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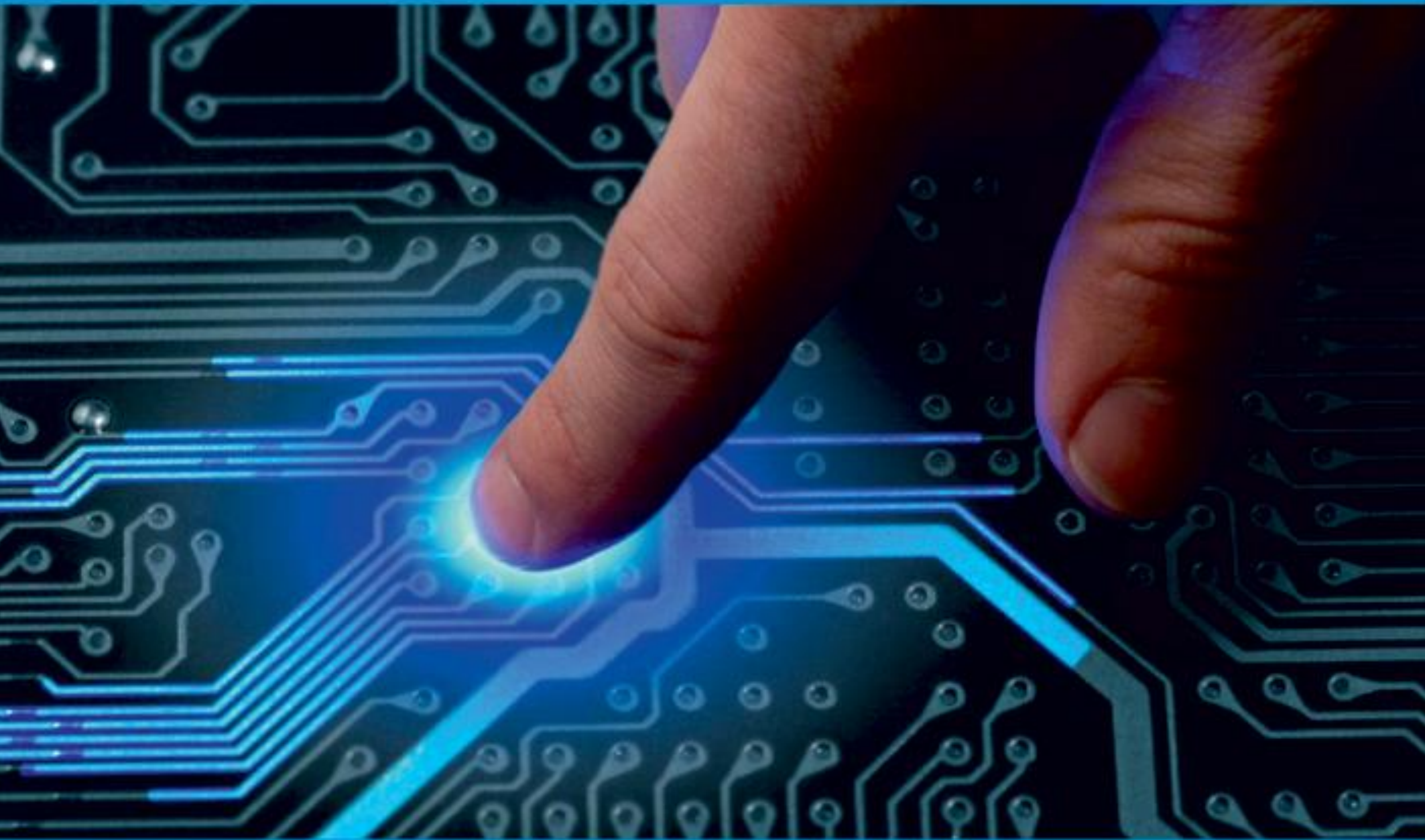

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Face Restoration Using Machine Learning

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ABSTRACT: This work suggests a face restoration method based on machine learning that makes use of facial image priors such facial geometry or reference priors. Due to its intricate structure and power consumption, the GAN, which is built on generative face priors, is better suited for image production. It can improve quality and colors, restore facial details, and perform better on real-world and artificial datasets. The GAN's practical application is constrained by subpar inputs and the challenge of locating reliable references.

KEYWORDS: Face Restoration,remove noise,improve quality, color,

I. INTRODUCTION

Face image restoration employs StyleGAN to recover high-quality images from low-resolution, noisy, and fuzzy photos. StyleGAN is a powerful face generative adversarial network model. But because earlier attempts were so inaccurate, it is challenging to integrate generative priors. Thanks to advancements in machine learning and computer vision, facial features in digital photos and movies are now more accurate.It might be challenging to restore highquality facial photos from low-quality ones because of deterioration, positions, and expressions. Current techniques include facial component dictionaries and face-specific priors. Deep learning techniques can take advantage of GAN's capacity to produce a variety of, rich geometric priors with texture and colors, enabling the restoration and enhancement of real-world color and face features.

II. RELATED WORK

Here we have selected few key literatures after exhaustive literature survey and listed as below:

Rameen Abdal et al [1], A technique for embedding images into the StyleGAN latent space is presented in the 2019 ICCV paper "Image2StyleGAN: How to Embed Images Into the StyleGAN Latent Space" by Abdal, Qin, et Wonka. The authors optimize the code using gradient descent and an encoder network to map images to the latent space. Additionally, the method incorporates image interpolation, allowing for seamless transitions between images as well as fine-grained control and manipulation of image production. This method can be used for editing, style transferring, and image synthesis.

Yochai Blau et al [2], At the ECCVW in 2018, the 2018 PIRM Challenge on Perceptual Image Super-Resolution was presented. The study's participants, including the authors, Yochai Blau, Roey Mechrez, Radu Timofte, Tomer Michaeli, and Lihi Zelnik-Manor, present their findings in the paper. It's possible that the authors' method or strategy for perceptual picture super-resolution is new.

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Andrew Brock et al [3], The authors of the study "Large Scale GAN Training for High Fidelity Natural Image Synthesis" (2018) provide a method for training GANs on a big scale to produce high-fidelity images. They suggest a brand-new generator design dubbed BigGAN, which raises the caliber and variety of images. To regulate image quality and diversity, they introduce orthogonal feature vectors and a "truncation trick". The authors carried out indepth tests and showed superior outcomes in terms of image quality and diversity.

Adrian Bulat et al [4], In order to solve issues with facial landmark localization and super-resolution in diverse postures, the 2018 CVPR conference paper, "Super-FAN: Integrated Facial Landmark Localization and SuperResolution of Real-World Low Resolution Faces in Arbitrary Poses with GANs," was published. While superresolution creates a high-resolution rendition of a low-resolution image, facial landmark localization includes precisely identifying important face landmarks

Qingxing Cao et al [5], The paper "Attention-aware Face Hallucination via Deep Reinforcement Learning" presented at the 2017 CVPR conference suggests a novel method for enhancing the quality of hallucinated face images by combining deep reinforcement learning and attention mechanisms. The technique enhances facial characteristics like the eyes, nose, and mouth by selectively focusing on key facial parts and employing a spatial attention module to assign attention weights to various location

Grigorios G Chrysos et al [6], Chrysos and Zafeiriou's work at the 2017 CVPRW, "Deep Face Deblurring," explored the use of deep learning methods to handle face blurring in photos. The authors restored distorted facial characteristics and enhanced visual quality using a convolutional neural network design. The network was trained using an adversarial training framework, which produced deblurred faces that are more realistic and appealing to the eye.

Xiangyu Xu et al [7], A deep learning-based method for super-resolving hazy face and text images is presented in the 2017 ICCV paper "Learning to Super-Resolve Blurry Face and Text Images". Based on a sizable dataset of fuzzy photos, the authors suggest a novel network design employing convolutional neural networks to learn the mapping between low-resolution and high-resolution images.

Manjunatha HT and AjitDanti et al [8], “A Novel Approach for Detection and Recognition of Traffic Signs for Automatic Driver Assistance System Under Cluttered Background” -Recent Trends on Image Processing and Pattern Recognition, Springer Nature Singapore,Pte Ltd. 2019, RTIP2R 2018, CCIS 1035, pp. 1–8, 2019, ISBN 978-981-13-9181-1DOI-https://link.springer.com/chapter/10.1007/978-981-13-9181-1_36

Manjunatha HT and AjitDanti. et al [9], “Detection and Classification of Potholes in Indian Roads using Wavelet Based Energy Modules“ IEEE- 978-1-5386-9319-3/19© 2019 ,SCOUPS Nature

III. PROBLEM STATEMENT

In order to improve degraded or corrupted facial photos, the project intends to develop a machine learning model for face restoration. The objective is to develop an automated system capable of enhancing low-resolution photos, reducing noise, and repairing damaged facial characteristics. The model should respect privacy and ethical concerns, be effective, and generalize across different ages, genders, and races. In order to ensure the accuracy and aesthetic attractiveness of the photos, it should also handle obstructed facial images.

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IV. DESIGN AND IMPLEMENTATION

Amass a sizable collection of face photos with a range of degeneration or damage for face restoration using machine learning. Resize the dataset, normalize the pixel values, and use data augmentation techniques as part of the preprocessing. The dataset should be manually annotated to add ground truth labels for any regions that are damaged or missing. Select a suitable machine learning model architecture, like convolutional neural networks (CNNs), train the model on the labeled dataset, assess its performance on a different validation dataset, apply the trained model to unseen face images, and use post-processing methods like image denoising, edge enhancement, or color correction. In order to evaluate the performance and effectiveness of the deployed face restoration system, evaluate the quality of the restored faces using metrics and user input.

In the following figure 1 shows the flowchart of different features which can be performed by using this project:

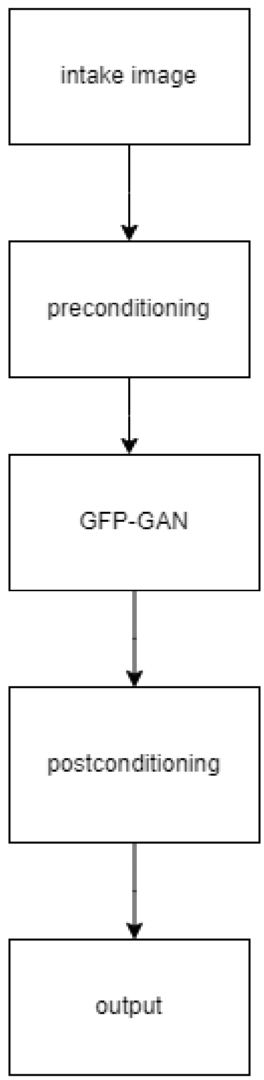

Fig 1: Flowchart of the system

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1. **Input Image**: Restore the original, damaged, or deteriorated image.
2. **Preprocessing**: Utilizing techniques including scaling, normalization, and noise reduction, preprocessing entails getting the input image ready for restoration.
3. **Generative Facial Prior Generative adversarial network(GFP-GAN):** A deep learning model for face restoration called Generative Face Prior GAN consists of a generator network that creates realistic facial features using GFP modules and a discriminator network that evaluates the created image's realism and offers suggestions for improvement.
4. **Postprocessing**: Postprocessing improves the visual quality of a restored image by using methods including denoising, color correction, and sharpening.
5. **Resored Image:** enhanced quality, clarity, and visual authenticity in the restored facial

V. RESULTS AND DISCUSSION

Machine learning-based face restoration attempts to enhance facial images with blur, noise, occlusion, and other abnormalities. By using high-quality datasets for training, deep learning models have demonstrated success in improving image quality. For good face restoration, biases and data accessibility are essential. For fair and trustworthy outcomes, efforts are being taken to address bias and assure representative datasets. In addition, training algorithms to infer absent or obscured facial features from full faces is a component of face feature reconstruction.

Fig 2: Face restoration

In the above figure 2 show the results of restore the original image and remove noise .clarity and quality of the image. Restore the image.

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VI. CONCLUSION AND FUTURE WORKS

Image restoration and facial reconstruction could be revolutionized by employing machine learning algorithms for face repair. Realistic and excellent face restorations can be produced using deep learning models, such as CNNs and GANs, which can learn complicated patterns and correlations from big datasets. These models can enhance facial characteristics, replace age, gender, or expression, and restore missing or injured body parts. Applications for face restoration can be found in forensics, entertainment, medicine, and facial animation. However, difficulties come from handling sensitive facial data ethically, vast and heterogeneous training datasets, and ethical problems.

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