###### DAMAGED IMAGE REPAIR USING MASKS WITH COMPUTER VISION INPAINT METHOD

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***ABSTRACT***

***Image inpainting is used to automatically fix damaged areas using data from sections that have been saved. With the development of deep learning in recent years, image drawing performance has substantially increased. We are devoted to reviewing the main methods for automating picture inpainting research in this work. The article gives a brief overview of traditional techniques while concentrating on deep learning-based inpainting techniques, covering model categorization, strengths and drawbacks, scope of application, and performance comparison. Finally, the challenges and trends surrounding automated image inpainting are examined and foreseen. A tool called image inpainting uses the data from the remaining components to repair damaged areas. With the advancement of society, image inpainting has become a vital research area in the field of computer vision. It is extensively used in culture, daily life, and security, including object removal and the preservation of digital cultural assets. Conventional methods build geometric models based on geometric consistency and image content similarity, or they use texture generation to patch up small sections of damaged images. It partially solves the problem of loose coupling between high-level semantics and low-level image properties, enabling deep learning to gradually overtake traditional methods in computer vision.***

### **Keyword**s—**Image Inpainting; Mask; deep learning;** (**keywords**)

# **Introduction**

Everything we observe with our own eyes during our whole lives is recorded on the largest hard drive in the world, which we refer to as the human brain. We'll try to remember a lot of things, but there will also be some that we forget. As the years go on and we become older, our brain's ultimate hard disc steadily degrades, and we lose track of many crucial details. A camera is technological advancement that has been around for many years helped us capture the key events of our lives. People are quite fond of this technology and have started to record a variety of life events, such as weddings, vacations with friends or family, reunions with old friends, the first grin your child gives you when he or she is born, and many more, in the form of pictures or photographs. Thousands or hundreds of photos are saved today each year. Even if they were taken a very long time ago, we still want to view them and remember those special moments. Unless his picture is photographed or it was created by a skilled artist, no one will ever know what Einstein would look like. Even if history is largely communicated to us via words or written texts, the artwork created at various points in time by the artist gives our imaginations life. We may be able to envision the way of life or the environment throughout those eras by viewing such work. So, are we keeping those priceless pictures that describe our ancestors? Imagine what would happen if the photos we hold dearest were to be harmed in any way, such as by scratching, tearing, fading, or other physical damage. How many times would we have wondered if there was a way to restore the gorgeous image that makes our day so special. Okay, but why do we keep bringing up old pictures alone? Is it all that matters to us? Then, let's consider a different circumstance. Imagine a windy day when you and your life partner had decided to visit the beach early in the morning. By snapping a selfie, you're attempting to capture that special romantic moment. After you get home, you may find that the selfie you took has some distant individuals in the background or other things that you do not need. Relax. Not to worry!

Image Inpainting: For all those many cases that we discussed before, we have a solid fix for it that is referred to as Image Inpainting. Let's now define picture inpainting in formal terms. Picture inpainting is the art or practise of accurately replacing information that has been lost in an image or deleting undesired or damaged areas. Image inpainting is the technique of eradicating imperfections from images, such as noises, strokes, or writing. Ink smudges or damaged edges on vintage images may be repaired with this technique exceptionally well. These may be eliminated digitally using this technique.



Face inpainting has shown promise, but it has never been able to ensure good quality. In order to ensure that the corrected face picture is as near to reality as possible, we offer in this study a unique inpainting network based on facial qualities known in advance, such as nose, fat, makeup, gender, mouth, beard, and young. The process of creating visually realistic content for the empty spaces in damaged input photos is known as image inpainting. It may be used for many different things. For instance, it enables the removal of obtrusive items from images or the synthesis of features in occlusion regions. The branch of face inpainting is both intriguing and difficult. The fundamental difficulty with face inpainting is that, while the facial features' textures are continuous and inconspicuous, the face is a region with significant structural and semantic elements. Due to these special characteristics, face inpainting is necessary in order to maintain consistency in texture and structure as well as to retrieve sufficient semantic information.

# **LITERATURE REVIEW**

International Conference on Machine Learning, Big Data and Business Intelligence (MLBDBI), 2020. Tongyang Xu and Qian Zheng, "Research on Repairing Historical Photos of Damaged Scratches Based on Computer Technology."The value of old images in preserving human history and culture cannot be overstated. They have distinct ideals and are real, vibrant, and realistic. Damage and ageing, however, will happen for a number of reasons. As computer technology develops, restoration technology is being employed more and more in picture restoration and virtual restoration of cultural artefacts. Using a mix of statistics and computer image processing technologies, this research first investigates the computer-based method of mending picture archives before using it to find and fix scratches in old photos. The study also illustrates a model repair framework, which presents a fresh method for fixing such old photos. The outcomes of the trials demonstrate that the approach has a sizable influence on repair.

International Conference on Computer Network, Electronic and Automation (ICCNEA), 2019. Qi Guo and Jinhui Li, "Damaged Image Restoration Based on Improved Criminisi Algorithm."Despite being frequently used to correct damaged photos, the Criminisi method still has drawbacks such an inappropriate priority selection mechanism and a high percentage of fixed sample block matching errors. This study improves the priority method, adds edge terms, and uses the Crminisi algorithm to fairly sort the picture filling order based on these existing concerns. The improved Criminisi method may fix picture discontinuity after repair issues and enhance the effectiveness of restoring damaged images, according to experiments.

Tien-Ying Kuo, Yu-Jen Wei, Ming-Jui Lee, and Tzu-Hao Lin, "Automatic Damage Recovery of Old Photos Based on Convolutional Neural Network," International Symposium on Intelligent Signal Processing and Communication Systems (ISPACS), 2020. The bulk of currently used techniques for fixing old images include manually altering them with photo-editing software like Photoshop. The amount of time and effort required for manual restoration directly relates to the severity of the photo's damage. As a result, Tien-Ying Kuo suggests in this research a two-stage convolution network to automatically fix damaged antique images. The photographs' damaged areas are found in the first step, and they are repaired in the second. The findings of the experiment show that the method can properly identify and fix photo damage.

Image Completion Using Sample Synthesis, IEEE 31st International Conference on Advanced Information Networking and Applications (AINA), 2017. Shwu-Huey Yen, Hsien-Yang Li, and Po-Yen Kuo. To fix the damaged image, Shwu-Huey Yen suggests utilising an outside reference image. His approach adds three things: (1) By using photos from outside sources, a quick contour matching technique is suggested to repair damaged photographs. It is possible to reconstruct crucial structural details that were lost in the first damaged region. (2) To solve the problem of erroneous transforms to non-existent colours when conventional histogram criteria are employed, a fragment colour transform technique is developed. (3) A K map threshold weighted synthesis approach is suggested to address the problem of misleading textures being produced because a corresponding block is missing in the initial site of harm. The results of several studies clearly demonstrate that the above-mentioned flaws may be corrected more effectively.

An improved exemplar-based image mending method was developed by Tien-Ying Kuo, Yun-Ping Kuan, Kuan-Hung Wan, Yu-Shuo Wang, and Yi-Jun Cheng. This work was presented at the 2017 IEEE International Conference on Multimedia and Expo (ICME). Using the method of "image inpainting," damaged areas of photographs may be fixed or undesired post-production effects can be eliminated. The image should be returned to a condition that seems unaltered after inpainting. In this research, Tien-Ying Kuo suggested an image inpainting method that employs a straightforward methodology to partition picture patches into several priority levels. This study devised a scheduling technique that releases the inpainting approach from the strict repair sequence required by the majority of studies in the literature, enabling better performance.

"Digital Image Restoration Using Image Filtering Techniques," International Conference on Automation, Computational and Technology Management (ICACTM), 2019; Reeturaj Mishra, Neetu Mittal, and Sunil Kumar Khatri. This study can restore a damaged image to its original condition using image restoration techniques. The picture can be restored using certain filters and algorithms, including the Weiner, Regularized, and Lucy-Richardson filters. This experiment sought to recover blurry noised photos using these three methods using MATLAB software. Noise and Gaussian blur were applied to the photos. Then, three approaches for restoring damaged photos are employed, and their effectiveness is evaluated using three metrics: PSNR (Power Signal to Noise Ratio), SSID (Structural Similarity Index), and MSE (Mean Squared Error). The experiment's findings demonstrate that the Lucy-Richardson method offers the highest performance on picture restoration when compared to all other factors.

Image Restoration Using Joint Patch-Group-Based Sparse Representation, IEEE Transactions on Image Processing (Volume: 29), 2020. Zhiyuan Zha, Xin Yuan, Bihan Wen, Jiachao Zhang, Jiantao Zhou, and Ce Zhu. In this research, Zhiyuan Zha suggests a brand-new sparse representation model called joint patch-group-based sparse representation (JPG-SR). The suggested JPG-SR provides an effective method for merging the local sparsity and nonlocal self-similarity of pictures, as compared to previous sparse representation models. Next, image restoration tasks like image inpainting and image deblocking are handled using the suggested JPG-SR. An iterative technique built on the alternate direction method of multipliers (ADMM) framework is created to address the suggested JPG-SR-based picture restoration issues. According to the experimental findings, the suggested JPG-SR is effective and surpasses numerous cutting-edge techniques in terms of both objective and perceived quality.

# **EXISTING SYSTEMS**

1. Image Pre-Processing: The damaged picture must first be pre-processed before the image can be repaired. In order to do this, the image must be cleaned up of noise, the edges rounded, and any holes or gaps filled in. This may be accomplished using a variety of methods, including morphological processes, Gaussian blurring, and median filtering.

2. Mask Generation: The creation of a mask of the injured region is the following phase. Several methods can be used to accomplish this.

Create text and pictures without restrictions.

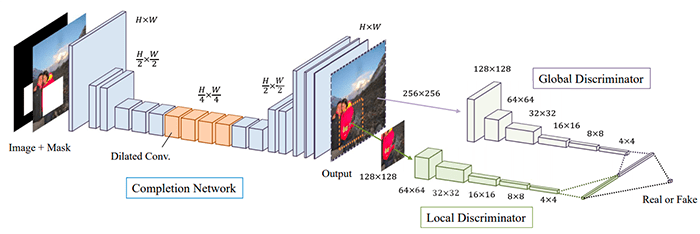
# **PROPOSED SYSTEMS**

The Digital photography frequently results in damaged photos. Scratches, dust, and water damage are just a few examples of the many causes. Although there are several techniques to fix damaged photos, the majority of them need physical labor and/or specialized software. The suggested solution uses computer vision inpainting with masks to automate the process of fixing damaged photos.

The suggested approach is a development. There are four key distinctions. First of all, the actual image is different. The original image is the ground truth image, and the restored image produced by the procedure is identical to the original image. In the suggested approach, the repaired image differs from the original image and must be closer to the ground truth image, which is an image of a person using Photoshop to remove moles and facial pimples. Second, the resolution of the corrected image is different.

The HRHF dataset used in the procedure is substantially larger than the resolution of the dataset that was chosen (256 256). High-resolution datasets may be used for model training or model testing with our technique. Thirdly, whereas [1] employs the fully connected layer to process masks with set size and form, the GAP layer is utilised to process masks of any shape or size. The loss function is the difference's fourth component. The suggested technique uses the loss function of a global picture when creating the loss function; the loss function of the repair region is not taken into account. However, the local loss function of the repair region must be taken into account.

# **SYSTEM ARCHITECTURE**



It A frequent pre-processing procedure with photos containing sensitive information is content censorship. Before uploading a picture to a cloud-based service, users might want to hide some parts of it for a number of reasons. In the battle against human trafficking, for instance, a special-purpose picture search engine was created to recognise hotel rooms from photos [28]. In this circumstance, users (i.e., law enforcement) frequently employ off-the-shelf picture editing software to cover up the victims in the photographs, especially in the case of kids. There are several easily accessible image processing methods, such as "painting" solid colours or patterns over certain parts, blurring or pixelating specific regions, and, more recently, utilising deep learning to forecast the value of "missing" pixels.

It comprises of two auxiliary context discriminator networks that are only used for training the completion network and are not utilised during testing, as well as a completion network. The local discriminator network only accepts a limited region surrounding the finished area as input, while the global discriminator network accepts the full picture. While the completion network is trained to deceive both discriminator networks, both discriminator networks are trained to discern whether an image is real or finished by it.

1). The technique of restoring lost information from a picture is known as image inpainting. Inpainting is frequently used to fix pictures that have been damaged in some way. The instance where inpainting is utilised to expand the image's backdrop into a location where a foreground object may have been purposefully removed to obscure the existence of an object or person—typically for privacy preservation—is the main topic of this study.

Censoring of image content is possible via masking (top right) or inpainting (bottom left). In this study, we investigate the impact of masking or inpainting on picture retrieval and categorization. The objective of this study is to assess how effectively inpainted pictures can be utilised as stand-ins for the original in contemporary image classification and retrieval situations. Prior surveys have assessed the reconstruction performance of inpainting approaches subjectively

# **CONCLUSION**

Convolutional network's amazing expression learning powers, generative adversarial networks' capacity to adapt the probability distribution of data to fix images, and image inpainting techniques based on deep learning are the main focuses of these techniques. Given the issues and difficulties currently present in the ongoing research activities, the following predictions for future study orientations and development patterns are provided in this section:

* Successful information extraction and the creation of an information connection with missing material are prerequisites for enhancing inpainting quality. Consequently, improving the inpainting model's ability to learn picture characteristics continues to be one of the areas that merits in-depth study in further research.
* The multiple-stage inpainting technique enables a smooth transition from rough to fine.
* These techniques do, however, have drawbacks that must be ignored. Future study will construct an end-to-end model and apply an internal optimization model to achieve high-quality picture inpainting with consistent texture, coherent structure, and unambiguous semantics.

**Narrow masks Wide masks**

Method FID ↓ LPIPS ↓ FID ↓ LPIPS ↓

***Training masks***

Narrow

|  |  |  |  |
| --- | --- | --- | --- |
| DeepFill v2 1*.*06 | 0*.*104 | 5*.*20 | 0*.*155 |
| EdgeConnect 1*.*33 | 0*.*111 | 8*.*37 | 0*.*160 |
| RegionWise 0*.*90 | 0*.*102 | 4*.*75 | 0*.*149 |

LaMa-Regular 0*.*68 0*.*091 5*.*41 0*.*144

LaMa-Regular 0*.*60▼12% 0*.*089▼2% 3*.*51▼54% 0*.*139▼4% DeepFill v2 1*.*35▲21% 0*.*107▲3% 4*.*34▼20% 0*.*148▼4% EdgeConnect 2*.*78▲52% 0*.*141▲27% 7*.*94▼5% 0*.*160▼3%

Wide

Chart, line chart

Description automatically generated

The FFC-based inpainting models are capable of scaling to higher resolutions—which are never encountered during training—while suffering substantially less quality deterioration. The Big LaMaFourier, our best model, is offered as a reference because it was trained under many circumstances. All LaMa models are trained in 256 256 resolution (Sec. 3.4). Image inpainting is a pretty good method that can more realistically rebuild the damaged pixels in the image. Additionally, it is capable of removing any undesirable elements from the input image to create a more appealing visual without altering its surroundings. There is still a lot of study being done to find a solid solution to the picture inpainting problem, with researchers from all around the world participating.

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