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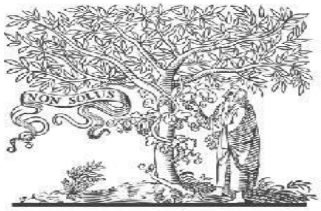

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IJIEMR Transactions, online available on 05th Apr 2023. Link :http://www.ijiemr.org/downloads.php?vol=Volume-12&issue=Issue 04

10.48047/IJIEMR/V12/ISSUE 04/07

Title **CYCLEGAN AGE REGRESSOR**

Volume 12, ISSUE 04, Pages: 45-51

Paper Authors
Dr.N.Sri Hari, Shaik Nelofor, Siramdasu Leela Vardhan, Sura Rana Prathap Reddy, Sakhamuri Devendra

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CycleGAN Age Regressor

Dr.N.Sri Hari[1], Associate Professor, Department of CSE,
Vasireddy Venkatadri Institute of Technology, Nambur, Guntur Dt., Andhra Pradesh.

Shaik Nelofor[2], **Siramdasu Leela Vardhan**[3], **Sura Rana Prathap Reddy**[4], **Sakhamuri Devendra**[5]
[2,3,4,5] UG Students, Department of CSE,
Vasireddy Venkatadri Institute of Technology, Nambur, Guntur Dt., Andhra Pradesh.
[1,2,3,4,5] **E-Mail ID: nshari2011@gmail.com, neloforshaik5@gmail.com, pslvvardhan@gmail.com, ranareddy025@gmail.com, devendrasakhamuri@gmail.com**

Abstract

The use of technology in the last decades has been shooting up to the sky. Everything is interlinked with technology. As the world is moving faster towards technology, humankind is also changing their regular needs with technology. The technology involved in the processing of the image is been extremely popular. Image processing is one of the innovative and creative methods to deal with the amazing outcome of the images. This project involves the technology of image processing, in which deep learning is being used. There has been a major problem in predicting the age of a person just by looking at them. The technology is so developed, that we can do anything using it. This project not only predicts the age of a person but also can-do age progression on the image that is, we can see how the child will age and how the old looks in his child's age. The use and development of this project are by machine learning algorithms and models. A subfield of artificial intelligence and computer science called "machine learning" focuses on using data and algorithms to mimic how people learn, gradually increasing the accuracy of its predictions. A key element of the developing discipline of data science is machine learning. GANs of the machine learning model is used in this project. Generative Adversarial Networks are a method of generative modelling that creates new data from training data that closely resembles training data. Two competing core blocks in GANs are able to copy, collect, and analyse changes in a dataset. Typically, the two models go by the names Generator and Discriminator. In this project CycleGANs are used, like in GANs similarly in CycleGANs there are two generator and discriminator models.

Keywords: Age Prediction, Age Progression, Age Regression, CNN, CycleGAN, GAN

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Introduction

From the earliest stone tools to the latest advances in artificial intelligence, robotics, blockchains, and virtual reality, technology has continuously transformed our lives. Technology, or as it is sometimes referred as, "the alteration and manipulation of the human environment," is the application of scientific knowledge to the practical goals of human life. Age estimation through human face images has grabbed attention due to its vivid range of true-world applications in world.

Age Prediction

Predicting the age is quite typical for machines and humans as well. Besides, this researcher built their knowledge on machine learning of age with high accuracy than human prediction. Age prediction is typically performed using multiple imaging modalities. By extracting features from datasets, machine learning is used to develop prediction models. Different machine learning algorithms are used in age prediction via images.

A dataset is a collection of data. Image datasets comprises digitised photographs selected for use in training, testing, and assessing the performance of computer vision, machine learning, and artificial intelligence algorithms. Raw dataset is taken for this project which has the image features. The dataset is being trained on age prediction model. This model groups the images based on the age groups. There are two age groups involved in this project. Based on the age prediction, the images are grouped into the children category and above 60 too old age category. The grouping of age categories is done based on the age prediction model. The images that are groped are combined to form a new dataset. In this way the new dataset from the raw dataset is formed.

Age Progression

Age progression is the technology used to see how a child will age. Age progression is considered a typical task performed by machines. Showing how the person looks in different ages is considered a remarkably interesting and creative idea.

Age progression is the method involved with changing a photo of an individuals to show the impact of maturing of their appearance. It is defined as rendering the aging face at any future age for an individual face. Age progressing is done using a photograph of a child, with a single photograph as the input, a complex process is then used to produce future images as a child's face evolves. Time has an impact on physical appearance, and so do facial expression, which are influenced by both internal and external factors.

Age Regression

Age Regression is the technology used to see how the old looks in their child age. Age regression is also considered as very typical tasks. Showing how the image of a person looks in different ages is highly creative and innovative. Age regression is the method involved with changing a photo of an individuals to show the impact of childhood of their appearance. It is defined as rendering the aging face at any past age for an individual face.

Age regression is done using a photograph of an old, with a single photograph as the input, a complex process is then used to produce past images as an old's face evolves. Time has an impact on physical appearance, and so do facial expression, which are influenced by both internal and external factors.

Literature Survey

A group of machine learning frameworks called generative adversarial networks. Using GANs achievement of desired outcomes has become much easier. The related work to this paper is dealing with the image-to-image translation. Image-to-image translation involves transforming of the image from one to another. The image is first considered and the processing is being done on it. Image-to-image translation is the goal to convert one image into the other image by considering the features that are in common with the images. The dataset is being trained in such a way that the features that are common are considered and the relevant changes are to be applied on the second image.

The main advantage of this translation is that we can the same image with the different modifications that are required. This translation involves changing the image of summer season to the same image in any other season, changing zebras with horses with the same background, changing Monet to photo and vice versa. This paper is also similar with the image-to-image translation instead of changing the seasons or animals in the image, we are changing the age of a person like from old to child and vice versa. Firstly, the raw dataset is considered and the dataset is trained with age prediction model then the outcome of this images is grouped into the groups. The images that are predicted with less than 15 years are grouped to children category and the images predicted with more than 60 years of age is grouped as old
age category. These images are then grouped together to form a new dataset, this new dataset is trained over the age progression and regression models to provide the desired results. CycleGANs of the deep learning model is used to achieve the outcome. progression and regression models to provide the desired results. CycleGANs of the deep learning model is used to achieve the outcome.

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Generative Adversarial Network

One of the most valuable classes of neural networks is the GAN, which is employed in unsupervised learning. Because GANs learn, generate, and improve over time, they can produce anything that is provided to them. Convolutional neural networks include GANs. Deep learning CNNs are trained to categorise images according to their neurons based on the neurons that were used to train the models. If a CNN receives an image, it examines it pixel-by-pixel before passing it via various nodes in the CNN's hidden layers and passing it as an output, which provides information about the picture's subject matter or what is seen in the image.

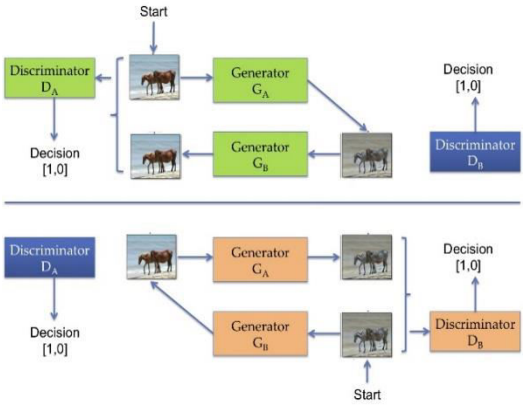

Figure1: GAN architecture

For example, when a picture is fed to a CNN that has been trained to classify dogs and cats using a dataset.

Discriminator

A component of GANs that can be compared to what CNNs perform is the discriminator. The output layer of GANs can only have two outputs, but CNN can have outputs depending on how many labels it is trained on. A discriminator is similar to a Convolutional Neural Network in that it has several hidden layers and one output layer. Due to the discriminator's carefully selected activation function for this assignment, the output can only be either 1 or 0. If the output is 1, the provided data is deemed to be real, and if it is 0, it is deemed to be fake data. Discriminator is trained with real data that it can learn to recognize what actual data will look like and the features should the data have to be real.

Generator

Generator is the generative algorithm. The generator is an inverse convolutional neural network, and it performs the exact opposite of what a CNN does because, whereas a CNN expects an actual image as an output and a classified label as an input, a generator expects an actual image as an output from a random noise input. Simply put, it uses its own creativity to generate data from a piece of data.

CycleGAN

CycleGAN is used to transfer it is possible to map the properties of one image to another or the distribution of images to another image. The issue is handled as an image reconstruction issue in CycleGAN. The generator G is used to transform the picture input (x) into the

reconstructed image. With a generator F, repeat this procedure from the original image to the one that has been rebuilt. Next, determine the mean squared error loss between the original and rebuilt images. The ability of this CycleGAN to perform image-to-image translation on an unpaired image without establishing a relationship between the input and output image is a key feature. CycleGANs also have models in it. The models in CycleGANs are discriminator and generator. But the difference is that there are two generators and discriminators present in CycleGANs. The dataset is trained and given to first GAN and then the output of this is given to the second GAN, that again produce the image of an input. In this way the result is compared and checked in CycleGANS.

Implementation

To implement the project, the raw dataset is considered and it is given to the generator of the GAN. The generator processes the raw dataset first, the image from the dataset is considered and down sampling is performed on it. Downsampling is also called encoding, in which the image is considered as nxn blocks. From each block, the features in the image are considered. The images that have the same features of the children and old age people are considered and taken into separate datasets. Now, that image is decoded, decoding is also called upsampling. Upsampling means combining back the blocks into the complete image and producing the desired results. This process is done by the generator of the GAN.

The second model of the GAN is the discriminator, which will perform classification. The type of classification is binary classification. Binary classification means is the supervised machine learning algorithm that classifies the result into two classes that is either zero or one. Discriminator looks if the result generated by the generator is correct or not. This work is done by a discriminator.

While implementing the project using GANs there are some losses that occur. There are two ways to calculate cycle consistency in each training iteration, there is a tency loss to update the generator models. A child's image will be fed into the first GAN, which will then create an old person's image as output, which will then be fed into the second GAN, which will then create another child's image. In order to lessen the difference in images, the generator models are updated based on the cycle consistency loss, which calculates the difference between the input image to the first GAN and the output image by the second GAN. This is a consistency loss cycle that is moving ahead.loss to update the generator models in each training iteration. The first GAN will take an image of a child, and generate an image of an

old person, which is provided as input to the second GAN, that again produces the image of a child. The cycle consistency loss here calculates the difference between the input image to the first GAN and the output image by the second GAN, and then the generator models are updated according to that to reduce the difference in images. This is a forward cycle of cycle of consistency loss.

When comparing the actual photo of the old with the generated photo of the old, a similar process is related in reverse order for a backward cycle consistency loss from the second generator to the first generator. In this case, a small person is a child, and a large person is an elderly individual.

Forward Cycle Consistency Loss:

- Input photo of small to GAN1
- Output photo of big from GAN1
- Input photo of big from GAN1 to GAN2
- Output photo of small from GAN2
- Compare photo of small to photo of small from GAN2

Backward Cycle Consistency Loss:

- Input photo of big to GAN2
- Output photo of small from GAN2
- Input photo of small from GAN2 to GAN1
- Output photo of big from GAN1
- Compare the photo of big from GAN1
- Compare photo of big to photo of big from GAN1

Conclusion and Future Scope

Inspired by the rapid development in technology, we proposed a solution to get images of the child and old age of a person. This is a remarkably interesting and innovative task. With the help of the GANs of deep learning the project is made. We further added filters to the image that are taken and built the face app. We can change the images from black and white to color, enhance the quality of the image, add a few styles to the image, convert the image to a cartoon filter, and add the doggy, beard, and leans filters to the images. We not only made the project which converts the ages of a person but also prepared a mini face app, which has the features included as mentioned above. We can further extend the project by considering the better dataset and can add many other such filters.

Figure 2: Result

Limitations

Although, our project has proven the results with the outcome that there are still some limitations that are present. Everything in this world is not ideal there are some or more improvements to be done which make the best-happening things. To get 100% accuracy in the project is imaginary and ideal, which not exist in the real world there is any form of loss that exists. Similarly, this project is also having some limitations that include the speed of getting the results. It takes some seconds of time to produce a result, which can be reduced to some nan seconds. For example: if for some reason if there is a change in the face of the person then the result is not that accurate. In the child age, the person does not have a beard but he might have it in his old age, but this cannot be done with this project. The model may neglect some minute features like a beard, silvered color hair, etc.

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