

# **PROJECT REPORT & SYNOPSIS**

## **GENDER DETECTION AND AGE PREDICTION**

SUBMITTED IN COMPLETE FULFILLMENT OF THE  
REQUIREMENTS FOR THE AWARD OF THE DEGREE  
OF  
BACHELOR OF TECHNOLOGY  
IN  
**COMPUTER ENGINEERING**

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## **Synopsis**

The project focuses on utilizing deep learning and machine learning techniques to address the challenging problem of automatic age prediction and gender detection using facial images. With the exponential increase in the number of images due to the widespread use of cameras and selfies, there has been a growing interest in developing tools for analyzing and interpreting these images. Despite humans' innate ability to determine gender and recognize individuals, accurately estimating age from facial images remains a formidable task. The project aims to leverage Convolutional Neural Networks (CNNs) and Logistic Regression to develop a software application capable of predicting age and detecting gender from facial images. The success of this project could have significant implications for various domains, including targeted advertising, demographic analysis, and security identification.

## **Introduction**

In recent years, the surge in image data, fueled by the ubiquity of cameras and the popularity of selfies, has prompted a renewed interest in developing tools for analyzing and interpreting facial images. Among the most challenging tasks in this domain are automatic age prediction and gender detection. Despite humans' innate abilities in recognizing gender and identifying individuals, accurately estimating age solely from facial images remains an elusive goal. This project seeks to tackle this challenge head-on by leveraging the power of deep learning and machine learning techniques.

The proliferation of image data on the internet has made deep learning methods, particularly Convolutional Neural Networks (CNNs), increasingly popular for image analysis tasks. Alongside these techniques, traditional machine learning approaches like Logistic Regression are also being explored for their potential in age prediction and gender detection.

To emphasize the significance of the problem, the project highlights the difficulty of evaluating age prediction accuracy, often measured using metrics such as mean absolute error (MAE). By minimizing this error, the project aims to enhance the accuracy of age prediction and gender detection, thus unlocking a myriad of potential applications.

The introduction sets the stage for the project by outlining the background of the problem, the motivation behind it, and the technological approaches employed. Furthermore, it underscores the potential impact of the project's outcomes in various real-world scenarios, ranging from targeted advertising to security identification.

## **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:** 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)

## **Results**

**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.

