Soft Clustering for Enhancing the Diagnosis of Chronic Diseases over Machine Learning Algorithms

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Research Paper Overview

Title

Soft Clustering for Enhancing the Diagnosis of Chronic Diseases over Machine Learning Algorithms

Authors & Venue

Theyazn H.H. Aldhyani, Ali Saleh Alshebami, Mohammed Y. Alzahrani; _Journal of Healthcare Engineering, 2020_

Problem Statement and Objectives

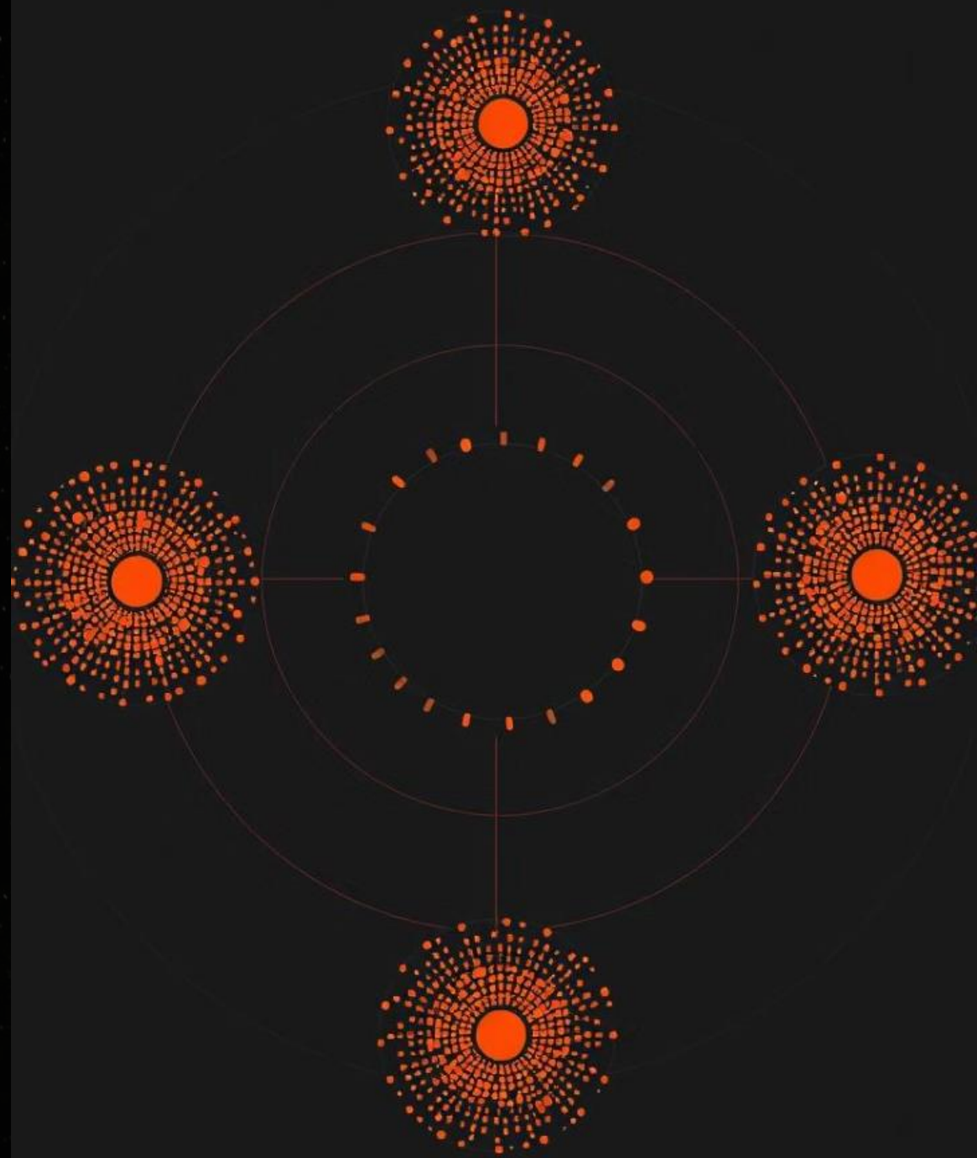
Challenge

Ambiguous data in chronic disease diagnosis hinders traditional classifiers.

Objectives

Implement Rough K-Means for ambiguous data.

Compare performance to K-Means, GMM, and DNN.



Literature Review

Rough K-Means (RKM)

Separates data into lower and upper approximations.

K-Means

Traditional clustering, struggles with ambiguous data.

Gaussian Mixture Models (GMM)

Models complex distributions but lacks precision with overlapping clusters.

Deep Neural Networks (DNN)

Handles complex patterns effectively.

Algorithm:Rough K-Means (RKM)

Lower Approximation

Exclusive cluster data points.

Upper Approximation

Ambiguous data spanning multiple clusters.

Steps

Data Preprocessing, RKM clustering, Centroid recalculation, Classifier training.

Datasets and Experimental Setup

Diabetes

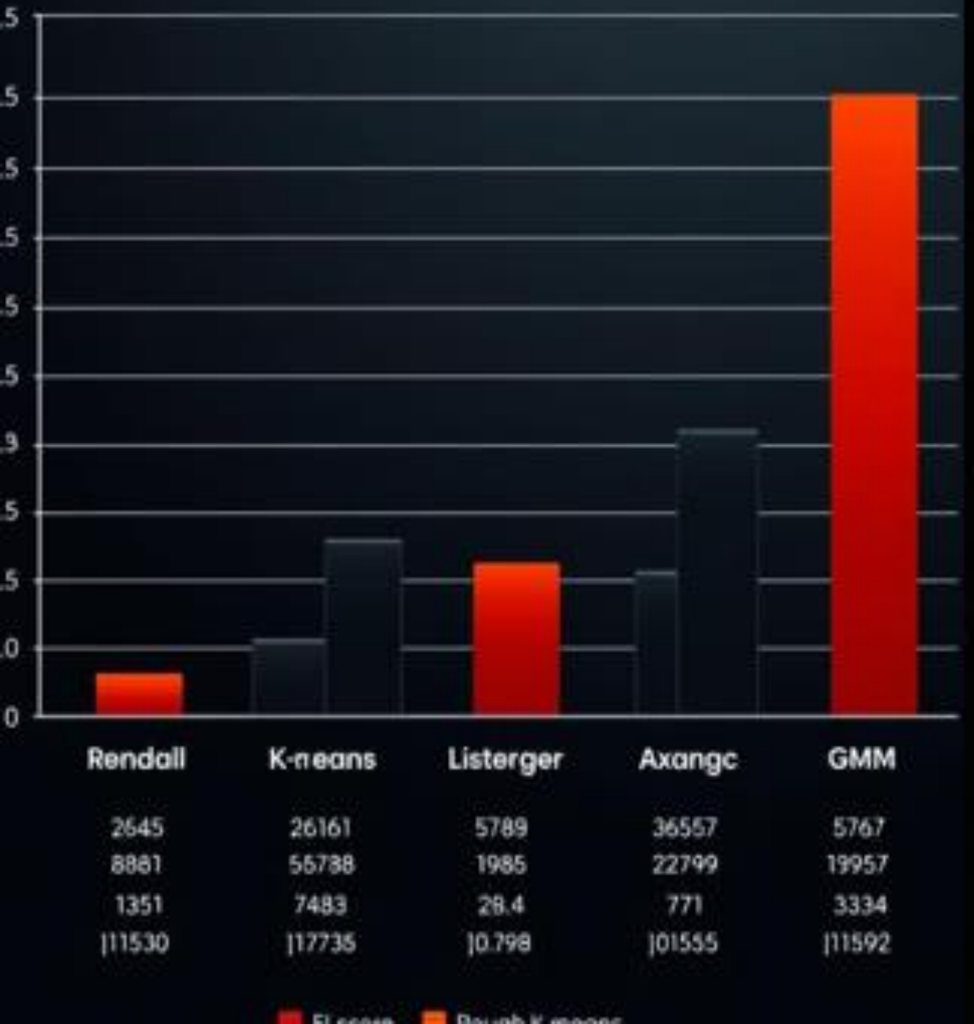
768 instances, 8 features (_UCI Repository_).

Breast Cancer

569 instances, 30 features (_Kaggle_).

Chronic Kidney Disease

400 instances, 24 features (_Kaggle_).



Results and Analysis

Method	Accuracy	F1-Score (Class 0)	F1-Score (Class 1)
Rough K-Means	68%	72%	62%
Traditional K-Means	32%	38%	24%
Gaussian Mixture	34%	100%	0%
DNN	89%	89%	89%

Weaknesses and Improvements

Weaknesses

Sensitive to initial centroids and thresholds.

Improvements

Adaptive threshold selection, scalability enhancements.

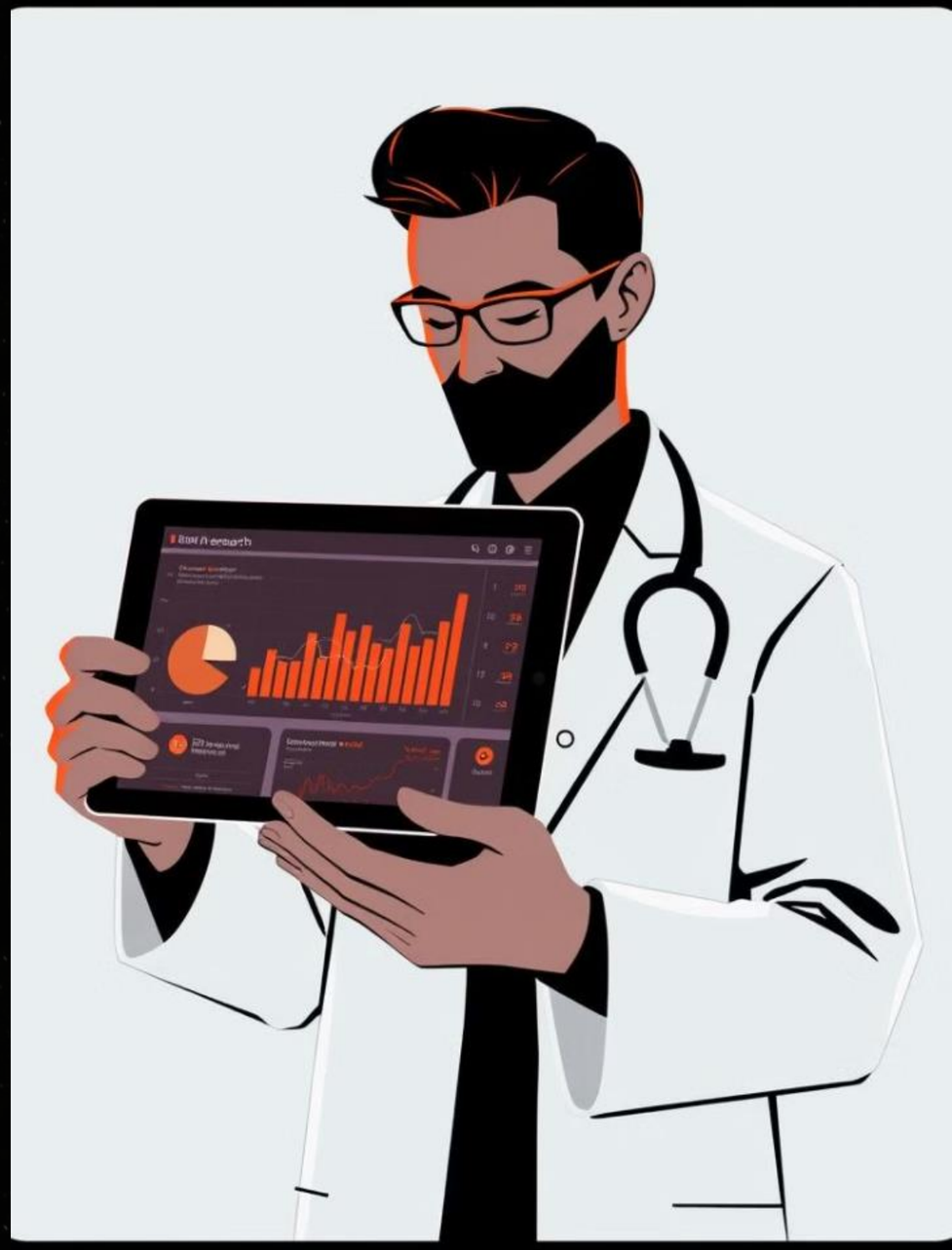
Conclusion

Summary

Implemented RKM for ambiguous data handling. RKM outperformed K-Means and GMM. DNN integration achieved highest accuracy.

Significance

Improved diagnostic accuracy for chronic disease classification.



Q&A

Thank you! Any questions?