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| Internship Project Title | TCS iON RIO 210 |
| Project Title | AUTOMATE IDENTIFICATION AND RECOGNITION OF HANDWRITTEN TEXT FROM AN IMAGE |
| Name of the Company | TCS iON |
| Name of the Industry Mentor | DEBASHIS ROY |
| Name of the Institute | ALVA’S INSTITUTE OF ENGINEERING AND TECHNOLOGY |

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| Start Date | End Date | Total Effort (hrs.) | Project Environment | Tools used |
| 02/10/2020 | 31/12/2020 | 210 hrs | online | Keras, TensorFlow 2.0.0,  OpenCv, python3.9, googlecolab |
| Project Synopsis:  Handwritten text recognition is still an open research issue in the domain of Optical Character Recognition (OCR). This paper proposes an efficient approach towards the development of handwritten text recognition systems. 3-layer Artificial Neural Network (ANN) is utilized in this Paper using supervised learning approach. The choice of optimal feature vectors greatly the accuracy of any text recognition system therefore bit map representation of input samples are utilized as feature vector. The feature vectors are first pre-processed and then applied to the ANN along with the generated target vectors; that are generated on the basis on input samples. 55 samples of each English alphabet are used as a ANN training process in order to make sure the general applicability of system towards new inputs. Two different learning algorithms are utilized in this paper. Additive image processing algorithms are also developed in order to deal with the multiple characters input in a single image, tilt image and rotated image. The trained system provides an average accuracy of more than 95 % with the unseen test image.  Handwritten text recognition is still an open research issue in the domain of Optical Character Recognition (OCR). This paper  proposes an efcient approach towards the development of handwritten text recognition systems. 3-layer Articial Neural Network  (ANN) is utilized in this Paper using supervised learning approach. The choice of optimal feature vectors greatly the accuracy of  any text recognition system therefore bit map representation of input samples are utilized as feature vector. The feature vectors are  rst pre-processed and then applied to the ANN along with the generated target vectors; that are generated on the basis on input  samples. 55 samples of each English alphabet are used as a ANN training process in order to make sure the general applicability of  system towards new inputs. Two different learning algorithms are utilized in this paper. Additive image processing algorithms are  also developed in order to deal with the multiple characters input in a single image, tilt image and rotated image. The trained system  provides an average accuracy of more than 95 % with the unseen test image  Handwritten text recognition is still an open research issue in the domain of Optical Character Recognition (OCR). This paper  proposes an efcient approach towards the development of handwritten text recognition systems. 3-layer Articial Neural Network  (ANN) is utilized in this Paper using supervised learning approach. The choice of optimal feature vectors greatly the accuracy of  any text recognition system therefore bit map representation of input samples are utilized as feature vector. The feature vectors are  rst pre-processed and then applied to the ANN along with the generated target vectors; that are generated on the basis on input  samples. 55 samples of each English alphabet are used as a ANN training process in order to make sure the general applicability of  system towards new inputs. Two different learning algorithms are utilized in this paper. Additive image processing algorithms are  also developed in order to deal with the multiple characters input in a single image, tilt image and rotated image. The trained system  provides an average accuracy of more than 95 % with the unseen test image  Handwritten text recognition is still an open research issue in the domain of Optical Character Recognition (OCR). This paper  proposes an efcient approach towards the development of handwritten text recognition systems. 3-layer Articial Neural Network  (ANN) is utilized in this Paper using supervised learning approach. The choice of optimal feature vectors greatly the accuracy of  any text recognition system therefore bit map representation of input samples are utilized as feature vector. The feature vectors are  rst pre-processed and then applied to the ANN along with the generated target vectors; that are generated on the basis on input  samples. 55 samples of each English alphabet are used as a ANN training process in order to make sure the general applicability of  system towards new inputs. Two different learning algorithms are utilized in this paper. Additive image processing algorithms are  also developed in order to deal with the multiple characters input in a single image, tilt image and rotated image. The trained system  provides an average accuracy of more than 95 % with the unseen test image | | | | |
| Solution Approach:  We are used ANN, OpenCv, tenserFlow and resnet to train the model and used mnist, az dataset which is downloaded from <https://fki.tic.heia-fr.ch/databases/iam-handwriting-database> The training of ANN involves specifying the hidden layers and choice of learning algorithm. The input vector and target vector are also normalized in the range of [-1 to 1], so that the training can be done efficiently. During training, gradient is set as e-10 and maximum number of iteration as 1000. 55 samples of each character are used for creating of training dataset. Now, New test images are created in order to check the validity of our designed system. figure (6) show a sample of handwritten document. | | | | |
| Assumptions: | | | | |
| Project Diagrams: | | | | |
| Algorithms:    1. Image Acquisition  The first step is to acquire images of paper documents with the help of optical scanners. This way, an original image can be captured and stored. Most of the paper documents are black and white, and an OCR scanner should be able to threshold images. In other words, it should replace each pixel in an image with a black or a white pixel. It is a method of image segmentation.  2. Pre-processing  The goal of pre-processing is to make raw data usable by computers. The noise level on an image should be optimized and areas outside the text removed. Pre-processing is especially vital for recognizing handwritten documents that are more sensitive to noise. Pre-processing allows obtaining a clean character image to yield better results of image recognition.  3. Segmentation  The process of segmentation is aimed at grouping characters into meaningful chunks. There can be predefined classes for characters. So, images can be scanned for patterns that match the classes.  4. Feature Extraction  This step means splitting the input data into a set of features, that is, to find essential characteristics that make one or another pattern recognizable. As a result, each character gets classified in a particular class.  5. Training a Neural Network  Once all the features are extracted, they can be fetched to a neural network (NN) to train it to recognize characters. A training dataset and the methods applied to achieve the best output will depend on a problem that requires an OCR-based solution.  6. Post-Processing  This stage is the process of refinement as an OCR model can require some corrections. However, it isn’t possible to achieve 100% recognition accuracy. The identification of characters heavily depends on the context. The verification of the output requires a human-in-the-loop approach. | | | | |
| Outcome: | | | | |
| Exceptions considered:  If the given image quality is poor then it won’t recognize the text in the image , if the hand writing of the text is bad then our model will not recognize the text. | | | | |
| Enhancement Scope:  By enhancing this project we can easily digitalized all the paper work and it helps to understand the hand written text what the pepole had written.  Through this project we can easily translate the text of other language to our native language.  It can be further developed and used by the traffic police to read the number plate of the vehicle. | | | | |
| Link to Code and executable file: https://github.com/JahnaviPC/TCS | | | | |