CCTV SURVEILLANCE ANOMALY DETECTION SYSTEM

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1. Project Overview

This project focuses on detecting abnormal activities such as robbery in CCTV surveillance footage. The system analyzes motion patterns between video frames and classifies activities as Normal or Anomaly. The approach combines motion-based feature extraction with machine learning classification to identify suspicious behavior.

2. Dataset Used

Dataset Name: UCF Crime Dataset Dataset Type: Surveillance video frames (Robbery and Normal activities) Dataset Source (Kaggle): https://www.kaggle.com/datasets/odins0n/ucf-crime-dataset The dataset contains real-world CCTV footage of various abnormal events. For this project, Robbery and Normal video frames were used for training and evaluation.

3. System Pipeline

1   Video Frame Extraction from CCTV footage
2   Preprocessing (Resize and Grayscale conversion)
3   Motion Feature Extraction using Frame Difference
4   Optical Flow computation using Farneback method
5   Feature Vector Creation (motion statistics and flow magnitude)
6   Stratified Train-Test Split
7   SVM (RBF Kernel) Classification
8   Evaluation using Accuracy, Confusion Matrix, and ROC Curve

4. Social Force Inspired Approach

The system is inspired by the Social Force Model where abnormal behavior is interpreted as sudden changes in motion intensity. Frame-to-frame motion and optical flow magnitude act as force indicators. Higher force values correspond to suspicious or abnormal events.

5. Tools and Technologies

Programming Language: Python Libraries: OpenCV, NumPy, Scikit-learn, Matplotlib, Seaborn
Classifier: Support Vector Machine (RBF Kernel) Platform Used: Kaggle Notebook Environment

6. Model Performance

The model was evaluated using a stratified train-test split. The current implementation achieves approximately 75% accuracy on the evaluation set. The ROC-AUC score demonstrates strong class separation capability. The confusion matrix indicates balanced detection of both Normal and Robbery frames.

7. Project Completion Status

1   Dataset preprocessing completed
2   Motion feature extraction implemented
3   Optical flow integration completed
4   SVM classification model trained
5   Evaluation metrics generated
6   Model optimization ongoing

Prepared for CCTV Anomaly Detection Project Submission.