isrjournals

International Journal of Advanced Research in Computer Science Engineering and Information Technology

Volume: 6, Issue: 3,Special Issue: 3 ,Apr,2024 ,ISSN_NO: 2321-3337

CRIME PREDICTION AND DETECTION USING FACE RECOGNITION: ENHANCING SECURITY THROUGH FACIAL ANALYSIS

Arun E G[1], Munuswamy P[2], Rajkumar C[3], Malathi S[4*]

[123]UG Scholar-Dept. CSE, GRT Institute of Engineering and Technology, Tiruttani, India.

[4]Assistant Professor- Dept. CSE, GRT Institute of Engineering and Technology, Tiruttani, India.

egarun753@gmail.com, pmunuswamy2020@gmail.com, aka371693@gmail.com

[*]**Corresponding Author:s.malathi83@gmail.com**

Abstract

Crime Prediction and Detection Using Face Recognition with ResNet is an innovative application of deep learning and computer vision technologies aimed at enhancing law enforcement's ability to identify and apprehend criminals. This project utilizes the ResNet architecture to capture, recognize, and match faces in real-time from a camera feed against a database of target criminal faces. When a match is detected, the system automatically stores relevant information and promptly sends an email alert to the designated police station with comprehensive details. The core components of this system encompass real-time face detection, facial recognition using ResNet, a comprehensive database of target criminal faces, advanced face matching algorithms, and an automated email notification.

Keywords*: ResNet Algorithm, Web Camera, Real Time monitoring, Haar Algorithm.*

1. Introduction

In an era marked by growing security concerns, this project harnesses the power of cutting-edge technology to enhance crime prevention and detection. The core idea revolves around the utilization of facial recognition technology integrated with a deep learning model known as ResNet. This innovative system operates through cameras that capture faces in various public spaces. These captured faces are then compared with a database of known criminals facial images. When a match is found, the system triggers an automatic email notification to the relevant law enforcement agencies, providing them with crucial details about the identified individual. This project serves as a force multiplier for the police, enabling them to proactively identify and apprehend criminals before they can commit further offenses.

2. Related Work

Predicting crime is more accurately using supervised learning techniques. It utilizes algorithms like decision trees and k-nearest neighbours, along with Random Forest and Ada boost, to improve prediction accuracy. By analysing a dataset containing records of past crimes and their patterns, the system aims to provide early information to law enforcement teams, helping them respond faster to crime activities in different areas of a city. Additionally, oversampling is employed to enhance the accuracy of the predictions. The system is trained on twelve years of criminal activity data from San Francisco city, aiming to help prevent and solve crimes more effectively.[1]

The paper proposes a method to predict crime patterns in New York City neighbourhoods using a dataset spanning from 2006 to 2019, comprising 2.2 million criminal records across 25 different crime types. It employs advanced geographic information systems and spatial data mining techniques to enhance crime detection. The methodology involves

visualizing the crime data, then using three different classifiers (Support Vector Machine, Random Forest, and XGBoost) to predict crime types. Results show that XGBoost accurately predicts the highest number of crime types (22 out of 25), outperforming Random Forest (21 types) and SVM (17 types). Therefore, XGBoost is recommended for crime detection in neighbourhoods.[2]

Ensemble learning combines predictions from multiple classifiers to enhance accuracy. The proposed SBCPM method, utilizing SVM algorithms in MATLAB, outperforms individual models like J48 and Random Forest for crime prediction in India. Achieving 99.5% accuracy on testing data, it surpasses previous baselines focused solely on violence datasets. This method not only aligns with criminological theories but also predicts potential crimes effectively. The stacking ensemble model demonstrates superior prediction accuracy compared to individual classifiers, showcasing its efficacy in handling the dynamic nature of crime data.[3]

In simple terms, crime is increasing rapidly, and traditional methods of solving crimes aren't keeping up. So, researchers suggest using machine learning and computer vision to predict and prevent crimes more effectively. By analyzing data and images, these techniques can help police officers work more efficiently and accurately, ultimately making our communities safer.[4]

Crime is a significant issue worldwide, including in Bangladesh, disrupting normal life and economic stability. This paper shifts focus to predict high-crime areas using the Random Forest algorithm. By identifying regions prone to crime, law enforcement can anticipate and prevent criminal activity, enhancing safety and security. This proactive approach enables authorities to allocate resources effectively and take preventive measures, ultimately reducing crime rates and fostering a safer society.[5]

3. Objective

The main objective of the Project is to leverage advancements in face recognition technology to improve crime prediction and detection measures. This research aims to develop algorithms and methodologies that can accurately identify individuals from facial images and analyse their behaviour patterns to predict potential criminal activities. By integrating facial analysis techniques with existing security systems, the goal is to enhance overall security measures and provide law enforcement agencies with more effective tools for crime prevention and investigation.

4. Proposed System

The proposed system aims to revolutionize criminal face detection and prediction by leveraging advanced ResNet technology. In this system, faces captured through live webcam feeds will undergo highly accurate recognition and be compared against a database of target criminal faces. Unlike traditional systems that process images and videos offline, our system operates in real-time. By using ResNet technology for face recognition ensures a high level of accuracy. This reduces the chances of negative face matching and leads to more relatable results.

5. Architecture Diagram

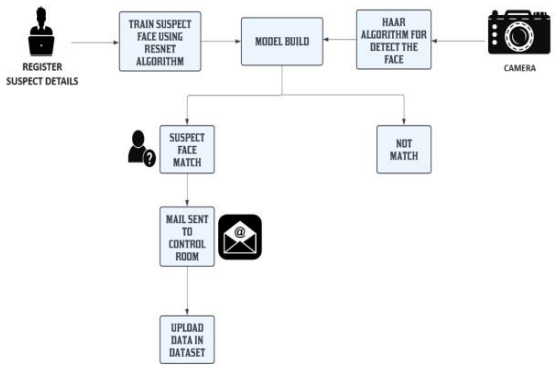

Fig. 5.1 Architecture diagram

Volume: 6, Issue: 3,Special Issue: 3 ,Apr,2024 ,ISSN_NO: 2321-3337

6. Algorithm

6.1 ResNet Algorithm

ResNet, short for Residual Networks, is a ground breaking deep learning architecture widely used in computer vision tasks, particularly image classification. What sets ResNet apart is its innovative "residual blocks" design, which helps mitigate the vanishing gradient problem during training. These blocks enable the training of extremely deep neural networks, with hundreds or even thousands of layers, resulting in state-of-the-art performance on tasks like image recognition. ResNet's skip connections allow gradient flow through the network, facilitating the training of very deep models and leading to improved accuracy. Consequently, ResNet has become a foundational model for various applications, from image classification and object detection to more complex tasks like crime prediction using surveillance cameras. Its ability to capture intricate features in images has significantly advanced the field of computer vision.

6.2 Haar Cascade Algorithm

Haar Cascade is a machine learning-based algorithm used to detect objects in images or videos. The algorithm uses a set of Haar-like features, which are rectangular patterns of pixel values, to distinguish between the object and the background. The algorithm trains a classifier using these features, which can then be used to detect objects in new images or videos.

7. Implementation

7.1 Admin Module

The Admin verification module plays a major role in the project and allows admin to upload the Criminal details. Once verified, the information is securely stored in the database, enabling efficient organization and retrieval of criminal profiles. The module also prioritizes data privacy, restricts access to authorized users, maintains an audit trail for transparency, and ultimately contributes to the system's integrity by safeguarding against false or unauthorized data.

Fig.7.1 Admin Uploading Details

7.2 Face Matching Using Resnet

The ResNet algorithm is used for face matching. It employs state-of-the-art deep learning techniques, specifically ResNet-based neural networks, to accurately identify and match faces in real-time. This module is designed to capture faces from live camera feeds, compare the live camera feeds with a database and match with the Criminal faces.

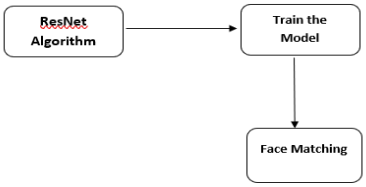

Fig.7.2 ResNet Face Matching

7.3 Haar Classifier to Detect Face

It utilizes the Haar Cascade Classifier, a time-tested algorithm for face detection, to identify faces in images and video streams. While our primary face matching module relies on ResNet for precise recognition, this module acts as a preliminary filter to locate faces in the input data. The Haar Classifier analyses features of different scales in the image to identify potential face regions. Once a face is detected, it is subsequently passed to the face matching module for further analysis and comparison with known criminal profiles.

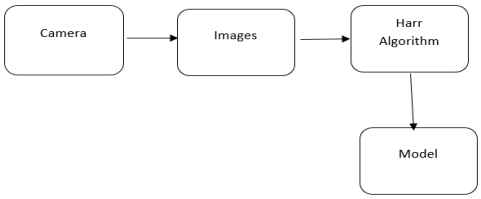

Fig.7.3 Haar For Face Detecting

7.4 Surveillance using Web Camera

This module allows for real-time monitoring and surveillance through a webcam. It continuously captures video frames and feeds them into our face recognition and matching algorithms. In this module, the webcam serves as the primary data source, making it possible to detect and identify faces in real-time. As faces are captured, the system checks them against a database of known criminal profiles. If a match is found, the system triggers an alert, and relevant details are recorded and potentially sent to law enforcement agencies.

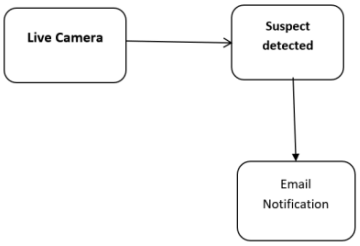

Fig.7.4 Surveillance using Web Camera

8. Experimental Results

This Result discuss about the implementation of identifying the Criminals and below Fig 8.1 shows uploading details, Fig 8.2 shows Tracking, Fig 8.3 shows founded criminal list and Fig 8.4 surveillance using camera and Fig 8.5 shows email notification.

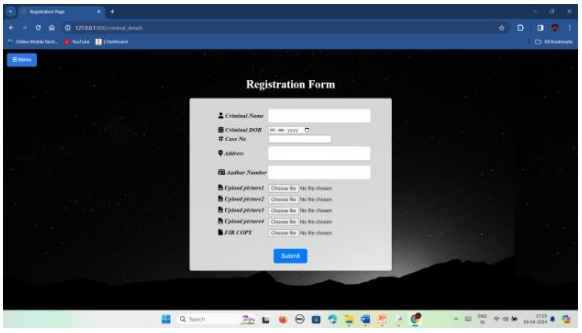

Fig.8.1. Uploading Details

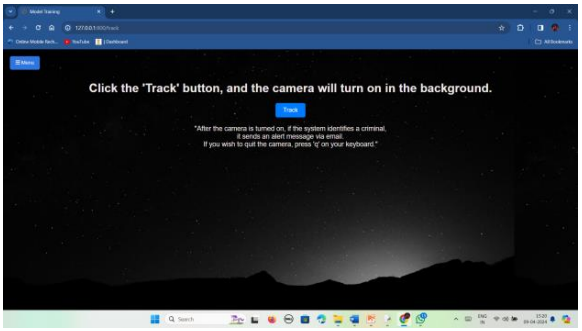

Fig.8.2 Tracking

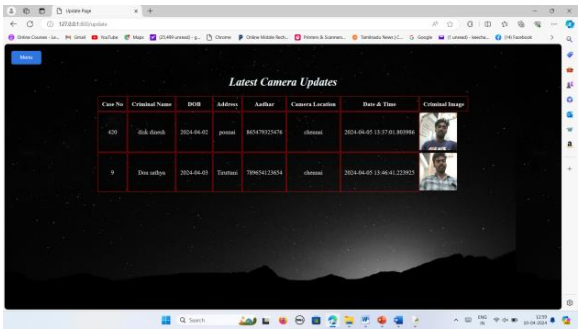

Fig 8.3 Founded Criminal List

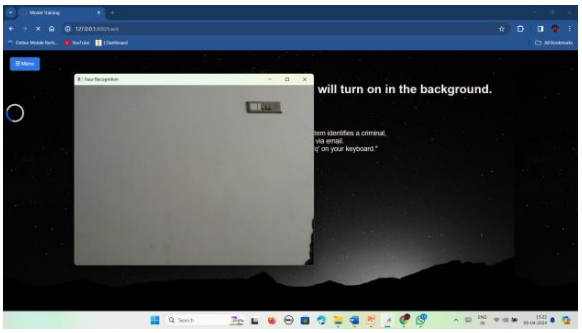

Fig.8.4 Surveillance using web camera

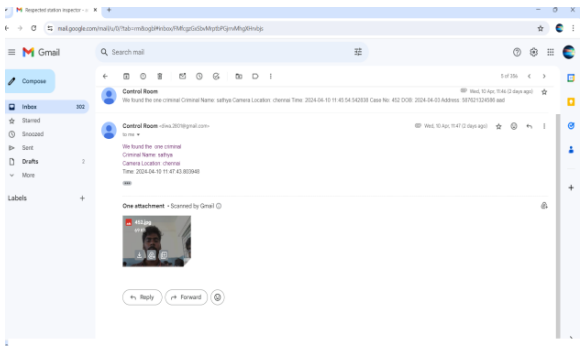

Fig.8.5 Email Notification

9. Conclusion and Future Work

In conclusion, our real-time face recognition system, utilizing ResNet-based algorithms and Haar Cascade Classifier, offers proactive crime detection by alerting law enforcement to potential criminals. With admin-verified suspect details, it enhances data accuracy and reliability, promising significant improvements in public safety.

Future Enhancement: This includes real-time tracking of identified individuals, integration with law enforcement databases for a wider scope of criminal profiles, support for multiple cameras and locations, behavioural analysis for detecting suspicious activities, addressing privacy concerns, optimizing scalability, continuous model improvement, alert prioritization, user-friendly interfaces, mobile applications for remote access, predictive policing algorithms, collaboration with complementary technologies like drones, and establishing a feedback loop with law enforcement agencies

10. Reference

[1]. Hossain S, Abtahee A, Kashem I, Hoque M, Sarker IH (2020) Crime prediction using spatio-temporal data. arXiv preprint arXiv:2003.09322.

[2]. A. A. Almuhanna, M. M. Alrehili, S. H. Alsubhi, and L. Syed, ‘‘Prediction of crime in neighbourhoods of New York City using spatial data analysis,’’ in Proc. 1st Int. Conf. Artif. Intell. Data Analytics (CAIDA), Apr. 2021, pp. 23–30.

[3] W. Safat, S. Asghar, and S. A. Gillani, ‘‘Empirical analysis for crime prediction and forecasting using machine learning and deep learning techniques,’’ IEEE Access, vol. 9, pp. 70080–70094, 2021.

[4]. Wang B, Yin PH, Bertozzi AL, Brantingham PJ, Osher SJ, Xin J (2019) Deep learning for real-time crime forecasting and its ternarization. Chin Ann Math Ser B 40(6):949–966.

[5]. Wibowo AH, Oesman TI (2020) The comparative analysis on the accuracy of k-NN, naive Bayes, and decision tree algorithms in predicting crimes and criminal actions in Sleman regency. J Phys Conf Ser 1450:012076.

[6]. Bandekar SR, Vijayalakshmi C (2020) Design and analysis of machine learning algorithms for the reduction of crime rates in India. Procedia Comput Sci 172:122–127.

[7]. Prithi S, Aravindan S, Anusuya E, Kumar AM (2020) GUI based prediction of crime rate using machine learning approach. Int J Compute Sci Mob Comput 9(3):221–229.

[8]. M. A. Toçoğlu and A. Onan, in International Conference on Intelligent and Fuzzy Systems, pp. 1693–1700, Springer, Berlin, Germany, 2020.

[9].Zhihong Pan, Glenn Healey, Manish Prasad, Bruce TrombergFace Recognition in Hyperspectral Images IEEE Transactions on Pattern Analysis and Machine Intelligence 2019. Empirical evidence from five european countries,”West European Politics,vol. 43, no. 6, pp. 1285–1314, 2020.

[10]. Jangra M, Kalsi S (2019) Crime analysis for multistate network using naive Bayes classifier. Int J Comput Sci Mob Comput 8(6):134–143

[11]. P. Pławiak, M. Abdar, and U. R. Acharya, ‘‘Application of new deep genetic cascade ensemble of SVM classifiers to predict the Australian credit scoring,’’ Appl. Soft Compute., vol. 84, Nov. 2019, Art. no. 105740, doi:

[12]. S. Kim, P. Joshi, P. S. Kalsi, and P. Taheri, ‘‘Crime analysis through machine learning,’’ in Proc. IEEE 9th Annu. Inf. Technol., Electron. Mobile Commun. Conf. (IEMCON), Nov. 2018, pp. 415–420.

[13]. D. M. Raza and D. B. Victor, ‘‘Data mining and region prediction based on crime using random forest,’’ in Proc. Int. Conf. Artif. Intell. Smart Syst. (ICAIS), Mar. 2021, pp. 980–987.

[14]. L. Elluri, V. Mandalapu, and N. Roy, ‘‘Developing machine learning based predictive models for smart policing,’’ in Proc. IEEE Int. Conf. Smart Comput. (SMARTCOMP), Jun. 2019, pp. 198–204.

[15]. A. Meijer and M. Wessels, ‘‘Predictive policing: Review of benefits and drawbacks,’’ Int. J. Public Admin., vol. 42, no. 12, pp. 1031–1039, Sep. 2019.