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BRINGING BACK OLD PHOTOS INTO LIFE USING DEEP LEARNING TECHNIQUES

Manasa Subburu[1], Rithika sama[2]

Department of Computer Science and Engineering, Stanley College of Engineering and Technology for Women, Telangana, India

Abstract.

Machine learning is a type of computer algorithm that learns from examples rather than being explicitly programmed to do a task. Artificial intelligence is based on machine learning. Depending on the structure and complexity of the algorithm, it can be further separated into shallow and deep learning. Image processing has permeated every area of today's technologically advanced culture in the last two decades. Medical imaging, machine vision, remote sensing, and astronomy are just a few of the specialized disciplines where it can be used. A range of specialist image processing algorithms can quickly edit personal photographs acquired by various digital cameras. Image restoration can be thought of as a crucial aspect of image processing. The main goal is to improve the quality of an image by removing flaws and making it more appealing.

We suggest using machine learning and deep learning to recover ancient photos that have been severely degraded. Image restoration is the process of estimating the clean, original image from a corrupted/noisy image. Because image corruption comes in varying degrees of severity, the complexity of restoring photos in real-world applications will likewise vary greatly. Motion blur, noise, and camera mis-focus are examples of corruption. Reversing the process that blurred the image is how image restoration is done. We'll train two variational autoencoders (VAEs) to translate old and clean pictures into two latent spaces, respectively. Furthermore, we must address several degradations intermingled in one old photo, such as structured defects like scratches and dust spots, as well as unstructured defects like sounds and blurriness, in order to increase the ability to repair old photos with many flaws. Furthermore, we may use another face refinement network to retrieve small details of faces in ancient pictures, resulting in higher-quality photos.

1. Introduction

1. About Project

Photos are taken to freeze the happy moments that otherwise gone. Even though time goes by, one can still evoke memories of the past by viewing them. Fortunately, as mobile cameras and scanners become more accessible, people can now digitalize the photos and invite a skilled specialist for restoration. However, manual retouching is usually laborious and time consuming, which leaves piles

of old photos impossible to get restored. Hence, it is appealing to design automatic algorithms that can instantly repair old photos for those who wish to bring old photos back to life**.** The technique of restoring an image from a degraded version—usually a blurred and noisy image—is known as image restoration. Image restoration is a fundamental problem in image processing that also serves as a testbed for inverse problems in general. The quality of the recovered image, the algorithm's computational efficiency, and the estimation of necessary parameters such as the point-spread function (PSF) to restore the image information lost to the blurring process are all important considerations. Many methods exist for restoring noisy and motion blurred images, and in this paper, inverse filtering and wiener filtering are used for this purpose. As a result, both motion blurred and noisy motion blurred images are restored using inverse filtering and wiener filtering techniques, and a comparison is made between them.

1.2 Objectives of the Project

Our image restoration model's goal is to:

• Pre-process data
• Determine the type of noise
• Apply the appropriate image restoration techniques
• Reduce noise in photos and restore them

1.3 Scope of the Project

In the past two decades, the technique of image processing has made its way into every aspect of today's tech-savvy society.

2. Its applications encompass a wide variety of specialized disciplines including medical imaging, machine vision, remote sensing and astronomy.
3. Personal images captured by various digital cameras can easily be manipulated by a variety of dedicated image processing algorithms.
4. It's natural that old photos prints deteriorate when kept in poor environment condition, which causes the valuable photo content permanently damage.
5. Image restoration can be described as an important part of image processing technique.

2. Literature Survey

2.1 Existing System

1. Manual retouching is laborious and time consuming, which leaves piles of old photos impossible to get restored.

2. Inprinting uses hand crafted and low-level features which are difficult to detect and fix such defects. Some defects such as color fading or low resolution cannot be restored.

3. Cycle GAN(Cycle Generative Adverse Network)

4. Remini

5. Meitu

2.2 Proposed System

1. Image corruption exists in various degrees of severity, the difficulty of restoring images will also vary significantly.

2. Corruption -motion blur, noise and camera mis-focus.Image restoration is performed by reversing the process that blurred the image using Deep Latent Space Translation.

3. Train two variational autoencoders (VAEs) to transform old photos and clean photos into two latent spaces.

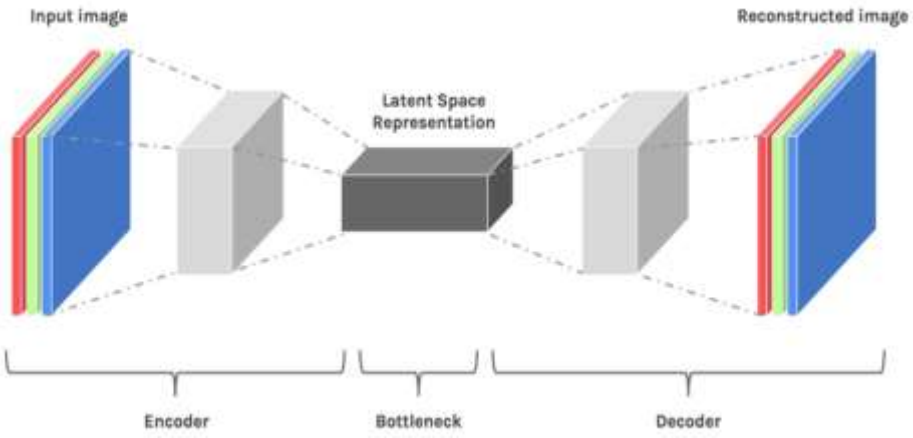
4. Need to address multiple degradations mixed in one old photo

structured defects - scratches and dust spots

unstructured defects - noises and blurriness .

5. Another face refinement network can be applied to generate photos with enhanced quality

3. Proposed Architecture



Depiction about Deep Latent space Translation

4. Implementation

4.1 Algorithm

DEEP NEURAL NETWORK ALGORITHM:

Basically, we use two variational auto encoders , also called VAEs to transform old photos (degraded) and clean photos (restored) into two latent space.

This translation into latent space is learned through synthetic paired data, but is able to generalize well on real photos since the same domain gap is way smaller on such compact latent spaces. The domain gap from two latent spaces produced by the VAEs is closed by training an adversarial discriminator.

You can see in this figure, the new domains from latent spaces “Z r” and “Z x” are much closer to each other than the original old pictures “R” and the synthetic old pictures “X”. The mapping to restore the degraded photos is done in this latent.

The Network is divided into specific branches that each solve particular problem , called partial non local block. There is a global branch targeting the structured defects such as scratches and dust spots using nonlocal block considering the global context.Then they dive deep into local branches that target unstructured defects such as noises and blurriness by using several residual blocks. Finally these branches are fused into latent space that improves the capability to restore old photos from all these defects.

4.2 Code Implementation

Google Colab Python

Colaboratory, or “Colab” for short, is a product from Google Research. Colab **allows anybody to write and execute arbitrary python code through the browser**, and is especially well suited to machine learning, data analysis and education.
With Colab **you can import an image dataset, train an image classifier on it, and evaluate the model, all in just a few lines of code**. Colab notebooks execute code on Google's cloud servers, meaning you can leverage the power of Google hardware, including GPUs and TPUs, regardless of the power of your machine.

5. Result

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6. Conclusion

Image processing is a technique in which we enhance the data (raw images) sensed from the sensors placed on different artifacts of the life for various specified applications. The result is of greater quality as the objects are clearly visible as compared to the original sensed image. There are various fundamental steps involved in the image processing that is representation of images, preprocessing of images, enhancement, restoration, analysis, reconstruction of images and image data compression.

7. Future Scope

With the improvement of image and video visual requirements, digital image restoration plays an increasingly irreplaceable role in digital image processing. Firstly, the development of digital image restoration technology can drive the development of other areas of image processing. Image restoration has a strong correlation with the basic problems involved in image restoration, image compression and image enhancement. The research on image restoration can promote the progress of the basic problems of image processing.

Image restoration is different from common image processing problems, such as image restoration, compression and enhancement. The idea of image restoration is to restore or reconstruct degraded images by some prior knowledge. Image enhancement is the processing of images for specific applications to make the visual effects better and more useful. Image compression is to reduce the amount of data needed to express the image information and reduce the redundant information of the original image.

In other words, it is to restore the image with the least bit and the least distortion. These image processing techniques refer to the real information of the original image, while the pixel of the defect area is almost completely unknown in the image restoration technique, and the goal of restoration is usually to obtain the complete image based on the prior knowledge of human beings.

In other words, image restoration is to analyze images according to the rules of human vision. The improvement of this technology mainly relies on the research of image model and human visual cognitive rules.

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