2) Word Segmentation: This time, we should track each obtained line column by column. As previously stated, instead of cropping the image, we introduce a threshold concept, which means that whenever you find an empty column, we crop the image only when certain consecutive columns of the line segmented image are

empty. In this case, we define threshold as 12 of the character's height. If it exceeds the threshold, segment (crop) it as a word.

3) **Character Segmentation:** It is same as word segmentation. We take threshold as 1⁄2 of the character height and if it is below threshold then segment (crop) it as character

4)Edge detection : Edges in a digital image are significant local changes in intensity. An edge is a connected set of pixels that forms a boundary between two disjoint regions. Edges are classified into three types:

- Horizontal borders
- Edges that are vertical
- Edges that are diagonal

Edge Detection is a method of segmenting an image into regions of discontinuity. It is a popular technique in digital image processing, such as

- Image morphology feature extraction pattern recognition

Edge detection allows users to examine image features for significant changes in grey level. This texture marks the end of one region of the image and the start of another. It reduces the amount of data in an image while preserving the image's structural properties.

5) Dilation: Dilation adds pixels to the edges of objects in an image, whereas erosion removes pixels from the edges of processing methods are not used, it produces good results. In our context, we employ three types of features. They are based on distance, density, and geometry. In our subsequent discussion, distance- based features are referred to as f1, and density-based features are referred to as f2. objects. The number of pixels added or removed from an image's objects is determined by the size and shape of the structuring element used to process the image.

6**. Feature Extraction**: We employ a zone-based approach for feature extraction. Even when certain pre- processing methods are not used, it produces good results. In our context, we employ three types of features. They are based on distance, density, and geometry. In our subsequent discussion, distance- based features are referred to as f1, and density-based features are referred to as f2.

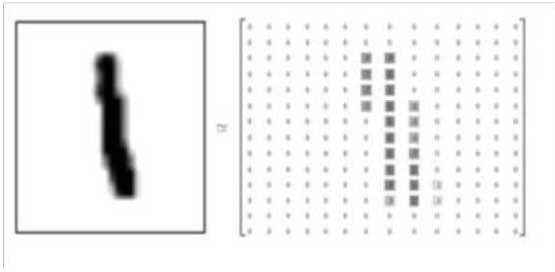

Fig 3: Feature Extraction

7. Classifications: For each of our methods, we extracted features. We use KNN as a classifier for classification. We save the feature vectors and class labels of the training samples during the algorithm's training phase. The same features as before are computed for the test samples during the testing phase.

6 . POST PREPROCESSING

Photographic image editing In audio, audio editing software Differential GPS post-processing is a GPS system enhancement that improves accuracy. Video post-processing, video processing methods, and 3D graphics Post-processing of finite element model data, software that simplifies computer calculation output.

RESULTS

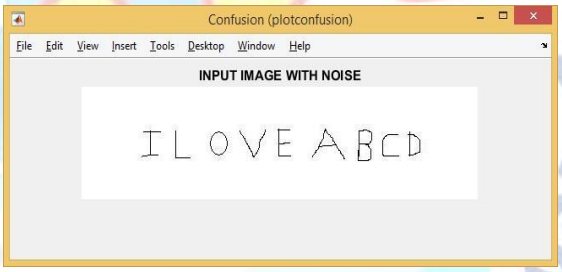

Fig. 4 Input Image with Noise

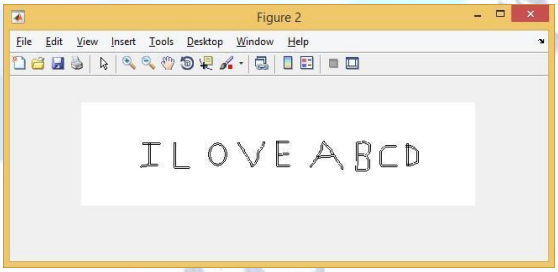

Fig. 5 Detected edges

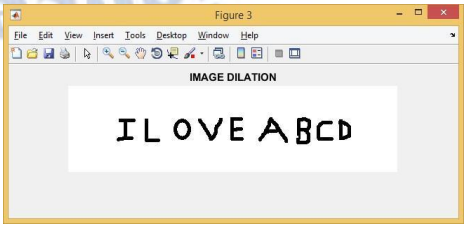

Fig. 6 Image dilation

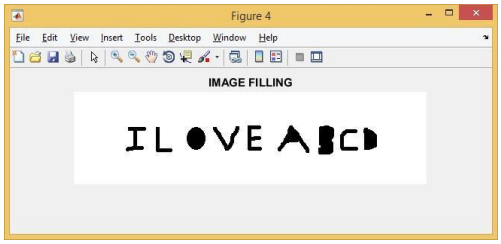

Fig 7. Image filling

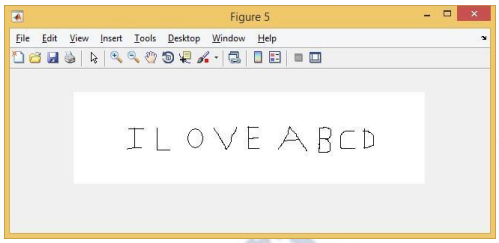

Fig. 8 final image for feature extraction

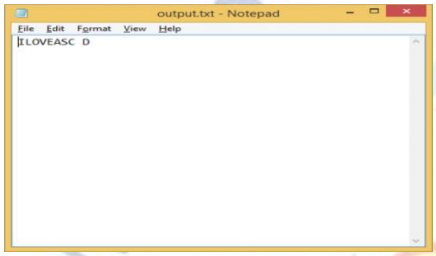

Fig. 9 Final data showed in text file

IMAGE RECOGNITION :

Fig 10: Original image

Fig.11 Edge detection

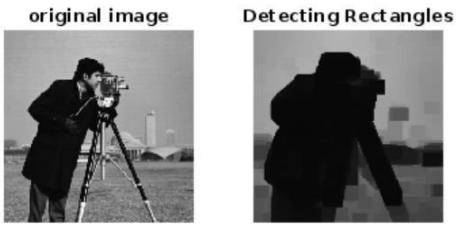

Fig. 11 Dilation

7. CONCLUSION

After reviewing the papers, it was determined that feature extraction methods such as diagonal and direction techniques produce far superior high-accuracy results than many traditional vertical and horizontal methods. Using a Neural network with the best tried layers also has the advantage of having a higher tolerance to noise, resulting in more accurate results. In neural networks, the feed forward model is primarily trained using the back-propagation algorithm in order to classify and recognise characters while also becoming more and more trained. Aside from these, the use of normalisation in conjunction with feature extraction produced better and higher accuracy results in character recognition. It has also been observed that the larger our training data set and the better our neural network design, the better accurate is the result.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Singh, Sameer, Mark Hewitt, "Cursive Digit And Character Recognition on Cedar Database", Pattern Recognition, 2000.Proceedings. 15th international conference on. Vol. 2. IEEE 2000.

[2] K. Gaurav and Bhatia P. K., "Analytical Review of Pre-processing Techniques for Offline Handwritten Character Recognition", 2nd International Conference on Emerging Trends in Engineering & Management, ICETEM, 2013.

[3] Salvador España-Boquera, Maria J. C. B., Jorge G. M. and Francisco Z. M., "Improving Offline Handwritten Text Recognition with Hybrid HMM/ANN Models", IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 33, No. 4, April 2011

[4] U. Pal, T. Wakabayashi and F. Kimura, "Handwritten numeral recognition of six popular scripts," Ninth International conference on Document Analysis and Recognition ICDAR 07, Vol.2, pp.749-753, 2007.

[5] Reena Bajaj, Lipika Dey, and S. Chaudhury,"Devnagari numeral recognition by combining decision of multiple connectionist classifiers", Sadhana, Vol.27, part. 1, pp.-59-72, 2002.

[6] Theingi Htike and Yadana Thein "Handwritten Character Recognition Using Competitive Neural Trees" IACSIT International Journal of Engineering and Technology, Vol. 5, No. 3, June 2013

[7] Manoj Sonkusare and Narendra Sahu "A SURVEY ON HANDWRITTEN CHARACTER RECOGNITION (HCR) TECHNIQUES FOR ENGLISH ALPHABETS" Advances in Vision Computing: An International Journal (AVC) Vol.3, No.1, March 2016

[8] Hallale, Sumedha B., and Geeta D. Salunke. "Twelve Directional Feature Extraction for Handwritten English Character Recognition." International Journal of Recent Technology and Engineering 2, no. 2 (2013)