

Assignment 2

Course Title: Research Methodology in Computer Science

Student Name: Waleed ABDELGAWAD

ID/ 2553002839

AI Impact on Crowd Management Using CCTV Footage in Riyadh Metro Operations

Problem Statement:

In the rapid growth of urban populations, metro systems are becoming the primary mode of public transportation, during peak hours and holidays like (national days), these stations often experience overcrowding. Traditionally, metro authorities have relied on manual observation through CCTV surveillance and station personnel to monitor crowd movement and respond to incidents. As highlighted by Chen (2020) traditional CCTV monitoring is inefficient and Liu & Sun (2021) discusses how human operators cannot efficiently process large visual data streams leading to delays response.

This research aims to address and enhance crowd management efficiency by automating real-time analysis of CCTV footage Through computer vision and deep learning algorithms.

Research Objectives:

- 1. To analyze the role of Artificial Intelligence in enhancing crowd monitoring within metro operations**
 - To understand how AI models process CCTV data to detect crowd density, movement patterns, and potential safety hazards in real time.
- 2. To evaluate the effectiveness of AI-based crowd management systems compared to traditional manual methods**
 - To critically assess the strengths and weaknesses of explainable AI methods in enhancing transparency
 - To explore the proposed approaches proposed by Chen at (2020)

3. To propose a practical framework for integrating AI-based crowd monitoring systems into metro control operations

- To offer actionable guidance for organizations and developers to integrate the AI framework into OCC metro operations control center

Literature Review:

Recent systematic reviews and domain studies show rapid progress in deep learning-based crowd analytics counting, density maps, flow prediction, and growing interest in applying these techniques to rail/metro contexts, but they also highlight privacy, and deployment gaps.

1. Gaps and directions for future research: The literature reviewed understood the critical importance of impacts of surveillance on women privacy, intersectional analyses (how gender intersects with race, class, disability), and evaluations of mitigation effectiveness in operational deployments. There is also a need for standardized metrics to evaluate gendered privacy harm and for more publicly available datasets describing harm outcomes (with ethical safeguards)

References:

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- Singh, P., & Reddy, A. (2021). Responsible AI for public infrastructure: A framework for human–machine collaboration. *AI and Society*, 36(6), 1149–1162.

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