TECH4HERITAGE
HACKATHON

Team 45 Submission

Shashwat Chandra

Objective 1: Dataset Chosen

TECH4HERITAGE
HACKATHON

The problem statement before us is to regenerate broken paintings by filling in their discontinuities. As such, the best dataset to evaluate the output will be one where an expert has filled in such discontinuities in real works of art.

Based on this, I collected images of before-restoration and after-restoration photos of artwork. Specifically, I found images of the following artworks:

1. Restoration work done by Nashik-based artist Prasad Pawar, who has digitally restored lots of paintings in the Ajanta Caves
2. Paintings restored by the experts from Art Gallery 101, Washington DC.

Objective 1: Dataset Chosen
Examples

TECH4HERITAGE
HACKATHON

Mid. 19th century oil on canvas

Objective 1: Dataset Chosen
Examples

TECH4HERITAGE
HACKATHON

Ajanta Caves

Objective 2: Roadmap

TECH4HERITAGE
HACKATHON

We want to build an algorithm that will digitally restore the provided artwork. To do this, we need to work on the following set of problems:

1. Identify the parts of the artwork that need to be digitally restored.
2. Identify the context of the artwork to understand the content of the missing part of the artwork
3. Identify the style of the artist and artwork to best understand the mode with which to fill in the missing content

Objective 2: Roadmap
1. Identify parts

TECH4HERITAGE
HACKATHON

Ideally, the logic to identify the parts of the image that represent damage and require restoration should be manual. This is because a human being is best-suited for understanding what reflects damage and what doesn't.

Having said, that, with the data that I had available, I have been able to make some basic identifiers for damage, which I have used in trying out my digital restoration attempts.

Objective 2: Roadmap
1. Identify parts (contd.)

TECH4HERITAGE
HACKATHON

Algorithms:

1. **Naive Algorithm**
   In many images, the damaged parts of the image are much whiter than the rest. The naive algorithm will be a mask on the parts of the image that are bright white

2. **Sophisticated Algorithm**
   The better way of tackling this problem will be to divide the image into multiple small sections, take the color histogram of each section; cluster these histograms based on their closeness to the entire image, and identify the outliers.

Objective 2: Roadmap
2. Identify context

TECH4HERITAGE
HACKATHON

There are multiple existing algorithms that are currently in use to solve this specific part of the problem:

1. PatchMatch algorithm *(used by Adobe Photoshop)*
2. Image Inpainting - Fast Marching Method *(used by OpenCV inpaint method)*
3. Globally and Locally Consistent Image Completion *(SIGGRAPH 2017)*

Objective 2: Roadmap
3. Identify style

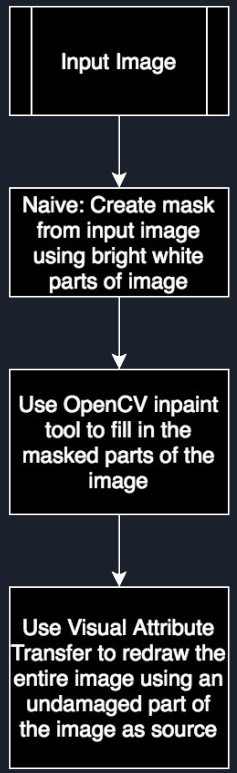
TECH4HERITAGE
HACKATHON

This is likely the hardest part of this problem. I don't have any specific ways to tackle this problem, but I have gone through some research in this problem, which seems to point me in the right direction:

1. Visual Attribute Transfer through Deep Image Analogy *(ACM Transactions on Graphics 2017)*
2. A Neural Algorithm of Artistic Style *(Journal of Vision 2016)*

Proposed Methodology

TECH4HERITAGE
HACKATHON



Code

TECH4HERITAGE
HACKATHON

- Code available at: https://github.com/Shashwat986/Tech4Heritage
- Editable Jupyter Notebooks available at:
  - https://colab.research.google.com/github/Shashwat986/Tech4Heritage/blob/master/Automatic%20Mask%20Generation%20Example.ipynb
  - https://colab.research.google.com/github/Shashwat986/Tech4Heritage/blob/master/Manual%20Mask%20Example.ipynb
- Dataset Available at: https://github.com/Shashwat986/Tech4Heritage/tree/master/dataset