PROBLEM SOLUTION FIT

Define CS, fit into CC

1.CUSTOMER SEGMENT(S) — CS

- In real time applications it is difficult to differentiate the handwritten digits of various people since everyone has unique handwriting style.
- It is used in the detection of vehicle number, banks for reading cheques, recognize zip codes on mail for postal mail sorting, numeric entries in forms filled up by hand.

6.CUSTOMER CONSTRAINTS — CC

Artificial Neural Network used for the digit recognition requires lot of hardware dependence and requires lot of computational power. Data preparation and model optimization requires careful attention. It does not work for small dataset and hence large number of dataset are required for training.

5. AVAILABLE SOLUTIONS — AS

There are number of ways and algorithms to recognize handwritten digits including Deep learning/CNN, SVM, Gaussian Naive Bayes, KNN, RNN, Decision trees, Random forests, Stochastic Gradient Descent. The accuracy of Gaussian Naïve Bayes, decision trees and random forests are less while SVM used for character recognition provides very high accuracy. CNN has high accuracy for digit recognition.

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

2. JOBS-TO-BE-DONE / PROBLEMS — J&P

Digits from 0-9 are difficult to recognize as everyone has unique handwriting. To recognize these handwritten digits MNIST dataset is used for recognition process and the artificial neural networks is used to train the images. Initially, images are to be scanned and converted to text format. OpenCV is used for finding structures in the images automatically break the images into handwritten segments.. Web application is to be developed where the image can be uploaded and this image is analyzed and detected by the model.

9. PROBLEM ROOT CAUSE — RC

The need to develop a handwritten digit recognition system arises due to illegible handwritten digits. Every human has different way of writing style, the numbers from 0 to 9 are different in structure. Sometimes it takes time to understand the digit written in bank cheques and post mail services. When a digit is recognized wrong, it may result in trouble. This causes the need for handwritten digit recognition system.

7. BEHAVIOUR — BE

As everyone has the unique style of handwriting it is difficult to recognize the handwritten digits in bank cheque books and post mail boxes. A web application should be developed by using python flask and necessary libraries are to be installed. The image scanned are splitted, trained and tested using machine learning algorithms. The image uploaded in the model will be detected and the digit recognized will be displayed.

Focus on J&P, tap into BE, understand RC

Identify strong TR & EM

3. TRIGGERS — TR

An efficient method for digit recognition with high accuracy and the model is trained using 70000 MNIST samples, this makes the model more reliable.

4. EMOTIONS: BEFORE / AFTER — EM

Before using this model, it is difficult to read the handwritten digits and it takes more time to recognize the digit. Some may feel frustrated due to the illegible handwritten digits. After using this model, it is easy to recognize the digits and feel relaxed.

10. YOUR SOLUTION — SL

Multilayer Perceptron Neural Network is used to recognize and predict the handwritten digits from 0 to 9. The dataset was trained using gradient descent back-propagation algorithm and further tested using the feed-forward algorithm. The system performance is observed by varying the number of hidden units and the number of iterations. By using this method, digits can be recognized easily. It has a very high accuracy rate of 99.32% so that the digits are recognized accurately.

8. CHANNELS of BEHAVIOUR — CH

8.1 ONLINE

The web application is created using python libraries as backend. The system is trained using MNIST dataset. The online computational data can also be recognized.

8.2 OFFLINE

The input digits to be recognized such as vehicle license plate recognition, postal letter sorting services, cheque truncation system scanning. The OpenCV is used for automatically breaking the image into handwritten segments.

Extract online & offline CH of BE