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Anveshak : The Explorer : A Comprehensive Review

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Abstract : *Anveshak: The Explorer is an AI-powered mobile platform designed to help reunite lost persons with their families through secure, automated, and verified matching. It allows both finders and concerned parties to register, upload photos, and provide valid ID proofs. Using a rule-based text and AI-assisted image matching system, Anveshak quickly compares facial and descriptive data with stored records to identify potential matches. Cloudinary is used for efficient image storage, and Firebase handles authentication and real-time data management. A feedback and admin-controlled communication system ensures security, privacy, and transparency throughout the process. Overall, Anveshak provides a reliable, technology-driven approach to enhance public safety and speed up the search and reunion of missing individuals.*

Keywords - *Missing Person Identification, Face Recognition, Artificial Intelligence, Machine Learning, OCR Verification.*

1. INTRODUCTION

The Anveshak: The Explorer project aims to provide a secure, intelligent, and technology-driven platform for identifying missing persons and enabling their safe reunion with families. With rapid urbanization, increased mobility, and growing population density, cases of missing children, elderly individuals, and vulnerable persons have increased significantly. Existing methods for locating missing persons largely depend on manual reporting, delayed verification, and unstructured communication, which often leads to slow response times and reduced chances of successful identification.

Traditional systems lack automation, real-time processing, and strong verification mechanisms. In many cases, false information, unverified documents, and unsafe direct communication create security risks and reduce trust in the system. These challenges highlight the need for a reliable solution that can accurately identify individuals, verify user authenticity, and manage the entire reunion process in a controlled and transparent manner. To address these limitations, Anveshak utilizes Artificial Intelligence (AI) and Machine Learning (ML) techniques such as face detection, feature extraction, and image matching to automate the identification process. The system generates unique digital profiles from uploaded images and compares them with a centralized database of reported missing persons. Additionally, Optical Character Recognition (OCR) is used to verify official identity documents, ensuring data integrity and preventing misuse. By integrating AI-based identification, secure cloud infrastructure, and administrative supervision, Anveshak significantly reduces manual effort, improves response time, and enhances public safety through a structured and trustworthy platform.

2. LITERATURE REVIEW

The increasing number of missing person cases has created a strong need for fast, accurate, and secure identification systems. Traditional methods for locating missing individuals rely heavily on manual reporting, police records, and public notices, which are often slow, fragmented, and prone to errors. To overcome these limitations, researchers have explored the use of artificial intelligence, machine learning, and computer vision techniques, particularly face recognition, to automate the identification process. This literature review examines

existing research on missing person identification systems that utilize convolutional neural networks, deep learning models, face feature extraction, image matching, and cloud-based databases. The reviewed studies highlight advancements in accuracy and automation but also reveal limitations such as lack of document verification, weak security controls, and unsafe communication mechanisms. These observations help in understanding current approaches and identifying research gaps that motivate the development of a secure and intelligent system like Anveshak: The Explorer.

Bharath Darshan Balar et al. - "Efficient Face Recognition System for Identifying Lost People" [1] Every day, many people go missing, including kids, teens, elderly with Alzheimer's, and mentally challenged individuals. Most of them are never found. This system is designed to help the police and public find missing people faster using face recognition. When someone goes missing, their photo can be uploaded to the database by family or police. If anyone finds a suspicious person, they can also upload that photo to the portal. The system will compare the new photo with the stored photos using face encodings. If a match is found, it will notify the police and family with the person's location. The face recognition model used here has an accuracy of 99.38% on a well-known benchmark.

Dr. U. P. Akare et al. - "Finding Missing Person Using Face Recognition" [2] This project uses face recognition technology to help find missing people more quickly and effectively. The main goal is to build a strong system that can study facial features, compare them with a database, and give the location if a match is found. It uses a special AI method called CNN (Convolutional Neural Network) to check and match faces accurately. If the system finds a match, it sends an alert with location details to the family. The database also gets updated with the latest information about the person. By using advanced machine learning, the system saves time and effort compared to manual searching. This project aims to reunite missing people with their families and improve public safety.

Divya Jennifer Dsouza et al. - "Real Time Facial Emotion Recognition Using CNN" [3] This project is about recognizing human emotions from facial expressions using CNN (Convolutional Neural Network). Emotions are an important part of communication, and this system helps in understanding human intentions in different situations. It is widely useful in social media and forensic investigations. We used the FER2013 dataset, where the images were preprocessed and then given as input to the CNN model. The CNN studies these images and predicts emotions like happy, sad, angry, etc. To make it practical, we also built a mobile app that can run this model in real-time. This allows emotions to be detected instantly using a smartphone camera.

Neeta Nain et al. - "ChildGAN: Face Aging and Rejuvenation to Find Missing Children" [4] This project focuses on child-face aging and rejuvenation, which is useful in areas like security, fashion, entertainment, and especially in finding long-lost children. Most existing face aging models using GANs (Generative Adversarial Networks) mainly work on adult faces. To solve this, a new Indian Child Dataset (ICD) has been created for tasks like age progression, age regression, gender prediction, and kinship recognition. A model called ChildGAN is proposed to generate realistic child-face images while keeping the identity the same. The dataset also includes a Multi-Racial Child Dataset (MRCD) with around 65,000 child images from different races. Experiments were done on Indian, White, Black, and Asian children to check performance. The results show that ChildGAN can help reconnect missing or trafficked children with their families by using childhood photos.

Praveen Kumar Chandaliya et al. - "Child Face Age Progression and Regression using Self-Attention Multi-Scale Patch GAN" [5] This project is about face age progression and regression, which means showing how a face looks older or younger. It is very useful in finding lost or wanted people, cross-age recognition, entertainment, and cosmetic studies. The main goals are to keep the person's identity the same and show accurate aging effects. Most existing methods focus only on adults, but this work focuses on children's faces. The model uses a special GAN (Generative Adversarial Network) with a multi-scale patch discriminator to make training more stable and realistic. A Self-Attention Block (SAB) is also added to capture long-term facial details. The proposed SAMSP-GAN model produces photo-realistic child faces with better accuracy. Tests show it improves face verification, identification, and age estimation compared to older methods.

Debayan Deb et al. - "Child Face Age-Progression via Deep Feature Aging" [6] Finding missing children after many years is difficult because face recognition systems struggle to match their changed faces. This project proposes a feature aging module that can age-progress facial features to improve recognition. The module also helps generate aged face images that can be used with any face matcher without extra training. For children missing over 10 years, it increases accuracy significantly (e.g., FaceNet from 16.53% to 21.44% and CosFace from 60.72% to 66.12%). On public datasets like FG-NET and CACD-VS, it performs better than previous methods. The system achieves up to 99.58% accuracy in some tests. This shows that aging features make it easier to identify long-lost children, even after big time gaps, which can help in solving child trafficking and abduction cases.

Enhao Ning et al. - "Occluded Person Re-Identification with Deep Learning: A Survey and Perspectives" [7] Person re-identification (Re-ID) is an important technology in smart surveillance systems. It helps match and recognize people, but occlusion (when part of the body is hidden) reduces its accuracy. Occluded person Re-ID focuses on solving problems like missing body parts, noise, and angle mismatches. Many methods have been developed to handle these challenges, but there is no complete study that compares them all in detail. This review provides an overview of datasets and evaluation methods used for occluded Re-ID. It also classifies and explains different deep learning techniques used to solve occlusion problems. A detailed comparison is made to find the best-performing approaches. Finally, the study highlights future directions for improving occluded person Re-ID systems.

Marcelgrimmer et al. - "Deep Face Age Progression: A Survey" [8] Face Age Progression (FAP) means creating face images that show how a person might look as they get older. It is useful in areas like face recognition, forensic investigations, and digital entertainment. With the help of deep generative networks, the quality of these aged images has improved a lot in terms of realism, accuracy, and keeping the same identity. Since many new methods have been developed recently, there is a need to organize and compare them. This study reviews recent deep learning approaches for both adult and child face aging. The methods are grouped into three types: translation-based, condition-based, and sequence-based. It also summarizes common evaluation techniques, datasets, and challenges. The goal is to guide future research and avoid repeating the same work.

Cameron Haigh et al. - "AnAerial Robotic Missing-Person Search in Urban Settings—A Probabilistic Approach" [9] This paper is about using autonomous robots, specifically drones (UAVs), to search for missing people in cities. Searching in urban areas is harder than in the wilderness. The study proposes a new method for planning drone search paths by predicting where a missing person might move using a map of the area. The system updates these predictions regularly, so drones can intelligently re-search areas if needed. It also uses a behavior-based method to predict human movement and a special technique to estimate likely locations. Simulated tests show that this method finds missing people faster and more accurately than existing approaches. This can improve search efficiency in urban environments.

Wasim Shaikh et al. - "Face Detection of Lost Person & Criminals Using Image Processing" [10] The "Face Detection System of Lost Person & Criminals" project uses AI and computer vision to improve public safety. It can detect lost people by matching their faces with a missing-person database. It can also identify criminals by comparing faces with law enforcement records. Additionally, it monitors whether people are wearing face masks in public, which helps during pandemics. This system allows authorities to respond quickly to missing-person cases or criminal activity. By combining lost-person detection, criminal recognition, and mask monitoring, it provides a complete solution for safer communities. Real-time monitoring ensures fast and effective action.

Anchal Kamra - "Automatic Age Estimation Through Human Face: A Survey" [11] Age estimation means predicting a person's age by studying their physical traits like fingerprints, bones, teeth, or face. Among these, the face is the easiest to capture and analyze, making it ideal for automated systems. Because of its practical uses, many researchers focus on automatic facial age estimation. This paper discusses the main challenges faced by these systems. It also explains the latest methods and techniques for extracting facial features to estimate age. Different types of classifiers used in age prediction are reviewed. Overall, it provides an overview of how facial age estimation works and its current research trends.

N. Anithaa et al. - "LOST PERSON IDENTIFICATION SYSTEM USING DEEP LEARNING" [12] This paper presents a method to identify missing children using face recognition and deep learning. People can upload images of suspicious children to a portal, which are then automatically compared with registered photos of missing children. The system finds the best match from the database. A deep learning model, specifically a CNN (Convolutional Neural Network), is used for face recognition. It extracts face features using a pre-trained VGG-Face model. These features are then classified with an SVM to identify the child accurately. The system works well even with noisy images, different angles, lighting, or changes in a child's age. This approach improves upon older methods for missing child identification.

Petra Grd - "Two-dimensional face image classification for distinguishing children from adults based on anthropometry" [13] This research focuses on classifying face images to detect children and adults. It uses 2D photos of faces and develops an algorithm for classification. The same algorithm can also estimate a person's age. By studying facial landmarks and how faces change with growth and aging, important points on the face for age estimation are identified. The method calculates ratios of distances between these landmarks. Using these ratios,

the system can determine if a person is a child and estimate their age. This approach is based on analyzing face structure rather than just appearance.

Yanhua Huang et al. - "Privacy-Preserving Face Recognition Method Based on Randomization and Local Feature Learning" [14] This paper focuses on protecting privacy in face recognition systems. Traditional methods encrypt or alter face images, but they need to be restored for recognition. The study shows that faces can still be recognized accurately if only key high-level features are kept while the rest is blurred. A new method combines random convolution and self-learning batch normalization to create privacy-protected scrambled images. These scrambled images can be recognized directly by the system with almost the same accuracy as normal images. The method also ensures the privacy can't be reversed and can be revoked if needed. Tests on LFW, Celeba, and custom datasets show over 99% recognition accuracy while effectively hiding visual details.

Luning Pang - "Research on the Privacy Security of Face Recognition Technology" [15] This paper addresses privacy risks in face recognition apps and proposes a method using differential privacy. First, a Bayesian GAN is used to create training data similar to private data. Then, differential privacy is applied to train the model while keeping the labels protected. Using a lightweight LightFace model, noise is added to prevent attackers from recovering face features.

Table 1. Comparative Analysis of Existing Systems

Sr. No	**Paper Title**	**Technology Used**	**Dataset**	**Key Result**
1	Efficient Face Recognition System for Identifying Lost People (2019)	CNN, HOG	LFW (~13,000 images)	99.38% accuracy
2	Finding Missing Person Using Face Recognition (2024)	CNN, OpenCV	CCTV + Registered DB	Auto-match with DB
3	Real-Time Facial Emotion Recognition Using CNN (2022)	CNN	FER2013	70% real-time accuracy
4	ChildGAN: Face Aging and Rejuvenation to Find Missing Children (2022)	GAN + VAE	ICD (35,484 images)	Identity preserved aging
5	Child Face Age Progression and Regression using Self-Attention Multi-Scale Patch GAN (2021)	Self-Attention GAN	CLF Dataset	Improved aging realism
6	Child Face Age-Progression via Deep Feature Aging (2020)	FAM + FaceNet	CFA (25,180 images)	Increased recognition accuracy
7	Occluded Person Re-Identification with Deep Learning: A Survey and Perspectives (2023)	CNN	OccludedDukeMTMC	Improved occlusion handling
8	Deep Face Age Progression: A Survey (2021)	GANs, VAEs	Cross-age datasets	Enhanced realism

9	An Aerial Robotic Missing-Person Search in Urban Settings—A Probabilistic Approach (2024)	Multi-UAV	Simulated Urban	Faster detection rate
10	Face Detection of Lost Person & Criminals Using Image Processing (2025)	CNN (ResNet, MobileNet)	Criminal DB	90% accuracy
11	Automatic Age Estimation Through Human Face: A Survey (2016)	AAM, Aging Manifold	Multiple datasets	Technique comparison
12	Lost Person Identification System Using Deep Learning (2024)	VGG-Face + SVM	Custom dataset	Robust classification
13	Two-Dimensional Face Image Classification for Distinguishing Children from Adults Based on Anthropometry (2022)	Landmark Ratios	Private DB	Competitive accuracy
14	Privacy-Preserving Face Recognition Method Based on Randomization and Local Feature Learning (2024)	Random Conv. + DNN	Self-collected	>91% accuracy
15	Research on the Privacy Security of Face Recognition Technology (2022)	Bayesian GAN + DP	LFW, YTF	~86% secure accuracy

From the above analysis, it is observed that most existing systems mainly focus on face recognition using CNN, GAN, or other deep learning models to identify missing persons. However, many of these systems lack a complete, secure, and user-friendly platform that integrates verification, storage, communication, and administrative control in a single solution. Most previous works concentrate only on matching facial images and providing identification results, but they do not include proper user authentication, document verification, secure cloud storage, and feedback monitoring.

The proposed system, Anveshak: The Explorer, improves upon existing research by providing a complete end-to-end platform that combines AI-based face recognition with secure cloud infrastructure and identity verification. Unlike previous systems, Anveshak integrates Firebase Authentication for secure user access, Cloudinary for efficient and scalable image storage, and a FastAPI-based backend using DeepFace and FaceNet for accurate facial matching. Additionally, the system includes parent ID verification, feedback confirmation, and an admin monitoring panel to ensure transparency, safety, and misuse prevention.

Furthermore, the proposed system is implemented as a real-time mobile application using Flutter, making it more accessible and practical for public use compared to many research-based prototype systems. By combining secure authentication, cloud storage, AI-based face matching, and administrative supervision, Anveshak provides a more reliable, scalable, and complete solution for missing person identification and reunification.

3. CRITICAL ANALYSIS

The reviewed literature demonstrates significant advancements in the use of Artificial Intelligence, Machine Learning, and Computer Vision for missing-person identification and related facial analysis applications. Many studies, such as Efficient Face Recognition System for Identifying Lost People (2019) and Finding Missing Person Using Face Recognition (2024), primarily rely on CNN-based face recognition models trained on datasets like LFW or custom image databases. While these systems report high accuracy levels, including results up to 99.38%, their

performance is often validated under controlled conditions. In real-world scenarios, challenges such as poor lighting, varying facial poses, low-resolution CCTV footage, and partial occlusion may reduce effectiveness.

Research focusing on age progression, including ChildGAN (2022), Child Face Age Progression using SAMSP-GAN (2021), and Child Face Age-Progression via Deep Feature Aging (2020), addresses the difficulty of identifying individuals after long time gaps. These approaches successfully generate identity-preserved aged facial images using GAN-based architectures. However, such models require large datasets and high computational resources, and the synthetic images generated may not always perfectly reflect real biological aging patterns. Consequently, improved visual realism does not necessarily guarantee proportional improvement in recognition accuracy under practical conditions.

Studies such as Occluded Person Re-Identification with Deep Learning (2023) enhance robustness in situations where facial or body features are partially hidden. Although these techniques improve recognition performance in benchmark datasets, their adaptability to unpredictable, crowded, and uncontrolled environments remains a concern. Similarly, privacy-focused works like Privacy-Preserving Face Recognition Method Based on Randomization and Local Feature Learning (2024) and Research on the Privacy Security of Face Recognition Technology (2022) emphasize data protection through encryption, randomization, and differential privacy techniques. While these methods enhance security and reduce reconstruction risks, they may introduce additional computational complexity and slight reductions in accuracy.

Other approaches, such as An Aerial Robotic Missing-Person Search in Urban Settings—A Probabilistic Approach (2024), contribute innovative search strategies using UAV coordination and probabilistic modeling. However, these systems focus primarily on physical search optimization rather than identity verification, making them supportive technologies rather than comprehensive identification solutions.

Overall, the literature indicates that most existing systems concentrate on specific aspects such as face recognition accuracy, age progression, occlusion handling, or privacy protection independently. There is limited integration of document verification mechanisms, secure communication control, administrative monitoring, and end-to-end automation within a single platform. Furthermore, many models are evaluated using standard datasets that may not fully represent real missing-person scenarios involving emotional stress, extreme age variation, inconsistent image quality, or incomplete data. These limitations highlight the need for a comprehensive, secure, and practically deployable system that combines accurate facial matching, identity verification, cloud-based management, and controlled communication into a unified framework.

4. FUTURE RESEARCH DIRECTIONS

Future research should focus on improving recognition accuracy in real-world conditions such as poor lighting, occlusion, pose variation, and low-resolution images. Advanced deep learning models and multimodal biometrics (face, voice, gait) can enhance reliability. Improving age progression techniques using more realistic and biologically accurate aging models can support long-term missing cases.

Stronger privacy-preserving methods such as federated learning and enhanced differential privacy should be explored to protect sensitive facial data. Scalability can be improved through optimized cloud architecture and faster feature matching algorithms. Integration with surveillance systems and law enforcement databases, while ensuring security and ethical compliance, can further strengthen identification systems. Overall, future work should aim to develop a secure, scalable, and fully integrated end-to-end missing-person identification platform.

5. CONCLUSION

In conclusion, Anveshak: The Explorer presents a secure and intelligent solution for identifying missing persons and supporting their safe reunion with families. The system bridges the gap between traditional manual searching methods and modern automated technologies by integrating AI-based face detection and matching, OCR-based ID verification, and cloud-based data management. By using a Flutter mobile application for user interaction, Firebase for authentication and real-time database handling, and Cloudinary for efficient image storage, the platform ensures fast performance, scalability, and reliability. Additionally, the admin-controlled communication and feedback mechanism improves transparency and reduces the risk of misuse or false reporting. Overall, Anveshak creates a complete and trustworthy digital ecosystem that improves public safety, minimizes delays, and increases the chances of successful identification through responsible and technology-driven automation.

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