

A survey on Recognition of Handwritten ZIP Codes in a Postal Sorting System

K S Naga Sai Nischal¹, Guvvala Nithin Sai², Calvin Mathew³, Gagan CS Gowda⁴, Chandrakala B M⁵

^{1,2,3,4}Student, Dept. Of Information science and Engineering, Dayananda Sagar College of Engineering, Bangalore, Karnataka, India

⁵Assistant Professor, Dept. Of Information science and Engineering, Dayananda Sagar College of Engineering, Bangalore, Karnataka, India

Abstract – Handwritten digit recognition has a wide range of research in many fields like postal services, automatic bank cheques processing, license plate detection etc. In this paper, we explain about the offline Handwritten digit recognition system by using CNN(Convolution neural network) in object recognition and classifying them in a certain category. After all the recognition process is completed, training and testing the machine, data is taken from the MNIST database. The performance of the machine is measured in terms of accuracy, sensitivity and specificity.

Key Words: Handwritten recognition, ZIP codes, API, Convolution neural network, MNIST database.

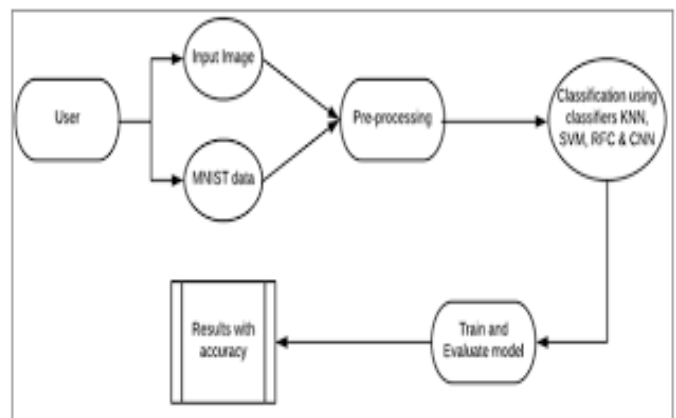


FIG 1: Flowchart representing the model

1. INTRODUCTION

For much of the 19th century, the addresses were sorted by hand using the “pigeon-hole” method, which means the addresses are manually read and slotted into the different compartments. To hand this difficulty a mechanical sorter machine is developed to reduce the time and to handle the rapidly growing volumes of data.

For sorting purposes in a postal sorting system. The ZIP code information in the address block of an address card is referred. The first four digits in the ZIP code represents the country, state, city and the last two digits in the ZIP code represents the post office number of an area. The main difficulty arises in recognising the handwritten digits on the postal card. Firstly we deal with the difficulties in recognising the handwritten digits. After we test the algorithm, the postal card is scanned and ZIP codes written on it are identified. The main problem arises at the stage of city ZIP block extraction, should deal with the specifics in the address syntax. To counter this problem we train our machine to recognise and convert the handwritten digits and verify it by making an API(Application Programming Interface)call, which contains the details of all postal codes information, we get from the MNIST database.

2. LITERATURE SURVEY

[1] In this paper, a new CNN-Based method for multi-directional transactions on intelligent transportation systems car license plate detection is explained. The limitations of the proposed model can only be used for the detection of license plates and not for extraction of the relevant features from them such as the car’s digits. Thus, an end to end system has yet to be proposed.

[2] This paper explains about low-quality license plate character recognition based on CNN(Convolutional Neural networks). The drawbacks are the training data set is not and accurate representation of the real-world scenarios and thus cannot be used in all instances of poor-quality images.

[3] In this paper, a robust Real-time Automatic license plate recognition based on YOLO detector. The drawbacks of this model is the CNN used for character segmentation was trained and specialized only to work on a certain aspect ratio. Thus, it proved inefficient on license plates that were not standardized or having different aspect ratios.

[4] This paper analyzes a mail sorting system based on handwritten Thai characters. This model is limited in ways as it works based on a specific template and doesn’t work for others. The digits in the Thai zip codes represent the regions which are different compared to others.

[5] In this paper we discuss handwritten digit recognition with a back propagation network. The limitations of this architecture is they implemented minimal preprocessing techniques on low levels of data as opposed to elaborate feature extraction.

[6] In this paper it describes the OCR and Image processing algorithms to read the destination addresses from non-standard letters. OCR scanning system is flawless, and poor quality documents can create enough errors to require lengthy and time-consuming proof reading.

[7] This paper describes a real-time system intended to recognize the 5-digit ZIP code part of delivery point code(DPC). The drawbacks are the ZIP code recognition rate is only 73% which means the model is not accurate and the accuracy and efficiency was even lower during cross-validation.

[8] This paper presents a cursive handwritten address recognition system which uses a hidden Markov model (HMM). This model is limited as it is built to recognize only cursive handwritten characters and wont recognize block or italics characters.

TABLE: Comparison of results from different literature surveys.

Author	Network Architecture	Data set	Accuracy
Lele Xie et al. 2018	CNN based method	Image net	79.5%
Liu pan et al. 2015	CNN based method	Image net	87.4%
Rayson Laroca et al. 2018	YOLO detector method	SSIG	93.5%
K.Inthavisas et al. 2014	BPNN	THPO (Thai post office)	87.45%
Y.LeCun et al	Backpropagation	B.N.Y. Post office	91%
M.P Fister et al.1999	TDNN	MNIST	97.5%
G.Dzuba et al. 1997	DEC Alpha Server 2100	ICDAR	73%
Jianchang Mao et al.	HMM	MNIST	83.5%

3. CONCLUSION

This paper describes the various techniques used to implement models to recognize handwritten ZIP Codes in a postal sorting system. The results from multiple literature surveys were analyzed and compared for the best possible outcome.

REFERENCES

- [1] Lele Xie, Tasweer Ahmad, Lianwen Jin , Member, IEEE, Yuliang Liu, and Sheng Zhang, "A New CNN-Based Method for Multi-Directional", IEEE Transactions On Intelligent Transportation Systems Car License Plate Detection, 2018.
- [2] Liu Pan, Li GuoHui, Tu Dan, "Low-quality License Plate Character Recognition Based on CNN", 8th International Symposium on Computational Intelligence and Design, 2015
- [3] Rayson Laroca, Evair Severo, Luiz A. Zanlorenzi, Luiz S. Oliveira,Gabriel Resende Goncalves, William Robson Schwartz and David Menotti, "A Robust Real-Time Automatic License Plate Recognition Based on the YOLO Detector", IEEE, 2018
- [4] K. Inthavisas and N. Sangprasert, "A Thai postal recognition system based on zip codes," in Proceedings of the 2nd International Conference on Computer, Electronics, Mechanical and Aerospace Engineering, Phuket, Thailand.
- [5] Y.LeCun, B.Boser, J.S.Denker, D.Henderson, R.E.Howard, W.Hubbard and L.D.Jackel, "HandWritten digit recognition with a back propagation algorithm" AT&T Bell Laboratories, Holmdel.
- [6] M.P Fister, S.Behnke, R.Rojas "Recognition of handwritten ZIP codes in a postal sorting system",1999.
- [7] Gregory Dzuba, Alexander Filatov, Alexander Volgunin. "Handwritten ZIP Code Recognition"IEEE 1997
- [8] Jianchang Mao, Prasun Sinha, K. Mohiuddin, "A System for Cursive Handwritten Address Recognition"