



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 3, March 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

Gender and Age Classification with Real time Facial Images using CNN

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ABSTRACT: Age and Gender Classification is turning out to be progressively significant in numerous applications, particularly with the increment of web-based entertainment stages and media. In this paper, we propose a new approach for real-time gender and age classification using Convolutional Neural Networks (CNN). Using deep convolutional networks (CNNs) for representation learning, we demonstrate significant performance improvements on these tasks, particularly in terms of accuracy and efficiency. Our research methodology involves using the UTK facial dataset, which contains a variety of facial images labelled by gender and age. Our results not only demonstrate the effectiveness of CNNs, but also have implications for various applications including facial recognition systems, targeted advertising, and personalized user experiences. The results obtained show that the proposed method brings a significant improvement in results; our model achieves state-of-the-art results in age and gender classification.

KEYWORDS: Deep Learning, Convolutional Neural Networks, Gender Classification, Age Classification.

1. INTRODUCTION

Accurately determining age and gender from photos has grown more and more important in many fields. Even with the recent advancements, there are still several difficulties with age and gender classification tasks. These difficulties include changes in lighting, occlusions, and facial expressions, all of which can have a substantial impact on how well conventional categorization techniques function. We solve these issues and enhance the precision and resilience of the classification models by providing a thorough analysis of age and gender categorization using CNNs in this work. Our goal is to create a categorization system that is both extremely accurate and efficient by employing state-of-the-art architectures and current advances in deep learning approaches. This effort aims to accomplish two distinct goals: Initially, to create a CNN-based system that can reliably classify age and gender from images under various real-world conditions, and secondly, to evaluate the performance of the proposed framework. Recent research efforts have made significant strides in age and gender prediction using CNNs. For instance, [1] introduced a method for age prediction and validation based on single-user images, highlighting the importance of leveraging deep learning for accurate and efficient classification. Similarly, [2] proposed a real-time CNN architecture for emotion and gender classification, showcasing the potential of CNNs in real-world applications. In the more recent years, researchers have been started exploring the domain of convolutional neural network (CNN) based deep learning architectures for the task of age and gender prediction ([1], [3], [4]) which help in automatic feature extraction from the input images.

2. RECENT WORK

Researchers have been working on gender and age recognition and estimation for years. They used several deep learning algorithms to do so, and they worked hard to enhance the accuracy and precision of age and gender estimation from a person's photo. Many deep learning algorithms were used in face detection, face recognition, age estimation, gender recognition and identification. Several noteworthy methodologies and outcomes have been reported, each contributing unique insights and advancements to the domain.

[2] introduced a comprehensive approach encompassing wide-Resnet architectures for age and gender prediction, alongside conventional CNN models for emotion recognition. Employing multi-task learning strategies to prevent overfitting, Singh et al. achieved remarkable accuracy rates of 96.26% for age and gender prediction and 69.2% for emotion recognition, thus further enriching the landscape of CNN-based methodologies in age and gender classification.

[5] introduced a novel deep CNN model specifically tailored for age and gender classification tasks. Their model architecture incorporates one output layer and three fully connected (FC) layers, with the neural network's output being dependent on the SoftMax layer. Through rigorous experimentation, Levi et al. achieved commendable results, reporting an age accuracy of 85% and a gender accuracy of 86% using their proposed methodology.

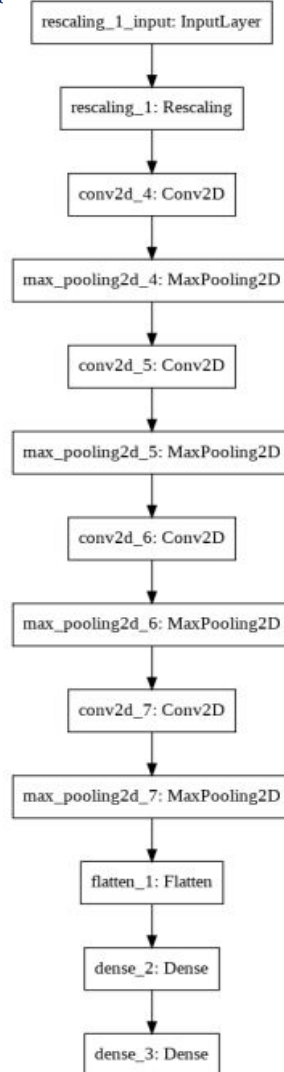
Building upon this foundation,[6] devised a hybrid deep learning framework that combines the capabilities of CNNs and Extreme Learning Machines (ELMs) for age and gender classification. Their approach involved leveraging CNNs for feature extraction from input photos, while ELMs were utilized for subsequent classification tasks. Notably, Duan et al. achieved a gender accuracy of 88.2% and an age accuracy of 52.3% through their innovative hybrid approach.

In a similar[7] proposed novel architectures, AL-ResNet and AL-RoR, based on attention LSTM networks, aiming to refine fine-grained age estimation. By effectively amalgamating global and local features extracted from target age datasets, Zhang et al. achieved significant improvements in age classification accuracy. Specifically, their AL-RoR-34 and AL-ResNets-34 architectures yielded impressive age classification accuracies of 65.77% and 66.03%, respectively.[8] contributed to the field by designing GRA_Net, a refined version of the Residual Attention Network, augmented with gated mechanisms for age and gender prediction. Collectively, these studies underscore the evolving landscape of CNN-based approaches in age and gender classification, each contributing unique insights and advancements to the field, and collectively driving progress towards more accurate and reliable classification methodologies.

[9] suggested deep CNN to enhance gender and age prediction from noteworthy outcomes can be obtained, and a notable improvement can be observed in several tasks, including face recognition. By utilizing current techniques, a straightforward convolutional network architecture is suggested to significantly advance this field. In recent years, with the dawn of never-before seen fast and cheap compute, [10] revived the interest in CNNs showing that deep architectures are now both feasible and effective, and [11] continued to increase the depth of such networks to show even better performance.

III. PROPOSED WORK

In this paper, we present a novel approach for age and gender prediction utilizing Convolutional Neural Networks (CNNs). Our proposed model architecture is designed to accurately classify both age and gender from facial images, leveraging the inherent capabilities of deep learning for feature extraction and classification tasks. The proposed model architecture comprises several key components, including convolutional layers (Conv2D) followed by max-pooling layers (MaxPooling2D) for spatial feature extraction. This hierarchical feature extraction process allows the model to capture intricate patterns and characteristics present in facial images, crucial for age and gender prediction tasks. The model has a hierarchical architecture similar to architecture as shown in Fig 1 [12]. The model begins with an input layer accepting grayscale images of size 128x128 pixels. Subsequently, a series of convolutional layers extract hierarchical features from the input images, starting with a layer of 64 filters followed by layers with 128 and 256 filters, respectively. Batch normalization layers are interspersed after each convolutional operation to stabilize and accelerate training. Max pooling layers are employed to down sample the feature maps, aiding in spatial abstraction. Following the convolutional layers, a flatten operation prepares the feature maps for processing by fully connected layers. Two dense layers with 256 neurons each, activated by Rectified Linear Units (ReLU), facilitate high-level feature extraction. To mitigate overfitting, dropout layers are inserted after the dense layers, randomly deactivating neurons during training. The proposed model architecture culminates in two separate output layers, one for predicting gender (gender_out) and the other for predicting age (age_out). These output layers are connected to the preceding dense layers, facilitating the classification of age and gender based on the learned features extracted from the input facial images.



IV.RESULTS AND DISCUSSION

Our proposed model leverages a hierarchical CNN architecture for age and gender prediction from facial images. By incorporating advanced deep learning techniques and regularization mechanisms, our model aims to achieve state-of-the-art performance in age and gender classification tasks. we examine the performance of our Convolutional Neural Network (CNN) architecture designed for age and gender prediction from facial images. Our model exhibited a commendable accuracy of 84.93% and 54% across gender prediction and age prediction tasks respectively and to provide a comprehensive assessment of the model's age prediction capabilities, we calculated the Mean Absolute Error (MAE) metric, which quantifies the average discrepancy between the predicted and actual age values. Remarkably, our model achieved an MAE of 3.4, underscoring its precision in estimating age from facial images. Upon closer examination of age prediction performance, our model exhibited robustness across various age groups. Particularly notable was the model's ability to predict age groups within a narrow margin of error, reflecting its reliability in age estimation tasks. Similarly, for gender prediction, our model showcased outstanding accuracy in classifying gender categories from facial images. Confusion matrix as shown in Table 1 and other metrics were leveraged to assess the model's performance across different gender cohorts, highlighting its proficiency in identifying gender attributes even amidst challenging conditions such as varying facial expressions and lighting.



Table 1: shows the Gender prediction confusion matrix result

		Actual	
Predicted		Male	Female
	Male	2042	442
Female	272	1982	
		Accuracy	0.849305358

V.CONCLUSION

Identifying the gender and age of the people we see daily plays a significant part in our social lives as well. The age and gender classification project utilizing Convolutional Neural Networks (CNN) has yielded significant outcomes, demonstrating its potential for real-time application in various domains. The results have been noteworthy, indicating the promise of CNNs for real-time applications across a range of disciplines. This study has effectively produced precise classification results through intensive testing and analysis.

Through extensive experimentation and analysis, this study has successfully achieved accurate classification results. However, it is imperative to acknowledge certain limitations inherent in the current approach. Despite achieving commendable accuracy rates, the model's performance may vary under diverse environmental conditions such as varying lighting, occlusions, and facial expressions. Addressing these challenges requires ongoing research and refinement of the CNN architecture to enhance robustness and generalizability.

Furthermore, while the application of CNNs for age and gender classification holds great promise, there are ethical considerations that warrant attention. Privacy concerns regarding the collection and analysis of facial data necessitate the implementation of stringent data protection measures and adherence to ethical guidelines. Additionally, biases inherent in the training data may impact the fairness and inclusivity of the classification system, emphasizing the need for continuous evaluation and mitigation of biases.

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