Morphological Operations Applied to Digital Art Restoration

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Why?

Art restoration preserves objects of artistic, cultural, or historical value.

Digital art restoration provides:

- a comparatively inexpensive alternative.
- a nondestructive tool.
- an approximation of the initial appearance.

Outline

Outline

Criteria

1. Accuracy - low error rate
2. Localization - minimal distance between detected and actual edge
3. Uniqueness - only one response to a single edge

Canny Algorithm

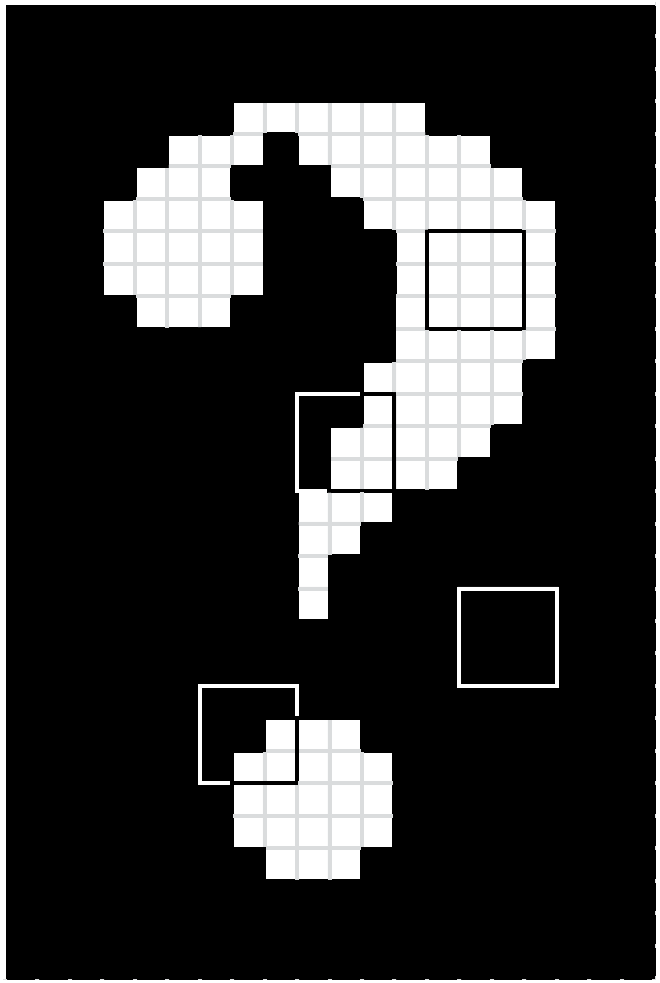
Outline

Morphological Operations

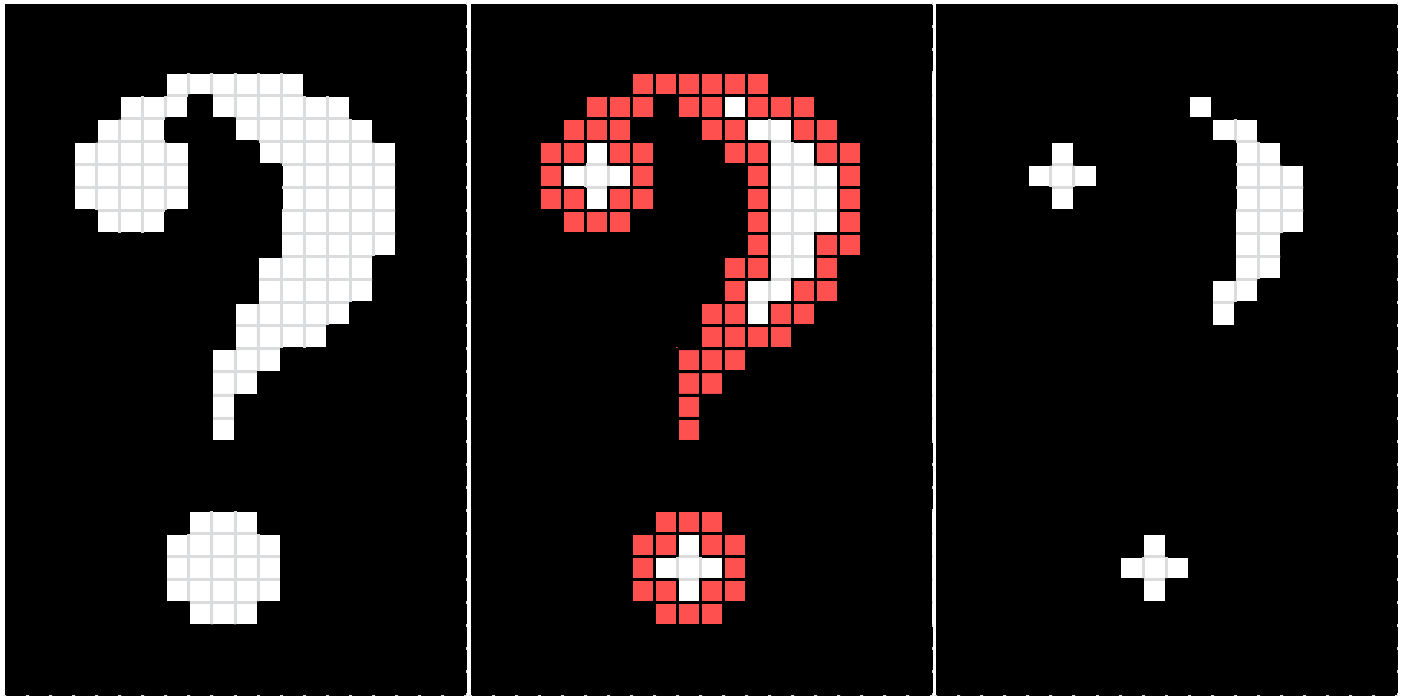
Binary and Greyscale Images

Two Inputs:

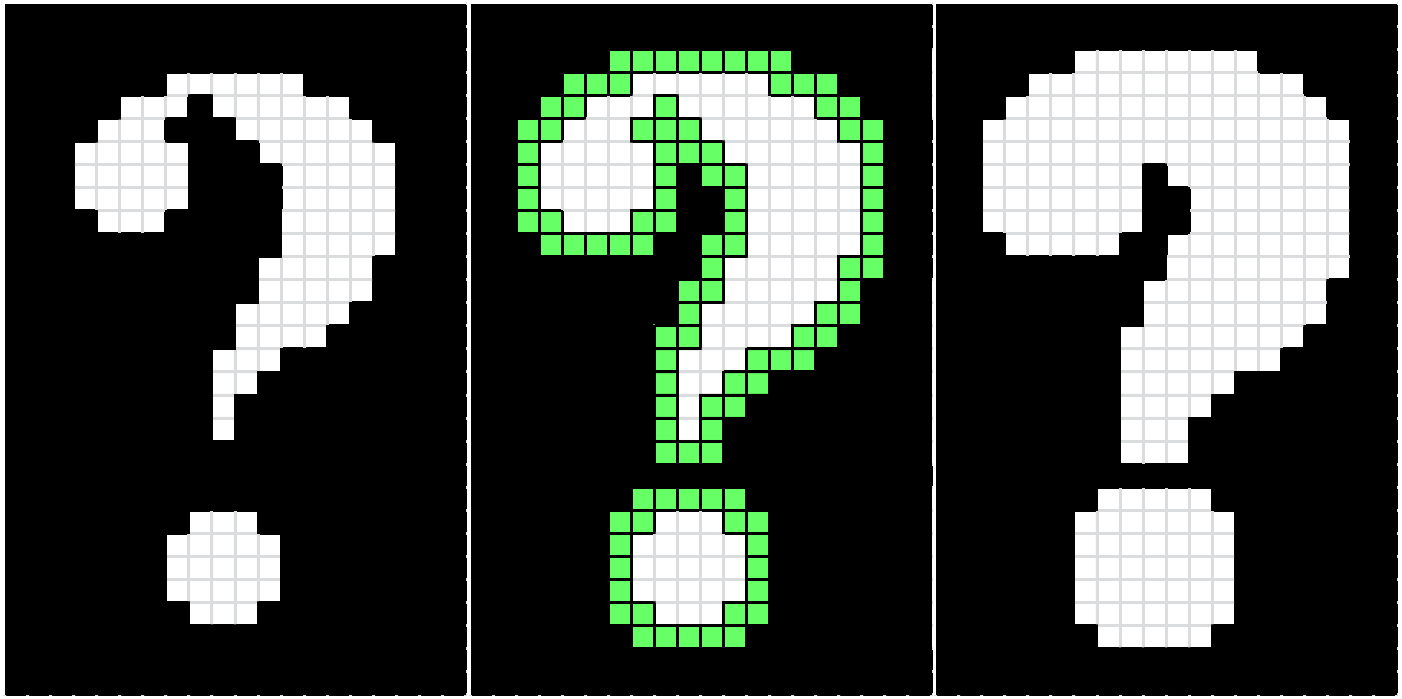
- Original Image
- Structuring Element



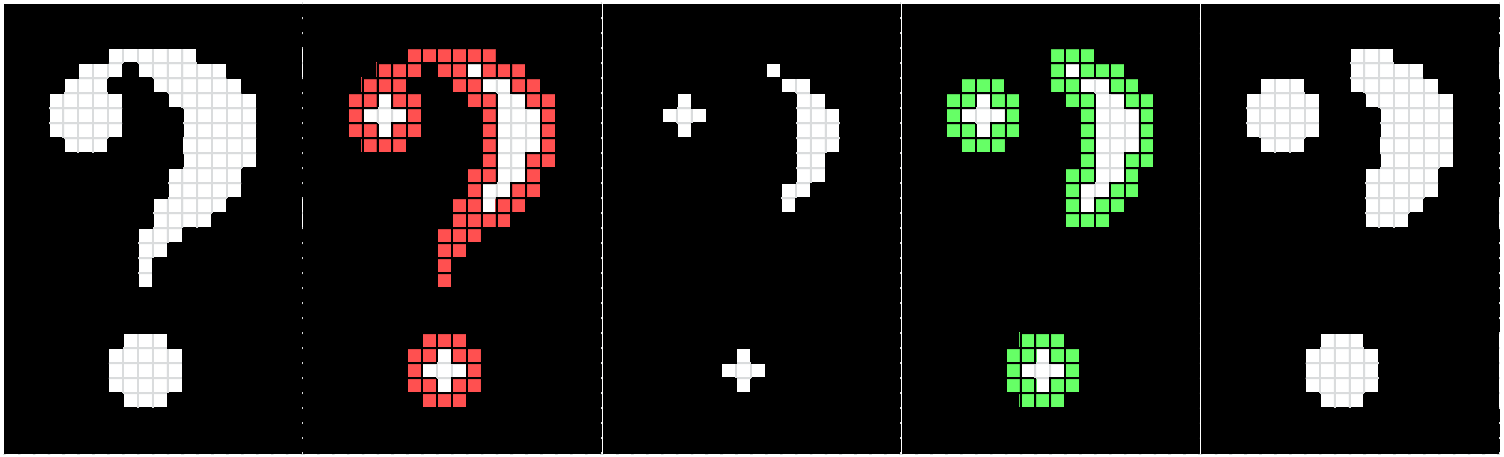
Erosion



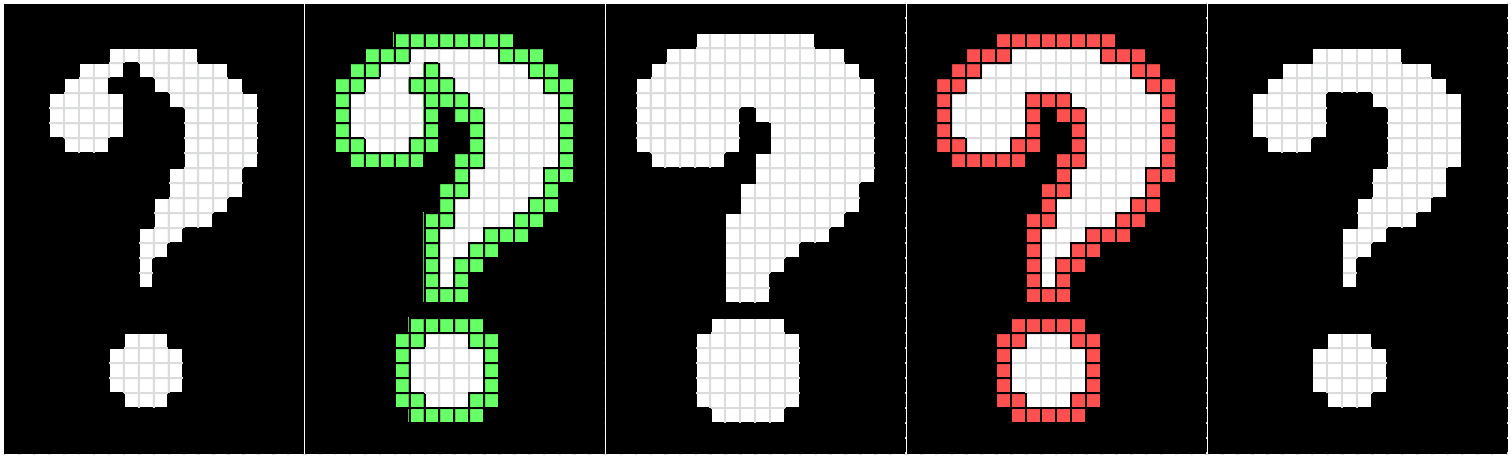
Dilation



Opening



Closing



Outline

Top-Hat Algorithm

Three Variations:

- Black Top-Hat
- White Top-Hat
- Multiscale Top-Hat

Black Top-Hat Transform

Darker Details on a Lighter Background

$BTH = (f \bullet s) - f$

White Top-Hat Transform

Lighter Details on a Darker Background

$$WTH = f - (f \circ s)$$

Outline

Inpainting Process

The image is broken down into regions, which are further broken down into neighborhoods. For each defective pixel *i*:

1. Find the context of *i*.
2. Examine all other neighborhoods within the region of *i*.
3. Find neighborhood most similar to context of *i* by sum of squared differences.
4. If the sum of squared errors is below a set threshold, replace all defective pixels in the neighborhood of *i* with corresponding pixels from most similar neighborhood.
5. Otherwise, replace pixel *i* with the median value of all non-defective pixels within its neighborhood.

Outline

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Thanks!

Questions?

References