EUROPEAN UNIVERSITY OF LEFKE

FACULTY OF ENGINEERING

Graduation Project I

AGE DETECTION USING DEEP LEARNING MODELS

SALEM SARTAWI

20140004

Unleashing the Power of Deep Learning within the age detection , Us as people can sometimes guess and estimate people's age around us in my project am creating a convolution neural network - CNN deep learning model that can do this for us , motivation behind this project is to provide a highly precise tool for age classification , showing how strong the computer science technology and future is and how can developing a model can estimate an age of a human using the power of the deep learning .

Supervisor

VESILE EVRIM

Publish Date

Table Of Contents

1.Introduction

1.1 Project Definition and Overview

My focus is not on solving a traditional problem but on pushing the boundaries of what technology can achieve in the realm of age estimation.

This project doesn’t address a problem but rather than demonstrating the capability of the modern technologies through the lens of computer science , we will dive into the new technology and the art of the CNNs showing the power of deep learning models aiming to highlight the remarkable potential and advancement in this field.

In this technological journey i will leverage CNNs into a peak of machine learning to dive into age detection , concentrating in features that these network forefront and the ability to automatically learn hierarchical representations from data which serves as the backbone of my journey.

Features extraction that are taken out of face photos are essential for many uses, such as CCTV and access control. A face image is a single point from which various attributes can be derived, including age, gender, race, and emotional state. If one could predict the age from people's facial images in real time, one would be able to control the content of the media that is read based on their age . Similarly, based on the customer's age and prediction, automatic prediction of age would help provide better buying preferences.

Conventional machine learning techniques frequently include the manual definition of features, which may not always result in the best possible representations for the issues at hand. However, little processed input can be assumed by deep neural networks for image recognition, such as CNN, which then use a training process to determine the ideal network configuration. A unique kind of feed-forward network called a convolutional neural network is mainly used to evaluate visual imagery . Convolutional neural networks are composed of neurons with learnable weights and biases, and they resemble ordinary neural networks in many ways. CNN distinct methodology allows them to outperform other deep neural network architectures in terms of performance. To comprehend an image, CNN aggregate several pixels together rather than examining each pixel separately.

1.2 Goals

- Improving the accuracy within the CNN base model for it's the unparalleled precision in such a project and dataset with a focus on improving overall accuracy , the diverse age annotations with the dataset ill be using in this project.
- Integrating the age detection model into the real world applications and scenarios on the practical insights derived from the dataset deep range collection of the facial images.
- evaluate and compare the performance of different CNN architectures in the realm of age detection, using the dataset I will choose as a benchmark.
- Investigate and contrast different methodologies employed in age detection, ranging from feature extraction techniques to training strategies, within the context of the dataset, Exploring how different CNN architectures and methods perform across diverse demographic groups within the dataset, ensuring a comprehensive understanding of their adaptability pushing the boundaries of age prediction accuracy within the dataset.
- Predicting the age range rather rather than absolute age going through different CNN architectures .

2. Literature Survey

Compare1 :

Convolutional Neural Networks (CNNs) have been used actively in age detection research projects to evaluate facial features and provide age predictions. One significant effort, for example, used a CNN-based method to estimate age from face photos (Abdullah M. Abu Nadaet 2020). Although the basis for accurate age prediction was established by their work, my effort stands out for its comparative comparison of several CNN architectures and methodological decisions. In contrast to earlier research, my goal is to investigate the effects of various feature extraction methods, training plans, and ethical issues in order to provide a more thorough picture of the state of age prediction.

Compare2:

In contrast to some existing projects that primarily focus on individual aspects of age prediction, our project adopts a holistic approach similar to the work of (Vincenzo Carletti, 2019). While their emphasis may be on specific CNN architectures, my project aims to provide a thoroug investigation into the interplay of methodologies, including feature extraction, training shtrategies, and ethical considerations. By doing so, we anticipate not only enhancing the accuracy of age prediction but also contributing valuable insights for future research and practical applications.

3. Background Information

3.1 Required software

- **Deep Learning Frameworks:**

  TensorFlow and Keras: These frameworks serve as the backbone for implementing and training.

  Tensorflow -> provides a comprehensive library for machine learning tasks

  Keras -> Keras acts as an interface for the TensorFlow library.

- **Python Programming Language:**

  A vast library ecosystem, and widespread adoption in the machine learning community make it an excellent choice for developing and experimenting with our age detection models.

- **IDE:**

  Spyder an (IDE) for scientific programming in the Python language. Spyder integrates with a number of prominent packages in the scientific Python stack, including NumPy, Matplotlib.

- **Visualization Tools:**

  Matplotlib library in python which will show us the visual presentation.

3.2 Other softwares

Needed for high CPU

- Google Colab -> is a free online service that lets you write and execute Python code in your browser, with access to GPUs and TPUs

4. Modules

4.1 Choosing An image Data Set module

A large number of identified images would be required in order to train a highly accurate deep learning model many different labelled images dataset around the network .

This module responsible for managing and preparing the dataset, a critical component for training the age detection model. This module ensures that the model is exposed to diverse and high-quality facial data, contributing to its ability to make accurate predictions.

Datasets	Summary	Quantity	Labels	Source
CK+ (2010)	Most extensively used laboratory-controlled facial expression database available	593 video sequences from 123 subjects, with variety of age, genders and heritage	Separate folders with 7 expression classes: anger, contempt, disgust, fear, happiness, sadness, surprise	https://paperswithcode.com/dataset/ck
UTK Faces (2017)	Dataset contains cropped faces, labelled by age, gender, and ethnicity	23,708 RGB images of faces in JPG format of size 200x200 pixels each	Image labels are embedded in the file names, formatted like: [age]_[gender]_[race]_[date&time].jpg	https://susanqq.github.io/UTKFace/
IMDB-WIKI (2015)	Largest public dataset for age prediction to date	500k+ face images taken from IMDb and Wikipedia	Age and gender labels of celebrities/public figures	https://data.vision.ee.ethz.ch/cvl/rrothe/imdb-wiki/
Labeled Faces in the Wild (2018)	Benchmark for face verification and pair matching	Size is 173MB, consisting of over 13,000 images in 250x250 jpg format	Each face labeled with name of the person pictured. 1680 of the people pictured have two or more distinct photos in the dataset.	http://vis-www.cs.umass.edu/lfw/
Facial Age (2018)	Structure of this dataset is very simple and easy to use	9,778 RGB images of faces in PNG format of size 200x200 pixels each	Images are separated into folders and the folder names correspond to the age labels of images inside those folders	https://www.kaggle.com/frabbisw/facial-age
All-Age Faces (2019)	Dataset contains face images (mostly Asian) distributed across all ages (from 2 to 80)	13,322 images, including 7381 females and 5941 males	Images are labelled with person serial numbers. Separate annotation file with serial number mapping with Age/Gender	https://github.com/JingchunCheng/All-Age-Faces-Dataset

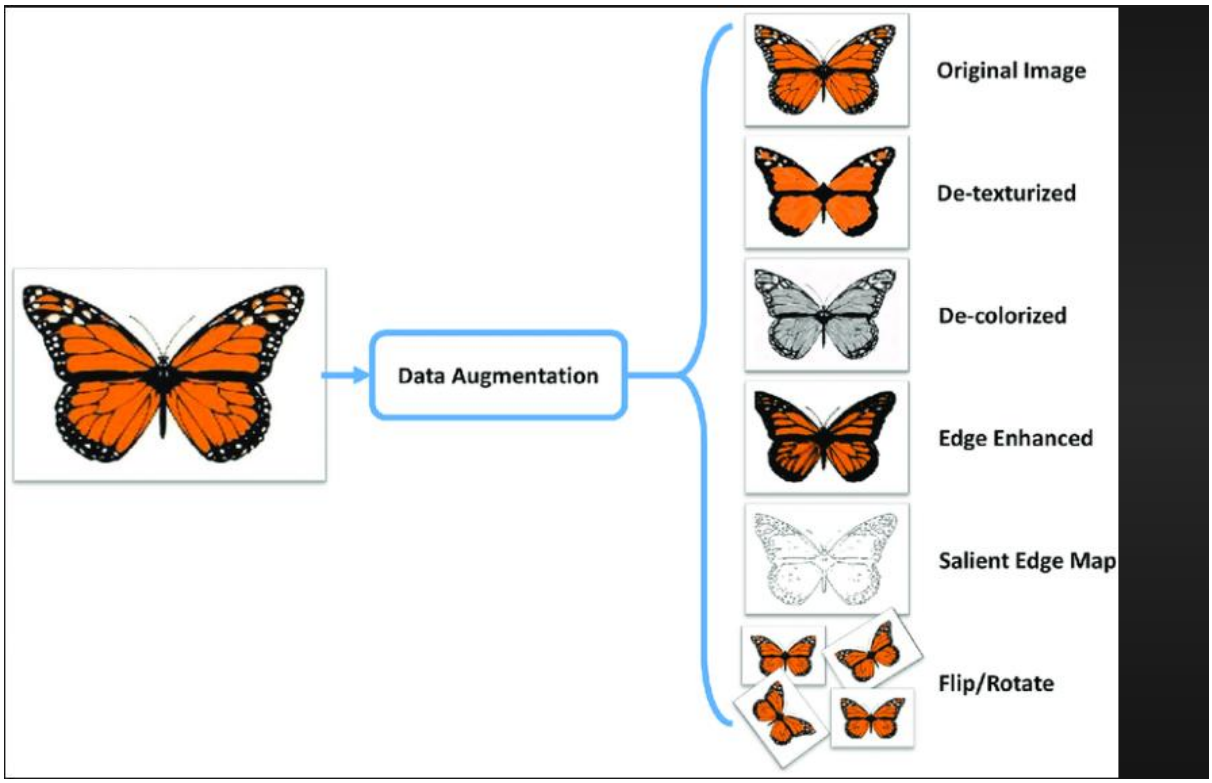
4.2 Image loading module:

allocated to tasks that improves the dataset's quality and use for training

Responsible for loading facial images from the dataset, ensuring a comprehensive set of images representing various individuals.

4.3 Dataset agumentation module :

Implementing data augmentation strategies, such as rotation, scaling, and flipping, to artificially increase the diversity of the dataset. Augmentation helps the model generalize better to different facial orientations and expressions. By this technique will hopefully expand our data.



4.4 Image convert to grayscale :

convert all the training set to grayscale to reduce the computational power we will need for this model.

4.5 Intuitively defining the age classes:

A critical step in predicting age ranges instead of absolute ages. By grouping individuals based on shared facial features, this process simplifies the age prediction task while aligning with real-world business needs.

4.5.1 Facial Feature Analysis:

Analyzing facial characteristics to identify features that exhibit age related patterns.

4.5.2 Age Grouping Strategy:

Develop a strategy for grouping ages based on observed facial features. Consider factors such as wrinkles, facial contours, and other indicators of aging.

All of the above could be considered as a submodule of the first module but since my process has many steps ive splited them into separate modules

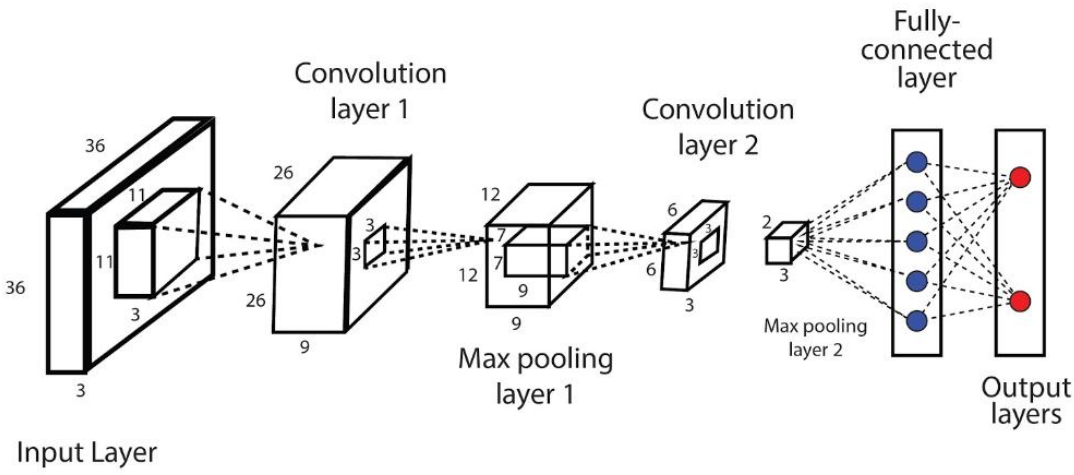
4.6 The Use of the CNN based deep learning approaches

focuses on leveraging state-of-the-art CNN architectures and techniques to build a robust age detection model. By carefully selecting models, implementing transfer learning, and optimizing hyperparameters, this module aims to achieve high accuracy and effective generalization.

4.6.1 Model Architecture Selection

A thorough selection of (CNN) architectures specifically designed for age identification is part of this submodule. Exploring and selecting CNN models that are well-known for working well with images.

Exploring popular CNN architectures that are appropriate for image classification problems, especially those that are related to age detection then comparing with other CNN architectures considering the factors .



4.6.2 Transfer Learning Implementation

Pre-trained model Selection Transfer learning can enhance the model's performance by leveraging knowledge gained from tasks similar to age detection.

Validation set Analysis using a validation set to assess the impact of hyperparameter choices on model performance. Make adjustments for improved generalization.

5. Risk Analysis

5.1 Data Quality and Quantity

poor-quality data may hinder model training and affect prediction accuracy.

5.2 Overfitting

The model may overfit to the training data, leading to poor optimazation on new data.

5.3 Computational Resources

Insufficient computational power may slow down model training or limit the exploration of complex architectures.

5.4 Training Time

Training large CNN models may require significant time, affecting project timelines.

5.5 Hardware Failures

This kind of failures may lead to data loss or disruption in model training.

5.6 Model Interpret ability

Deep learning models, particularly CNNs, can be challenging to interpret, leading to difficulties in understanding model decisions..

6. Ethics

- Respect the privacy of those whose face data is utilized to train the model. Put policies in place to protect and anonymize personal data, get people's informed consent by explaining the usage of their data and the reason behind age detection.

- Keep an effort to make the model's decision-making process transparent so that users understand how age detection are determined, recognize the limitations of age detection methods and inform users that the results are approximations and might not be exact.

- Avoid stigmatization implement measures to prevent the stigmatization of individuals based on age predictions, emphasize positive use cases and benefits, community awareness engage with the community to understand concerns and perceptions related to age detection technology.

- long-term Impact consider the potential long-term impact of age detection technology on individuals and society, taking steps to mitigate negative consequences.

Legal Adherence: Comply with all applicable laws and rules when using facial recognition technology to determine an age. Keep updated of any changes to regulations in the area.

7. Conclusion

7.1 Benefits

a. Benefits to users :

1. Enhanced Age Prediction Accuracy : The implementation of deep learning models, specific Neural Networks (CNNs), has demonstrated promising results in accurately predicting age ranges.

2. Real world applications : using the age predication can be in various and different applications.

b. Benefits to me :

1. Going through the new technologies and discovering the power of computer science which this kind of project will get me some advanced skills within the new tools and skills in technology.

2. Learning and comparing the different CNN architectures and dive into these types of deep topics.

3. Improving and applying my understandings in machine learning and neural networks

Why did I choose this project?

Taking this kind of project as my graduation project is rooted from my constant curiosity and eagerness to get through the latest advancements in my department and computer science . This project presents a dynamic learning opportunity , allowing me to dive into the latest technologies and what I find out is choosing deep learning will be suitable for me as a start to these kind of deep topics in computer science . As the technology evolves so this landscape and this project serves as a start platform for me to get some experience and develop my skills in deploying the deep learning art models for the real world applications . exploring through the challenges of age detection through deep learning models attracts my interest and fuels my motivation to learn by pushing myself into this project , I aspire witnessing the practical implication of age detection which will help me keeping up with the latest technological trends.

7.2 Future Works

Going through this kind of projects desires with my interests and plans after graduation specially the topics which includes machine learning , big data , data science . Age detection with deep learning project lays the foundation for my future explorations.

Refinement skills of machine learning planning to undertake projects dives deeper into advanced algorithims exploring big datasets.

8. References

[1] : Nada, A. A., Alajrami, E., Al-Saqqa, A. A., & Abu-Naser, S. S. (2020). Age and gender prediction and validation through single user images using CNN. Int. J. Acad. Eng. Res.(IJAER), 4, 21-24.

[2] : Aydogdu, M. F., Celik, V., & Demirci, M. F. (2017, January). Comparison of three different CNN architectures for age classification. In 2017 IEEE 11th international conference on semantic computing (ICSC) (pp. 372-377). IEEE.

[3] : Abirami, B., Subashini, T. S., & Mahavaishnavi, V. (2020). Gender and age prediction from real time facial images using CNN. Materials Today: Proceedings, 33, 4708-4712.

[4] : Aydogdu, M. F., & Demirci, M. F. (2017, May). Age classification using an optimized CNN architecture. In Proceedings of the International Conference on Compute and Data Analysis (pp. 233-239).