

Literature Review: Age detection using neural networks and machine learning

Darab Qasimi
Daqasimi18@earlham.edu
Earlham College
Richmond, Indiana, USA

ABSTRACT

Age detection using neural networks and machine learning is a capstone project that'll be written in form of a program to detect a human subject's age from a photo. The project will rely on online resources and most of the methods which will be used on this project will be implemented internet resources such as research papers, thesis papers, and blogs.

ACM Reference Format:

Darab Qasimi. 2022. Literature Review: Age detection using neural networks and machine learning. In *Proceedings of ACM Conference (Conference'17)*. ACM, New York, NY, USA, 2 pages. <https://doi.org/10.1145/nnnnnnnn.nnnnnnnn>

1 INTRODUCTION

My Computer Science capstone project will study 'Age detection using neural networks and machine learning.' Neural networks are computing systems where machines learn from data, and based on found patterns, machines derive conclusions. Neural networks use interconnected nodes in a layered structure inspired by how human neurons work. Companies such as Google use neural networks and machine learning to identify the right person to pass through security or predict somebody's reaction to a situation. As part of using machine learning, the program will be trained using a dataset [1] that contains photos of people from different age groups. After the model is trained, it will be tested with a quarter of photos from the dataset that was not used for training. Then, for the purpose of detecting age, machine learning concepts will be used to guess a person's age from their provided photo to the program.

2 DEEP LEARNING

As part of my research I'll be using multiple resources to further my analysis and understanding of programming. Age Estimation from Faces Using Deep Learning [3] written by Othmani et al estimates age using deep learning methods. The article compares many different Convolutional Neural Network (CNN) algorithms based on their performance in detecting age. In the datasets that are used for the experiment the robustness of the best deep estimator is evaluated under noise, expression changes, different ethnicity, and different genders. A layer-wise transfer learning evaluation is done

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.

Conference'17, July 2017, Washington, DC, USA

© 2022 Association for Computing Machinery.

ACM ISBN 978-x-xxxx-xxxx-x/YY/MM...\$15.00

<https://doi.org/10.1145/nnnnnnnn.nnnnnnnn>

to study the optimal number of layers to fine-tune on Automatic Age Estimation (AAE). In the research paper's experiments the results demonstrate the high performance of the popular convolutional neural network frameworks against the state-of-art methods which are the highest level of development of automatic age estimation. This work is related to my project because I'll be looking at image analysis through convolution neural network where I'll also be working on finding the optimal number of layers to produce the best result in AAE.

3 UNSUPERVISED LEARNING

Writing a program that can work unsupervised is vital in a program such as age detection to allow the algorithm learn useful patterns and structural properties of data. In Age Prediction Using Image Dataset Using Machine Learning [6] by Verma an unsupervised Convolution Neural Networks (CNNs) has been used for image processing and age detection. A CNN that handles multitasking, facial detection and emotional classification, is made by combining CNN and other algorithms and approaches. In the research, the object's face is first detected, then extracted from the photo, meaning the photo's background is eliminated first. If I decided to write an unsupervised machine learning program, Age Prediction Using Image Dataset Using Machine Learning research would be an approach I would take, but I'll be using unsupervised analysis concepts only. Some of the programming methods that are used in unsupervised machine learning are similar to some of the methods of programming in supervised method, and I'll make use of the similarities to implement supervised machine learning.

4 FACIAL FEATURES

In age detection, it's important that the program detects facial features of a person in a photo, because facial features of a person changes as they age. In Age estimation using deep learning [7] human facial features such as posture, vocabulary, wrinkles, and intonation are seen as elements of facial analysis and age estimation [7]. The research presents facial image age estimation based on autoencoders which is an artificial neural network used for unsupervised learning. One of the age estimation methods used in the study uses autoencoders, where a network of artificial neurons learns a hidden representation to reconstruct its inputs. For the purpose of my project, I find it interesting to learn autoencoders and unsupervised learning, where the algorithm keeps learning from any image input even after training it with a test dataset. I'll be using some of the concepts that are presented in the cited source as a comparison to how I'll be implementing a supervised method of analysis and machine learning to create more understanding of the differences between the two methods.

5 DEEP LEARNING AND PHOTO DIMENSION CONVERSION

Age and Gender Detection Using Deep Learning [?] is a research paper that has used deep learning to predict the age of a person from photo. The dataset used in the research is comprised of age, gender, image, and pixels that are stored in .csv format and analyzed in Python programming language. Using Keras, an open-source Neural Networks library, images are processed to detect age and gender. After reading the dataset's data, photos' dimensions are converted to 48 by 48 to standardize images and sharpen the precision of age detection. Some of the program libraries in python, coding techniques, and machine learning implementation used in the blog are close to how I want to implement the programming side of my capstone. I'll use open-source python libraries on my dataset, then I'll standardize the size of photos in the dataset, and I'll analyze images based on their pixels and characteristics.

6 TRAINING WITH DATASET

Deep Age Estimation: From Classification to Ranking [2] is a research paper that has studied methods of human face analysis and age prediction. The images in the dataset have been categorized and each different approach of CNN has been trained with ordinal age labels. The study has used two methods of CNN: the first one is pre-training the program with facial images and secondly fine-tuning with age-labeled faces. In the photo analysis, many features are studied, such as the distance of eyes from mouth to train AI with features that are easily noticeable to humans. The paper is very well organized in modeling how photos are analyzed and how the algorithm works. I'll use the paper to learn organizing skills in a research paper, and how each stage of image analysis can help in increasing precision in predicting the age of a person based on their photo.

7 MAX POOLING

In neural networks methods such as max pooling can increase the accuracy of a program. In Qiu [4] Convolution Neural Networks (CNN) have been used to predict age based on a given image to a program. In the thesis, multiple layers of CNN are used to analyze an image, and after analysis, through the filters, a prediction of age is given to the user. When an image is given to the program, first, a 4X4 patch of the image is used for analysis which is then down-sampled to a 2X2 patch by putting through the max pooling layer. This way, the center of the image, which most often shows a person's face, is used for age analysis and prediction. Based on how the cited thesis is structured, it would be helpful for my research if some ideas are implemented, such as max pooling. Methods such as max pooling will give my project more precision in predicting a person's age from a provided photo.

8 CONCLUSION

Age detection using neural networks and machine learning project will heavily rely on analysis of photos. The program will initially be trained with the photos from the dataset and later part of the dataset will be used for testing the accuracy. Currently the plan is to use supervised CNN in the program with two to three layers of convolution. Besides, max pooling will be used for calculating

and taking the maximum value from each selected patch of a photo that shows the most present feature of a photo which will also help to get rid of the portions of the photo that aren't supposed to be highlighted such as the background of a photo. Meanwhile, the program will also take facial features of a person in the photo as an important consideration in predicting the age of a person.

REFERENCES

- [1] 2020. *Faces: Age Detection Dataset*.
- [2] Shixing Chen, Caojin Zhang, and Ming Dong. 2017. Deep age estimation: From classification to ranking. *IEEE Transactions on Multimedia* 20, 8 (2017), 2209–2222.
- [3] Alice Othmani, Abdul Rahman Taleb, Hazem Abdelkawy, and Abdenour Hadid. 2020. Age estimation from faces using deep learning: A comparative analysis. *Computer Vision and Image Understanding* 196 (2020), 102961.
- [4] Jiayan Qiu. 2016. *Convolutional neural network based age estimation from facial image and depth prediction from single image*. Ph.D. Dissertation. The Australian National University (Australia).
- [5]]sonia2021age Sonia Singla. [n. d.]. Age and Gender Detection Using Deep Learning.
- [6] Ishita Verma, Urvi Marhatta, Sachin Sharma, and Vijay Kumar. 2020. Age Prediction using Image Dataset using Machine Learning. *International Journal of Innovative Technology and Exploring Engineering* 8 (2020), 107–113.
- [7] Soumaya Zaghibani, Noureddine Boujneh, and Med Salim Bouhlel. 2018. Age estimation using deep learning. *Computers & Electrical Engineering* 68 (2018), 337–347.