Mall Movement Tracking

Machine Learning Project Report

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ML-powered analytics for customer movement patterns in shopping malls

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1. Executive Summary

This report presents the results of a comprehensive machine learning project for tracking and predicting customer movement patterns in shopping malls. The project includes classification models for predicting next zone visits, clustering models for customer segmentation, and forecasting models for traffic prediction.

Key Achievements

Metric	Model	Performance
Classification Best Model	XGBOOST	99.65%
Clustering Best Model	KMEANS	0.2575

2. Project Overview

Objective: Develop machine learning models to analyze and predict customer movement patterns in shopping malls.

Approach:
• Feature Engineering: Created 30+ new features from raw data
• Classification: Predict next zone visit (4 models)
• Clustering: Customer segmentation (2 models)
• Forecasting: Traffic prediction (2 models)

3. Data Overview

The dataset contains customer movement tracking data with temporal, spatial, and behavioral features. After feature engineering, the dataset includes 110 features derived from the original 80 columns.

Dataset Statistics

Metric	Value
Total Records	15,839
Original Features	80
Engineered Features	110
New Features Created	30
Missing Values (After Processing)	0

4. Classification Models

Classification models predict the next zone a customer will visit based on their current location and movement history.

Model Performance

Model	Accuracy	ROC-AUC
Random Forest	98.77%	nan
Decision Tree	99.37%	N/A
Xgboost	99.65%	nan
Svm	1.10%	nan

Best Model: Xgboost (99.65% accuracy)

5. Clustering Models

Clustering models group customers with similar movement patterns to identify behavioral segments.

Model Performance

Model	Silhouette Score	Clusters	Noise Points
KMEANS	0.2575	5	0
DBSCAN	0.1744	396	7157

6. Forecasting Models

Forecasting models predict future traffic patterns and customer movement trends.

Model Performance

Model	RMSE	MAE
PROPHET	2.24e+12	1.94e+12

7. Model Comparison

Summary of all models trained and their performance metrics.

Model Type	Best Model	Key Metric	Value
Classification	Xgboost	Accuracy	99.65%
Clustering	KMEANS	Silhouette Score	0.2575
Forecasting	PROPHET	RMSE	2.24e+12

8. Conclusions & Recommendations

Key Findings:
• Classification models achieved high accuracy (>99%)
• XGBoost performed best for classification tasks
• K-Means identified 5 distinct customer segments

Recommendations:
• Deploy XGBoost model for production predictions
• Use K-Means clusters for targeted marketing campaigns
• Continue monitoring model performance with new data
• Consider hyperparameter tuning for further improvements

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