**ABSTRACT**

Due in large part to the expansion of social media and online social networking websites, automatic gender, age, and emotion identification has become more significant, leading to an expansion of its usage in various software and hardware. The commercials could be tailored to the caller's age and gender. In criminal instances, it can also aid in the identification of suspects, or at the very least, it can reduce the number of suspects. A deep neural network (DNN) known as a convolutional neural network is frequently used for NLP and image recognition and processing. The model is trained for gender, age, and emotion recognition from photos using a convolutional neural network architecture.

**Chapter 1**

* 1. **Introduction**

An overview of gender, age, and emotion recognition is given in this chapter. The significance of gender, age, and emotion recognition is also discussed, as well as the part that IT plays in these areas.

* 1. **Overview of gender, age and emotion recognition**

There is now a paradigm shift taking place. For the past few decades, computers have routinely outperformed humans in many daily jobs, and we now rely more and more on them. The whole economy may crash if a bank's database servers went down for any reason and deleted all of its data. We live in an information age where technologies are increasingly used to gather and store data. This data is used by machine learning to discover patterns. It can be used to forecast the weather, assist with credit approval, or suggest a doctor's appointment if an abnormal heartbeat is found.

However, this paradigm shift is currently being driven by the development of deep learning and convolutional neural networks in the area of computer vision, a particular branch of computer science. The rate of image uploads to the internet has been rising significantly over the past ten years. This is driving an increase in computer vision research, along with the fact that high computational power is becoming more widely available to the average user. Now, efforts are being made to research issues that were previously thought to be intractable because of a lack of data or computational capability. These days, cars are capable of driving themselves, detecting pedestrians, and foreseeing or preventing accidents. Even though self-driving cars are a popular issue right now, facial analysis may be even more so. Several functions that are covered by facial analysis can be applied to a variety of situations. For tasks like face detection, pose estimation, age estimation, face recognition, smile detection, gender recognition, and more, there are models available. Machine estimating has frequently surpassed human performance, producing excellent results.

Competitions in artificial intelligence and the IT industry have created a sense of urgency in the desire to research and create the best model. These systems can be used for marketing, security, biometrics, platforms for human-computer interaction, and more.We are gradually moving towards total connectivity with technology, which can now detect and gauge our requirements and traits.

In this situation, facial analysis is crucial because nonverbal communication accounts for a large portion of human communication.

* 1. **Importance of gender, age and emotion recognition**

In the end, facial analysis technologies may transform how we live. When combined with artificial intelligence, it can offer individualised support in every area of life. It can predict our mood when we wake up and, by relating it to our habits, age, and other criteria, recommend the ideal meal for the occasion, the best music to go with that meal, and the ideal outfit, all of which are connected to the weather forecast. Similar to that, when you enter a clothes store, it can automatically recommend the ideal outfit for you based on your age and gender and send a photo of you virtually wearing that outfit to your smartphone. The boring aspects of life will eventually be completely handled by machines. The entire connection and understanding of humans will soon occur, supported by computer vision and facial analysis. In many facial analysis tasks, modern models have really already surpassed human recognition.

* 1. **Role of IT in gender, age and emotion recognition**

Convolutional neural networks (CNNs) are the foundation of all cutting-edge approaches for image-related tasks, including object detection and image categorization. After the introduction of Alex Net by Krizhevsky et al., human face analysis and soft-biometric categorization have grown in popularity. Several computer vision researchers are interested in the topic of such face soft-biometrics, which include age, gender, and facial expression. Deep learning's application to this field has eliminated the necessity for manually created facial features and data pre-processing techniques. D-CNN models have been effectively used for other purposes besides computer vision.

* 1. **Problem Specification**

In the end, facial analysis technologies may transform how we live. United with facial analysis tools may ultimately change the way we live. It can provide specialized assistance in every aspect of life when paired with artificial intelligence. The best cuisine for the occasion, the greatest music to go with that meal, and the optimum outfit- all of which are linked to the weather forecast- may be suggested by it based on our habits, age, and other factors. It can also predict our mood when we wake up. Any mundane part of life will be capable of being handled by robots. Complete human connection and comprehension will soon be possible thanks to facial analysis and computer vision.

* 1. **Problem Statement**

The potential of deep learning can be combined with the already significant role that mobile phones play in our lives to produce user experiences that astonish and delight people. There isn't a decent Android application that uses the convolution neural network to combine the gender, age, and emotion of a human face for facial recognition. The major goal is to provide a system for estimating the age and gender of human faces, which will remain crucial for pattern recognition and computer vision. Facial expression detection is another crucial component of computer vision, in addition to age estimation. For the simultaneous tasks of age estimation, gender recognition, and emotion detection on face photos, this implementation suggests a new framework of convolutional neural networks. Age, gender, and emotion identification are built into an Android application. The frames from the phone's photo capture are pre-processed and sent to the model to complete this task, and the forecast is then shown as a result.

* 1. **Applications**

The following use cases allow for the use of gender, age, and emotion recognition:

* Advertisements: Depending on the age and gender of the caller, the ads may be tailored.
* E-commerce also helps identify suspects in criminal cases, or at the very least, it can reduce the number of suspects because product lists can be changed based on the age and gender of the person on the phone.
* By monitoring client emotional responses, it can offer insightful feedback for in-store promotions, enabling businesses to better classify their products and deliver better customer care.
  1. **Objectives**
* To develop a deep learning model that can accurately recognize emotions in individuals based on their age and gender.
* To improve the accuracy of emotion recognition systems by incorporating age and gender parameters into the analysis.
* To explore the relationship between age, gender, and emotions, and how these variables can affect the accuracy of emotion recognition
  1. **Summary**

As this chapter explains, the system was designed with content customization in mind. The system handles age, gender, and mood prediction.

**Chapter 2 Literature Survey**

The suggested layout adheres to the CNN architecture. A deep neural network (DNN) known as a convolutional neural network is frequently used for NLP and image recognition and processing.

Human age, gender, and emotion detection have been extensively studied. This study's main objective is to examine how various deep learning techniques have been applied in recent years to identify age, gender, and emotion. The accuracy of the results has increased significantly with technological improvement and the use of new approaches.

A breakthrough in "facial emotion recognition using deep convolutional networks" was made in 2017 by Mr. M. Mohammadpour and his group [1]. This study's main objective was to build a model based on facial action units (AUs), which CNN first identified and then used to recognize the seven basic emotional states. They used the Cohn-Kanade database and integrated AU to get the best accuracy rate of 97.01, whereas other studies in the literature used a direct CNN and could only manage an accuracy rate of 95.75%.

According to P. Smith and C. Chen's paper Transfer Learning with Deep CNNs for Gender Recognition and Age Estimation [2], prediction accuracy was increased by transfer learning using both the VGG19 and VGGFace pretrained models by analysing the effects of changes in various design plans and training parameters. This study also shows that using the appropriate model training strategies can result in high accuracy.

In his article " A Quick Overview of Visual Information-Based Facial Emotion Recognition," Mr. Byoung C[3] categorizes approaches into two groups: traditional FER (Facial Emotion Recognition) approaches, which include three steps: face and facial component detection, feature extraction, and expression classification; and novel FER (Facial Emotion Recognition) approaches, which include four steps: face and facial component detection, feature extraction, expression classification, and this is a brief review of facial emotion recognition based on visual information

PCA is applied to PST of short EEG sequences. “Deep Learning Classification of Neuro-Emotional Phase Domain Complexity Levels Generated by Affective Video Film Clips [4]” is the title of a study by Aydin. This study serves as an example of a cutting-edge technique for identifying nine different emotional states.

According to a different article by Milad Mohammad Taghi Zadeh and colleagues titled "Fast Face Emotion Detection Using Convolutional Neural Networks and Gabor Filters [5]”, the Gabor filter really takes the image subfeature and delivers it to the neural network. As a result, the convolutional neural network gathers a large number of subfeatures and improves accuracy by percent when extracting emotions from faces.

It successfully implemented, a method developed by P. Aiswarya and her team that combines the general CNN design with the squeeze net and Xception architectures in a hierarchical approach may be able to recognize seven different types of emotions. Their article, "Emotion recognition by addition of age and gender factors with a unique hierarchical approach employing deep learning, [6]" describes the methodology.   
  
Imane Lasri [7] employed a very sophisticated method for face emotion detection in her paper, "Facial Emotion Recognition of Students Using Convolutional Neural Network," which contained four convolutional layers, four max pooling layers, and two fully connected layers. The system recognizes faces in input pictures and classifies them into seven facial emotions using a Haar-like detector.

Rabie Helaly and colleagues used a method similar to the one used in the previous paper [8] in their "Deep Convolution Neural Network Implementation for Emotion Detection Rabie Helaly and colleagues used a method similar to the one used in the previous paper [9] in their "Deep Convolution Neural Network Implementation for Emotion Detection System" [10], but the training and testing of the models were completely different. To test and validate the accuracy of the stated system, they developed two procedures: model training and testing on the GPU and model testing on an embedded system (the Raspberry Pi 4). When the described system is trained and tested on the GPU, the results are accurate to 94 percent. It also showed that precision was quite high even with simple embedded systems.

**Chapter 3 REQUIREMENT ANALYSIS**

The project's requirements are:

3.1 Functional specifications  
The following list summarizes the functional requirements for deep learning-based gender, age, and emotion recognition:  
• Image capture: A mobile device takes a picture of a person's face to use as input for the prediction.  
• Image preprocessing: For effective recognition, the acquired image needs to be aligned and trimmed.  
• Computing gender, age, and emotion: To compute the gender, age, and emotion of the human in the taken image, the preprocessed image is input to the developed model.  
• Show the result: The user must be shown the computed results.

3.2 Non-functional requirements  
The following are the non-functional requirements for the deep learning-based gender, age, and emotion recognition system:  
• Performance and scalability: The system should operate accurately and efficiently overall.  
• Usability: Taking a selfie is comparable to how it works.  
• Maintainability: If a better dataset is created in the future, the existing dataset can be swapped out for one that is more accurate.

3.3 Hardware specifications  
• Intel Pentium 2 or later Processor.  
• Dual cores at the very least.  
• Memory of at least 8 GB.  
• A 100 GB or larger hard drive.  
• An Android smartphone for the app's testing.

3.4 Software requirements: Flask, NGROK, OpenCV-python, Tensorflow, and Android Studio

3.5 Challenges  
• People from different ethnic groups have varied facial characteristics, which could slightly change the actual age from the anticipated age, which could lead to misclassifications.  
• Wearing glasses could interfere with the traits that are used to classify emotions.  
 . In order to have a better categorization, it is tough and delicate to extract features from one face to another from the database, which may contain gray-scale images of human faces.  
• Overfitting is a minor issue that typically arises when using machine learning or deep learning techniques with a dataset that only contains a small number of face photos.

3.6 Summary   
The problems and the hardware and software components are summarised in this chapter. Each element is crucial, and its implementation requires careful consideration.

**Conclusion and Future Scope**

The suggested frame has contemporaneous, quick, and effective gender, age, and emotion recognition capabilities. As a result, both a Beaker operation to emplace web operations and an Android operation are created. People from different ethnical groups have varied facial characteristics, which could slightly change the factual age from the awaited age, which can lead to misclassifications. By snooping with the learned features, the use of specs may have an impact on emotion bracket.  
The sigmoid function was employed by the models in our exploration, but we enforced it far more effectively by replacing it with a ReLU function, which boosts both speed and delicacy.  
  
We can observe a sizable enhancement in age and gender discovery delicacy when we differ our design and perpetration with the other executions listed in our exploration. Our programme also mixes gender, age, and emotion to produce results that are specifically acclimatized to each stoner's gender, age, and emotion. Our model's effective delicacy for age, gender, and emotion is 93, 80, and 85, independently.  
  
Incipiently, applying this approach to a performing business service would be interesting. This design can be used to outline culprits and help in catching them either as they're committing the crime or after they've escaped, as well as to customize announcements and content on social media, product rosters ine-commerce, and OTT(over-the-top) content in the entertainment assiduity.

Programme testing is a procedure used to estimate the delicacy, thoroughness, and class of the created programme. Testing is the process of probing a product in order to estimate it; the tester asks questions by trying to use the product, and the product responds by carrying in a certain way in response to the tester's delving.  
After development, a testing process is carried out to find all excrescencies, give quality control, and guarantee the responsibility of the product. The system's success depends on testing. During testing, a series of test cases are used to run the programme under test, and the system's geste for each test case is assessed to see if it behaves as intended. It's egregious that the test cases play a pivotal part in determining whether testing is successful in relating problems.  
  
Individual software units and factors are tested as part of the software testing process known as unit testing. The thing is to confirm that each piece of software operates as intended. The lowest testable element of any software is called a unit. It generally has one or further inputs and one affair. An individual programme, function, procedure,etc. can all be considered units in procedural programming. The lowest unit in object- acquainted programming is a system, which can be a part of a base or super class, an abstract class, or a deduced or child class.( Some people consider an operation module to be a unit.)  
  
Unit testing has the following advantages  
  
It boosts confidence when modifying or maintaining law. We'll be suitable to snappily identify any excrescencies introduced by the update if effective unit tests are written and run each time any law is modified. also, the unintended consequences of changes to any law are reduced if the canons have formerly been made to be less interdependent to enable unit testing.  
Canons can be reused more frequently. Canons must be modular in order for unit testing to be possible. Code exercise is eased by this.  
  
A excrescence discovered during unit testing is less precious to amend than a disfigurement discovered at a advanced position. Compare the cost of a problem set up during acceptance testing vs after the software has gone live( time, trouble, destruction, and shame). Testing is simple. Only the most recent changes need to be delved when a test fails.  
Changes made over the course of several days, weeks, or months must be scrutinized for with advanced degrees of testing; canons are more reliable. To a rational person, I believe there's no need to explain this.

Spyder

Spyder is a Python- grounded intertwined development terrain( IDE) that's open- source andcross-platform. The scientific Python mound's most well- known packages, similar as NumPy, SciPy, Matplotlib, Pandas, IPython, SymPy, and Cython, as well as fresh open- source programmes, are all integrated with Spyder. It's distributed under the MIT licence.  
Since 2012, a group of scientific Python inventors and the community have been maintaining and constantly enhancing Spyder, which was first designed and erected by Pierre Raybaut in 2009.  
  
In addition to supporting interactive tools for data examination and embedding Python-specific law quality assurance and soul-searching tools like Pyflakes, Pylint, and Rope, Spyder is expandable using first- and third- party plugins. Through Anaconda, it's available on all major operating systems, including Windows, macOS, and major Linux distributions like Arch Linux, Debian, Fedora, Gentoo Linux, openSUSE, and Ubuntu.  
The Python tapes for PyQt or PySide can be used with Spyder, which uses Qt for its graphical stoner interface. Use of either backend is possible thanks to QtPy, a featherlight abstraction subcaste created by the Spyder design and latterly used by multitudinous other packages.