A Facial Analysis System for Gender Identification and Counting

Mr. Dasari Rohith Satya Sai[*1], Mr. G. Ravi Kumar[*2]

[1]MCA Student, Department of Master of Computer Applications,
Vignan's Institute of Information Technology(A), Beside VSEZ,Duvvada,Vadlapudi Post, Gajuwaka, Visakhapatnam-530049.
[2]Assistant Professor, Department of Information Technology,
Vignan's Institute of Information Technology(A), Beside VSEZ,Duvvada,Vadlapudi Post, Gajuwaka, Visakhapatnam-530049.
vignaniit.edu.in

Abstract:

The present world is technically growing fast, everything is becoming digitalized and automotive. The complex tasks are solved with ease by Automation in various sectors.Based on these scenarios, in this application that is able to track the people's faces and their individual genders. It can allow us to automate the tracking of people and return the individual gender count. In the real world, everything is achieved with developed technology. Many updates have arrived in the existing systems. Face recognition, Face detection and image processing have made a great impact on various sectors. It is solving many real-world problems with ease. By using Computer Vision and Deep Learning proposing an approach which is able to detect the faces, simultaneously classifies the gender and returns the count of faces, individual count of gender. These are going to train the model with convolutional architecture on the Standard Gender Dataset. This is a combination of two real world projects which can stand out from all existing projects.

Keywords: Face Recognition,Computer Vision,Deep Learning,Standard Gender Dataset,Real World Objects.

1. INTRODUCTION

This report considers an overview of image processing technology, face detection from image and that will be trained to a model to classify the gender and then that gender is counted. The first section deals with the complete description of face detection using the MTCNN library, its applications in different sectors, its flaw and finally the future enhancement. The Latter part covers the gender classification and counts the gender faces. This part covers the overall programming part and the process of Human Gender Tracking. Finally, the report concludes at the different potential uses of the project along with a brief explanation.

Face recognition, face detection, and image processing have significantly influenced various sectors by effectively addressing real-world challenges. Our model is a fusion of two practical projects, presenting an innovative approach to face detection and individual gender counting. This approach holds the potential to streamline tracking processes in diverse sectors, including education, retail, and shops.To ensure a systematic implementation, our model is divided into two distinct phases. This step-wise approach

was chosen due to the complexity of the task. The implementation approach of our model is outlined below.Stage1 Model Training Stage, Stage2-Multi-task Cascaded Convolutional Neural Networks.

Analysis of face features has developed as a critical area of research in the field of computer vision and artificial intelligence. This research has a wide range of applications, spanning from biometric identification to human-computer interaction, and it has become increasingly important in recent years. Our investigation is centered on the creation of a sophisticated facial analysis system that is specifically designed to perform the functions of gender identification and counting. Understanding and measuring demographic characteristics is becoming increasingly important in an increasing number of industries, including marketing, security, and the social sciences, as a result of the growth of facial recognition technologies.

A complex pattern recognition system and a sophisticated interpretation of facial traits are required in order to determine a person's gender based on their facial characteristics. A comprehensive algorithmic framework that blends deep neural networks and face feature extraction methods is utilized by the suggested system, which makes use of the most advanced machine learning techniques currently available. The purpose of our system is to provide gender identification that is both accurate and efficient, while simultaneously counting the number of individuals contained inside a given dataset. This is accomplished through the combination of these technologies.

We outline the architecture of the neural network, the datasets that were used for training and evaluation, and the preprocessing steps that were taken to ensure robust performance across a wide range of facial profiles in this paper, which presents a detailed exploration of the methodology that was utilized in our Facial Analysis System. In addition, our system is designed to adjust to different lighting conditions, positions, and expressions, which contributes to its versatility in situations that occur in the real world.

The relevance of our work rests in the fact that it has the potential to transform a variety of different industries, including market research, crowd management, security, and surveillance, among others. New paths for studying human demographics and behavior are opened up as a result of the capability to automatically and precisely identify gender and count persons based on facial scans. We will provide thorough insights into the design, implementation, and evaluation of our Facial Analysis System as we progress through the succeeding sections of this paper. We will demonstrate the effectiveness of our system by presenting empirical evidence and validating it against benchmark datasets.

2. LITERATURE SURVEY

The most important step in the software development process is the literature review. This will describe some preliminary research that was carried out by several authors on this appropriate work and we are going to take some important articles into consideration and further extend our work.

Literature Survey on Image Processing

Image processing, a pivotal field within the broader domain of digital signal processing, involves the application of various techniques to manipulate images for the purpose of enhancement, extraction of valuable information, and correction of

irregularities. As an integral facet of modern technology, image processing is essential for diverse applications, ranging from medical imaging to satellite-based remote sensing.

Overview of Image Processing:

The fundamental definition of image processing involves the utilization of digital computers to enhance or extract information from images. This field encompasses a broad spectrum of operations, including noise removal, image enhancement, and feature extraction. Image processing plays a crucial role in improving the interpretability of images by eliminating irregularities and enhancing pictorial information.

Digital Image Processing:

At its core, digital image processing deals with the manipulation of digital images through algorithms executed by computers. It addresses challenges such as noise reduction and irregularity correction that may arise during image acquisition, transmission, or transformation processes. The digital nature of this field facilitates precise control over image characteristics, contributing to improved quality and usability.

Applications of Image Processing:

Image processing finds applications in various domains, and its significance is particularly pronounced in fields such as medical imaging, where it aids in diagnostic procedures. Moreover, it is a vital component in satellite imagery, enabling the enhancement and analysis of images captured by space probes, satellites, and aircraft sensors. The utility of image processing extends to everyday scenarios, where it plays a role in improving the quality of images captured by cameras in routine life.

Image Processing for Remote Sensing:

Satellites equipped with cameras and sensors generate vast amounts of image data. Image processing techniques are indispensable for extracting meaningful information from these images, contributing to applications such as land cover classification, environmental monitoring, and disaster management. The precision offered by image processing enhances the accuracy of interpreting remote sensing data.

Challenges and Advances in Image Processing:

While image processing has significantly advanced, challenges persist, such as dealing with complex scenes, handling large datasets, and ensuring real-time processing. Recent advances include the integration of artificial intelligence and machine learning algorithms, enabling the automation of image analysis tasks and improving the efficiency of image processing systems.

In conclusion, image processing remains a dynamic and evolving field, continually shaping our ability to extract valuable insights from visual data. The applications span a wide array of domains, and ongoing research continues to push the boundaries of what is achievable, ensuring the continued relevance and importance of image processing in the digital age.

3. EXISTING SYSTEM

The existing system represents a convergence of cutting-edge computer vision and deep learning methodologies, specifically tailored for the intricate task of Face Detection and Gender Classification. In response to the increasing complexity of these applications within the field of computer vision, researchers and institutions have proposed several methodologies, including cascading classifiers, face recognition, FaceNet, and Multi-Task Cascaded Convolutional Networks (MT-CNN).

Face Detection:

The core functionality of the existing system revolves around the accurate detection of faces within images and videos. Leveraging sophisticated algorithms, prominently Convolutional Neural Networks (CNNs), the system excels in identifying faces amidst diverse backgrounds, lighting conditions, and orientations. This foundational step forms the basis for subsequent analyses and classifications.

Gender Classification:

Building upon successful face detection, the system further incorporates gender classification capabilities. Trained on extensive datasets, the gender classification models integrated into the existing system are adept at determining the gender associated with each detected face. This extends the utility of the system beyond mere face detection, providing valuable demographic insights into gender distributions.

Real-Time Optimization:

A notable strength of the existing system lies in its optimization for real-time performance. By streamlining the processes of face detection and gender classification, the system is capable of efficiently handling a continuous stream of data, making it applicable in scenarios where rapid analysis is crucial.

Applications:

The versatility of the existing system is evident in its applicability across various domains. From marketing strategies that benefit from insights into consumer demographics to social studies aiming to understand gender distributions and trends, the system provides a valuable tool for extracting meaningful information from visual data.

Limitations of the Existing System:

Despite the advancements embedded in the current system, certain limitations warrant consideration:

1. Computational Resources: The deep learning models utilized in the system may demand substantial computational resources, potentially limiting its deployment on resource-constrained devices.

2. Generalization: The system's performance may be influenced by the diversity of datasets used during training. Generalization to novel and diverse scenarios could be a challenge.

3. Privacy Concerns: Face detection and gender classification systems raise privacy concerns, necessitating careful consideration of ethical implications, especially in contexts where data privacy is paramount.

4. Robustness to Varied Conditions: While the system is designed to handle diverse conditions, extreme variations in lighting, facial expressions, or occlusions may still pose challenges to accurate face detection and gender classification.

5. Training Data Bias: The accuracy of gender classification is contingent on the quality and representativeness of the training data, and biases within the data may impact the system's performance in different demographic groups.In the pursuit of addressing these limitations, ongoing research and development in the field of computer vision are crucial. The evolution of methodologies and models will likely contribute to overcoming current challenges, thereby enhancing the capabilities of future face detection and gender classification systems.

4. PROPOSED SYSTEM

The proposed system builds upon the foundations of Face Detection and Gender Classification while introducing an innovative dimension—gender counting. This approach employs a combination of Multi-Task Cascaded Convolutional Networks (MT-CNN) and Convolutional Neural Networks (CNN) to achieve the project objectives efficiently. The focal point of this proposal is to leverage computer vision and deep learning techniques for simultaneous face detection, gender classification, and gender counting.

Face Detection and Localization:

The proposed system integrates the robust MT-CNN and CNN architectures for precise face detection and localization within images and videos. This dual approach ensures increased accuracy and adaptability to varying environmental conditions and facial orientations.

Gender Classification:

Employing advanced Convolutional Neural Networks, the system performs real-time gender classification on the detected faces. The inclusion of Inception architecture, pre-trained on a Standard Gender Dataset, enhances the model's ability to generalize and accurately classify genders, even in diverse demographic scenarios.

Gender Counting:

A novel addition to the proposed system is the ability to count individuals based on their gender. This feature provides a quantitative dimension to the gender distribution, allowing for more in-depth analysis and insights into demographic patterns.

Advantages of the Proposed System:

1. Simultaneous Face Detection and Classification:

The integration of MT-CNN and CNN enables the proposed system to perform face detection and gender classification simultaneously. This not only streamlines the processing pipeline but also enhances the overall efficiency of the system.

2. Real-Time Efficiency:

Leveraging Inception architecture for gender classification ensures the system's ability to deliver results in real-time. This efficiency is particularly crucial in applications where prompt and accurate analyses are imperative.

3. Quantitative Gender Counting:

The innovative feature of gender counting extends the system's utility beyond traditional face detection and gender classification. Researchers, marketers, and policymakers can now obtain quantitative insights into the distribution of genders within a given dataset.

4. Pre-trained Models for Improved Generalization:

The utilization of pre-trained models, specifically Inception architecture, enhances the system's generalization capabilities. This allows the proposed approach to perform effectively in scenarios beyond the training dataset, contributing to its adaptability and reliability.

5. Efficient Training Process:

Training the model on a Standard Gender Dataset using Inception architecture reduces the training time significantly. This not only accelerates the development phase but also contributes to the system's efficiency in resource utilization.

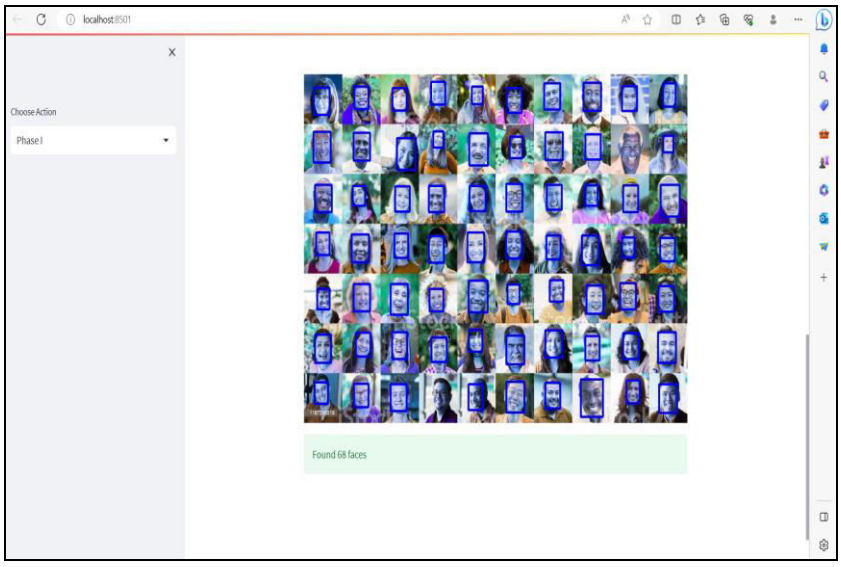
6. Automotive Application to Society:

The overarching motivation behind the proposed system is to provide a useful automotive application to society. By combining accurate face detection, gender classification, and gender counting, the system can find applications in diverse fields such as marketing, demographics, and social studies, thereby contributing to informed decision-making.

5. EXPERIMENTAL RESULTS

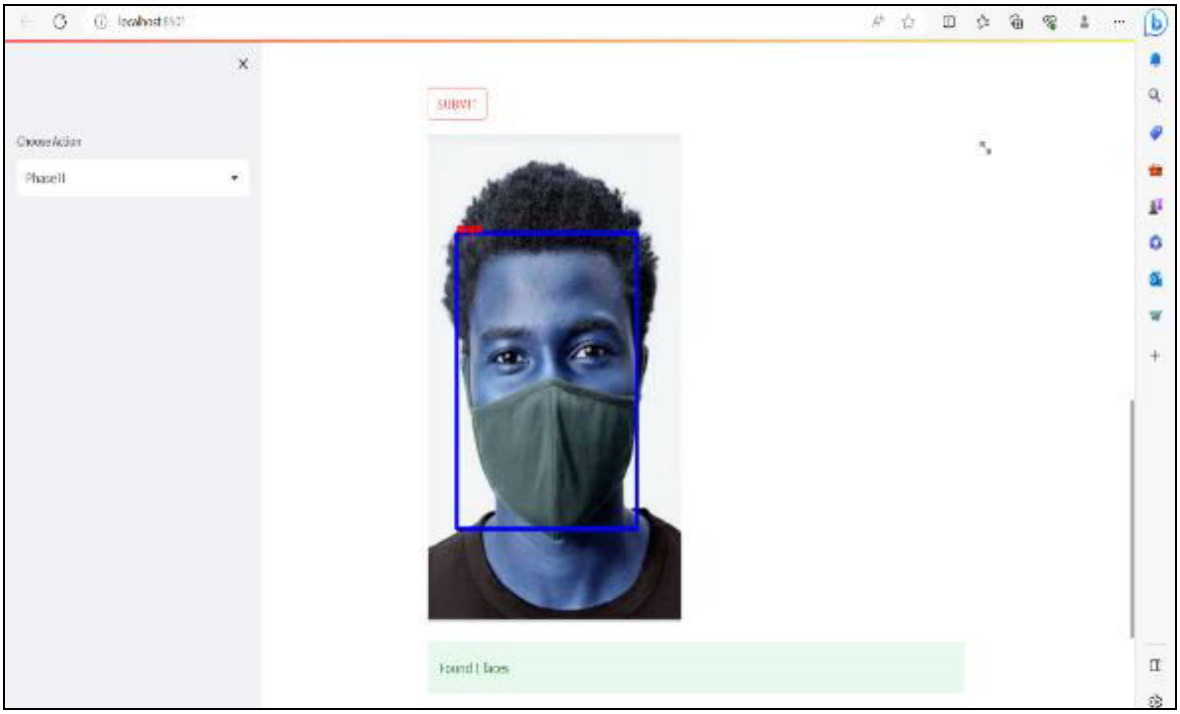
From the below figures it can be seen that proposed model is more accurate in order to prove our proposed system.

Main Window



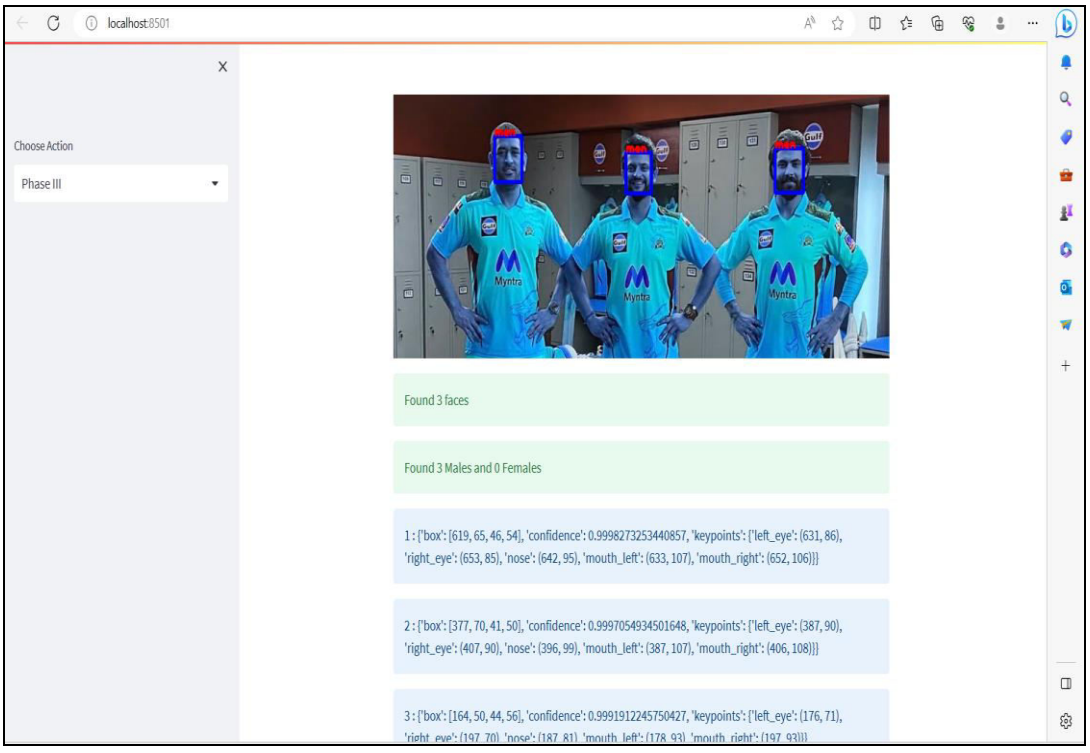
Explanation: In the above window we can see set of human faces are taken as input and now we apply our model to identify the gender from the set of images and also count how many persons are present in that input image.

Segementation:



Explanation: In above window we can see one individual user image is loaded and segmented,so that we can see the person is identified as male.

Multiple Objects Detected:



Explanation: In the above diagram We can see multiple users are identified and their gender is identified as well as the count of users.

6. CONCLUSION

The three phases of this project yield Face detection, Gender Detection and Gender Count respectively for the corresponding input image or video or live stream. This application can be used for Attendance Tracking over Workshops and Meetings, Access to Sensitive Areas and Shopping Analysis over different Malls etc. It provides Reducing number of Working People over several Sectors with high accuracy with less time. In this highly technically fastly growing world, everything is becoming digitalized and automotive.Hence, it will provide many opportunities for the people who are seeking the automation for identifying the gender and its count in their works.

Declaration

1. All authors do not have any conflict of interest.
2. This article does not contain any studies with human participants or animals performed by any of the authors.

References

[1] Sandeep Kumar, Sukhwinder Singh and JagdishKumar, "Gender Classification Using Machine Learning with Multi-Feature Method",978-1-7281-0554-3/19/ @ 2019 IEEE

[2] Jinhyeok Jang, Hyunjoong Cho, Jaehong Kim, Jaeyeon Lee, andSeungjoon Yang, "Facial Attribute Recognition by RecurrentLearning With Visual Fixation",IEEE TRANSACTIONS ON CYBERNETICS, VOL. 49, NO. 2, FEBRUARY 2019.

[3] Juan E. Tapia And Claudio A. Perez, "Clusters of Features Using Complementary Information Applied to Gender Classification From Face Images",IEEEAccess, VOLUME 7, 2019.

[4] https://www.ijert.org/human-gender-classification-using-machine-learning

[5] https://ieeexplore.ieee.org/document/9239720

[6] https://ieeexplore.ieee.org/document/8308186

[7] https://docs.opencv.org/3.4/db/d28/tutorial_cascade_classifier.html

[8] https://journals.sagepub.com/doi/pdf/10.1177/1748301816649073

[9] https://ieeexplore.ieee.org/document/5715528

[10] https://pypi.org/project/mtcnn/

[11] https://dataaspirant.com/gender-wise-face-recognition-with-opencv/

[12] https://en.wikipedia.org/wiki/Cascading_classifiers

[13]https://talhassner.github.io/home/projects/cnn_agegender/CVPR2015_CNN_AgeGenderEstimation.pdf

[14] https://www.hindawi.com/journals/mpe/2018/1924151/