GPR-132

OPTIMIZATION OF FIXED TIME IN ROUND ROBIN SCHEDULING USING CLUSTERING ALGORITHMS

Abstract

This project introduces a method to optimize the fixed time in Round Robin scheduling using unsupervised clustering, specifically DBSCAN. Traditionally, fixed time is chosen arbitrarily, often leading to inefficiencies like increased waiting times and frequent context switches. Our approach leverages DBSCAN to identify clusters of processes based on arrival and burst times, as well as to detect outliers that may need unique fixed times. This adaptive, data-driven adjustment has demonstrated improved performance over traditional methods, reducing waiting time, minimizing context switches, and enhancing system throughput. Simulations confirmed the effectiveness of this approach, especially in datasets with outlier processes, where DBSCAN performed exceptionally well.

Introduction

Round Robin (RR) scheduling is a widely used algorithm known for its simplicity and fairness but often suffers from inefficiencies due to fixed times. Research has sought to improve RR by dynamically adjusting the fixed time, with methods like Helmy et al.'s weighted RR, which allocates more fixed time to higher-weighted processes to favor shorter tasks and reduce waiting times. Other approaches adjust the fixed time based on the average burst times of processes, making it adaptable to real-time conditions. Recently, machine learning techniques, such as K-Nearest Neighbors (KNN) and Random Forest, have been employed to optimize fixed time assignment by classifying processes based on optimal service time values, enhancing scheduling efficiency.

We propose to utilize the DBSCAN clustering algorithm to group processes based on burst times and arrival characteristics. DBSCAN effectively identifies irregular processes, allowing unique fixed time assignments for these outliers. This data-driven approach aims to outperform other machine learning methods by reducing average waiting times and improving overall system throughput

Datasets

Dataset with 2 clusters

Process ID	Arrival Time	Burst Time
P1	12	10
P2	21	15
P3	8	25
P4	10	55
P5	12	65
P6	15	60

Dataset with Outliers

Process ID	Arrival Time	Burst Time
P1	12	10
P2	21	15
P3	8	25
P4	10	55
P5	12	65
P6	15	60
P7	5	120

Methods

Data Preparation

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Clustering

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Assigning Fixed Time

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Round Robin Simulation

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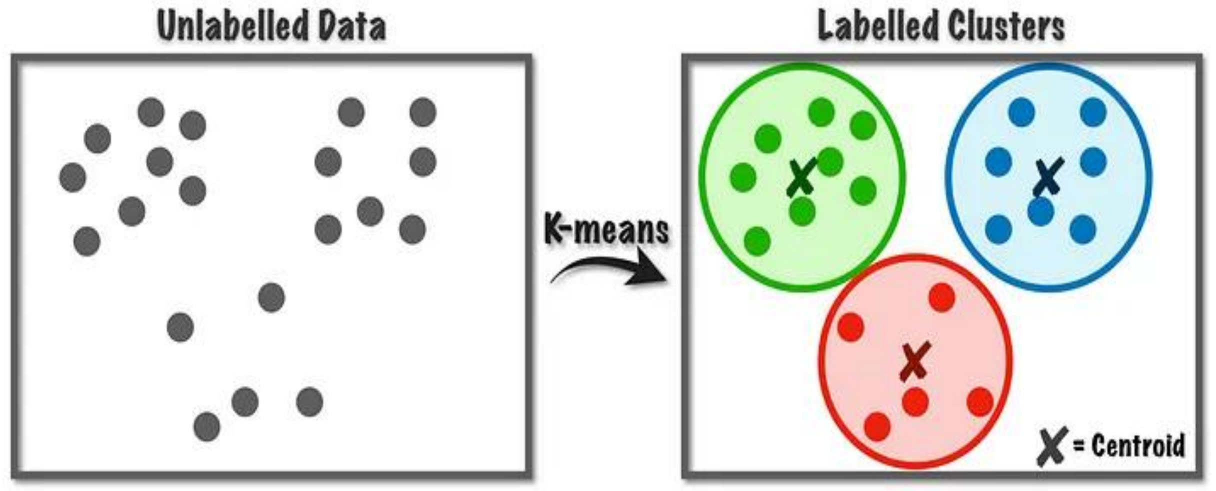
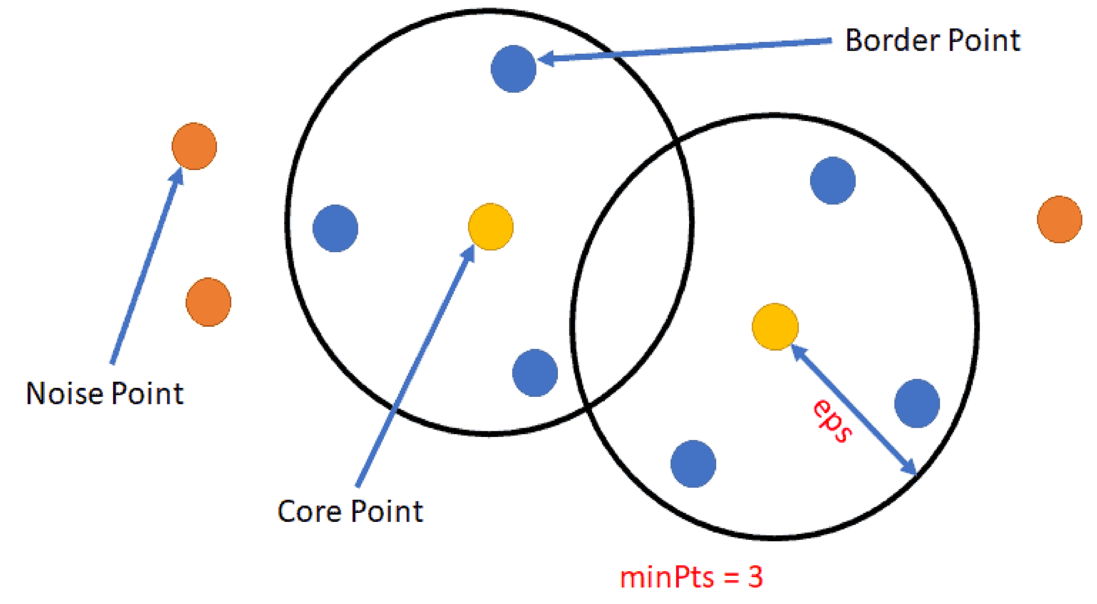
Performance Evaluation

Clustering

K-Means



DBSCAN



Results

Dataset with 2 clusters

Methods	Average Waiting Time	Average Turnaround Time
Round Robin	101.7	140
Round Robin with K-Means	59.16	97.5
Round Robin with Dbscan	59.16	97.5

Dataset with outliers

Methods	Average Waiting Time	Average Turnaround Time
Round Robin	156.7	206.71
Round Robin with K-Means	147.42	197.42
Round Robin with Dbscan	120.28	170.28

Conclusions

This study demonstrates that clustering techniques, specifically DBSCAN and K-means, can enhance Round Robin scheduling by reducing average waiting and turnaround times. K-means groups processes by burst time for more balanced workload distribution, while DBSCAN effectively handles outliers, isolating irregular processes for unique scheduling adjustments. Future research will test these methods on varied datasets to validate their adaptability, especially DBSCAN's handling of noisy data, aiming to create more responsive and efficient scheduling algorithms for dynamic workloads.

Contact Information

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Project Website: https://github.com/saitsuer/Optimization-of-Fixed-Time-in-Round-Robin-Scheduling-using-Clustering-Algorithms

References

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