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Lab 3: Colorizing the Prokudin-Gorskii photo collection

Prokudin-Gorskii collection images

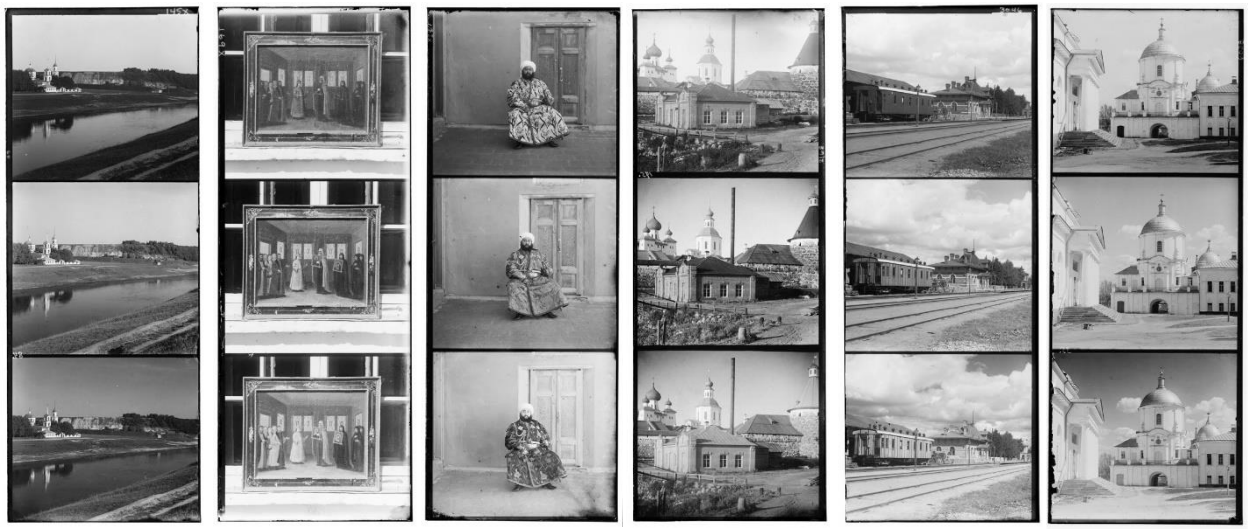

image 4 *image 5* *image 3* *image 2* *image 1* *image 6*

Unaligned color images

The following images have been obtained by splitting the color plate images in 3 parts of R, G and B channels to form unaligned color images

image-color 1

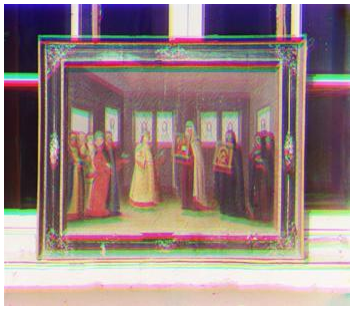

image-color 2

image-color 3

image-color 4

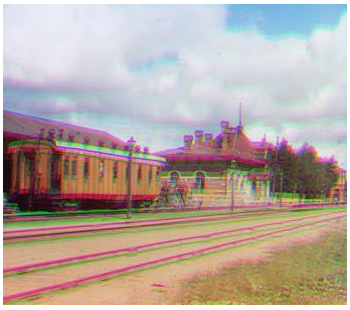

image-color 4

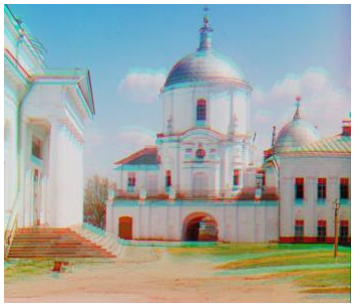

image-color 6

Aligning Images using Sum of Squared Differences (SSD)

Keeping the B channel stationary, the R and G channels are offset in the range of [-15,15] along the x and y-axis. Then these frames are used to calculate the sum of squared differences between the reference B channel and the R or G channel after normalizing them. By Iterating over the range of offsets and keeping a track of the lowest SSD calculated, we find the best offset to align the different channels.

image-ssd 1

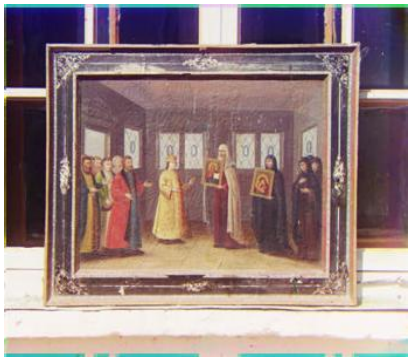

image-ssd 2

image-ssd 3

image-ssd 4

image-ssd 5

image-ssd 6

Alignment offsets using SSD

Images	Image1-ssd		Image2-ssd		Image3-ssd		Image4-ssd		Image5-ssd		Image6-ssd	
channels	R	G	R	G	R	G	R	G	R	G	R	G
X offset	-2	4	-3	3	2	6	1	3	-1	4	-7	-1
Y offset	1	2	2	2	5	3	1	1	4	3	1	0

Aligning images using normalized cross-correlation (NCC)

This method is like the method used for Sum of Squared Differences (SSD). We find the best offset by keeping a track of the highest NCC while iterating over the range of offsets [-15,15] along the x and y-axis.

image-ncc 4

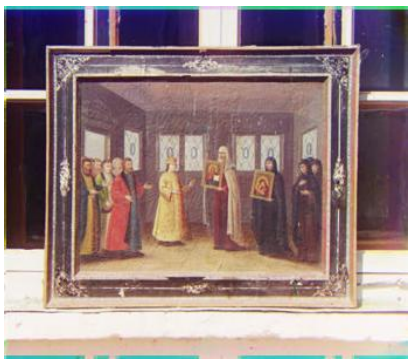

image-ncc 5

image-ncc 6

image-ncc 4

image-ncc 5

image-ncc 6

Alignment offsets using NCC

Images	Image1-ncc		Image2-ncc		Image3-ncc		Image4-ncc		Image5-ncc		Image6-ncc	
channels	R	G	R	G	R	G	R	G	R	G	R	G
X offset	-2	4	-3	3	2	6	1	3	-1	4	-7	-1
Y offset	1	2	2	2	5	3	1	1	4	3	1	0

Aligning images using Harris corner detection and RANSAC

To align the color channels of the image, we find the Harris response of R, G and B channels. We need to take the top 200 features from the response, but most of them are bunched up around their local maxima, which wouldn't help in properly aligning the color channels. So, we take the top 200 local maxima and use them to align the channels. We choose a random feature from the reference B frame and R/G frame and use them to calculate the offset between them. This offset is applied to the R/G frames and used to calculate the numbers of inliers by seeing if there are features in a particular range of the features of frame B. The offset with the highest inliers is used to align the color channels.

image-corner 1

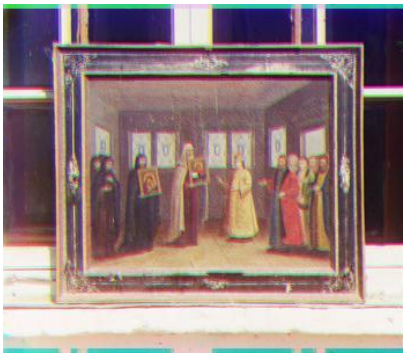

image-corner 1

image-corner 3

image-corner 4

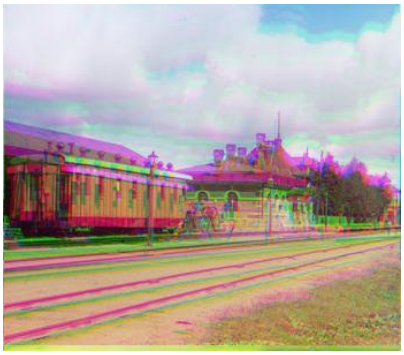

image-corner 2

image-corner 6

Alignment offsets using Harris corner and RANSAC

Images	Image1-corner		Image2-corner		Image3-corner		Image4-corner		Image5-corner		Image6-corner	
channels	R	G	R	G	R	G	R	G	R	G	R	G
X offset	-2	4	-4	4	5	4	1	3	-2	-5	-7	-1
Y offset	-5	0	0	0	-1	-4	-1	-1	-1	1	7	1