Intelligent System for Locating Missing Children Using Machine Learning

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Abstract: *Missing children is a major social issue, especially in developing countries like India where thousands of children go missing every year. Traditional identification methods are inefficient due to lack of centralized systems, manual processing, and difficulty in matching images across different regions. To overcome these limitations, this paper proposes a Missing Child Identification System using Deep Learning and Multiclass Support Vector Machine (SVM). The system allows parents and authorities to upload images of missing children, while the public can upload images of suspected children. This creates a collaborative platform for faster identification. A Convolutional Neural Network (CNN), specifically the VGG-Face model, is used for extracting important facial features from images. These features are then passed to a Multiclass SVM classifier to identify and match the child with the database. The system is capable of handling variations such as lighting conditions, pose changes, and minor facial differences. The system automatically compares uploaded images with stored data and provides accurate results. Experimental results show an accuracy of 99.41%, demonstrating the effectiveness and reliability of the proposed approach in identifying missing children efficiently.*

Keywords: Missing Child Identification, Deep Learning, CNN, SVM, Face Recognition, VGG-Face, Image Processing

I. INTRODUCTION

Children represent the future of any nation, yet a large number go missing every year due to kidnapping, trafficking, runaways, and other unfortunate circumstances. In countries like India, the number of missing children cases is significantly high, and a considerable percentage of these cases remain unresolved. One of the major reasons behind this issue is the lack of an efficient, automated, and centralized identification system.

Traditional methods for identifying missing children rely on manual comparison of photographs and records maintained by police or authorities. These methods are time-consuming, error-prone, and inefficient when dealing with large volumes of data. Moreover, the child who goes missing from one region may be found in another region or state, making it difficult to match records across different locations.

Identifying missing children manually is difficult because:

- Children may be found in different locations or jurisdictions
- Facial features change over time due to aging and growth
- Image quality varies due to lighting, pose, occlusion, and background noise

Additionally, images captured by the public are often of low resolution or taken without proper conditions, further complicating the identification process. Variations in facial expressions, orientation, and environmental conditions also reduce the accuracy of traditional face recognition methods.

With the rapid advancement in computer vision and deep learning, automated face recognition systems have shown significant improvements in accuracy and reliability. Deep learning models, especially Convolutional Neural Networks

(CNNs), are capable of extracting complex facial features and handling variations in images more effectively than traditional approaches.

In this paper, we propose an automated Missing Child Identification System using deep learning-based face recognition. The system leverages a pre-trained CNN model for feature extraction and a Multiclass Support Vector Machine (SVM) for classification. By combining these techniques, the system can efficiently compare input images with a database of missing children and provide accurate matching results. This approach reduces manual effort, improves identification speed, and enhances the overall effectiveness of missing child tracking systems.

II. LITERATURE SURVEY

Several approaches have been proposed for face recognition over the years, each with its own advantages and limitations. Early methods mainly focused on feature-based and statistical techniques, while recent advancements have shifted towards deep learning-based approaches.

HOG (Histogram of Oriented Gradients): This method extracts edge and gradient structures from images and is effective for basic face detection. However, it is sensitive to variations in lighting conditions, pose, and occlusions, which reduces its performance in real-world scenarios.

SIFT (Scale Invariant Feature Transform): SIFT is widely used for extracting distinctive key points and features from images. It is robust to scale and rotation changes, but it is computationally expensive and not suitable for real-time applications with large datasets.

PCA & Eigenfaces: Principal Component Analysis (PCA) reduces the dimensionality of facial data and represents faces as a combination of eigenfaces. Although it simplifies computation, it lacks accuracy when dealing with variations such as lighting, expression, and pose.

Deep Learning Models: Modern approaches use Convolutional Neural Networks (CNNs) for face recognition. These models automatically learn complex features from images and provide higher accuracy and robustness compared to traditional methods. They can handle variations in lighting, pose, and facial expressions more effectively.

Despite these advancements, existing systems still face several challenges. Many traditional approaches lack sufficient accuracy when applied to real-world conditions. They also struggle with real-time processing, especially when dealing with large datasets. Additionally, robustness to variations such as aging, illumination changes, and low-quality images remains a major concern.

Therefore, there is a need for a more efficient and accurate system that can overcome these limitations. The proposed system addresses these issues by combining deep learning-based feature extraction with an efficient classification technique, improving both accuracy and performance.

III. PROPOSED METHODOLOGY

A. System Overview

The proposed system is designed to provide an automated and efficient solution for identifying missing children using facial recognition techniques. It consists of multiple stages that work together to process input images and generate accurate results.

The system begins with **image upload**, where parents, police authorities, or the public can upload images of missing or suspected children. The uploaded image is then processed through a sequence of steps including face detection, feature extraction, classification, and database matching. Each stage plays a crucial role in ensuring accurate identification and reducing manual effort.

B. Face Detection

Face detection is the first step in the system, where the facial region is identified from the input image. The proposed system uses the **Haar Cascade Classifier**, a widely used method for real-time face detection.

This technique scans the image and detects faces based on trained features such as edges and textures. It is efficient, fast, and suitable for real-time applications. The detected face region is then extracted and passed to the next stage for further processing.

C. Feature Extraction

Once the face is detected, the system extracts meaningful features using a deep learning model. The proposed system utilizes the **VGG-Face Convolutional Neural Network (CNN)** model for this purpose.

The CNN model analyzes the facial image and extracts high-level features that uniquely represent the face. These features are robust and can handle variations such as:

- Illumination changes
- Pose variations
- Aging effects
- Facial expressions

By using deep learning, the system achieves better accuracy compared to traditional feature extraction methods.

D. Classification

After extracting the features, the system uses a **Multiclass Support Vector Machine (SVM)** for classification. The SVM takes the extracted features as input and classifies the face into one of the known identities stored in the database. Multiclass SVM is efficient for handling multiple classes and provides good performance even with limited data. It helps in accurately matching the input image with the corresponding child in the database.

E. Workflow

The overall workflow of the system is simple and efficient. Initially, the user uploads an image through the system interface. The system then detects the face from the image and extracts relevant features using the CNN model. These features are passed to the SVM classifier, which compares them with the stored database. Finally, the system displays the result indicating whether a match is found or not.

This automated workflow reduces human effort, speeds up the identification process, and improves the overall accuracy of missing child identification.
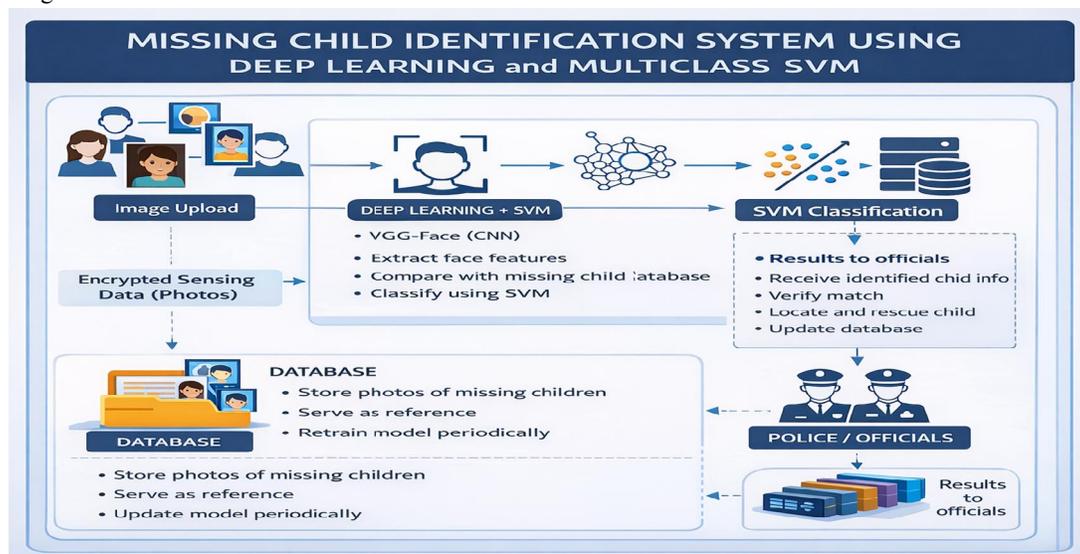

Fig 3.1: Identification process

IV. IMPLEMENTATION DETAILS

Technologies Used

- Python
- OpenCV
- TensorFlow & Keras
- Django
- NumPy

Dataset
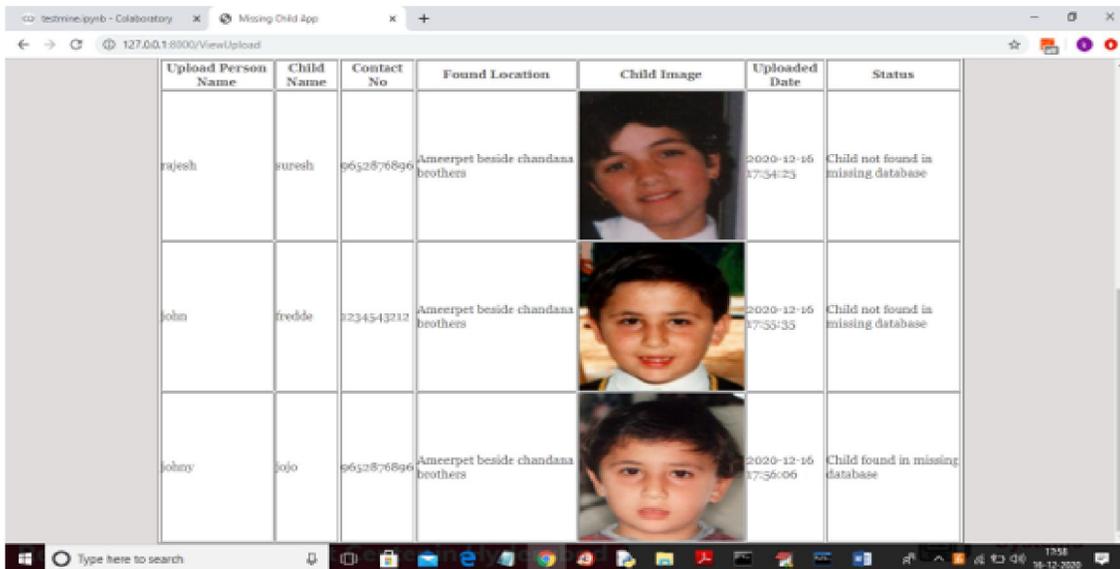
- FGNET dataset used
- Contains child face images

Modules

- Public Upload Module
- Face Detection Module
- Feature Extraction Module
- Classification Module
- Admin Module

V. RESULTS AND DISCUSSION

- Achieved accuracy: **99.41%**
- System performs well under:
- Different lighting conditions
- Pose variations

Noise

Fig.5.1: Recognization table

Advantages

- High accuracy
- Automated system
- Real-time identification

Limitations

- Requires clear images
- Performance affected by poor lighting

VI. FUTURE WORK

The proposed system shows promising results; however, there are several areas where further improvements can be made to enhance its performance and usability.

One important enhancement is the **integration with CCTV systems**, which would enable real-time monitoring and automatic detection of missing children in public places such as railway stations, bus stops, and malls. This would significantly improve the chances of locating missing children quickly.

Another improvement is the development of a **mobile application**, allowing users to upload images directly from their smartphones. This would increase public participation and make the system more accessible and user-friendly.

The system can also be extended by implementing a **cloud-based database**, which would allow centralized storage and easy access to data across different regions. This would improve scalability and enable better coordination between authorities.

Additionally, using a **larger and more diverse dataset** can further improve the accuracy and robustness of the model. Training the system with images under different conditions such as varying lighting, angles, and age differences will enhance its performance in real-world scenarios.

These future enhancements will make the system more efficient, scalable, and capable of handling real-time applications for missing child identification.

VII. CONCLUSION

This paper presents a deep learning-based system for missing child identification using **Convolutional Neural Networks (CNN)** and **Multiclass Support Vector Machine (SVM)**. The proposed system effectively combines the strength of CNN for feature extraction and SVM for accurate classification, resulting in improved performance compared to traditional face recognition methods. The system provides an automated solution that reduces manual effort and enables faster identification of missing children. It is capable of handling variations such as lighting conditions, pose changes, and facial differences, making it suitable for real-world applications. The inclusion of public participation through image uploads further enhances the effectiveness of the system. With an achieved accuracy of **99.41%**, the proposed approach demonstrates high reliability and efficiency in identifying missing children. This system can serve as a valuable tool for law enforcement agencies and society in improving child safety and increasing the chances of successfully locating missing children.

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