

# CSC730: Report for Assignment 2

## South Dakota School of Mines and Technology

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January 28, 2024

## 1 Introduction

The second assignment of this course tasked us with analyzing a set of skewed data from the MNIST dataset. This skewed dataset contained eight classes from a total set of ten classes. Also, each class was not represented with equivalent frequency. The dataset contains 12244 records of data. Each record contains a 784-element list that represents a 28x28 image of a handwriting sample.

This report will detail the steps taken by our team to generate an anomaly score for each image and compare our results for accuracy.

We used two primary toolsets to perform the analysis. One toolset was python executed on VS code and the other was python executed on Google Colab.

## 2 Methodology

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Implement fuzzy-cmeans from scratch

The paper this will be implemented from is titled, *A Survey of Clustering Algorithms for Big Data: Taxonomy and Empirical Analysis*

[1] FCM pseudo-code: Input: Given the dataset, set the desire number of clusters  $c$ , the fuzzy parameter  $m$  (a constant  $> 1$ ), and the stopping condition, initialize the fuzzy partition matrix, and set stop = false. Step 1. Do: Step 2. Calculate the cluster centroids and the objective value  $J$ .  $v_k = \frac{\sum_{i=1}^n \mu_{ik}^m p_i}{\sum_{i=1}^n \mu_{ik}^m}$

$$|p_i - v_k| = \sqrt{\sum_{i=1}^n (x_i - v_k)^2}$$

$$J = \sum_{i=1}^n \sum_{k=1}^c \mu_{ik}^m |p_i - v_k|^2$$

Step 3. Compute the membership values stored in the matrix.

$$\mu_{ik}^m = \frac{1}{\sum_{l=1}^c \left( \frac{|p_i - v_k|^2}{|p_i - v_l|^2} \right)^{\frac{2}{m-1}}}$$

Step 4. If the value of  $J$  between consecutive iterations is less than the stopping condition, then stop = true. Step 5. While (!stop) Output: A list of  $c$  cluster centres and a partition matrix are produced.

An example of two handwriting samples is shown as images in figure ?? and figure ??. These images

were produced using the imshow function from the matplotlib python library.

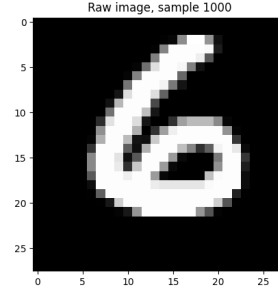


Figure 1: Handwriting Sample 1000

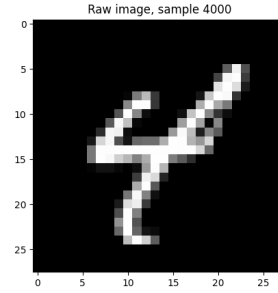


Figure 2: Handwriting Sample 4000

## 3 Results

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## 4 Discussion

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## 5 Conclusion

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## 6 References

[1] Fahad, A., Alshatri, N., Tari, Z., Alamri, A., Khalil, I., Zomaya, A. Y., ... & Bouras, A. (2014).

A survey of clustering algorithms for big data: Taxonomy and empirical analysis. *IEEE transactions on emerging topics in computing*, 2(3), 267–279.