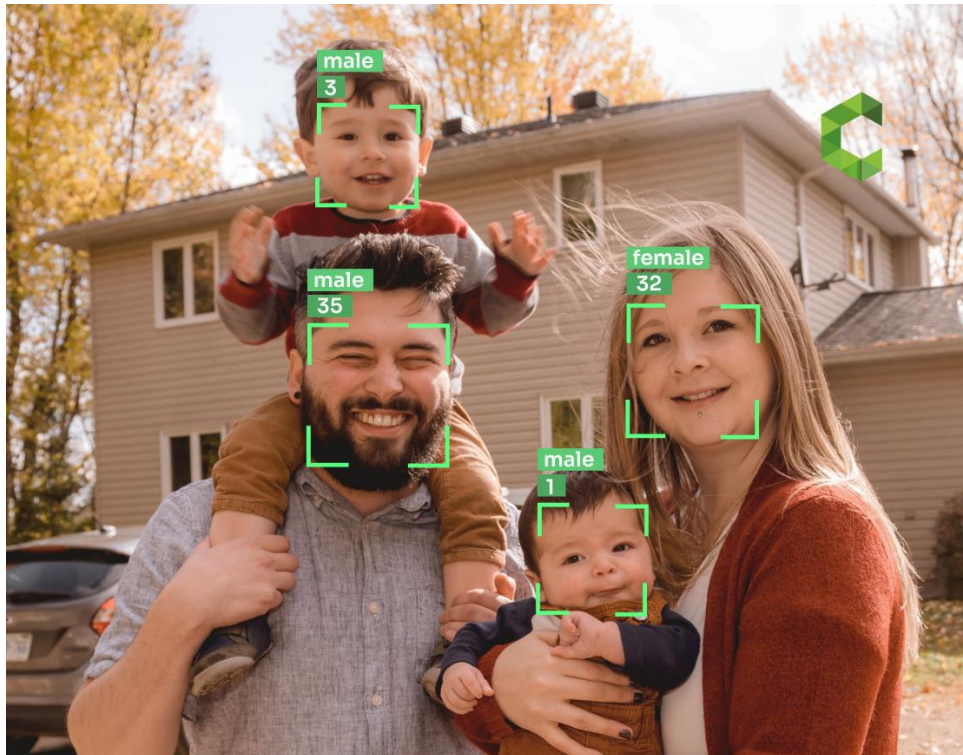


AGE AND GENDER DETECTION SYSTEM



Bachelor of Technology
Computer Science and Engineering (Core)

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TABLE OF CONTENTS

S. No.	Description	Page No.
1.	Introduction & Overview of Age and Gender Detection System	1
2.	What is Artificial Intelligence (AI)?	2
3.	Philosophy of Age and Gender Detection System	4
4.	History of Age and Gender Detection System	5
5.	Application of Age and Gender Detection System	6
6.	Code for the Age and Gender Detection System	7
7.	Terminologies	10
8.	Advantages and Disadvantages	11
9.	Current Scenario/position of Age and Gender Detection System	12
10.	Future aspects of Age and Gender Detection System	13
11.	Conclusion	14
12.	Glossary	15

Age and Gender Detection System

1) Introduction and Overview:

An age and gender detection system using AI/ML is a computer vision technology that utilizes algorithms to identify and classify human faces into different age and gender categories. The system is designed to analyze facial features, such as the shape and structure of the face, skin texture, and wrinkles, to estimate a person's age and gender accurately.

The age and gender detection system can be used in various applications such as security, marketing, and entertainment. In security, the system can be used to identify individuals who are attempting to gain access to secure areas or buildings. In marketing, the system can be used to tailor advertisements to specific age and gender groups. In entertainment, the system can be used to personalize content to individuals based on their age and gender.

AI/ML algorithms are trained using large datasets of labeled images that have been manually annotated with age and gender information. The system uses these datasets to learn and recognize patterns in facial features that correlate with age and gender.

Overall, an age and gender detection system using AI/ML is a valuable tool for identifying and classifying individuals based on their age and gender accurately. It has many practical applications and can improve efficiency and accuracy in a variety of industries.

2) What is Artificial Intelligence?

What is “intelligence”? Can we emulate intelligent behavior in machines? How far can we take it?

The ability of a system to calculate, reason, perceive relationships and analogies, learn from experience, store and retrieve information from memory, solve problems, comprehend complex ideas, use natural language fluently, classify, generalize, and adapt new situations.

2.1 Types of Intelligence:

As described by Howard Gardner, an American developmental psychologist, the Intelligence comes in multiple forms as described in Figure 2 and Figure 3.

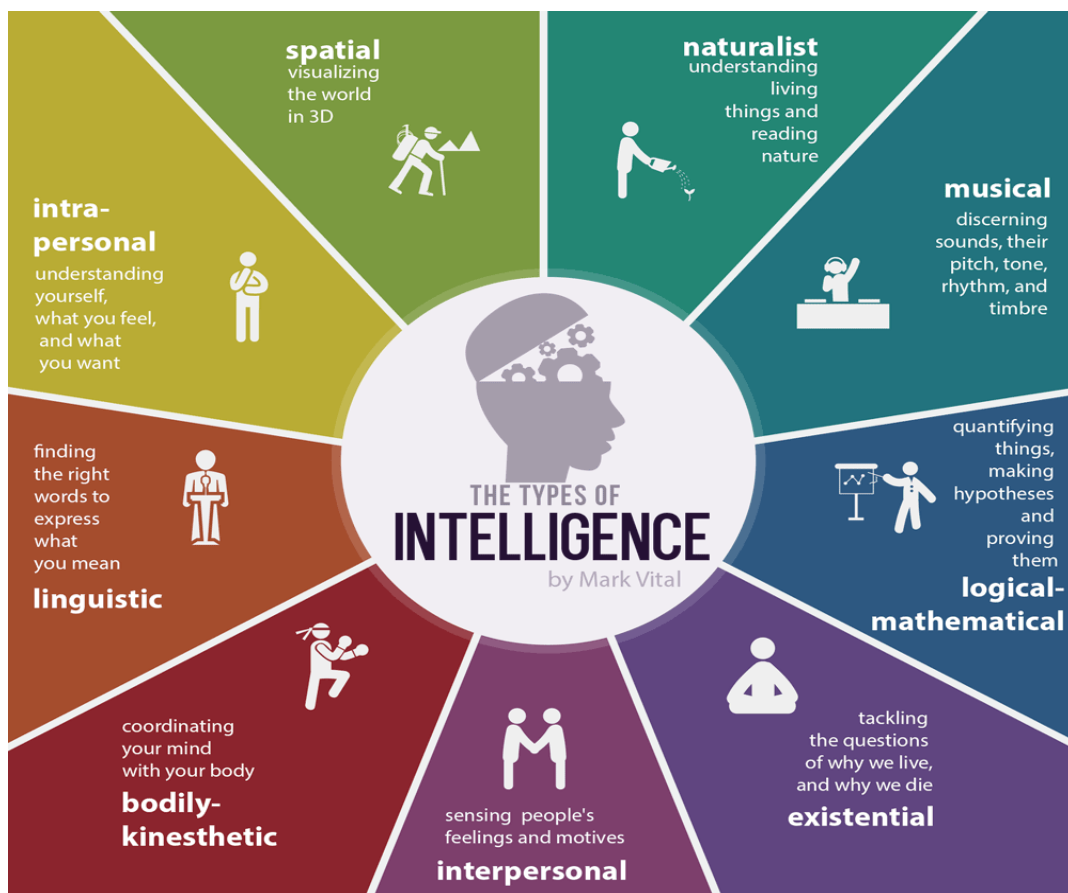


Figure 2: Types of Intelligence

Intelligence	Description	Example
Linguistic intelligence	The ability to speak, recognize, and use mechanisms of phonology (speech sounds), syntax (grammar), and semantics (meaning).	Narrators, Orators
Musical intelligence	The ability to create, communicate with, and understand meanings made of sound, understanding of pitch, rhythm.	Musicians, Singers, Composers
Logical-mathematical intelligence	The ability of use and understand relationships in the absence of action or objects. Understanding complex and abstract ideas.	Mathematicians, Scientists
Spatial intelligence	The ability to perceive visual or spatial information, change it, and re-create visual images without reference to the objects, construct 3D images, and to move and rotate them.	Map readers, Astronauts, Physicists
Bodily-Kinesthetic intelligence	The ability to use complete or part of the body to solve problems or fashion products, control over fine and coarse motor skills, and manipulate the objects.	Players, Dancers
Intra-personal intelligence	The ability to distinguish among one's own feelings, intentions, and motivations.	Gautam Buddha
Interpersonal intelligence	The ability to recognize and make distinctions among other people's feelings, beliefs, and intentions.	Mass Communicators, Interviewers

Figure 3: Description of Intelligence with Examples

3) Philosophy of Age and Gender Detection System:

The philosophy behind age and gender detection systems in AI is based on the idea that the characteristics of the human face can be objectively and accurately analysed by computer algorithms. This philosophy is rooted in the broader belief that AI can be used to automate tasks that are traditionally performed by humans, such as facial recognition and analysis.

From a philosophical perspective, age and gender detection systems raise questions about the ethics and accuracy of using algorithms to classify individuals based on physical characteristics. Some critics argue that the use of AI in this context could perpetuate bias and discrimination against certain groups of people, such as those who do not fit within traditional gender and age categories.

Proponents of age and gender detection systems argue that they can be used for positive purposes, such as improving security and personalizing marketing content. They also contend that the accuracy of these systems is continually improving as algorithms are trained with larger and more diverse datasets.

Ultimately, the philosophy behind age and gender detection systems in AI is shaped by the potential benefits and drawbacks of using technology to automate the analysis of facial features. It is important to consider the ethical implications of these systems and ensure that they are used in a responsible and transparent manner.

4) History of Age and Gender Detection System:

The development of age and gender detection systems using AI/ML can be traced back to the early 2000s. One of the first significant contributions to the field was the work of Paul Viola and Michael Jones, who developed the Viola-Jones face detection algorithm in 2001. This algorithm was one of the first to use machine learning techniques to identify faces in images.

In 2005, researchers at the University of Maryland developed an age detection algorithm based on a combination of texture analysis and support vector machines. This algorithm was able to estimate the age of individuals with an accuracy of around 70%.

Over the next decade, there were numerous developments in the field of age and gender detection using AI/ML. In 2011, researchers at the University of Central Florida developed an age estimation system that used a combination of texture analysis and feature extraction techniques.

In 2015, researchers at the University of Texas at Dallas developed a deep learning-based age and gender estimation system that achieved state-of-the-art accuracy on several benchmark datasets.

In recent years, age and gender detection systems have become increasingly sophisticated, thanks in part to the availability of large, annotated datasets and advances in deep learning algorithms. Today, these systems are widely used in a variety of applications, including security, marketing, and entertainment.

5) Applications of Age and Gender Detection:

- Age and gender detection systems using AI/ML have a wide range of applications in various fields. Here are some examples:
- Security: Age and gender detection systems can be used in security applications to identify individuals who are attempting to gain access to secure areas or buildings. The system can flag any discrepancies between the detected age and gender and the credentials provided by the individual, alerting security personnel to potential security threats.
- Marketing: Age and gender detection systems can be used to personalize marketing content to specific age and gender groups. By analyzing the age and gender of customers, companies can tailor their advertisements and promotions to better meet the needs and preferences of different demographic groups.
- Entertainment: Age and gender detection systems can be used to personalize content in the entertainment industry. For example, streaming services can use this technology to suggest TV shows and movies that are more likely to appeal to individuals of different ages and genders.
- Healthcare: Age and gender detection systems can be used in healthcare applications to monitor the health and wellbeing of patients. For example, the system can analyze the skin texture and wrinkles of patients to estimate their age accurately, which can help healthcare professionals develop more effective treatment plans.
- Education: Age and gender detection systems can be used in educational applications to improve the effectiveness of online learning platforms. For example, the system can personalize learning materials and assessments to better match the age and gender of students, which can help improve engagement and academic performance.
- Overall, age and gender detection systems have numerous practical applications and can improve efficiency and accuracy in a variety of industries.

6) Code for the Age and Gender Detection System:

```
import cv2 as cv
import math
import time
import argparse

def getFaceBox(net, frame, conf_threshold=0.7):
    frameOpencvDnn = frame.copy()
    frameHeight = frameOpencvDnn.shape[0]
    frameWidth = frameOpencvDnn.shape[1]
    blob = cv.dnn.blobFromImage(frameOpencvDnn, 1.0, (300, 300), [104,
117, 123], True, False)

    net.setInput(blob)
    detections = net.forward()
    bboxes = []
    for i in range(detections.shape[2]):
        confidence = detections[0, 0, i, 2]
        if confidence > conf_threshold:
            x1 = int(detections[0, 0, i, 3] * frameWidth)
            y1 = int(detections[0, 0, i, 4] * frameHeight)
            x2 = int(detections[0, 0, i, 5] * frameWidth)
            y2 = int(detections[0, 0, i, 6] * frameHeight)
            bboxes.append([x1, y1, x2, y2])
            cv.rectangle(frameOpencvDnn, (x1, y1), (x2, y2), (0, 255, 0),
int(round(frameHeight/150)), 8)
    return frameOpencvDnn, bboxes

parser = argparse.ArgumentParser(description='Use this script to run age
and gender recognition using OpenCV.')
parser.add_argument("-i", help='Path to input image or video file. Skip
this argument to capture frames from a camera.')

args = parser.parse_args()

faceProto = "opencv_face_detector.pbtxt"
faceModel = "opencv_face_detector_uint8.pb"

ageProto = "age_deploy.prototxt"
```

```

ageModel = "age_net.caffemodel"

genderProto = "gender_deploy.prototxt"
genderModel = "gender_net.caffemodel"

MODEL_MEAN_VALUES = (78.4263377603, 87.7689143744, 114.895847746)
ageList = ['(0-2)', '(4-6)', '(8-12)', '(15-20)', '(25-32)', '(38-43)',
'(48-53)', '(60-100)']
genderList = ['Male', 'Female']

# Load network
ageNet = cv.dnn.readNetFromCaffe(ageProto, ageModel)
genderNet = cv.dnn.readNetFromCaffe(genderProto, genderModel)
faceNet = cv.dnn.readNet(faceModel, faceProto)

# Open a video file or an image file or a camera stream
cap = cv.VideoCapture(args.i if args.i else 0)
padding = 20
while cv.waitKey(1) < 0:
    # Read frame
    t = time.time()
    hasFrame, frame = cap.read()
    if not hasFrame:
        cv.waitKey()
        break
    frameFace, bboxes = getFaceBox(faceNet, frame)
    if not bboxes:
        print("No face Detected, Checking next frame")
        continue

    for bbox in bboxes:
        # print(bbox)
        face = frame[max(0, bbox[1]-padding):min(bbox[3]+padding, frame.shape[0]-1), max(0, bbox[0]-padding):min(bbox[2]+padding, frame.shape[1]-1)]

        blob = cv.dnn.blobFromImage(face, 1.0, (227, 227),
MODEL_MEAN_VALUES, swapRB=False)
        genderNet.setInput(blob)
        genderPreds = genderNet.forward()
        gender = genderList[genderPreds[0].argmax()]

```

```

        print("Gender : {}, confidence = {:.3f}".format(gender,
genderPreds[0].max()))

    ageNet.setInput(blob)
    agePreds = ageNet.forward()
    age = ageList[agePreds[0].argmax()]

    print("Age : {}, confidence = {:.3f}".format(age,
agePreds[0].max()))

    label = "{},{}".format(gender, age)
    cv.putText(frameFace, label, (bbox[0]-5, bbox[1]-10),
cv.FONT_HERSHEY_SIMPLEX, 0.75, (0, 0,255), 2, cv.LINE_AA)
    cv.imshow("Age Gender Demo", frameFace)
    name = args.i
    cv.imwrite('./detected/'+name,frameFace)
    print("Time : {:.3f}".format(time.time() - t))

```

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7) Terminologies:

First introducing you with the terminologies used in this advanced python project of gender and age detection –

What is Computer Vision?

Computer Vision is the field of study that enables computers to see and identify digital images and videos as a human would. The challenges it faces largely follow from the limited understanding of biological vision. Computer Vision involves acquiring, processing, analyzing, and understanding digital images to extract high-dimensional data from the real world in order to generate symbolic or numerical information which can then be used to make decisions. The process often includes practices like object recognition, video tracking, motion estimation, and image restoration.

What is OpenCV?

OpenCV is short for Open Source Computer Vision. Intuitively by the name, it is an open-source Computer Vision and Machine Learning library. This library is capable of processing real-time image and video while also boasting analytical capabilities. It supports the Deep Learning frameworks TensorFlow, Caffe, and PyTorch.

What is a CNN?

A Convolutional Neural Network is a deep neural network (DNN) widely used for the purposes of image recognition and processing and NLP. Also known as a ConvNet, a CNN has input and output layers, and multiple hidden layers, many of which are convolutional. In a way, CNNs are regularized multilayer perceptron.

8) Advantages & Disadvantages of AI :

Advantages of age and gender detection using AI/ML:

- **Accuracy**: AI/ML-based age and gender detection systems can provide high levels of accuracy, especially when trained with large, diverse datasets.
- **Speed**: AI/ML-based systems can analyze large volumes of data quickly, making them well-suited for real-time applications.
- **Personalization**: Age and gender detection systems can personalize content, services, and products to better meet the needs and preferences of different demographic groups.
- **Efficiency**: Age and gender detection systems can automate tasks that would otherwise require significant human resources, improving efficiency and reducing costs.
- **Security**: Age and gender detection systems can improve security by identifying individuals who may be attempting to gain access to secure areas or buildings.

Disadvantages of age and gender detection using AI/ML:

- **Bias**: AI/ML-based systems can perpetuate bias and discrimination against certain groups of people, particularly those who do not fit within traditional gender and age categories.
- **Privacy concerns**: Age and gender detection systems can raise concerns about the collection and storage of personal data, particularly in applications such as security and surveillance.
- **Ethical considerations**: Age and gender detection systems can raise ethical questions about the use of technology to analyze and classify individuals based on physical characteristics.
- **Technical limitations**: Age and gender detection systems may not be accurate or reliable in certain situations, such as when analyzing images with poor lighting or resolution.
- **Lack of transparency**: Some AI/ML-based age and gender detection systems are not transparent in how they make decisions, making it difficult to understand or challenge the system's output.

9) Current Scenario/Position of Technology in IA:

Currently, age and gender detection systems using AI/ML have **become increasingly sophisticated and accurate**. With the availability of large, diverse datasets and advanced algorithms, these systems can provide high levels of accuracy and speed.

Age and gender detection systems are being used in a variety of applications, such as security, marketing, entertainment, healthcare, and education. In the security domain, these systems are being used to improve access control and surveillance. In marketing, they are being used to personalize content and promotions to different age and gender groups. In healthcare, they are being used to estimate the age of patients accurately and develop more effective treatment plans.

However, there are also concerns about the ethical implications of using age and gender detection systems, particularly around issues of bias, privacy, and discrimination. It is crucial to address these concerns and ensure that these systems are developed and used in a responsible and ethical manner.

Overall, the current position of age and gender detection systems is one of significant potential for improving efficiency, accuracy, and personalization in a variety of applications, but also one that requires careful consideration of the ethical implications of their use

10) Future Aspects & Outlook of AI :

The future of age and gender detection systems using AI/ML is promising, with ongoing advancements in technology and research. Here are some potential future aspects of age and gender detection systems:

- **Improved accuracy**: As AI/ML algorithms become more sophisticated and datasets become larger and more diverse, age and gender detection systems will become more accurate and reliable.
- **Integration with other technologies**: Age and gender detection systems can be integrated with other technologies, such as facial recognition and emotion recognition, to provide more comprehensive analysis of individuals and their behaviors.
- **Ethical considerations**: There will likely be an increased focus on the ethical implications of age and gender detection systems, including issues of bias, privacy, and discrimination, which will inform the development and implementation of these systems.
- **Multi-modal analysis**: Age and gender detection systems can be developed to analyze other physical and behavioral characteristics, such as posture, gait, and speech patterns, to provide more comprehensive analysis of individuals.
- **Personalization**: Age and gender detection systems can be developed to provide more personalized content and services, including customized learning materials, medical treatments, and entertainment options.
- **New applications**: Age and gender detection systems can be applied to new fields and industries, such as retail, transportation, and finance, to improve efficiency and accuracy.

In conclusion, the future of age and gender detection systems using AI/ML is exciting, with numerous potential advancements in accuracy, integration with other technologies, and personalization. However, there will also be increased focus on ethical considerations and new applications that will inform the development and implementation of these systems.

11) Conclusion:

In conclusion, the age and gender detection system is an AI/ML-based technology that has significant potential for improving efficiency, accuracy, and personalization in a variety of applications, such as security, marketing, healthcare, and entertainment. These systems have become increasingly sophisticated and accurate, and ongoing advancements in technology and research will likely lead to further improvements in the future.

However, there are also concerns about the ethical implications of using age and gender detection systems, including issues of bias, privacy, and discrimination. It is crucial to address these concerns and ensure that these systems are developed and used in a responsible and ethical manner.

Overall, the age and gender detection system is a promising technology that has the potential to revolutionize a wide range of fields and industries. However, it is important to approach its development and use with careful consideration of its potential benefits and drawbacks, and to prioritize ethical considerations to ensure that it is used in a responsible and equitable manner.

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12) Glossary:

- | | |
|-------------|-------------------------------|
| 1. A.I. | - Artificial Intelligence |
| 2. N.L.P. | - Natural Language Processing |
| 3. M.L. | - Machine Learning |
| 4. IoT | - Internet of Things |
| 5. N.E.I.L. | - Never Ending Image Learner |

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