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HANDWRITTEN DIGITS RECOGNITION USING MACHINE LEARNING

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Abstract: Handwritten character recognition is one of the practically important issues in pattern Recognition applications. The applications of digit recognition includes in postal mail sorting, bank check processing, form data entry, etc. The heart of the problem lies within the ability to develop an efficient algorithm that can recognize hand written digits and which is submitted by users by the way of a scanner, tablet, and other digital devices. This paper presents an approach to off-line handwritten digit recognition based on different machine learning technique. The main objective of this paper is to ensure effective and reliable approaches for recognition of handwritten digits.

Keywords **– Machine Learning, MNIST, Convolutional Neural Network(CNN)**

I. INTRODUCTION

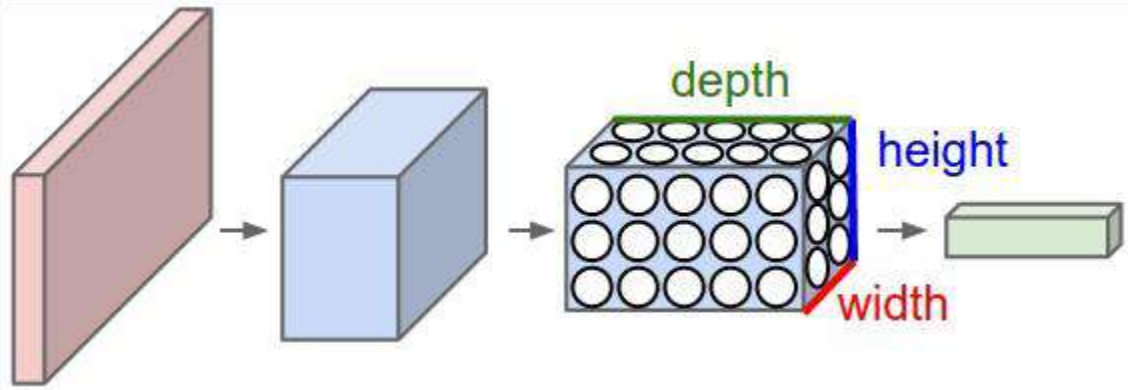
It is easy for the human brain to process images and analyses them. When the eye sees a certain image, the brain can easily segment it and recognize its different elements. The brain automatically goes through that process, which involves not only the analysis of this images, but also the comparison of their different characteristics with what it already knows in order to be able to recognize these elements. There is a field in computer science that tries to do the same thing for machines, which is Image Processing.

Image processing is the field that concerns analyzing images so as to extract some useful information from them. This method takes images and converts them into a digital form readable by computers, it applies certain algorithms on them, and results in a better quality images or with some of their characteristics that could be used in order to extract some important information from them.

Image processing is applied in several areas, especially nowadays, and several software's have been developed that use this concept. Now we have self-driven cars which can detect other cars and human beings to avoid accidents.

II. CNN (CONVOLUTIONAL NEURAL NETWORK)

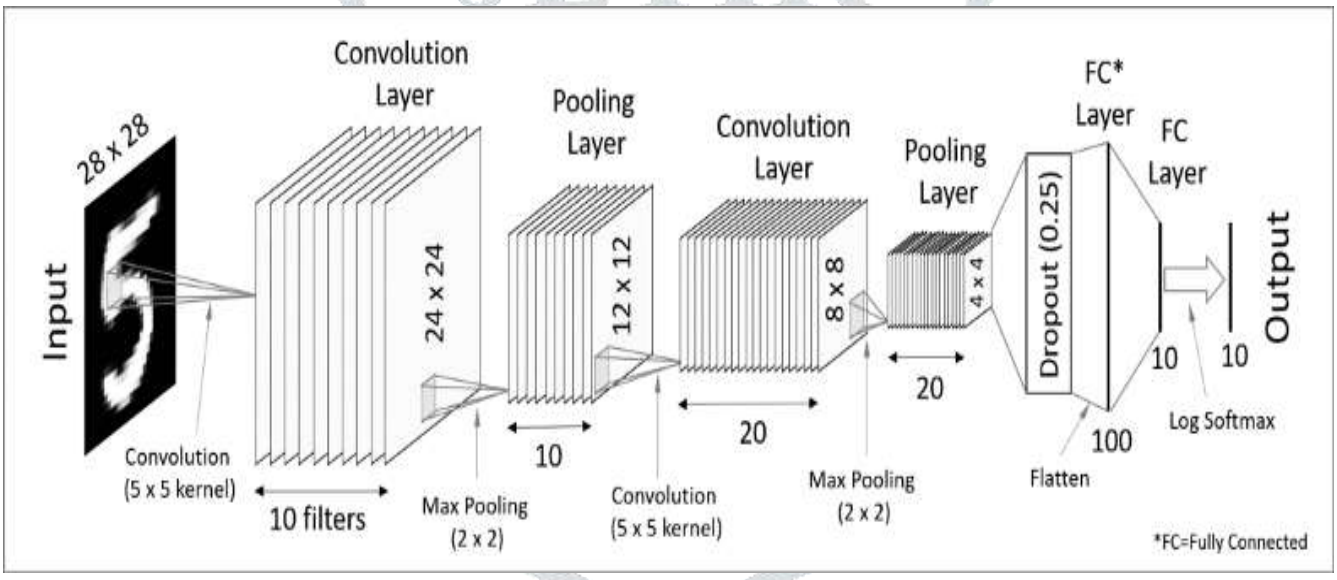
Now let's discuss the Convolutional Neural Networks, CNN has become famous among the recent times. CNN is part of deep, feed forward artificial neural networks that can perform a variety of task with even better time and accuracy than other classifiers, in different applications of image and video recognition, recommender system and natural language processing.



Use of CNN have spread as Facebook uses neural nets for their automatic tagging algorithms, Google for photo search Amazon for their product recommendations, Interest for their home feed personalization and Instagram for search infrastructure. Image classification or object recognition is a problem is passing an image as a parameter and predicting whether a condition is satisfied or not (cat or not, dot or not), or the probability or most satisfying condition for an image. We are able to quickly recognize patterns, generalize from previous information and knowledge

III. INPUT AND OUTPUT

When a computer or system takes an image, it just sees an array of pixel values. Suppose 480*480*3 where 480*480 is size, 3 refer to RGB values. Each of these numbers is assigned with a value of 0 to 255 as pixel intensities at that point. The key point is that based on taking the image as an input, computer system predicts and make an assumption as output for describing the probability of the image being a said or certain class (say 0.90 for class 1, 0.96 for class 2, 0.4 for class 3).



IV. MNIST DATASET

Samples provided from MNIST (Modified National Institute of Standards and Technology) dataset includes handwritten digits total of 70,000 images consisting of 60,000 examples in training set and 10,000 examples in testing set, both with labeled images from 10 digits (0 to 9). This is a small segment form the wide set from NIST where size was normalized to fit a 20*20 pixel box and not altering the aspect ratio. Handwritten digits are images in the form of 28*28 gray scale intensities of images representing an image along with the first column to be a label (0 to 9) for every image. The same has opted for the case of the testing set as 10,000 images with a label of 0 to 9.

The third byte represents whether the data is an integer, float, short, long or unsigned type. The fourth byte tells the dimension of the vector or matrix i.e. the number of rows and columns. If it is equal to 1, then it's a vector else it is a matrix. The number of items variable is also read as MSB first.

Future Scope of This Project

Recently handwritten digit recognition becomes vital scope and it is appealing many researchers because of its using in variety of machine learning and computer vision applications. However, there are deficient works accomplished on marathi pattern digits because marathi digits are more challenging than English patterns.

V. CONCLUSION

In this research, we have implemented three models for handwritten digit recognition using MNIST datasets, based on deep and machine learning algorithms. We compared them based on their characteristics to appraise the most accurate model among them. Support vector machines are one of the basic classifiers that are why it's faster than most algorithms and in this case, gives the maximum training accuracy rate but due to its simplicity, it's not possible to classify complex and ambiguous images as accurately as achieved with MLP and CNN algorithms. We have found that CNN gave the most accurate results for handwritten digit recognition. So, this makes us conclude that CNN is best suitable for any type of prediction problem including image data as an input. Next, by comparing execution time of the algorithms we have concluded that increasing the number of epochs without changing the configuration of the algorithm is useless because of the limitation of a certain model and we have noticed that after a certain number of epochs the model starts overfitting the dataset and give us the biased prediction.

REFERENCES

[1] G. Anbarjafari, "1. Introduction to image processing," Sisu@UT. [Online]. Available: https://sisu.ut.ee/imageprocessing/book/1.

[2] S. Tanner, "Deciding whether Optical Character Recognition is feasible" [Online].

Available: http://www.odl.ox.ac.uk/papers/OCRFeasibility_final.pdf

[3] H. F. Schantz, The history of OCR, optical character recognition. Manchester Center, VT: Recognition Technologies Users Association, 1982.

[4] History of Computers and Computing, Internet, Dreamers, Emanuel Goldberg. [Online]. Available: https://history-computer.com/Internet/Dreamers/Goldberg.html.

[5] "Optical Character Recognition: What you Need to Know". Phoenix Software International. Available: http://www.phoenixsoftware.com/pdf/ocr_data_entry.pdf [6]

S. N. Srihari, & E. J. Kuebert. Integration of Hand-Written Address Interpretation Technology into the United States Postal Service Remote Computer Reader System.

Available: http://www.cedar.buffalo.edu/papers/articles/HWAI-RCR97.pdf

[7] V. Sharma, S. Rai, & A. Dev (2012). International Journal of Advanced Research in Computer Science and Software Engineering. Available:

http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.468.9353&rep=rep1&type=

pdf

[8] V. Shrivastava, & N. Sharma (2012). Artificial Neural Network Based Optical Character Recognition. Available:
https://pdfs.semanticscholar.org/e0df/4d4c89af84b6caa250ba26e7f355258968de.pdf

[9] P. Y. Simard, D. Steinkraus, & J. Platt. Best Practices for Convolutional Neural Networks Applied to Visual Document Analysis. Available:
https://www.microsoft.com/en-us/research/publication/best-practices-for-convolutional- neural-networks-applied-to-visual-document-analysis/?from=http%3A%2F%2Fres