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Research Article

A Real-Time Framework for Human Face Detection and Recognition in CCTV Images

Rehmat Ullah ,[1] Hassan Hayat,[2] Afsah Abid Siddiqui,[2] Uzma Abid Siddiqui,[2] Jebran Khan ,[3] Farman Ullah,[2] Shoaib Hassan,[2] Laiq Hasan,[1] Waleed Albattah ,[4] Muhammad Islam,[5] and Ghulam Mohammad Karami [6]

[1]*Department of Computer Systems Engineering, University of Engineering and Technology Peshawar, Peshawar, Pakistan*
[2]*Department of Electrical and Computer Engineering, COMSATS University Islamabad, Attock Campus, Attock, Pakistan*
[3]*Department of Arti cial Intelligence, AJOU University, Suwon, Republic of Korea*
[4]*Department of Information Technology, College of Computer, Qassim University, Buraydah, Saudi Arabia*
[5]*Department of Electrical Engineering, College of Engineering and Information Technology, Onaizah Colleges, Al-Qassim, Saudi Arabia*
[6]*SMEC International Pvt. Limited, Kabul 1007, Afghanistan*

Correspondence should be addressed to Ghulam Mohammad Karami; ghulam.karami@smec.com

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□ is paper aims to develop a machine learning and deep learning-based real-time framework for detecting and recognizing human faces in closed-circuit television (CCTV) images. □ e traditional CCTV system needs a human for 24/7 monitoring, which is costly and insu□cient. □ e automatic recognition system of faces in CCTV images with minimum human intervention and reduced cost can help many organizations, such as law enforcement, identifying the suspects, missing people, and people entering a restricted territory. However, image-based recognition has many issues, such as scaling, rotation, cluttered backgrounds, and variation in light intensity. □ is paper aims to develop a CCTV image-based human face recognition system using di□erent techniques for feature extraction and face recognition. □ e proposed system includes image acquisition from CCTV, image preprocessing, face detection, localization, extraction from the acquired images, and recognition. We use two feature extraction algorithms, principal component analysis (PCA) and convolutional neural network (CNN). We use and compare the performance of the algorithms K-nearest neighbor (KNN), decision tree, random forest, and CNN. □ e recognition is done by applying these techniques to the dataset with more than 40K acquired real-time images at di□erent settings such as light level, rotation, and scaling for simulation and performance evaluation. Finally, we recognized faces with a minimum computing time and an accuracy of more than 90%.

1. Introduction

Today's organizations face signi□cant security challenges; they need several specially trained personnel to achieve the required security. However, humans make mistakes that a□ect safety. Closed-circuit television (CCTV) is currently used for various purposes in everyday life. □ e development of video surveillance has transformed simple passive monitoring into an integrated intelligent control system. Face detection and its new applications for secure access control, □nancial transactions, etc. Biometric systems (faces, palms, and □ngerprints) have recently gained new importance. With advances in microelectronics and vision systems, biometrics has become economically viable. Facial recognition is an essential part of biometrics. In biometrics, human fundamentals are mapped to current data. □ e facial features are hauled out and implemented using an e□cient algorithm, and some variations are made to improve the