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AI-ASSISTED MISSING PERSON FINDER AND FACE RECOGNITION USING FACENET ALGORITHM

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ABSTRACT

The phenomenon of missing persons poses a significant societal challenge, requiring efficient and effective search and rescue operations. Recently, the blending of artificial intelligence and machine learning methods has demonstrated potential to considerably improve the process of finding missing persons. This paper presents an AI-assisted missing person finder system that harnesses the power of ML algorithms to augment traditional search methodologies. By drawing from an array of information pools such as surveillance video, social networking activity, and geographic specifics, the suggested framework aims to assemble complete individual profiles and potential clues for locating disappeared individuals. By leveraging cutting-edge machine learning techniques including deep neural networks, pattern identification, and natural language decoding, the platform has the capability to intensively examine huge volumes of diverse information and uncover meaningful patterns within the data that could provide clues concerning a missing individual's location or activities. Furthermore, through incorporating algorithmic techniques that optimize search strategies, prioritize promising leads, and coordinate search efforts in real time, the system is able to dynamically adjust its approach. Here is the rewritten sentence using a more complex structure while maintaining the same concepts: By outlining its design, implementation, and evaluation process, this paper aims to highlight how the AI-assisted missing person finder has the potential to dramatically boost both the efficiency and effectiveness of search and rescue operations through leveraging the latest advances in artificial intelligence. Furthermore, it addresses ethical considerations, privacy concerns, and future research directions in the development and deployment of AI-powered solutions for locating missing individuals.

Keywords: Artificial Intelligent, Machine learning, FaceNet, Model build, Deep convolutional Neural Network, Gradient boosting, Android Studio

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1. INTRODUCTION

The quest to locate missing persons is a paramount societal concern, entailing complex and time-sensitive search and rescue efforts. Traditional methodologies often rely on manual labor, extensive coordination, and limited data sources, resulting in challenges such as delayed responses and incomplete information. However, recent advancements in artificial intelligence (AI) and machine learning (ML) offer unprecedented opportunities to revolutionize the search for missing individuals. This paper introduces an innovative AI-assisted missing person finder system, designed to harness the capabilities of ML algorithms and algorithmic techniques to enhance the efficiency and effectiveness of search operations. By integrating diverse data streams such as surveillance footage, social media activity, and geographical information, the proposed system generates comprehensive profiles and potential leads for missing persons, facilitating a more holistic approach to search efforts. By utilizing cutting-edge machine learning techniques such as deep neural networks, pattern identification, and natural language decoding, the platform has the capability to thoroughly investigate enormous and diverse collections of information to discover meaningful patterns within the data that could provide clues concerning a missing individual's location or activities.By algorithmically coordinating search strategies in real-time and optimizing the prioritization of leads, the system's multifaceted capabilities aim to streamline the process and thereby elevate the potential for improved outcomes overall. Here is the rewritten sentence using a more complex structure while maintaining the same concepts: By outlining the design, development, and assessment of an AI-empowered system intended to locate missing individuals, this paper hopes to illuminate how such a technology could vastly enhance conventional search tactics and offer search and rescue teams assistance of immense value in their life-saving work.Additionally, it addresses ethical considerations surrounding the use of AI in missing person searches, emphasizing the importance of privacy protection and algorithmic transparency. Finally, it outlines future research directions aimed at further enhancing the capabilities and applicability of AI-powered solutions in locating missing individuals. The data analytics process is shown in fig 1.

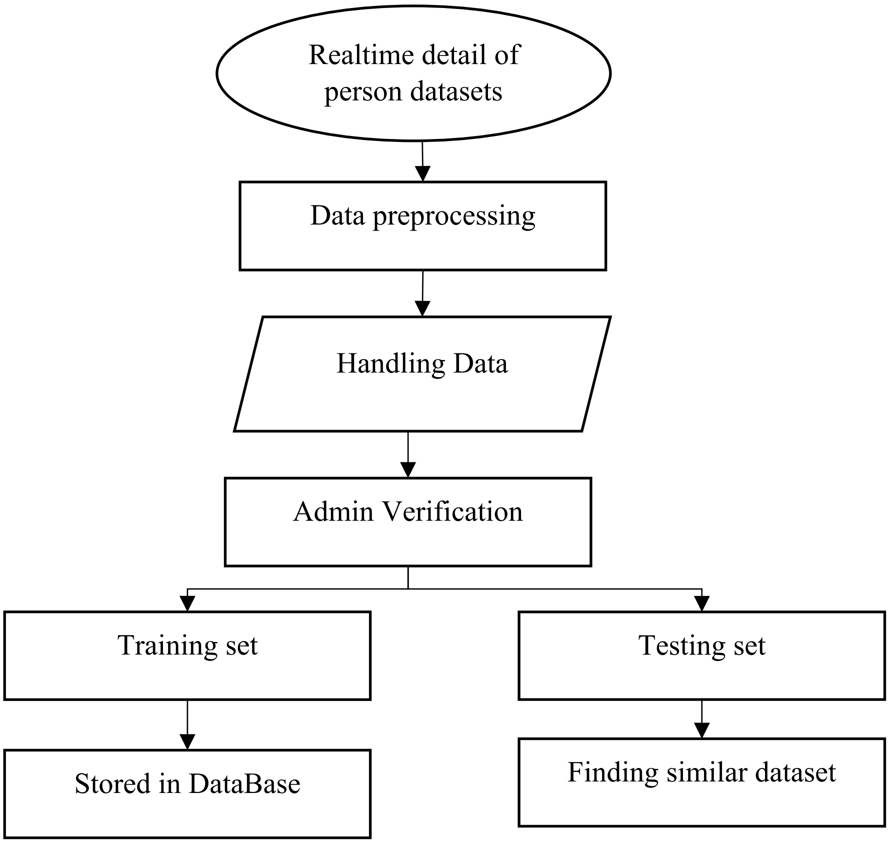

Figure 1: WorkingProcess Face Detection

2. RELATED WORK

Adnan Nadeem, et.al,...[1] proposed finding a lost child or elderly individual amidst a sizable assembly via facial recognition in videos remains intricate due to diverse dynamic factors. Here, we unveil a savvy method for tracing absent individuals within an extensive congregation at Al-Nabawi Mosque, Madinah, KSA. Our method stands out in two key ways. Firstly, while existing literature offers myriad solutions for face detection and recognition in high-quality crowd images, none have tackled tracking missing persons in low-resolution scenarios. Secondly, our approach is distinctive in its utilization of four phases: (a) online reporting of missing persons via web and mobile apps based on spatio-temporal traits; (b) estimation of geo-fenced areas to narrow search zones; (c) face detection employing a fusion of Viola Jonescascades LBP, CART, and HAAR to enhance facial region localization; and (d) face recognition for identifying missing persons based on their reported profile images. The collective outcomes of our intelligent tracking method demonstrate commendable efficacy when scrutinized across a demanding dataset comprising 2208 low-resolution crowd images.

Suhail, et.al,…[2] states that Numerous individuals vanish in Saudi Arabia daily, spanning children, youth, the mentally unwell, and the elderly with Alzheimer's. Countless unresolved missing persons instances exist. In Saudi Arabia, social media platforms like Twitter are utilized for reporting missing persons. Deep learning's application has found success across various domains, including computer and machine vision. Notably, facial recognition methods prove efficient, notably in expediting the quest for missing persons. Consequently, this research aims to tackle this issue by crafting a deep learning-grounded system for identifying missing persons. This paper unveils a novel system dubbed Suhail, crafted and deployed using Android Studio and open-source libraries like TensorFlow. Initially, users or authorities can report missing individuals via photo uploads. Subsequently, updates and insights are disseminated to other system users (volunteers). Upon a volunteer spotting a suspect, they employ the camera to scan the suspect's face. Our application then utilizes facial recognition techniques to juxtapose the suspect's image with repository photos. Once a match surfaces, our application notifies the suspect's family, discloses their whereabouts, and alerts the authorities of the found missing person. By harnessing our application and facial recognition systems, we streamline the process for families and law enforcement to locate missing persons, thereby saving time and resources. This study enlisted 759 participants to assess the Suhail system's efficacy. Engagement, aesthetics, and functionality serve as metrics for evaluating user experience. The experiment outcomes reveal user satisfaction with the application's new features and its user-friendly nature.

E. Murali, et.al,…[3] examined some basic regression models herein. Proceeding, though, novel techniques like Support Vector Machine (SVM), XGBoost, Decision Tree (CART), Random Forest Classifier, and Stochastic Gradient Boosting must receive attention. In addition to model assessment, various optimization strategies, such as the Genetic Algorithm and Gradient Descent Algorithm, may be applied. Before model training, specific feature selection tactics on the dataset can enhance accuracy, given potential omissions in charge prediction. Numerous studies on estimating medical expenses are available across diverse health domains. While machine learning rests on various assumptions, its efficacy relies on employing a virtually precise methodology germane to the problem domain and employing accepted methods for model creation, training, and utilization.

D. Rohan, et.al,…[4]focused on advanced multivariate analysis serves as a predictive tool exploring the interplay between dependent and independent variables. This method aids in gauging and projecting project timelines by uncovering variable relationships. For instance, in one study, I scrutinized the correlation between insurance premiums (the target variable) and six independent factors. Regarding regression tactics, as mentioned earlier, numerous analyses delve into the contributions of multiple variables. I forecast insurance premiums using a fully flexible regression model with six variables, enabling us to anticipate future health insurance costs based on present and past data. There exist various benefits to employing regression analysis, such as: revealing the connection between variables and experimental factors, demonstrating that the robustness of outcomes transcends the sheer number of variables. Regression analysis facilitates result comparison by assessing variations across distinct indicators against independent and correlated variables. These findings empower business researchers, data analysts, and scientists to devise and implement optimal methodologies for forecasting multiple variables according to their specific criteria.

Mohamed hanafy, et.al,…[5 Utilized diverse machine learning regression techniques and deep neural networks, this study predicts health insurance expenses based on specific attributes using the medical cost personal dataset from Kaggle.com. The results are outlined in Table IV, revealing that Stochastic Gradient Boosting achieves optimal efficiency, boasting an RMSE value of 0.380189, an MAE value of 0.17448, and an accuracy rate of 85.82. Consequently, Stochastic Gradient Boosting emerges as a superior choice for estimating insurance costs compared to other regression models. By forecasting insurance expenses based on select factors, insurers can entice consumers and streamline plan development. Machine learning significantly streamlines these policy-making endeavors, as ML algorithms swiftly compute costs, a task that would typically consume considerable human resources. This efficiency enhancement facilitates businesses in enhancing profitability, while the scalability of ML models enables them to handle vast datasets effortlessly.

3. EXISTING METHODOLOGIES

In the realm of search and rescue operations, traditional methodologies for locating missing persons have been augmented significantly through the integration of artificial intelligence (AI) and machine learning (ML) techniques. These innovative approaches leverage a plethora of data sources including surveillance footage, social media activity, mobile phone records, financial transactions, and geographical data to construct comprehensive profiles of missing individuals, offering valuable insights into their habits and potential whereabouts. ML algorithms such as deep learning, convolutional neural networks (CNNs), recurrent neural networks (RNNs), and natural language processing (NLP) analyze this heterogeneous data to extract meaningful patterns and correlations, enabling the identification of relevant clues or sentiments indicative of a person's state or intentions. Moreover, algorithmic techniques are employed to optimize search strategies and prioritize leads for investigation, integrating geographical information systems (GIS), graph-based algorithms, clustering techniques, and optimization algorithms to identify high-probability search areas or potential hotspots. Real-time coordination and adaptive decision-making are facilitated through the integration of AI algorithms with communication and collaboration platforms, enabling search and rescue teams to respond promptly to new information or emerging leads. As a result, AI-assisted missing person finder systems represent a promising frontier in leveraging technology to address the challenges associated with locating missing individuals, ultimately leading to more successful outcomes in search and rescue operations

4. PROPOSED METHODOLOGIES

The registration process initiates by registering the missing individual with our platform. Following a thorough background check and verification process, a unique Face ID is generated for the missing person utilizing FaceNet Algorithm. When volunteers report a suspected missing person, we conduct a similar verification process and generate a Face ID accordingly. Utilizing FaceNet, we compare the generated Face IDs against our database of missing persons to identify potential matches. Upon discovering a match, we promptly notify you of the findings. This project harnesses various tools and languages, including Java, Firebase, and Git. To access Firebase Cognitive Services for Face Analysis, you'll need a Google Firebase account and a Computer Vision Resource in your Firebase account. To set up the project locally, create a folder for the project and clone the repository. Then, set up a virtual environment, install dependencies, update the configuration file (config.json) with your API credentials and email details, adjust settings in msengage\settings.py as per your deployment environment, apply migrations, create an admin account, and run the server locally. The project features a user-friendly home screen providing an overview of the project, technologies used, and an FAQ section, along with functionalities for registering a missing person, reporting a suspected missing person, an admin panel for managing missing people data, approvals, and matches, and utilizes FaceNet Algorithm for face detection and face recognition, matching reported faces with missing person data using FaceNet.

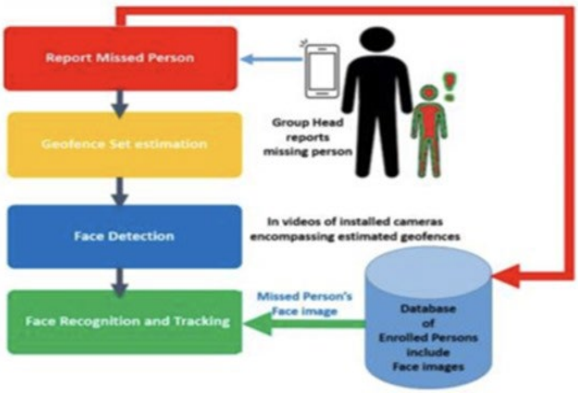

Figure 3 working model of Face Detection

FACENET ALGORITHM

FaceNet is a deep learning model developed by Google researchers for face recognition. It's based on a convolutional neural network (CNN) architecture. Here are the basic steps involved in the FaceNet algorithm for detecting faces:

INPUT IMAGE: The algorithm takes an input image containing one or more faces.

PREPROCESSING: The input image is preprocessed to ensure uniformity in terms of lighting conditions, orientation, and resolution. This may involve steps such as resizing, normalization, and possibly even alignment to ensure faces are correctly positioned and scaled.

FEATURE EXTRACTION: FaceNet uses a deep convolutional neural network to extract features from the preprocessed face images. This network learns to identify distinctive features of faces in a hierarchical manner. The network architecture typically involves many layers of convolutional, pooling, and fully connected layers.

Embedding Generation: Once the features are extracted, FaceNet generates a fixed-length numerical representation (embedding) for each face in the image. This embedding is a high-dimensional vector that captures the essential characteristics of the face. Importantly, the embeddings are designed to have desirable properties such that similar faces have embeddings that are close together in the embedding space, while dissimilar faces are far apart.

Comparison/Classification: To detect faces, FaceNet typically employs a similarity measure such as cosine similarity or Euclidean distance to compare the embeddings of different faces. This allows it to determine whether two face images contain the same person or not. In a face detection scenario, this step may involve comparing embeddings of faces in the input image to a database of known faces or a threshold to determine whether a detected face is a match or not.

THRESHOLDING: Based on the similarity scores obtained from the comparison step, a threshold is applied to decide whether a detected face is considered a match or not. This threshold can be adjusted based on the desired balance between false positives and false negatives.

Output: Finally, the algorithm outputs the locations of detected faces in the image and, if applicable, any identification or classification results associated with those faces.

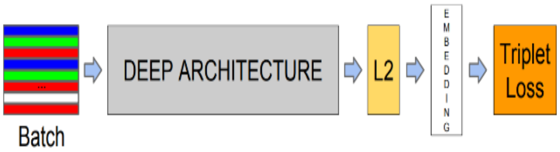

Fig. 4 FaceNet Triple Loss

5. EXPERIMENTAL RESULTS

The performance evaluation of the implemented Face Recognition system was conducted to assess its effectiveness in finding missing persons. The experiments focused on measuring the accuracy and efficiency of the system using real-world data.

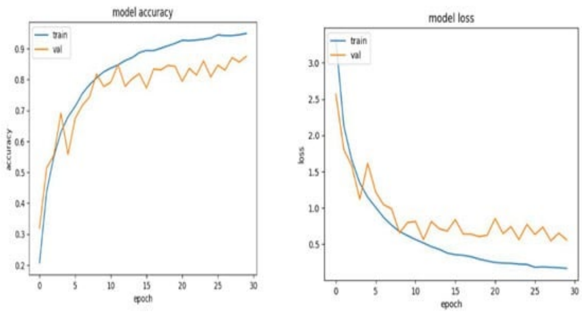

Fig. 5 performance chart

Accuracy: The proportion of correctly matched missing persons to reported sightings.Efficiency: The speed and resource utilization of the system during matching operations.Data Collection: Real-world data consisting of images of missing persons and reported sightings were collected and used to test the system.Evaluation Methodology: The system's performance was assessed based on its ability to accurately match missing persons with reported sightings.Experiment Execution: The system was tested using various scenarios and datasets to evaluate its robustness and reliability.

layer	size-in	size-out	kernel	param	FLPS
conv1	220×220×3	110×110×64	7×7×3, 2	9K	115M
pool1	110×110×64	55×55×64	3×3×64, 2	0	
rnorm1	55×55×64	55×55×64		0	
conv2a	55×55×64	55×55×64	1×1×64, 1	4K	13M
conv2	55×55×64	55×55×192	3×3×64, 1	111K	335M
rnorm2	55×55×192	55×55×192		0	
pool2	55×55×192	28×28×192	3×3×192, 2	0	
conv3a	28×28×192	28×28×192	1×1×192, 1	37K	29M
conv3	28×28×192	28×28×384	3×3×192, 1	664K	521M
pool3	28×28×384	14×14×384	3×3×384, 2	0	
conv4a	14×14×384	14×14×384	1×1×384, 1	148K	29M
conv4	14×14×384	14×14×256	3×3×384, 1	885K	173M
conv5a	14×14×256	14×14×256	1×1×256, 1	66K	13M
conv5	14×14×256	14×14×256	3×3×256, 1	590K	116M
conv6a	14×14×256	14×14×256	1×1×256, 1	66K	13M
conv6	14×14×256	14×14×256	3×3×256, 1	590K	116M
pool4	14×14×256	7×7×256	3×3×256, 2	0	
concat	7×7×256	7×7×256		0	
fc1	7×7×256	1×32×128	maxout p=2	103M	103M
fc2	1×32×128	1×32×128	maxout p=2	34M	34M
fc7128	1×32×128	1×1×128		524K	0.5M
L2	1×1×128	1×1×128		0	
total				140M	1.6B

Fig. 6 ZF-Net architecture in FaceNet

6. CONCLUSION

In conclusion, this project offers a crucial solution to the harrowing ordeal of missing persons by harnessing Face Recognition Technology. By facilitating the registration of missing individuals and FaceNet Algorithm, it endeavors to expedite the process of locating loved ones. The project's architecture, built with a combination of Java, FaceNet algorithm, firebase DataBaseand Android Application tool, ensures a robust and efficient system.The detailed setup instructions provided make the project accessible to users, requiring only basic prerequisites such as a Python installation and FireBaseaccount setup. The integration of email notification further enhances its utility, ensuring timely communication with stakeholders.The functionalities of the application, ranging from registering missing persons to administering the platform through an admin interface, demonstrate its comprehensive approach. Moreover, the implementation of face detection and recognition algorithms underscores its technological sophistication.Despite being developed within a constrained timeframe and limited API usage, the project represents a Minimum Viable Product (MVP) that effectively demonstrates the core functionalities. Future iterations aim to enhance scalability and efficiency by incorporating features such as faceListId integration and leveraging advanced FireBaseservices like PersonGroup and LargePersonGroup.In essence, this project not only addresses a pressing societal issue but also exemplifies the potential of technology to aid in humanitarian efforts. With continued refinement and adoption, it holds promise in mitigating the anguish associated with missing persons while fostering community resilience and support.

DATA AVAILABILITY STATEMENT

FaceNet Performance graph :https://github.com/thedhanush/FaceNet-Algorithm-Performance/blob/main/Comparative-analysis-of-FaceNet-VGGFace-VGG16-and-VGG19-for-face-recognition-on.png

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

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