

PROJECT REPORT

GENDER DETECTION AND AGE PREDICTION

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Overview

The last decade or two has witnessed a boom of images. With the increasing omnipresence of cameras and with the advent of selfies, the number of facial images available in the world has increased exponentially. Consequently, there has been a growing interest in automatic age prediction and gender detection of a person using facial images. We in our project focus on this challenging problem. Gender Detection & Age Prediction using Deep Learning could be used as a useful tool, to estimate age of individual humans quickly through use of this application. Age and gender prediction has become one of the more recognized fields in deep learning, due to the increased rate of image uploads on the internet in today's data driven world. Humans are inherently good at determining one's gender, recognizing each other and making judgements about ethnicity but age estimation still remains a formidable problem. To emphasize more on the difficulty of the problem, consider this - the most common metric used for evaluating age prediction of a person is mean absolute error (MAE). This software project leverages use of Deep Learning concepts such as Conventional Neural Networks (CNN), & Machine Learning concepts such as Logistic Regression. Such applications can be used for social media targeted advertisements for every age group, businesses can identify demographics of their consumers, and also for security identification purposes.

Concepts

- **Conventional Neural Networks (CNN):** It is a type deep learning algorithm that is particularly well-suited for image recognition and processing tasks. It is made up of many layers, including convolutional layers, pooling layers, and fully connected layers. The convolutional layers are the key component of a CNN, where filters are applied to the input image to extract features such as edges, textures, and shapes. The output of the convolutional layers is then passed through pooling layers, which are used to down-sample the feature maps, reducing the spatial dimensions while retaining the most important information. The output of the pooling layers is then passed through one or more fully connected layers, which are used to make a prediction or classify the image.
- **Logistic Regression:** It is a supervised machine learning algorithm used for classification tasks where the goal is to predict the probability that an instance belongs to a given class or not. Logistic regression is a statistical algorithm which analyse the relationship between two data factors. It involves the usage of dependent & independent variables along with sigmoid function. The dependent variable is

categorical & binary (0 or 1). It is used for detection problems such as: fraud detection, emergency detection, spam detection ('spam' or 'no spam') and also disease diagnosis.

- **Training, Testing and Validating Data Sets:** Training is the actual dataset from which a model trains, i.e. the model sees and learns from this data to predict the outcome or to make the right decisions. Testing dataset is independent of the training set but has a somewhat similar type of probability distribution of classes and is used as a benchmark to evaluate the model, used only after the training of the model is complete. The validation set is used to fine-tune the hyperparameters of the model and is considered a part of the training of the model.
- **Mean Absolute Error (MAE):** In simpler terms, MAE calculates the average of the absolute differences between each predicted value and its corresponding true value. It provides a measure of the model's accuracy in terms of how far off its predictions are from the actual values, regardless of the direction of the error (overestimation or underestimation).

Libraries

- **TensorFlow:** It is an open-source machine learning library developed by Google. TensorFlow is used to build and train deep learning models as it facilitates the creation of computational graphs and efficient execution on various hardware platforms. It is basically a software library for numerical computation using data flow graphs.
- **Pandas:** It is a Python library used for working with data sets. It provides functions for analysing, cleaning, exploring and manipulating data. It can make huge messy data sets clean and readable which is very helpful in field of data science and artificial intelligence.
- **Keras:** It is an open-source library high-level Neural Network library, written mainly in Python. It supports Conventional Neural Networks and its other combinations. It is not capable of handling low-level computations, so it makes use of the Backend library to resolve it. The backend library act as a high-level API wrapper for the low-level API, which lets it run on TensorFlow, Theano etc.
- **Matplotlib:** It is a low-level graph plotting library in Python that serves as a visualization utility. It is used for data visualization and statistical analysis.
- **Scikit-learn:** Scikit learn is popular python library for machine learning. It provides simple and efficient tools for data mining and data analysis, implementing a wide range of supervised and unsupervised learning algorithms. Scikit learn is a widely used for

tasks such as classification, regression, clustering, dimensionality reduction, and model selection.

- **Numpy:** NumPy is the fundamental package for scientific computing in Python. It is a Python library that provides a multidimensional array object, various derived objects (such as masked arrays and matrices), and an assortment of routines for fast operations on arrays, including mathematical, logical, shape manipulation, sorting, selecting, I/O, discrete Fourier transforms, basic linear algebra, basic statistical operations, random simulation and much more. At the core of the NumPy package, is the *ndarray* object. This encapsulates *n*-dimensional arrays of homogeneous data types, with many operations being performed in compiled code for performance.

Dataset Information

UTKFace dataset is a large-scale face dataset with long age span (range from 0 to 116 years old). The dataset consists of over 20,000 face images with annotations of age, gender, and ethnicity. The images cover large variation in pose, facial expression, illumination, occlusion, resolution, etc. This dataset could be used on a variety of tasks, e.g., face detection, age estimation, age progression/regression, landmark localization, etc. The objective of the project is to detect gender and age using facial images. Convolutional Neural Network is used to classify the images. There are 2 output types namely, gender (M or F) and age.

Download link: <https://www.kaggle.com/datasets/jangedoo/utkface-new>

Environment: Kaggle

Neural Network

- Convolutional Neural Network (CNN)

Gender Accuracy: 90.00 %

Age Mean Absolute Error (MAE): 6.5 years

Conclusion

In conclusion, our deep learning project utilizing Convolutional Neural Networks (CNNs) successfully achieved gender detection and age prediction tasks with a reasonably high degree of accuracy. By leveraging CNNs, we effectively extracted features from facial images, enabling accurate classification & detection of gender and prediction of age. This project demonstrates the efficacy of CNNs in addressing complex tasks in computer vision, offering promising applications in various domains such as security, marketing, and personalized user experiences.

