e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:06/June-2023 Impact Factor- 7.868 www.irjmets.com

A REVIEW ON CONVERSION OF HANDWRITTEN NOTES TO DIGITALIZED VERSION USING TENSER FLOW

Ruchita Mute[*1], Dhanashri Khadse[*2], Ayushi Lanjewar[*3], Snehal Selokar[*4], Divya Yadav[*5], Jayant Adhikari[*6]

[*1,2,3,4,5]Students Department of Computer Science Engineering, Abha Gaikwad-Patil College of Engineering and Technology, Nagpur, Maharashtra, India

[*6]Professor, Department of Computer Science Engineering, Abha Gaikwad-Patil College of Engineering and Technology, Nagpur, Maharashtra, India

ABSTRACT

Taking notes by hand is a highly practical approach to grasp topics, and this method of learning can make it simpler for students to remember the material. But everything has a downside, so handwritten notes are only beneficial if they are stored neatly and carefully; otherwise, damaged pages and pages that seem unclean cannot be used for very long. To preserve them secure and current until the very last minute in a drive or someplace else, the project concept of turning handwritten papers into digital ones came into mind. Neural networks and the Tensor flow Module may be used to recognize handwritten text. A handwriting recognition system manages formatting, completes accurate character segmentation, and identifies the most likely words. Thus, converting handwritten characters to digital representation is becoming more and more common. The words on a piece of paper will eventually fade away, while a file kept on a computer can only be lost by deletion. It has become crucial to save any handwritten documents in digital format.

Keywords: handwritten documents, digitalization, tensor flow, neural network, segmentation.

I. INTRODUCTION

Character recognition and handwritten numbers are becoming more and more significant in today's digital world as their practical uses in numerous daily tasks appear to be growing. Systems that read handwritten letters, characters, and numbers enable humans to complete complicated tasks that would otherwise be time-consuming and expensive to complete. As of right now, the technology of handwritten text recognition is becoming a must in modern planet. The biological neural networks that enable both humans and animals to learn and model non-linear and complicated interactions can serve as a paradigm for the handwriting recognition systems. Neural networks can mimic how the human brain functions while reading reduced handwriting. It makes it possible for robots to read handwriting on a par with, if not better than, a human. Humans use a variety of writing styles, some of which are challenging to understand. One of the key ways that people optically discern, comprehend, and explore the environment is through vision. Being a trustworthy source of environmental information, the image is however subject to objective authentic factors like the object's size, colour, shape, and spatial location as well as the subjective constraints of the human visual system, which averts obtaining direct and accurately pertinent information about the object-the object only through visual optical discernment of the human visual system. As a result, people have the propensity to misinterpret the image. The quandary of inelegant optical discernment caused by image groups with different focal points is now efficaciously solved by multi-focus image fusion technology. This technology can automatically determine the focus area of each image. The extracted focal area information is then fused into an image in which all target objects are pellucid, detailed information is more plentiful, and scene description is more precise. Multi-focus image fusion technology is frequently employed in the construction of imaging, medical, and armaments.

II. LITERATURE SURVEY

Sowmya Hegde et al. [1] throughout the hundreds of years of human history, this strategy worked efficaciously for us. Even though there are numerous technical inditing implements available, many people still prefer to take their notes the antediluvian way: on paper and with a pen. However, the conventional method of inditing text has some drawbacks. Physical papers are arduous to apportion with others, keep and retrieve in an organized way, and search through efficaciously. Handwriting apperception is the capability to translate understandable handwritten input into digital form from sources including paper documents, touch screens, and other contrivances. A handwriting apperception system manages to format, consummates precise character segmentation and identifies the most likely words. Thus, converting handwritten characters to digital representation is becoming more and more mundane. Aayush Shah et al. [2] text boxes are frequently used to fill out offline information or request forms that are available from certain regime agencies and commensurable businesses. The information from these hand-filled forms needs to be manually entered into the computer database, necessitating the utilization of a keyboard. The suggested approach automatically converts the text data from such forms into text that the computer can interpret and comprehend utilizing a coalescence of machine learning algorithms. Er. Asadullah Shaikh et al.

[3] even though there are systems for handwritten text, the precision is quite low and all current OCR solutions are for printed text. Authors are orchestrating to develop software that will take an image of the form taken with a camera or scanner as input and endeavor to convert it into text utilizing image processing and machine learning. As most NGOs conduct surveys in sundry rural areas where people fill out the form in handwritten text, inserting the information into the program is a very gradual and laborious process. As because our technology is concretely fixated on the NGO survey form, we may achieve higher precision than other subsisting OCR handwriting systems. Jebaveerasingh Jebadurai et al.

III. PROBLEM STATEMENT

Even though computers and smartphones are more common than ever, many individuals still enjoy the classic writing experience of ink on paper.

After all, over the hundreds of years of human history, this technique worked effectively for us. Even though there are several technological writing tools available, many individuals still prefer to take their notes the old-fashioned way: on paper and with a pen. However, the conventional method of writing text has certain drawbacks. Physical papers are challenging to share with others, keep and retrieve in an organized way, and search through effectively. Thus, handwriting recognition is the capacity to translate understandable handwritten input into digital form from sources like paper documents and other devices.

IV. PROPOSED WORK

The technique of electronically converting digital photos into machine-encoded text is known as optical character recognition, or OCR. Where the digital picture is often a representation of an image with areas that mimic linguistic characters. Pattern recognition, artificial intelligence, and computer vision are all areas of study in OCR. This is because more recent OCRs are taught using test data that is then run via a machine learning algorithm.

This method of text extraction from photographs is typically used in professional settings when it is assured that the image will include text data. We would discover how to extract text from photos in this essay. For this, we would use the Python programming language. A. System Overview This project's goal is to accept English-language handwritten papers as input, recognize the text inside them, and then edit the handwriting to create a more attractive version of the input.

The project is divided into two parts: handwriting recognition and handwriting beautifying. Recognition of handwriting Character recognition has received a lot of attention, while comprehensive document analysis has received less attention. Reading formal documents, such as bank checks and prescriptions, might benefit from text recognition in a variety of contexts.

It will also be put to use in detective or police agencies for tasks like identifying people based on their handwriting and distinguishing authentic papers from fakes, among other things. It is possible to divide handwriting recognition into a number of largely separate modules. The accuracy and effectiveness of these solutions were then evaluated individually and together.

Additionally, using feature extraction and relative location matching with the aid of directed graphs, we developed a novel concept. In order to create a handwriting recognition programmed that is overall accurate, effective, and marketable, our project aims to put this concept into practice. Handwriting Beautification: A 100% accurate handwriting recognition programmed has not yet been produced due to individual variances in handwriting. The capacity of a person to read depends on a number of things, such as their understanding of language and the context. As a result, developing artificial systems that can detect documents as precisely as

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:06/June-2023 Impact Factor- 7.868 www.irjmets.com

people is challenging. In addition, proper noun identification accuracy cannot be guaranteed by handwriting recognition software with dictionary and context understanding features. Due to these drawbacks, we describe a method for handwriting beautifying that alters the document while retaining the writer's handwriting to make it more acceptable. Humans may interpret distorted documents using this scheme's output.

V. METHODOLOGY

This project proceeds in the following steps to generate the desired output

- Building feature-graph database
- Removing Noise
- Thinning: A two-step process.
- Slant Estimation
- Slant Correction
- Separating Lines
- Separating Characters
- Feature Extraction
- Matching

The following stages are described:

Creating a database of feature-graphs: A feature graph is created and stored in the database once all the capital letters have been divided up into features. The next section provides an explanation of features and feature graphs in depth. It should be noted that there may be many feature graphs relating to a single alphabet, depending on the most typical ways that character is written.

Eliminating Noise:

The first step is to eliminate any extraneous noise from the address block picture. Despite being a straightforward step, it is a crucial one that makes the subsequent processing easier.

Thinning: Thinning is the process of reducing the size of all written letters to one pixel, or the black portion of the image. This crucial phase serves as the foundation for both recognition and beauty.

Slant estimation:

After a picture has been thinned, it is scanned from left to right to identify all the vertical or slanted lines present across the whole image. The slant of the picture is determined by averaging the slants of these lines.

Slant Correction: After the slant has been identified, the original picture is given a slant correction. The revised picture is once again thinned.

Separating Lines: The address block is split into lines in this stage, and each line is examined independently.

Character Separation:

By examining a vast number of examples, we were able to conclude that capital letters are typically written with various characters spaced apart. To split a line into individual characters to enable feature extraction and matching easier.

Feature extraction:

The most intriguing stage is feature extraction. To determine the locations of the black pixels, each row of the image is scanned from left to right and top to bottom.

With consideration for the variations in these features that may result from variations in handwriting, the features horizontal line, vertical line, left slant, right slant, higher curve, lower curve, left curve, and right curve are intelligently recognised based on their places. When one feature could be confused for another, it may be prudent to detect the features in a certain order and mark the visited black pixels to prevent confusions.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:06/June-2023 Impact Factor- 7.868 www.irjmets.com

Block diagram:

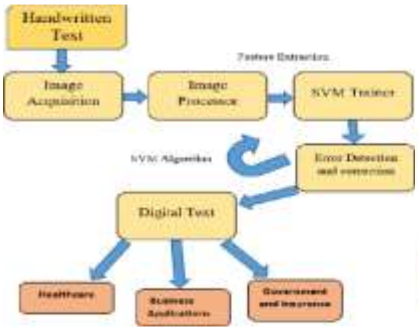

Fig. 1 System Architecture

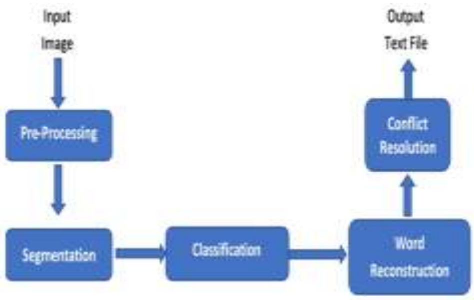

Fig. 2 Algorithmic flow of the proposed method

Pre-Processing: the document's picture will be used as the input query image. Pre-processing is used first, which entails border detection, border cropping, and page straightening transformation, noise removal, skew correction, size normalisation, and sharpening kernel application. To get the original input picture ready for subsequent processing, it is scanned and examined. The Live Corp tool is utilised for page straightening, cropping, and border checking. Following the detection of the provided page's border, noise is eliminated using a Gaussian filter and Otsu threshold. Additionally, the picture is changed to a greyscale version.

Character segmentation: Segmenting the picture into words is the crucial step following image preprocessing. For segmentation, an open-source library called Tessaract-ocr is employed. It produces a stream of characters that is then forwarded to the following stage. The character segmentation is carried out in the next stage by splitting the input into three zones: the top, middle, and lower zones. The actual word is represented by the center zone. This step aids in determining whether or not words have been connected. In this step, the characters are corpsed into a picture that is 32 by 32 in size.

Recognition: The characters will be divided up into several Devanagari characters that are included in the training dataset, DHCD, during the classification step. After the words have been scanned, each character is classified by being compared to another character of a similar type that is stored in a specified class. In this stage, CNN is used to classify the Devanagari script into 46 categories. Therefore, each character is identified from the cropped picture.

VI. RESULT AND DISCUSSION

Collection of images from IAM dataset, easily available on the formal archive, were used for preparing and testing the project. Around 1000 pictures were used. After completion the system was put for observation, around 350 pictures were used for observation purposes and it was discovered that training and testing accuracy are 80% and 88% respectively. The Levenshtein Distance metric was used in this project for determining efficiency of the system. The smallest quantity of exclusive character modifications (introduction, terminations or replacements) needed for turning single word to alternate word is the Levenshtein distance among these words.

Fig. 1 Python Program Interface

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:06/June-2023 Impact Factor- 7.868 www.irjmets.com

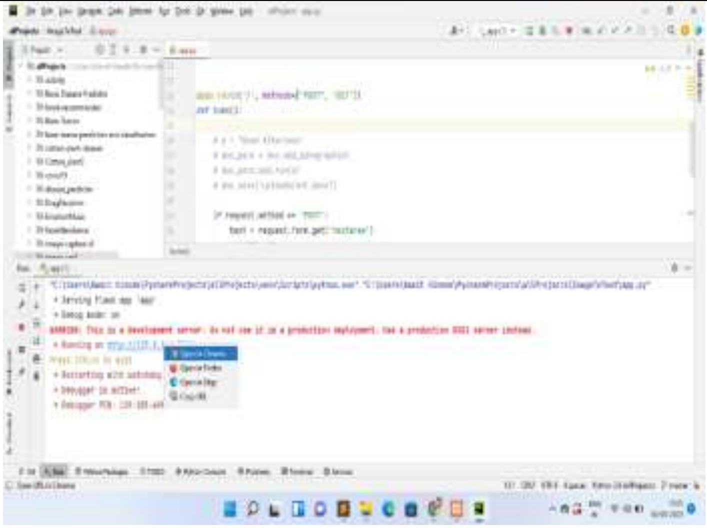

Fig. 2 Web App Link Generation

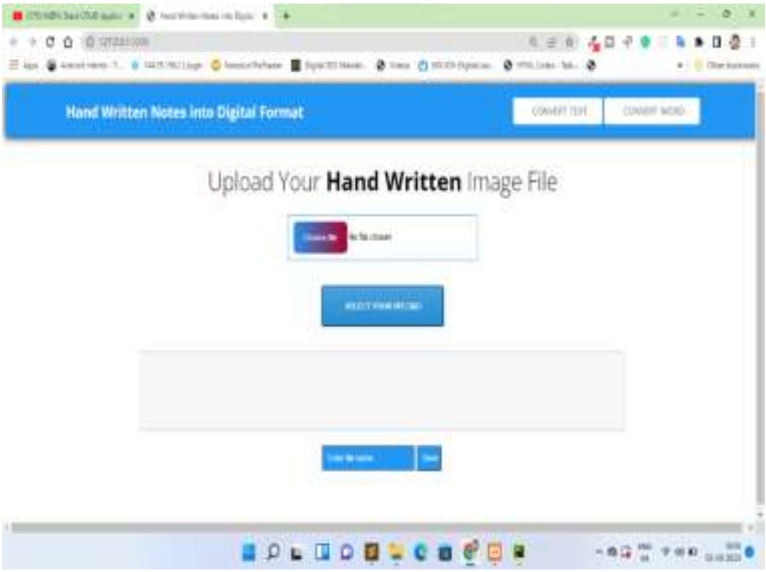

Fig. 3 Dashboard for Hand Written Notes will convert into Digital Format

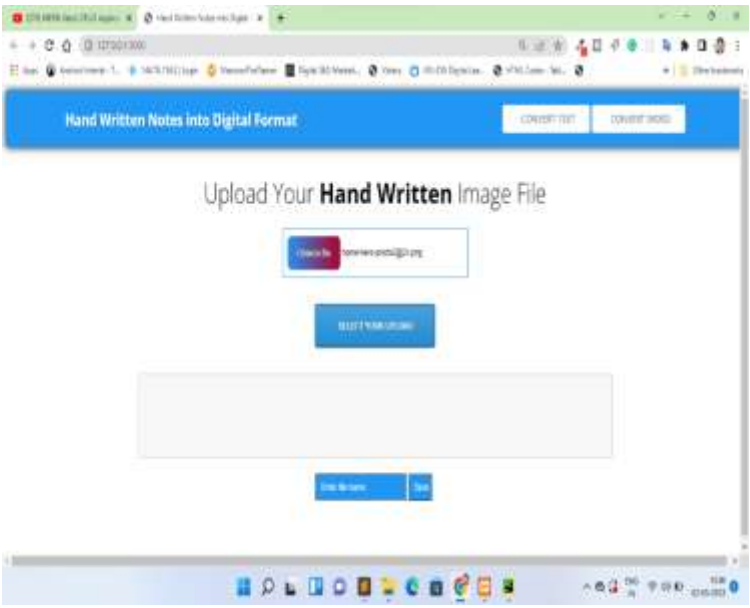

Fig.4 File Selection Option

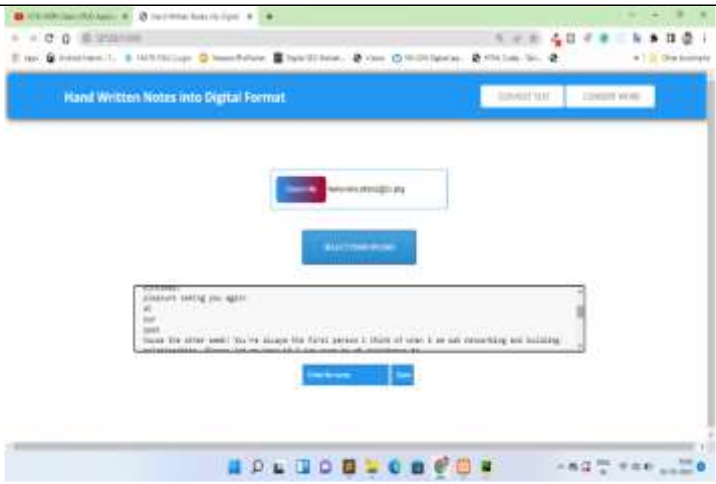

Fig.5 Image converted to Text

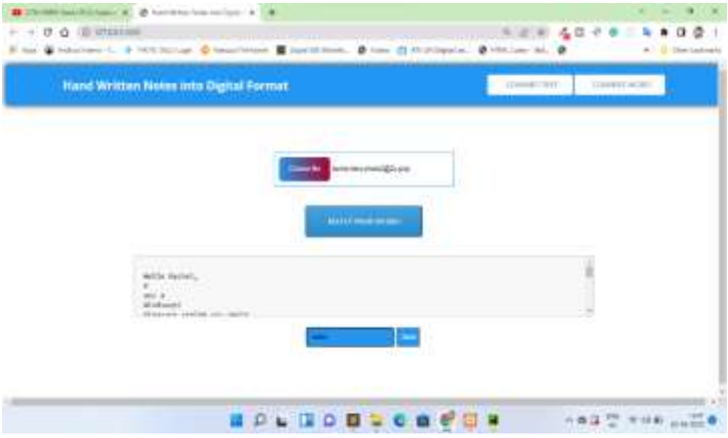

Fig. 6 Digital File will be saved

VII. CONCLUSION

An attempt has been made to identify various address blocks penned in cursive and small characters, in this endeavor. The algorithms we utilized have the advantage of being able to identify text with characters that are somewhat linked. Due to the program's optimized design, it has been shown that CRNN (CNN + SVM + LSTM) can recognize handwritten sentences in photos. This system uses seven CNN layers and two LSTM layers to construct a matrix of character probabilities. The CRNN was used to identify the penned line text picture with no division into words or letters. The CTC loss Function is then employed for learning. The system got an accuracy of around 85 percent at the time of training as well as 80 percent at the time of testing.

VIII. REFERENCES

[1] Sowmya Hegde, Shreyashree A V, Bimba Prasad, Chinmayi, Sunitha P, 2021, Machine Learning Approach for Translating Handwritten Document to Digital Form, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) ICDML – 2020 (Volume 09 – Issue 02)

[2] Aayush Shah, Neel Doshi, ainam Shah, Kunal Goel, and Purva Raut, "Extraction of handwritten and printed text from a form", March 2021 Journal of Physics Conference Series 1831(1):012029 DOI:10.1088/1742- 6596/1831/1/012029

[3] Er. Asadullah Shaikh, Shaikh Arsalan, Khan Mohammad Altaf, Sayyed Athar, "Handwritten Text Recognition of Document Form Using Machine Learning", Volume: 05 Issue: 02, Feb-2018, p-ISSN: 2395-0072, (IRJET)

[4] J. Jebadurai, I. J. Jebadurai, G. J. L. Paulraj and S. V. Vangeepuram, "Handwritten Text Recognition and Conversion Using Convolutional Neural Network (CNN) Based Deep Learning Model," 2021 Third International Conference on Inventive Research in Computing Applications (ICIRCA), 2021, pp. 1037-1042, doe: 10.1109/ICIRCA51532.2021.9544513.

[5] R. Vaidya, D. Trivedi, S. Satra and P. M. Pimpale, "Handwritten Character Recognition Using Deep Learning," 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT), 2018, pp. 772-775, doi: 10.1109/ICICCT.2018.8473291

[6] Darmatasia and Mohammed Ivan Fanany, Handwriting Recognition on Form Document Using Convolutional Neural Network and Support Vector Machines (CNN-SVM), Fifth International Conference on Information and Communication Technology (ICoICT), ISBN: 978-1-5090-4911-0 (c) 2017 IEEE

[7] Ahmed Mahi Obaid, Hazem M EI Bakry, M. A. Eldosuky, A.I. Shehab, Handwritten Text Recognition Based on Neural Network, IJARCST, Vol. 4, Issue 1, 2016.

[8] A. N. S. Chakravarthy, Penmesta V Krishna raja, P. S Avahani, Hand- written Text Image Authentication using Back Propagation, IJNSA, Vol. 3, No. 5, 2011

[9] Savitha Attigeri, Neural Network based Handwritten Character Recognition System, IJECS, Vol. 7, Issue 3, P.No. 23761-23768, 2015.

[10] J. Pradeepa, E. Srinivasana, S. Himavathib, Neural Network Based Recognition System Integrating Feature Extraction and Classification for English Handwritten, IJET, Vol. 25, Issue No. 2, 2012.

[11] Amandeep Kaur, Seema Bhagla, Sunil Kumar, Study of Various Character Segmentation Techniques for Handwritten Off-Line Cursive Words, IJASEAT, 2015

[12] R. S. Sabeenian M. Vidhya, Hand written Text to Digital Text Conversion using Radon Transform and Back Propagation Network (RTBPN), International Conference on Advances in Information and Communication Technologies , pp. 498-500, 2010.

[13] Shubham Sanjay Mor, Shivam Solanki, Saransh Gupta, Sayam Dhin- gra, Monika Jain, Rahul Saxena, Handwritten Text Recognition : with Deep Learning and Android, International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 8958, Volume-8, Issue-3S, February 2019 IEEE