

Image Alignment Project

Overview

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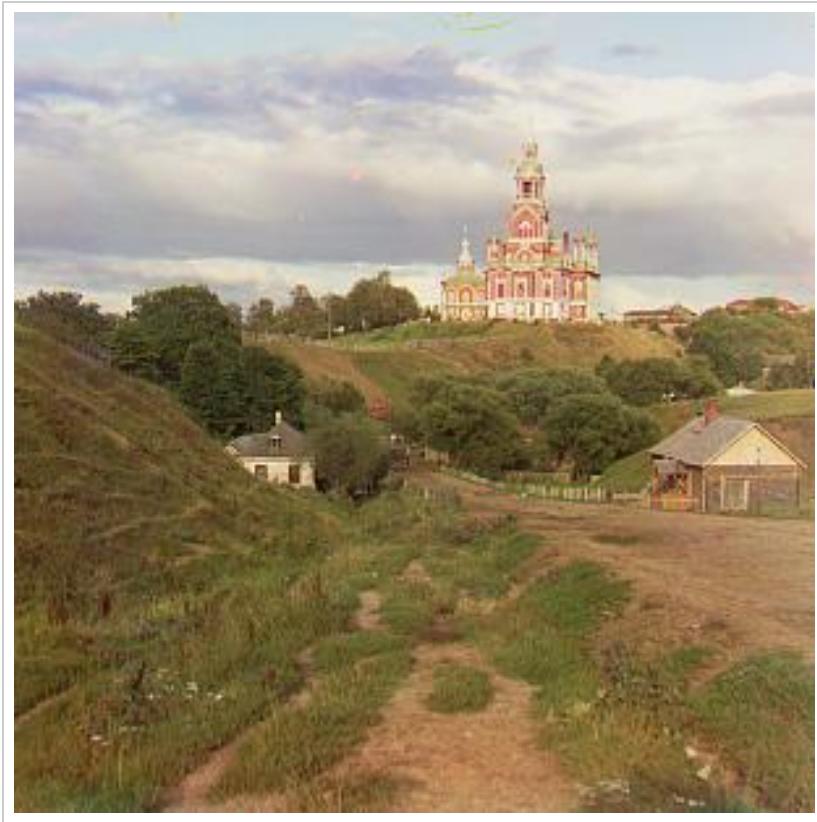
The project utilizes the historic photos taken by Sergei Prokudin-Gorskii, a visionary who captured the Russian Empire in color long before modern color photography existed. Using his method of capturing three images through red, green, and blue filters, one can reconstruct his black-and-white images into color photos.

The program loads an input image and divides it into three separate color channels: red, green, and blue. Image adjustment is done using pyramid. Each channel is adjusted to achieve proper color alignment by using an image pyramid (a series of images with gradually reduced resolution). Some different metrics were used but the l2_norm was found to be sufficient. After alignment, borders are removed using the `remove_borders()` function. The adjusted color channels are assembled into a color image that is saved and displayed. Translated with DeepL.com (free version)

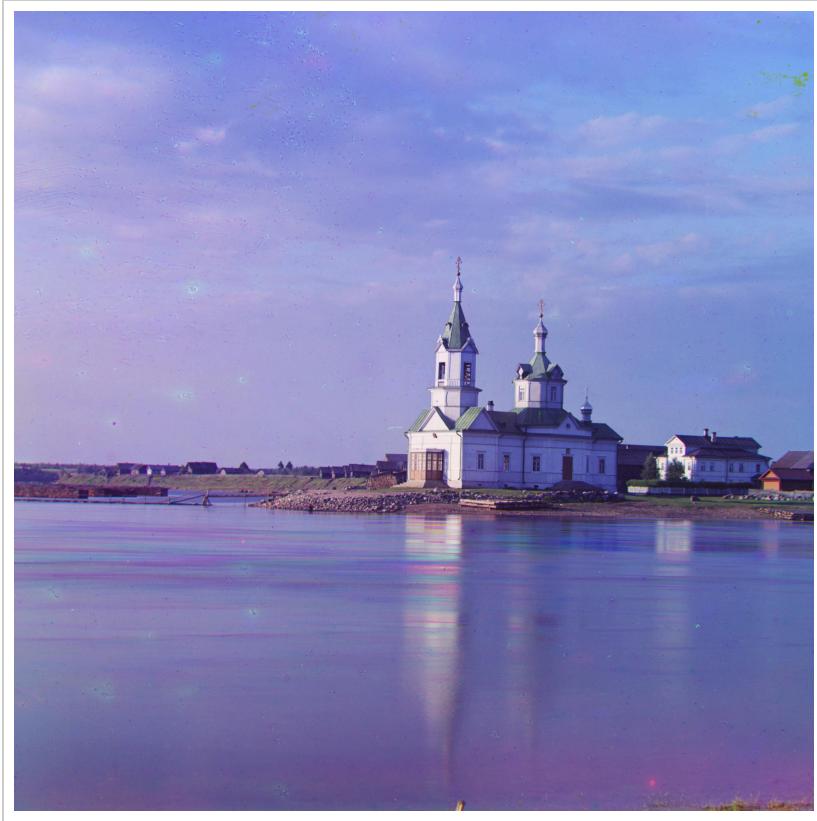
Results

Below are the results of the algorithm applied to various images:

**The next 13 images are based off of source images provided at
<https://inst.eecs.berkeley.edu/~cs180/fa24/hw/proj1/data/>**



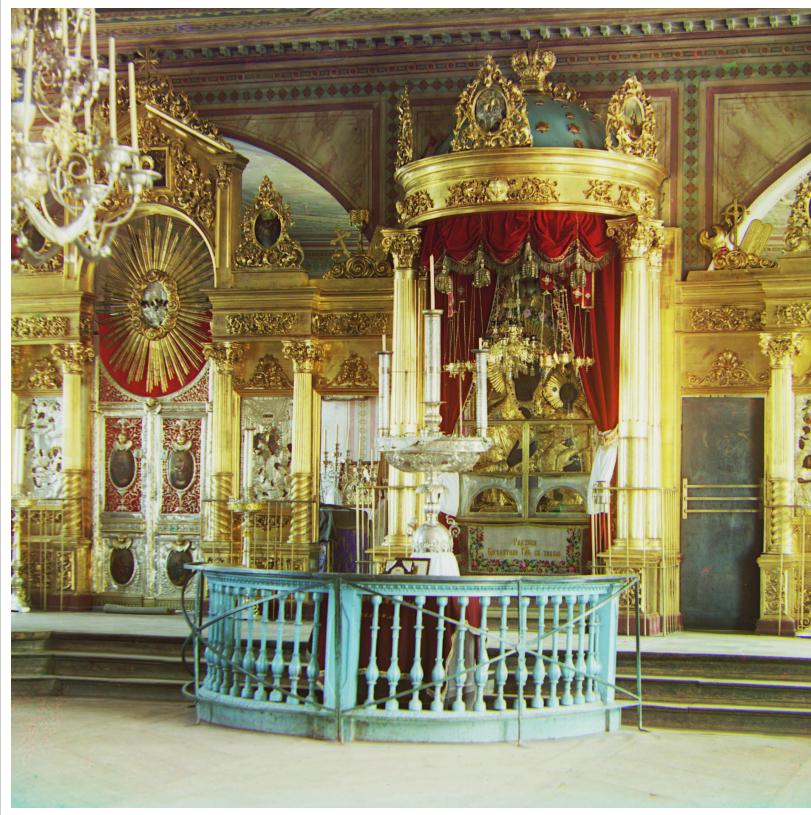
- Cathedral:
- Red offset (dx , dy) = (1,7)
- Blue offset (dx , dy) = (-2,-5)



- Church:
- Red offset (dx, dy) = (-8,34)
- Blue offset (dx, dy) = (-4,24)



- Emir:
- Red offset (dx, dy) = (17,58)
- Blue offset (dx, dy) = (-24,-48)



- Icon:
- Red offset (dx, dy) = (5,48)
- Blue offset (dx, dy) = (-18,-40)



- Lady:
- Red offset (dx, dy) = (2,61)
- Blue offset (dx, dy) = (6,-64)



- Melons:
- Red offset (dx, dy) = (4,96)
- Blue offset (dx, dy) = (-4,-80)



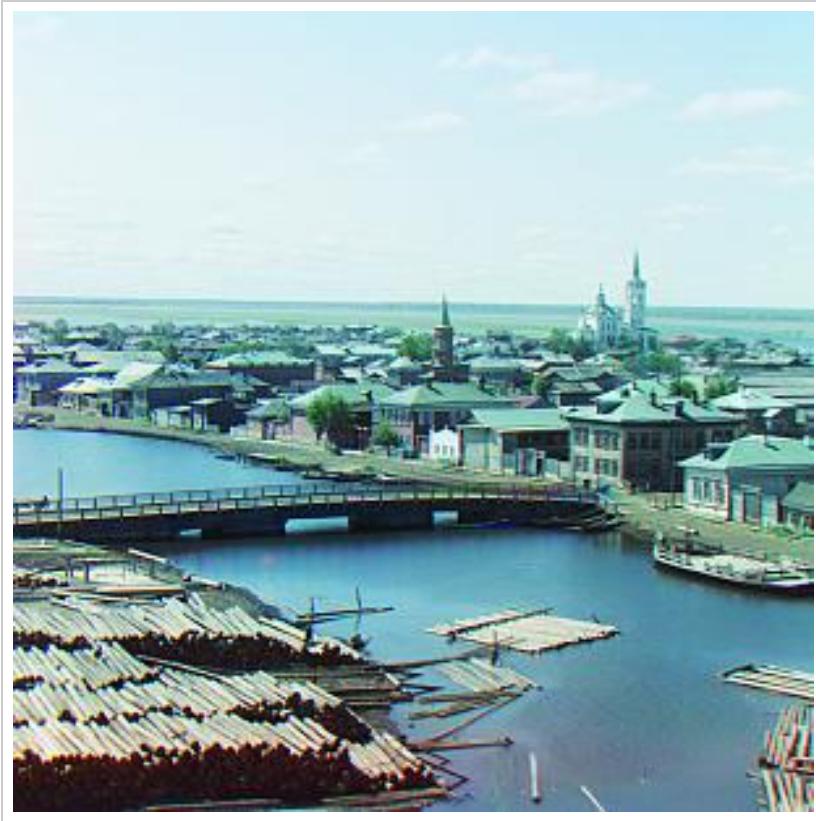
- Monastery:
- Red offset (dx, dy) = (1,6)
- Blue offset (dx, dy) = (-2,3)



- Onion Church:
- Red offset (dx, dy) = (10,58)
- Blue offset (dx, dy) = (-26,-49)



- Three Generations:
- Red offset (dx, dy) = (-4,60)
- Blue offset (dx, dy) = (-16,-48)



- Tobolsk:
- Red offset (dx, dy) = (1,4)
- Blue offset (dx, dy) = (-3,-3)



- Train:
- Red offset (dx, dy) = (26,43)
- Blue offset (dx, dy) = (-6,-42)



- Sculpture:
- Red offset (dx, dy) = (-16,106)
- Blue offset (dx, dy) = (11,-33)



- Self Portrait:
- Red offset (dx, dy) = (8,97)
- Blue offset (dx, dy) = (-30,-78)

Prokudin-Gorskii Collection Examples

The following 3 examples are retrieved from the Prokudin-Gorskii Collection at
<https://www.loc.gov/collections/prokudin-gorskii/?st=grid>



- Poliana:
- Red offset (dx, dy) = (10,56)
- Blue offset (dx, dy) = (2,-40)
- Source material retrieved at 8. September at: <https://www.loc.gov/item/2018679023/>



- Lugano:
- Red offset (dx, dy) = (-12,52)
- Blue offset (dx, dy) = (16,-38)
- Source material retrieved at 8. September at: <https://www.loc.gov/item/2018679128/>



- Brick building with arched entrance and arcade:
- Red offset (dx, dy) = (-16,56)
- Blue offset (dx, dy) = (12,-43)
- Source material retrieved at 8. September at: <https://www.loc.gov/item/2018681278/>

Bells and Whistles

Additional features implemented include:

- N/A