

Script Recognition Methodology: A Survey A Theoretical Study of Recognition Techniques

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Abstract—We all have different handwritings, sometimes we ourselves not able to recognize our own handwriting then how would computer understand that what is written. In this paper we will focus on the question that how computers recognize the scripts. The paper describes about the working of different methodologies and algorithms used for recognition of scripts such as Optical Character Recognition(OCR), Hidden Markov model(HMM), Convolution Neural Network (CNN). It also explains about the advantage of implementing it and the comparison of different approaches made till now. The main idea of the paper is to come up with the importance of man-machine interaction.

Keywords—Deep learning, Optical Character Recognition (OCR), Hidden Markov model(HMM), Convolution Neural Network (CNN), scripts.

I. INTRODUCTION

Humans can easily recognize, read and interpret the characters word by word, letter by letter that what is written in front of them. Sometimes when the handwriting is not so good then also our brain recognize it because our brain is that much trained or developed that it can easily analyze what may be the word is, if it is not able to recognize then it manages itself that what may be come in this place or it is resembling to which word. All in all humans can also read bad handwriting with more than 90% accuracy. And now a day computers can also read the scripted text with more than 90% accuracy, what makes it possible is the Artificial Intelligence, Deep Learning etc.

Artificial Intelligence

Artificial Intelligence is the branch of computer science aiming to build a machine basically smart machines that is able to make a decision like humans. We can also say that Artificial Intelligence is providing a human like brain to the machines. It revolutionized the today's world with their increasing popularity in the field of image processing. One of the main application of it is pattern recognition.

Deep Learning

It belongs to the family of Artificial Intelligence, Deep Learning can be viewed as a subset of machine learning in artificial intelligence that is capable of learning unsupervised data with the help of their networks.

Optical Character Recognition

OCR or Optical Character Recognition is a traditional method of script recognition. It is working very smartly, although previously it was not so smart in working. The day by day developments in the computer makes it so good that now it can easily read your handwriting and recognizes it.

OCR fonts are developed in which there were standard fonts and for recognition process only these fonts were followed. The OCR standard fonts are shown below:-

ABCDEFGHIJKLMNOPQRSTUVWXYZPqRSTUVWXYZpqr
stuvwxyz ■ —
0123456789. , : ; = + / * " { } % ? & ' - \$ ^ []
< > () ! # @ \ . , ' - ù ñ ä ø ö å æ ç ÷

Fig1. OCR standard fonts

After that the features expanded and now the commonly used fonts like Times New Roman, Arial started using so that the system can also recognize these fonts but again the person can write in any style, so the next system which were developed is the concept where the scripts are broken into smaller parts so that the characters are recognized and then the complete word by word. This smart learning of computers is what we called as Deep Learning, a concept of AI. It is also able to analyze what the next word should come grammatically.

For example:- you must have seen in your smart phones whenever you type something you come up with the suggestion of next word. Similarly Google translate app translates a word or sentence on the spot as soon as you scan it.



Fig 2 Google Translate

So we can see that according to the changed scenario script recognition methodologies are also changing, capabilities are improving, even we can take feedback also whose application is the use of captcha code.





Fig 3. Captcha code

II. RELATED WORK

With the development of AI, machine learning and deep learning lots of algorithms are also developed for script recognition which reduces the time and efforts with their accuracy and reliable nature. Working of some of the algorithms are discussed here.

Optical Character Recognition: A traditional approach

OCR is a mechanism for recognition of handwritten text, printed text etc or we can say that OCR is a technology that converts printed text into digital format. The writing in different fonts makes it difficult to recognize a text.

The basic steps of OCR for script recognition are:

Preprocessing: This is the fundamental steps of OCR where the input is preprocessed, noises are removed, and then the image is binarize (black and white).

The next step is feature extraction and finally recognition.

Feature Extraction: This algorithm interprets the character, reduces it into smaller dimension.

Pattern Recognition: Identifying a character as a whole with the use of distance formula $d = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$

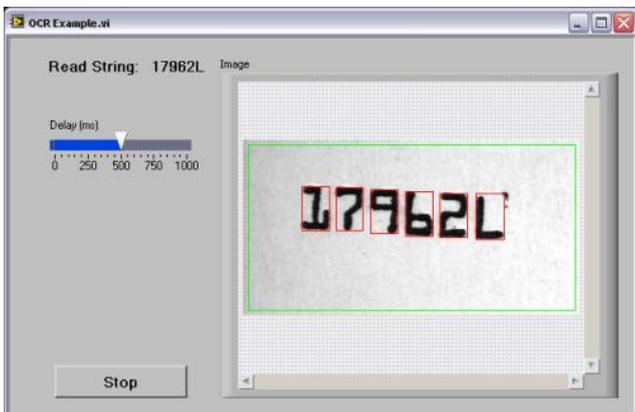


Fig 4 An OCR example

Convolution Neural Network

I will start it with an example that how a kid learns the things. A kid learns everything on the basis of training provided by his mother, family and environment, he is trained with the alphabets by making him learn and memorize it so that the next time if he asked to identify the character he must be able to identify that character. It may be a script, image, video, objects or a person in the place of character. If he is not able to remember then by trial and error method anyhow he will be able to recognize it. In the same way convolution neural network works. There are number of neural networks present here just like neurons in

the human brain which helps it to recognize the script. The first step is to train the networks with input datasets and an appropriate output and then hidden layers process this input, matches it with the patterns and gives an appropriate output. The image below describes the working of convolution neural network.

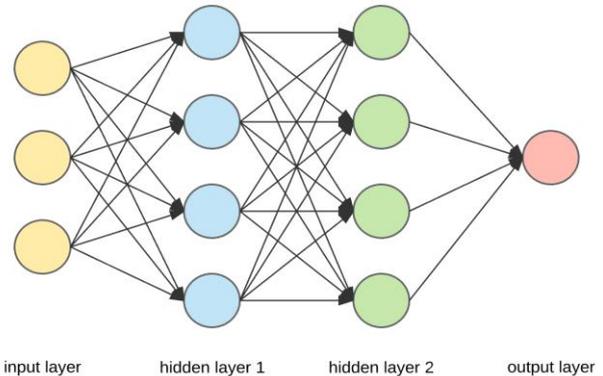


Fig 4 Convolution Neural Network

Hidden Markov Model

Hidden Markov model is a statistical model which generates models based on some set of input sequences. This input sequences are the states. The first requirement of hidden Markov model is Markov property which is memory less because HMM considers only 1 state. The next requirement is sole part- suppose you want to do future prediction then sole part predict only on the basis of present state. HMM can be called as finite state machine which consist of no. of states like Hidden States (w), Visible state/output state.

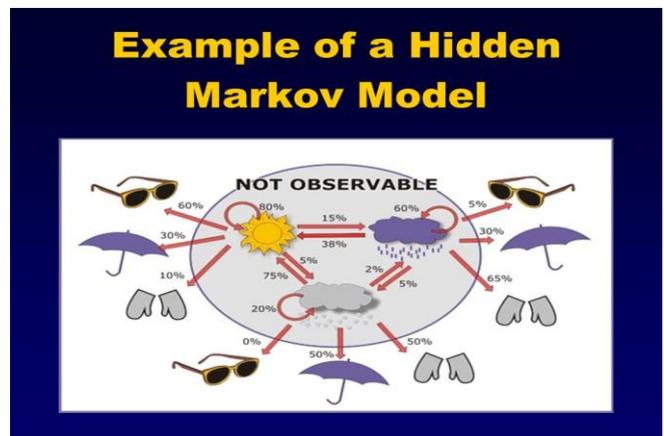


Fig 6. Hidden Markov Model

III. CONCLUSION

Script Recognition has been around for a long time, however as of late has turned into a rising innovation. When I look back on different methodologies, algorithms and research work done in the field of script recognition, I come to the conclusion that any type of script recognition requires the following main steps i.e. preprocessing, feature extraction any final recognition. Script recognition is such a complex task. This is somehow made easy with the available of pre-prepared datasets, with these datasets the algorithms can be trained so good that it works with more and more accuracy.

IV. FUTURE WORK

The number of researches done in the field of script recognition already describing the importance of pattern recognition. Despite all the methodologies discussed here many more to come such as incorporation of different scripts in different handheld devices like mobile, tablet, tabletop systems etc, particularly for those who previously felt that script recognition is not in their reach. Further empirical analysis can help in the choices of algorithms which will be chosen on the basis of accuracy they provide.

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REFERENCES

- [1] R. Nag, K.H. Wong, F. Fallside- Handwritten Script Recognition using HMMs, Cambridge University Engineering Department, Trumpington Street, Cambridge, England.
- [2] Gernot A. Fink- Markov Model for Handwriting Recognition, ICFHR 2010 Tutorial, Kolkata, India TU Dortmund University, Dortmund, Germany November 15, 2010.
- [3] P Sujatha, D. Lalitha Bhaskari- Telugu and Hindi Script Recognition using Deep Learning Techniques, International Journal of Innovative Technology and Exploring Engineering(IJITEE), ISSN: 2278-3075, Volume- 8 Issue-11, September 2019
- [4] Batuhan Balci, Dun Saadati, Dun Shiferaw- Handwritten Text Recognition using Deep Learning.
- [5] Jagan Mohan Reddy D, A Vishnuvardhan Reddy- recognition of handwritten Characters using Deep convolution neural Network, International Journal of Innovative Technology and Exploring Engineering(IJITEE), ISSN: 2278-3075, Volume- 8 Issue-684, April 2019
- [6] Katsuo I., "online recognition of handwritten characters utilising positional and stroke vector sequence", Pattern Recognition, Vol. 13, No. 3, pp. 191-206, 1981.
- [7] Pal, U., Chaudhuri, B.B.: Indian Script character recognition 37, 1887-1899(2004)
- [8] Chen X. and Yuille A. (2004) " Detecting and reading text in natural scenes", Computer Vision and Pattern Recognition, vol. 2, pp. 366-373
- [9] Kaur K. and Banga V.K. (2013) " Number Plate Recognition Using OCR Technique", IJRET, vol. 2, no. 9, pp. 286-290
- [10] J. Mantas, " An Overview of Character Recognition Methodologies," Pattern Recognition, vol. 19, no. 6, pp. 425-430, 1986.
- [11] V.K. Govindan and A.P. Shivaprasad, " Character Recognition- A Review," "Pattern Recognition, vol.23, no. 7, pp. 671-683, 1990.
- [12] U. Pal," Automatic Script Identification: A Survey," J. Vivek, vol.16, no.3, pp. 26-35, 2006
- [13] Anoop M. Nambodiri, Anil K. Jain, " Online Handwritten Script Recognition", IEEE Transactions on Pattern Analysis and machine intelligence, vol, 26 no. 1, January 2004
- [14] G.S Peake and T.N Tan, " Script and Language Identification from Documents, " Proc. Third Asian Conf. Computer Vision, pp. 96-104, Jan. 1998.
- [15] R. Duda, P. Hart, and D. Stork, Pattern Classification and Scene Analysis. Second edition. New York: John Wiley and Sons, 2011
- [16] Sonam Jain, Optical Character Recognition System for Multilanguage Script Recognition, International Journal of Recent Research Aspects ISSN: 2349-7688, vol. 4, Issue 3, Sept 2017, pp. 153-159
- [17] Arica N. and Yarman- Vural F.T (2001) " An Overview of Character Recognition Focused on Off-Line Handwriting", IEEE Transactions On Systems, Man and Cybernetics—Part C : Applications and Reviews, vol. 31, no. 2, pp. 216-233.
- [18] Patil V. and Shimpi S. (2011) " Handwritten English character recognition using neural network", Elixir Comp.Sci.& Engg, vol. 41, pp. 5587-5591.
- [19] Mithe R. Indalkar S. and Divekar N. (2013) " Optical Character Recognition", International Journal of Recent technology and Engineering (IJRTE), vol. 2, no. 1, pp. 72-75
- [20] Taha S., Babiker Y. and Abbas M. (2012) " Optical Character Recognition of Arabic Printed Text", IEEE, pp. 235-240.