International Journal of Interdisciplinary Innovative Research & Development (IJIIRD)
ISSN: 2456-236X
Vol. **11** Special Issue **03** | **2026**

Deep Learning Techniques for Age and Gender Detection

Mr. Siddharth M. Sarvekar[1], Mr. Vaibhav V. Mainkar[2], Mr. Ajit P. Gosavi[3], Ms. Prajakta S. Jamsandekar[4] Ms. Purva U. Bakre[5] Mr. Yash A. Ghadigaonkar[6]
[1,2,3,4] *Assistant Professor, Electronics & Computer Science Department, S.S.P. M's COE Kankavli, Maharashtra, India*
[5,6] *Student, Electronics & Computer Science Department, S.S.P. M's COE Kankavli, Maharashtra, India*

DOI: 10.5281/zenodo.20630352

ABSTRACT

Age and gender detection from facial images has become an important research area in computer vision and artificial intelligence. It has various applications such as surveillance systems, targeted advertising, human–computer interaction, and demographic analysis. Traditional methods relied on handcrafted features, which often produced limited accuracy under real-world conditions. With the advancement of deep learning, convolutional neural networks (CNNs) have significantly improved the performance of facial analysis tasks. This paper presents a deep learning-based approach for automatic age and gender prediction from facial images. The proposed system uses a convolutional neural network model trained on facial datasets to classify gender and estimate age groups. The model extracts facial features automatically and performs classification with high accuracy. Experimental results demonstrate that the proposed method achieves reliable performance and can be effectively used in real-time applications.

Keywords:- Deep Learning, Age Detection, Gender Classification, Convolutional Neural Networks, Facial Analysis

1. INTRODUCTION

Facial image analysis has received considerable attention in recent years due to its potential applications in many intelligent systems. Among the various facial attributes that can be extracted, age and gender information play an important role in understanding demographic characteristics [1]. These attributes can assist in applications such as automated surveillance, smart retail systems, and user behavior analysis. Traditional techniques for facial attribute recognition typically relied on handcrafted feature extraction methods such as Local Binary Patterns (LBP) and Histogram of Oriented Gradients (HOG) [2][3]. Although these techniques were useful for early research, their performance often decreased when faces appeared under challenging conditions such as illumination changes, occlusions, and pose variations.

With the emergence of deep learning, particularly Convolutional Neural Networks (CNNs), image analysis has achieved significant improvements. CNN models are capable of automatically learning hierarchical features from raw image data, which makes them highly effective for tasks like object detection and facial recognition [4]. This research focuses on developing a deep learning-based approach for predicting age and gender from facial images. By training a CNN model on labeled datasets, the system learns patterns that distinguish different gender categories and age groups. The goal is to design a model that performs accurately while remaining suitable for real- time applications.

2. RELATED WORK

Research on automatic age and gender recognition has evolved considerably over the past decade. Early studies mainly relied on traditional machine learning techniques that required manual feature extraction from facial images. Methods such as Local Binary Patterns (LBP), Histogram of Oriented Gradients (HOG), and Scale-Invariant Feature Transform (SIFT) were commonly used to represent facial features. These features were then classified using algorithms such as Support Vector Machines (SVM) or Decision Trees. Although these approaches provided reasonable results, their performance often decreased when images contained variations in pose, lighting, or facial expressions.

With the advancement of deep learning, researchers began adopting neural network-based models for facial analysis tasks. Convolutional Neural Networks (CNNs) have become particularly popular due to their ability to automatically learn hierarchical features directly from raw image data. Several studies have shown that CNN-based models outperform traditional approaches in tasks such as face recognition, object detection, and facial attribute classification [5][6].

One notable study proposed a CNN-based framework specifically designed for age and gender classification

using facial images. The model demonstrated improved accuracy compared to earlier handcrafted feature-based methods. Later research introduced transfer learning techniques using pre-trained networks such as VGGNet and ResNet, which further improved performance by leveraging knowledge from large-scale image datasets. Despite these improvements, challenges still remain in achieving high accuracy under real-world conditions. Factors such as occlusion, facial accessories, image resolution, and age progression can affect prediction accuracy. Therefore, continuous research is required to design models that are more robust and capable of handling diverse datasets.

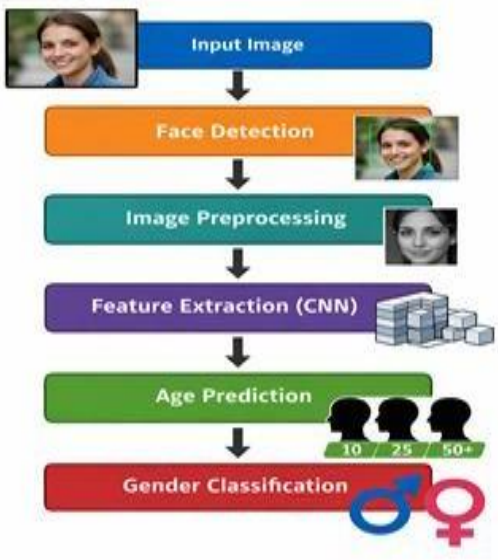

Fig -1: Deep learning age and gender detection flowchart

2.1 Proposed System

The proposed system focuses on predicting age and gender from facial images using a deep learning approach. The overall system is designed to process input images, detect facial regions, extract meaningful features, and classify the demographic attributes.

The system is composed of several main stages. First, an input image is provided to the system through a dataset or camera input. A face detection algorithm is then applied to locate and isolate the facial region from the image [1]. Extracting only the facial region helps improve the performance of the model by eliminating unnecessary background information.

After detecting the face, the image undergoes preprocessing steps such as resizing and normalization. These steps ensure that all input images are consistent in size and format before they are fed into the neural network. The processed facial images are then passed to a Convolutional Neural Network. The CNN automatically extracts relevant features such as facial structure, texture patterns, and other distinguishing characteristics. Based on these learned features, the network predicts the gender category and estimates the corresponding age group [3][7].

Table -1: Dataset Distribution

Category	Number of Images
Male Faces	12000
Female Faces	11500
Age Group (0–18)	4500
Age Group (19–35)	7000
Age Group (36–60)	8000
Age Group (60+)	4000

2.2 System Architecture

The architecture of the proposed system is designed to perform age and gender prediction from facial images through a sequence of processing stages. Each stage plays a crucial role in ensuring that the facial features are accurately extracted and analyzed by the deep learning model. The system begins with the image acquisition stage, where facial images are collected either from an existing dataset or through a real-time camera input. These images serve as the primary input for the model. Since raw images may contain background noise and varying resolutions, preprocessing is necessary before feeding them into the neural network.

The next stage involves face detection, where the facial region is identified and extracted from the input image. Face detection algorithms such as Haar Cascade classifiers or deep learning-based detectors can be used for this purpose. By isolating the facial region, irrelevant background information is removed, which improves the overall performance of the system. Once the face is detected, the image undergoes preprocessing operations such as resizing, normalization, and pixel value scaling. These operations ensure that all images have a

consistent format that can be efficiently processed by the convolutional neural network.

The preprocessed images are then passed to the Convolutional Neural Network (CNN), which automatically extracts hierarchical features from the facial image. The CNN consists of multiple layers including convolutional layers, pooling layers, and fully connected layers. These layers learn complex patterns related to facial structure, texture, and other distinguishing characteristics. Finally, the extracted features are used for classification and prediction, where the system determines the gender category and estimates the age group of the person. The output is displayed either as predicted labels or numerical values depending on the design of the model.

3. METHODOLOGY

The methodology of the proposed system focuses on building a deep learning model capable of predicting age and gender from facial images. The implementation involves several stages including dataset preparation, preprocessing, model training, and evaluation. Initially, a facial image dataset containing labeled information about age and gender is collected. The dataset is divided into training and testing sets to evaluate the performance of the model. Proper dataset preparation ensures that the model learns meaningful patterns without overfitting.

In the preprocessing stage, facial images are resized to a fixed dimension so that they can be processed efficiently by the neural network. Normalization techniques are applied to scale pixel values, which helps improve the training stability of the model. During the training phase, the model adjusts its internal parameters using optimization algorithms such as stochastic gradient descent or Adam optimizer. The training process continues until the model achieves satisfactory prediction accuracy.

The final stage involves evaluating the trained model using testing data. Performance metrics such as accuracy, precision, and loss values are used to measure the effectiveness of the proposed system.

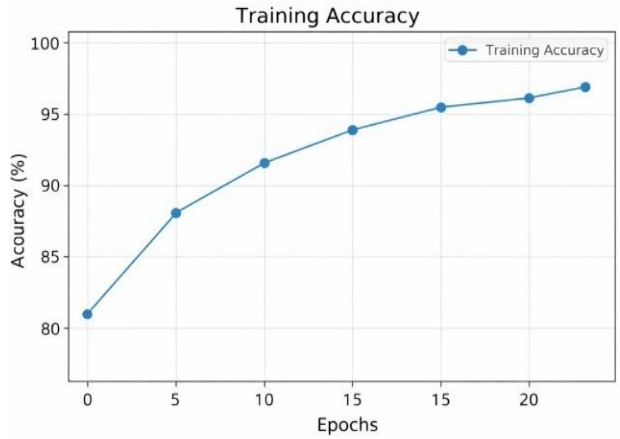

Fig -2: Modelling accuracy over epochs

3.1 Dataset and Model Training

For training the deep learning model, a facial image dataset containing labeled information about age and gender is used. Each image in the dataset is associated with a gender label (male or female) and an age value or age group. Before training the model, the dataset undergoes preprocessing to remove inconsistencies. All images are resized to a standard resolution, typically 224 × 224 pixels, which is commonly used for convolutional neural network architectures. Pixel values are normalized to improve model convergence during training.

The dataset is then divided into training and testing subsets. The training dataset is used to train the CNN model, while the testing dataset is used to evaluate its performance.During training, the CNN processes images in batches and updates its weights using a backpropagation algorithm. Loss functions such as categorical cross-entropy for gender classification and mean absolute error for age estimation are used to measure prediction errors. Regularization techniques such as dropout and batch normalization are applied to prevent overfitting and improve model generalization.

4. CONCLUSIONS

This study presented a deep learning-based approach for predicting age and gender from facial images. The proposed system utilizes a Convolutional Neural Network to automatically extract facial features and perform classification tasks efficiently. The system also highlights the potential of deep learning in real-time applications such as surveillance systems, smart retail analytics, and human–computer interaction. By combining face detection with deep learning classification models, the proposed approach provides an effective solution for automated demographic analysis. Future work can focus on improving the robustness of the model by training it

on larger and more diverse datasets. Additional improvements may include the use of advanced architecture such as transfer learning models and real-time deployment using optimized frameworks.

5. ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the faculty members and mentors who provided valuable guidance and support during the development of this research work. Their suggestions and encouragement greatly contributed to the successful completion of this study. The authors also thank the institution for providing the necessary resources and academic environment required to carry out this research on age and gender detection using deep learning techniques.

6. REFERENCES

[1]. Levi, G., and Hassner, T., “Age and Gender Classification Using Convolutional Neural Networks,” Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR) Workshops, *2015*.
[2]. Moschoglou, S., Papaioannou, A., Sagonas, C., Deng, J., Kotsia, I., & Zafeiriou, S. (2017). "AgeDB: The First Manually Collected, In-The-Wild Age Database.
[3].Gupta, K. K., Vijay, R., & Pahadiya, P. (2022). Detection of abnormality in breast thermograms usingCanny edge detection algorithm for thermography images. International Journal of Medical Engineeringand Informatics, 14(1), 31-42.
[4].Gupta, K. K., Vijay, R., Pahadiya, P., Saxena, S., & Gupta, M. (2023). Novel Feature Selection Using Machine Learning Algorithm for Breast Cancer Screening of Thermography Images. Wireless PersonalCommunications, 1- 28.
[5].Preeti Jain, et al. " Gender and Age Detection Using Deep Learning Techniques." Journal of Artificial Intelligence Research 17.4 (2023).
[6].Prateek Mishra, et al. "Gender and Age Detection in Facial Images" International Journal of Advanced Research in Computer Science 12.3 (2024).
[7].Aman Singh, et al. "Gender and Age Detection Using Machine Learning Techniques" International Journal of Computer Science and Information Technology 16.5 (2024).