|  |
| --- |
| VIETNAM GENERAL CONFEDERATION OF LABOR  **TON DUC THANG UNIVERSITY**  **FACULTY OF ELECTRICAL & ELECTRONICS ENGINEERING**  **Description: logoTDT%20(NH%E1%BB%8E)**  **RECOVER VARIOUS SHAPES FROM LOW QUALITY OR PARTIALLY LOST PHOTOS**  **GROUP PROJECT**  **ELECTRONIC AND TELECOMMUNICATIONS ENGINEERING**    **HO CHI MINH CITY, NOVEMBER 2023** |

VIETNAM GENERAL CONFEDERATION OF LABOR

**TON DUC THANG UNIVERSITY**

**FACULTY OF ELECTRICAL & ELECTRONICS ENGINEERING**

****

**NGUYEN DUC TRI – 41900297**

**NGO NGUYEN MINH HUY – 419H0106**

**TRAN HAI DANG – 419H0020**

**PHAN DINH DAT – 418H0027**

**RECOVER VARIOUS SHAPES FROM LOW QUALITY OR PARTIALLY LOST PHOTOS**

**GROUP PROJECT**

**ELECTRONIC AND TELECOMMUNICATIONS ENGINEERING**

*Instructer*:

***Dr. Tran Thanh Phuong***

**HO CHI MINH CITY, NOVEMBER 2023**

**Contents**

[**CHAPTER 1. THE INTRODUCTION** 1](#_Toc185928158)

[1.1. TARGET 1](#_Toc185928159)

[1.2. THE IDEA 1](#_Toc185928160)

[1.3. EVALUATION CRITERIA 1](#_Toc185928161)

[**CHAPTER 2. THE THEORY** 2](#_Toc185928162)

[2.1. THE RELATED THEORY 2](#_Toc185928164)

[2.1.1. Enhacing constrast 2](#_Toc185928165)

[2.1.2. Photo restoration through noise reduction 2](#_Toc185928166)

[2.1.3. Reconstruction lost information 2](#_Toc185928167)

[2.1.5. X-ray Computed Tomography (CT) 2](#_Toc185928168)

[2.2. THE MODEL 3](#_Toc185928169)

[**CHAPTER 3. SOURCE CODE - SIMULATION** 4](#_Toc185928170)

[3.1. RESTORED IMAGE CODING 4](#_Toc185928174)

[3.2. IMPROVED IMAGE QUALITY CODING 4](#_Toc185928175)

[**CHAPTER 4. THE ESTIMATION** 6](#_Toc185928176)

[4.1. EVALUATION ABOUT THE RESTORED IMAGE 6](#_Toc185928178)

[4.2. EVALUATION ABOUT THE IMPROVED IMAGE QUALITY 6](#_Toc185928179)

# **CHAPTER 1. THE INTRODUCTION**

## TARGET

Because the topic includes two main issues: processing low-quality images and processing partially lost images. Therefore, for each type, we will come up with the most suitable methods possible.

To handle blurry images, we will apply some type of filter circuit to eliminate noise or improve image quality by enhancing contrast, balancing histogram,...

To restore old photos that are partially lost or scratched, we will use convolution; filtering such as inverse filtering, wiener filtering,...; interpolation;...

## THE IDEA

As the teacher had already taught most of the main ideas in the image restoration and processing section, we decided that in addition to the knowledge we learned from outside, we would introduce some remaining knowledge based on the main program. Therefore, the remaining parts are mostly related to medical knowledge, CT techniques, and we will bring them into the presentation to present.

## EVALUATION CRITERIA

Based on the 2 main requirements of the topic, we will learn the code related to them.

For blurry images and poor quality images:

* The evaluation criteria is that the image will have sharper quality.
* The input: Blurred image.
* The output: Sharper images with higher contrast.

For partially lost or scratched photos:

* The evaluation criteria is that it will be possible to restore the original photo.
* The input: Photos are partially lost or photos are scratched.
* The output: Restore the photo to its original state.

# **CHAPTER 2. THE THEORY**



## THE RELATED THEORY

### Enhacing constrast

Enhacing contrast through the use of filters or algorithms such as Histogram Equalization, Contrast Limited Adaptive Histogram Equalization ( CLAHE).

In this part, we find the blurry picture like the sample in slide 13 in powerpoint then we made it by increasing the contrast that make it becomes darker.

### Photo restoration through noise reduction

You can use low-pass filtering methods such as Gaussian filter, mean filter, or median filter...

In this part, we find the ready-made examples of noisy images which is shown in slide 14 and then they used median filtering to remove salt and pepper noise.

### Reconstruction lost information

If an image is partially lost, you can use methods such as model-based restoration or interpolation-based restoration to reconstruct the lost information in the image.

Therefore, we will define a little bit about model-based restoration that it uses the comparison method with many sample sources then calculate the error to come up with a solution to restore the image closest to the original image.

After that, we will define about the interpolation-based restoration that is using a method to estimate the image level value, neighboring pixels that are close to each other will have the same brightness value (“same”) and vice versa for pixels that are far away.

* + 1. **Using image recovery algorithms**

We use some popular algorithms include: model-based restoration algorithm, interpolation-based restoration algorithm, segmentation-based restoration algorithm, and machine learning-based restoration algorithms.

### X-ray Computed Tomography (CT)

About this section, we will learn some interesting knowledge about the medical field of CT technology, not simply a medical testing method, X-ray computed tomography will show you how it helps us clearly see the things we want to pay attention to.

## THE MODEL

For this below model, we will know that how the model-based restoration work.

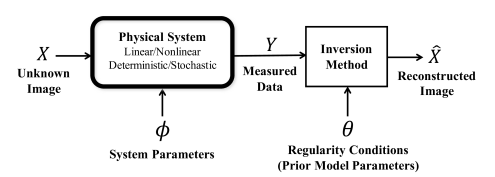


Figure . Model-based Restoration

For this below model, we will know that how the interpolation-based restoration work.

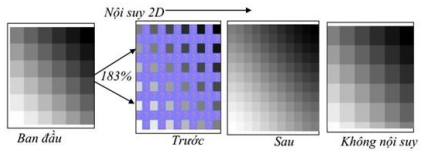


Figure . Interpolation-based Restoration

# **CHAPTER 3. SOURCE CODE - SIMULATION**



## RESTORED IMAGE CODING

import cv2

import numpy as np

OriginalImage = cv2.imread("abraham.jpg")

cv2.imshow("Origina lImage",OriginalImage)

makredDamages = cv2.imread("mask.jpg",0) # gray scale

# lets create a mask with threshhold

ret , thresh = cv2.threshold(makredDamages, 254, 255 , cv2.THRESH\_BINARY)

# lets make the lines thicker

kernel = np.ones((7,7), np.uint8)

mask = cv2.dilate(thresh , kernel , iterations=1)

# lets restore the image

restoredImage = cv2.inpaint(OriginalImage , mask , 3, cv2.INPAINT\_TELEA)

cv2.imshow("restored Image", restoredImage)

cv2.imwrite("Restore-Damaged-Photo/RestoredAbraham.jpg",restoredImage)

cv2.waitKey(0)

## IMPROVED IMAGE QUALITY CODING

import cv2

import matplotlib.pyplot as plt

import numpy as np

image = cv2.imread('1.jpg')

plt.imshow(cv2.cvtColor(image, cv2.COLOR\_BGR2RGB))

plt.title('Original Image')

plt.show()

# Áp dụng nâng cao chất lượng ảnh

# Khử nhiễu ảnh

denoised\_image = cv2.fastNlMeansDenoisingColored(image, None, 10, 10, 7, 21)

# Thực hiện kéo giãn tương phản

contrast\_stretched\_image = cv2.normalize(denoised\_image, None, 255, 0, cv2.NORM\_MINMAX, cv2.CV\_8UC1)

# Làm sắc nét ảnh

kernel = np.array([[0, -1, 0], [-1, 5, -1], [0, -1, 0]], np.float32)

sharpened\_image = cv2.filter2D(contrast\_stretched\_image, -1, kernel=kernel)

# Điều chỉnh độ sáng

brightness\_image = cv2.convertScaleAbs(sharpened\_image, alpha=1, beta=5)

# Hiệu chỉnh gamma

gamma = 1.5

lookup\_table = np.array([((i / 255.0) \*\* gamma) \* 255 for i in np.arange(0, 256)]).astype("uint8")

gamma\_corrected\_image = cv2.LUT(brightness\_image, lookup\_table)

# Lưu ảnh cuối cùng

cv2.imwrite('final\_image.jpg', gamma\_corrected\_image)

# Hiện ảnh được nâng cao sau khi hoàn thiện

plt.imshow(cv2.cvtColor(gamma\_corrected\_image, cv2.COLOR\_BGR2RGB))

plt.title('Final Enhanced Image')

plt.show()

# **CHAPTER 4. THE ESTIMATION**



## EVALUATION ABOUT THE RESTORED IMAGE

* *Goal*: Repair scratched photos and be able to restore partially lost photos
* *Results achieved*:
  + *Scratched photos*: Completed
  + *Lost photos*: Incompleted
* *Strengths*: Scratched image quality is significantly improved
* *Weaknesses*: There are few examples and this code is not yet capable of recovering partially lost images

## EVALUATION ABOUT THE IMPROVED IMAGE QUALITY

* *Goal*: Improve the quality of blurred images.
* *Results achieved*: Images are significantly improved.
* *Strengths*: Quality has improved.
* *Weaknesses*: There are few examples so we don't know specifically about the code's ability to improve images.