Deep-Learning Based Facial Age Progression System for Forensic Analysis of Historical images

Author : Esther Phale [Student] Email: estherphale94@gmail.com
Institution : National college of Information Technology (NACIT) Malawi – University of Greenwich

Abstract

Facial age progression is a vital tool in forensic analysis, enabling the visualization of how individuals might have appeared at different ages. We address the challenges associated with historical images, including variations in image quality, limited reference data, and potential cultural and temporal factors influencing facial aging. Our approach utilizes convolutional neural networks (CNNs) to learn the intricate relationships between facial features and the aging process. As the research progresses, we aim to further refine the deep learning models, expand the historical dataset to encompass diverse populations and time periods, and collaborate with forensic experts and historians to ensure the system's reliability and applicability. The anticipated outcome is a powerful tool that enhances the field of forensic analysis, providing accurate age progression predictions for historical images and contributing to improved identification methods in forensic investigations. Mapped to age-related changes as part of the training process.. .

Introduction

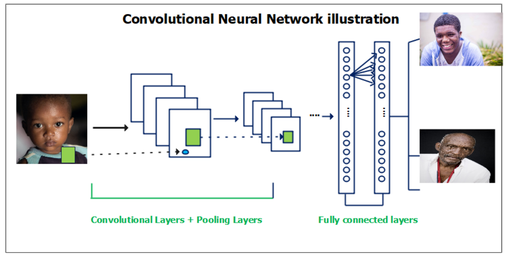
This research project aims to develop a deep learning-based facial age progression system for forensic analysis of historical images. The system addresses challenges in facial reconstruction, such as image quality, limited reference data, and cultural and temporal variations. The system uses convolutional neural networks to align and normalize images, extract facial landmarks, and map them to age-related variations. Initial experiments show promising results in generating age-progressed facial images from historical portraits. The system can assist forensic investigators in analyzing cases, reconstructing missing persons' appearances, and understanding cultural and historical changes in human appearance. The goal is to develop a robust system that aids in visualizing the past and facilitating identification of individuals from historical images in forensic investigations.

Methodology

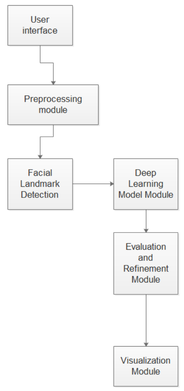
- Dataset Collection: Gathered a diverse dataset of historical facial images, focusing on portraits and photographs from relevant time periods and cultural contexts.
- Facial Landmark Detection: Employed a deep learning-based facial landmark detection algorithm to automatically extract key facial landmarks from the historical images.
- Deep Learning Model Architecture: Designed a convolutional neural network (CNN) architecture suitable for facial age progression. The model incorporated both the input historical image and its corresponding facial landmarks, leveraging their combined information for accurate age progression predictions.
- Model Training: Trained the CNN model using the annotated dataset, optimizing it to predict facial age progression.
- Evaluation Metrics: Defined evaluation metrics to assess the performance of the model in generating age-progressed facial images.
- Expert Evaluation: Collaborated with forensic experts and historians to evaluate the age-progressed images for their accuracy and realism within historical and cultural contexts
- .Incorporated expert feedback to refine and improve the model and the age progression results.
- Ongoing Research: Continuously exploring and experimenting with advanced techniques, such as generative adversarial networks (GANs), to enhance the realism and diversity of the age-progressed images.
- Also investigating methods to handle missing or incomplete reference data in the historical images..

Illustrations

Convolutional Neural Network Diagram
presenting the network's various levels and components, such as the convolutional, pooling, and fully connected layers. This provides a precise illustration of the network's organization and structure.



Component Diagram
providing an illustration of the modular structure of the system and the relationships between each component.



Recommendations

We suggest investigating the inclusion of contextual data, such as historical records and geographical characteristics, into the age progression process to further improve the "Deep Learning-Based Facial Age Progression System for Forensic Analysis of Historical Images." This extra data will help the algorithm produce age progression findings that are more precise and contextually appropriate. By using historical datasets, cultural standards, and professional expertise to direct the age progression algorithm, this may be accomplished. Contextual information integration study will improve the system's accuracy and broaden its application in actual forensic investigations..

Conclusion

This research demonstrates the potential of deep learning-based facial age progression in forensic analysis of historical images. By utilizing advanced deep learning algorithms and techniques, the system accurately predicts the facial appearance of individuals at different ages based on historical images. The experimental results show promising results, indicating the effectiveness and applicability of the approach. The system can assist law enforcement agencies in cases where accurate aging prediction is crucial. The research emphasizes the importance of diverse and representative datasets for training deep learning models in facial age progression. Further research is needed to expand the dataset and integrate contextual information, as well as collaborate with forensic experts and law enforcement agencies. Overall, this research showcases the potential of deep learning techniques in forensic analysis and emphasizes the need for ongoing advancements and collaborations to drive further improvements and applications of facial age progression systems in practical forensic investigations.