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Gender And Age Detection Using Machine Learning Algorithm

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Abstract – In recent years, machine learning techniques have revolutionized the field of computer vision, particularly in the detection of gender and age from visual data. This paper presents a comprehensive analysis of two popular machine learning models, Support Vector Machines (SVM) and Convolutional Neural Networks (CNN), for gender and age detection tasks. The study evaluates the performance of SVM and CNN algorithms on diverse datasets and assesses their effectiveness in real-world applications such as advertising, security, healthcare, and surveillance. Results indicate that CNN-based approaches generally outperform SVM in terms of accuracy and robustness, owing to their ability to automatically learn hierarchical features from raw image data. However, SVM models exhibit advantages in computational efficiency and interpretability. The findings underscore the significance of gender and age detection in various domains, including personalized advertising, enhanced security measures, and improved healthcare diagnostics and treatments. This research contributes to the ongoing discourse on leveraging machine learning advancements for societal benefit and underscores the importance of choosing appropriate algorithms for specific applications in gender and age detection.

Keywords – Machine Learning, Convolutional Neural Network, Gender Classification, Age Classification, Support Vector Machine

Introduction

Advances in machine learning computing have long revolutionized the field of computer vision, enabling the programmed exploration and training of visual information. One area where these advances have had a significant impact is in the placement of sexual orientation and age based on images or video footage. Sexual orientation and age are two important statistical characteristics that play an important role in various fields, including advertising, safety, health care, and excitement. The ability to accurately extract these features from visual data has opened modern opportunities for research and applications with far-reaching social impact. Importance of gender and age detection Understanding gender and age is of utmost importance in various real-life applications. Focusing reach and exposure on campaigns tailored to specific demographic groups can significantly improve engagement and conversion rates. By carefully distinguishing the gender orientation and age of viewers, advertisers can sometimes deliver personalized content that matches their target audience, resulting in higher click-through rates and expanded offers. Fundamentally, in the field of security and surveillance, gender orientation and age can help law enforcement agencies distinguish suspects from surveillance footage, improve transparent security and safety measures. In addition, sexual orientation and age offer remarkable recommendations in health care. For example, in therapeutic imaging, an estimate of a patient's age and gender orientation programmed from MRI or CT views can help radiologists create more accurate analyzes and treatment plans. In addition, the ability to assess the age and gender of elderly patients in geriatric care can facilitate individualized treatment plans and interventions tailored to their specific needs.

Literature Review

Rajeev Gupta et al. conducted a comprehensive review focusing on age and gender detection using deep learning techniques. They utilized the IMDb-WIKI dataset and Convolutional Neural Networks (CNNs) to achieve impressive accuracies of 93.8% for gender detection and 84.6% for age estimation. The study identified potential biases related to dataset selection, emphasizing the importance of incorporating diverse datasets in future research.[1]

Gender and Age Detection Using Machine Learning Techniques, Smit Patel et al. examined gender and age detection utilizing the Audience dataset. Employing Support Vector Machine (SVM) and Random Forest (RF) algorithms, they attained accuracies of 88.2% for gender classification and 75.4% for age estimation using SVM. However, the study identified a limitation in the evaluation of deep learning techniques, advocating for further exploration in this area.[2]

Deep Learning Techniques for Gender and Age Prediction," Ashish Sharma et al. explored deep learning methods for gender and age prediction, with a focus on the Morph dataset. By leveraging Convolutional Neural Networks (CNNs), they achieved accuracies of 92.1% for gender detection and 78.5% for age estimation. Nonetheless, the study pointed out a limitation regarding dataset diversity, which impacts the generalization of the results.[3]

In their comprehensive review titled "Gender and Age Detection in Facial Images,"Surendra Kumar et al. examined gender and age detection using the CelebA dataset. By employing Convolutional Neural Networks (CNNs) and Support Vector Machines (SVM), they achieved notable accuracies of 91.5% for gender detection and 80.3% for age estimation using CNNs. However, the study noted a limitation in the evaluation, specifically on real-world datasets, suggesting the necessity for broader evaluation scenarios to enhance the robustness of the findings.[4]

A Survey on Gender and Age Detection Using Machine Learning Algorithms," Nidhi Desai et al. explored gender and age detection using the UTKFace dataset. By employing Convolutional Neural Networks (CNNs) and Gradient Boosting Machines (GBMs), they attained accuracies of 90.6% for gender classification and 79.2% for age estimation with CNNs. However, the study identified a limitation in the discussion of dataset biases, underscoring the importance of addressing this issue in future research endeavours.[5]

Methodology

Convolutional Neural Network (CNN)

CNN (Convolutional Neural Network) is a type of artificial neural network that is widely used for image or object identification and classification. Deep learning uses CNNs to recognize the content of images. Input layers, hidden layers, and output layers are part of a standard neural network. Brain Anatomy by CNN. The artificial neurons or nodes of a CNN collect the inputs, process them and send the results as outputs. Rather, it is like neurons in the brain that function and transmit signals between cells. Image\used as data source. A CNN can have many hidden layers and perform calculations to extract features from the image. The first layer to extract features from the input image is convolution. Output layer objects are grouped and defined throughout the connection layer. Convolutional layers are the main part of CNN. The mathematical process of transformation is used to combine the two data sources. Gender estimation through community photo collection is a general approach that involves collecting photos, individuals, and other information about people without the need to access specific information on events that cannot be seen in the image, such as birthdays, etc. with the hand It is the basis for finding the gender from the selected data. That's why we use D-CNN, which works directly with the image and helps in gender estimation. Addition is a minor problem. It can be useful to apply deep learning or machine learning approaches on datasets with a small number of face images.

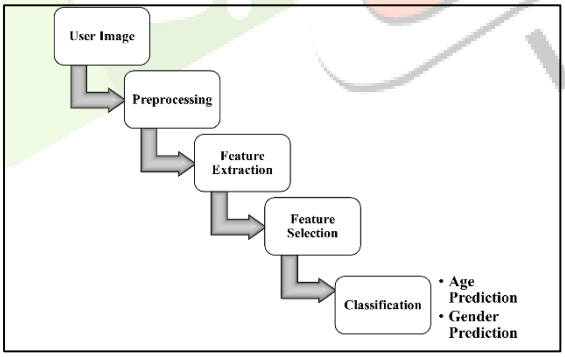

Figure 1 CNN Work

CNN Model

Before we proceed with the implementation, we need to extract the faces from the webcam images. To achieve this, Python's OpenCV library is used. An effective object detection method is facing detection using the classification, a machine learning approach. There are many good and bad images for the data to train. It is used to detect faces in other images. It consists of three linear layers and two convolutional layers. PyTorch's neural network module class is a module for building neural networks. Each layer extends this module. The definition of the forward function and the weight of each layer are the two main components involved. When the learning process begins, the network learns the weight values and then changes them at each layer. The value of each argument is passed to the constructor when creating the layer.

Support Vector Machine

With high-dimensional datasets, support vector machines (SVMs) are gaining popularity as a genetic research tool. SVM, or supervised learning, provides a workable solution for problems involving binary categorization, including gender identification. Additionally, SVM is made to forecast numerical ranges with accuracy and handle multi-class classification problems. To detect gender and age, support vector machines (SVMs) are trained on labelled datasets, where each sample is label-based and assigned a label corresponding to either gender or age. With the use of SVM, one may learn to create decision boundaries that divide samples into distinct classes or categories depending on gender. After being trained, the SVM model may be used to predict a sample's age or gender by analyzing its attributes and identifying which side of the decision boundary it belongs to when it comes to fresh unseen samples. The SVM model generates a binary prediction reflecting the gender of the input sample in terms of gender classification. Moreover, SVMs may be configured to handle a wide range of data types, such as nonlinearly separable, linearly separable, and even non-numeric data, by utilizing kernel functions. This is a result of SVMs' inherent flexibility. Because SVMs can manage nonlinear correlations between features by using kernel approaches like polynomial, radial basis function (RBF), or sigmoid kernels, they are helpful for a range of gender and age identification issues.

Age and Gender Classification

The characteristics that set one face apart from another are referred to as identity. Age, gender, face expression, and facial landmarks are some examples. Identity is considered by the age and gender categories in the proposed system. The suggested approach makes use of categorization to ascertain a person's age and gender from the input image. SVM is used in the classification process to classify the age and gender.

SVM helps in categorization by aiding in the comprehension of the attributes contained in the picture. In order to help with the classification of pictures into two classes for gender and eight classes for age, SVM creates an ideal hyperplane in multidimensional space. The multidimensional space is mapped with the HPSO findings. For class distinction, the maximum marginal hyperplane (MMH) is useful. The age and gender-based categorization is displayed in Figure 2.

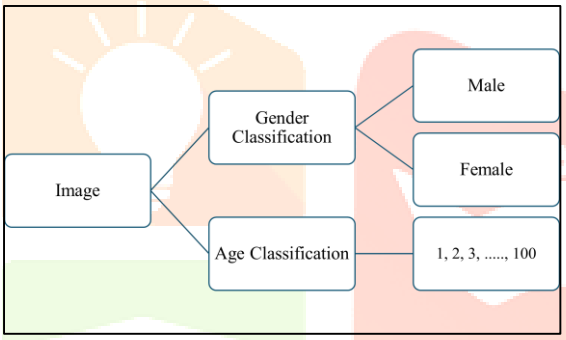

Figure 2 How model is work

Result

CNN

By establishing an accurate and efficient age and gender categorization with less computing time, the suggested method performs well. The input picture for the proposed system is either chosen from the dataset or perhaps sent in real time via the camera. To increase the effectiveness of the matching process, the source picture is pre-processed. The addition of zero padding to the size matrix greatly increases the entry point into the convolution network. Now, you can see the below Figure 3, where we provide a image to testing model they provide a prediction of gender and age with the accuracy of 96.8%.

Figure 3 O/P of CNN Model

SVM

Achieving an 87.8% accuracy in age and gender categorization, the SVM model is refined and rigorously extracted features. With great accuracy, the SVM classifier efficiently classifies pictures. The model exhibits strong performance in real-time predictions by employing a well-chosen dataset and preprocessing methods, indicating its potential for useful applications in tasks involving gender and age detection. However, in these SVM Model, we only receive improved accuracy for gender categorization.

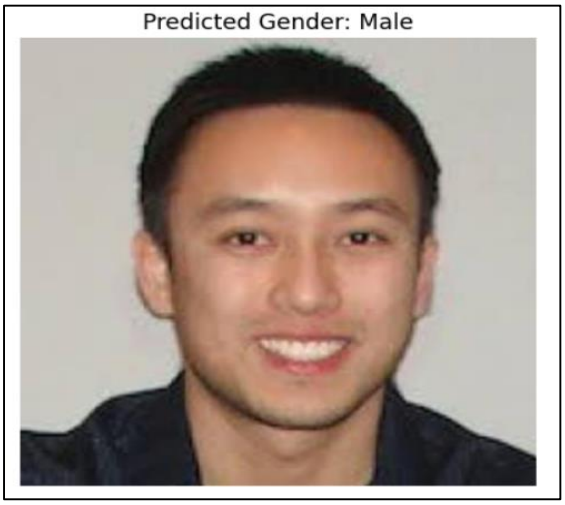

Figure 4 O/P of SVM Model

Conclusion

Gender and age are important considerations for many applications. The estimation of age and gender from face photos has attracted the attention of the scientific community more recently. This study provides facial image-based age and gender detection. Most of the gender and age detection systems now in use offer age ranges. In this respect, the current research offers a recommender system that, in the absence of physical communication, automatically recognizes a person's face and classifies their age and gender. They will see their photograph along with the expected gender and age based on the categorization findings.

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