

Digital Image Analysis (COL783)

Assignment-3 Report

Image Super-Resolution

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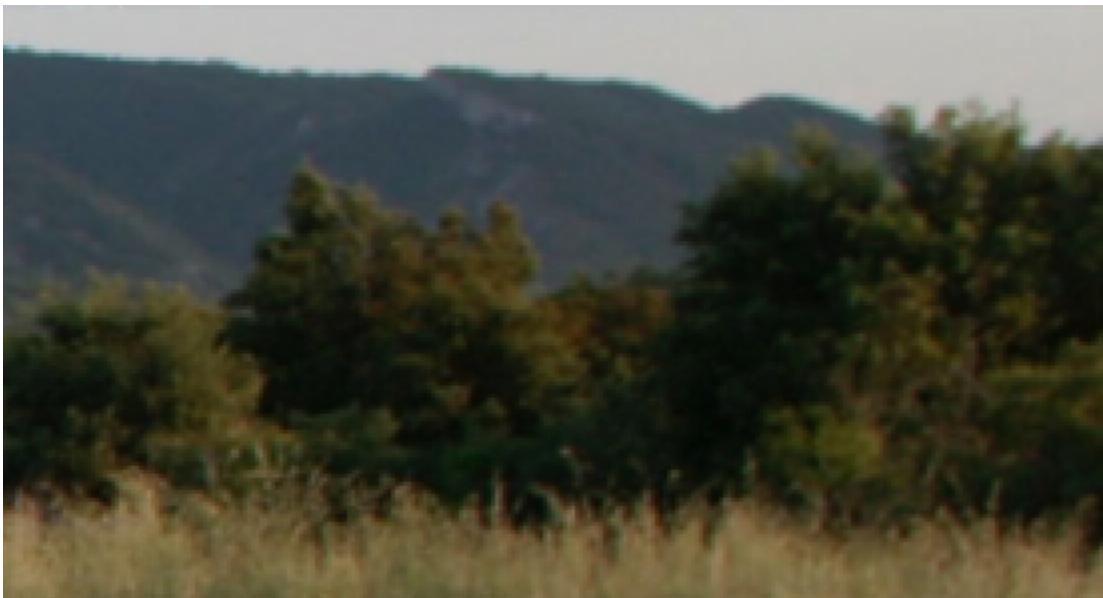
1. Image Super-Resolution using Single Image

We have used the following methods for Image Super-Resolution on the given input images:

- Nearest-Neighbor Interpolation Method
- Bicubic Interpolation Method
- Implemented the paper: [1] Super-Resolution from a single Image

A. Nearest-Neighbor Interpolation Method

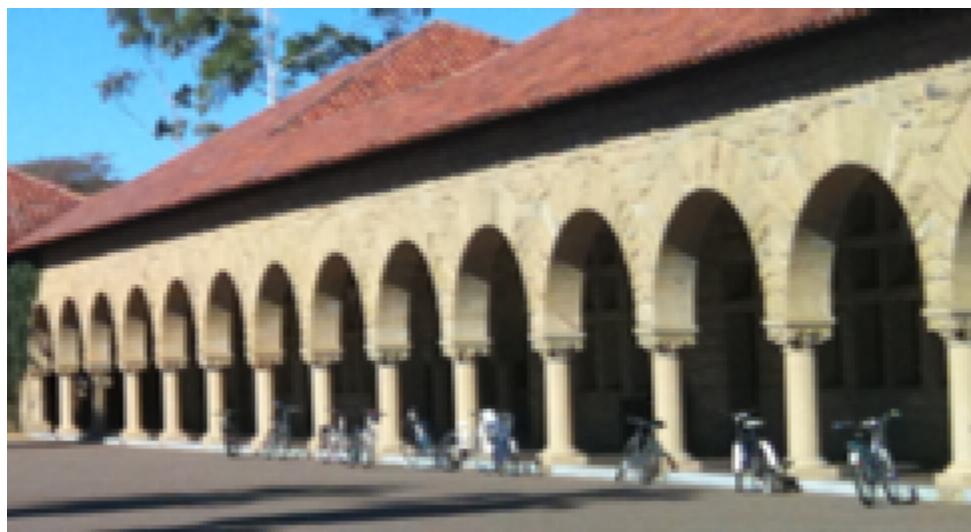
1. Image 1



2. Image 2



3. Image 3



B. Bicubic Interpolation Method

1. Image 1



2. Image 2

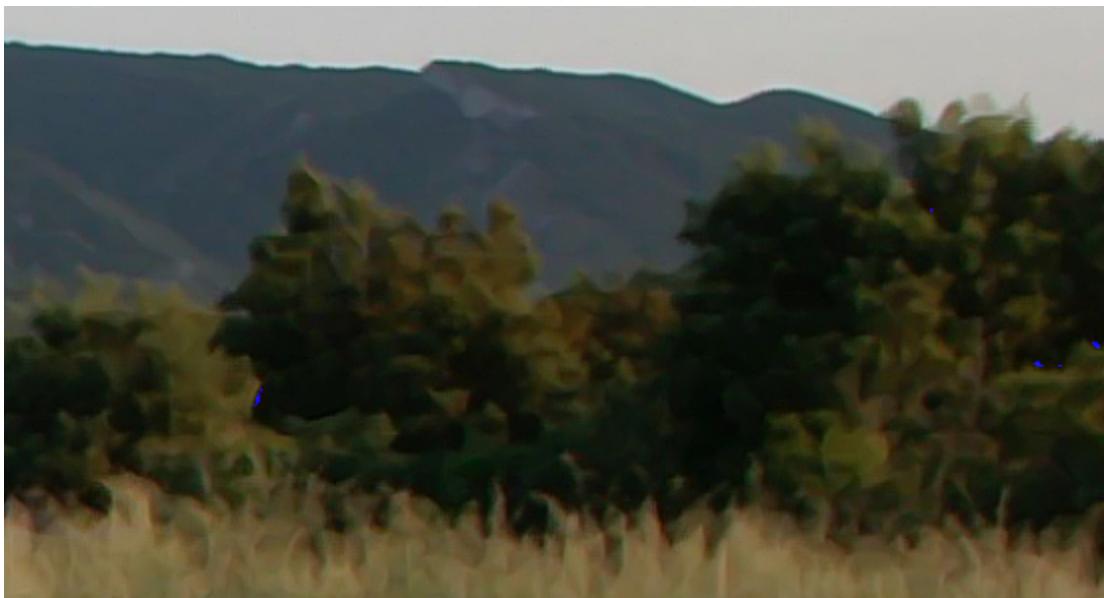


3. Image 3



B. Implementation of paper [1]: Superresolution using Single Image

3. Image 1



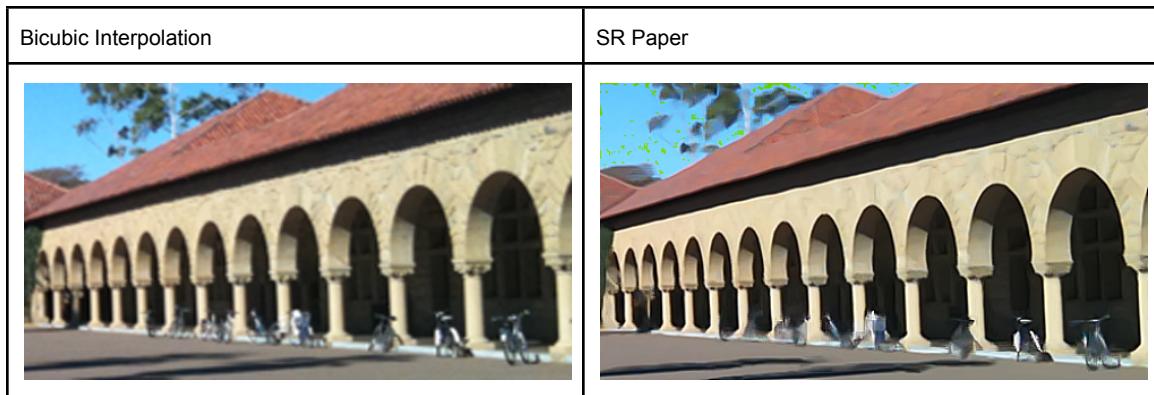
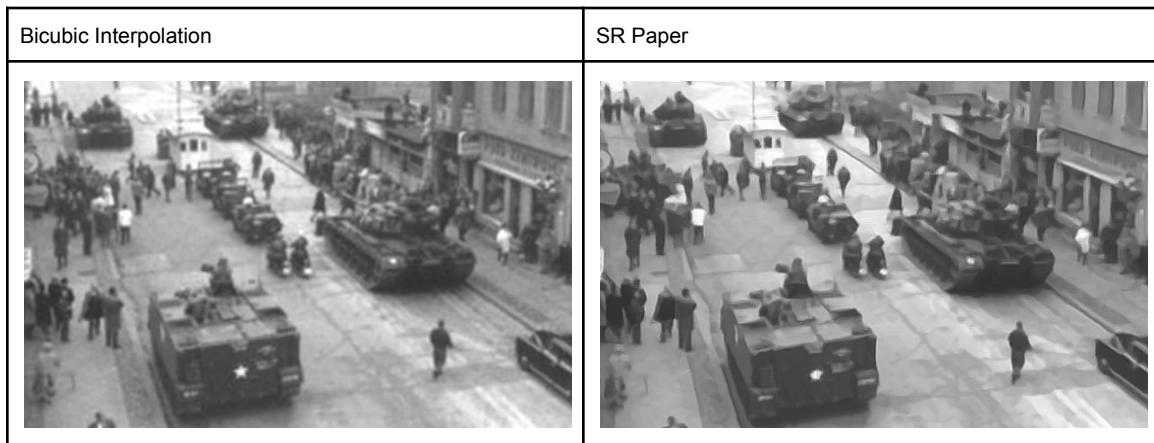
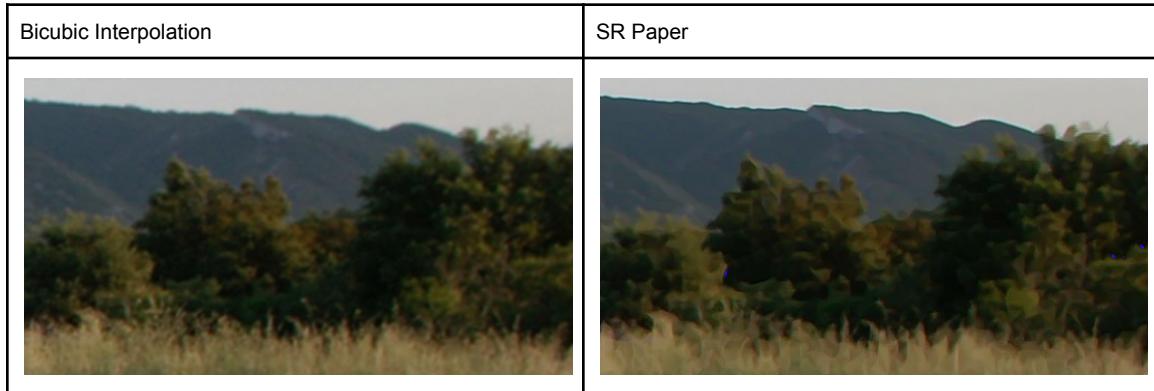
4. Image 2



3. Image 3



Comparison of SR Paper implementation with Bicubic Interpolation Images



2. Extensions

A. Patch Similarity Measure: Gaussian weighted SSD vs. Cosine Distances

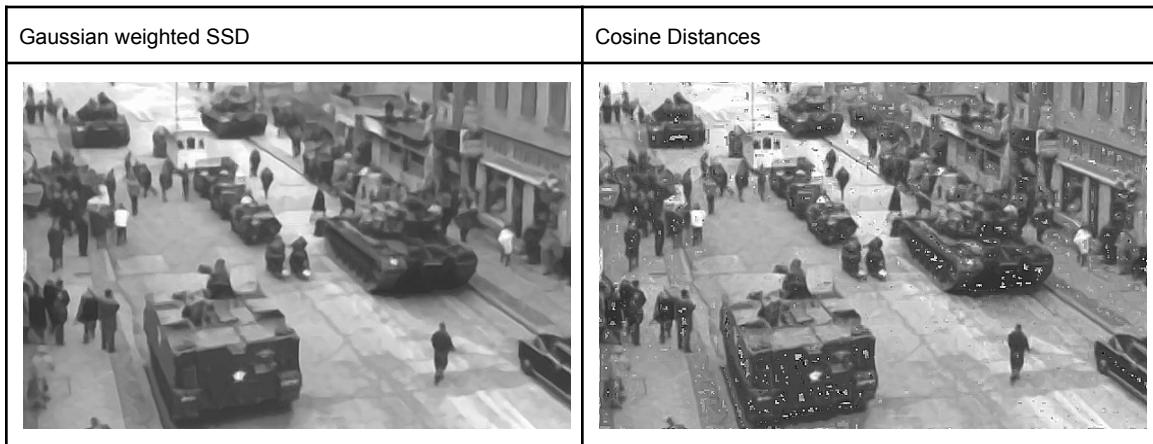
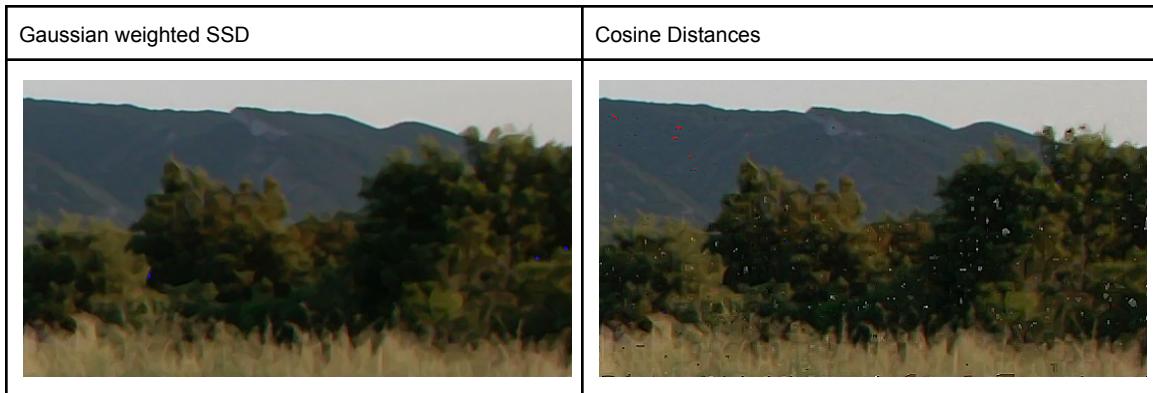
In this extension, we have compared the images based on the patch similarity measure used while comparing two 5x5 patches with the image scale space. That patch pair will be later used as an LR-HR pair of patches.

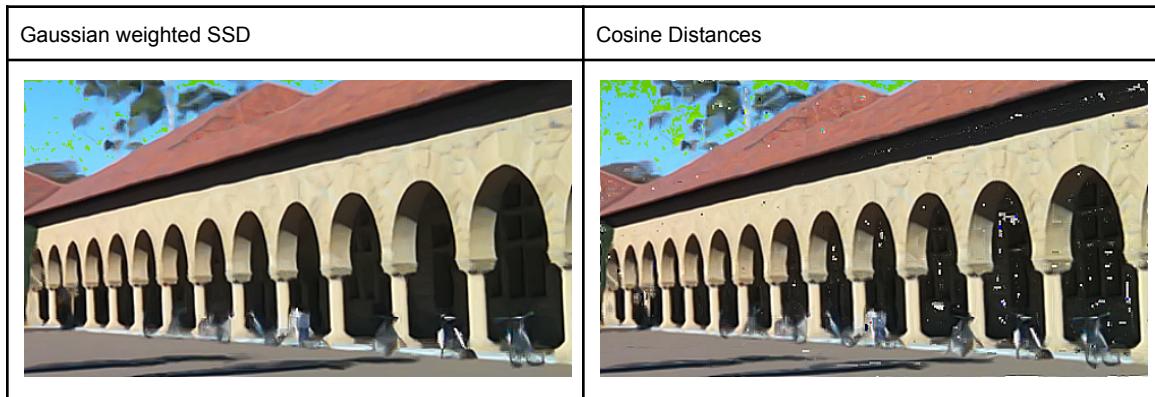
We have used Gaussian weighted SSD in the actual implementation of the paper [1].

Cosine Similarity b/w two patches p1 and p2 are compared as :

$$\cos \theta_{p_1, p_2} = \frac{p_1 \cdot p_2}{|p_1||p_2|}$$

Cosine Distance = 1-Cosine Similarity





B. Patch Similarity Measure: Gaussian Weighted SSD vs. Manhattan Distance

We have computed Manhattan distance b/w two patches p and q as

$$d_1(\mathbf{p}, \mathbf{q}) = \|\mathbf{p} - \mathbf{q}\|_1 = \sum_{i=1}^n |p_i - q_i|$$



Gaussian weighted SSD	Manhattan Distances
	

Gaussian weighted SSD	Manhattan Distances
	

C. Patch Similarity Measure: Gaussian Weighted SSD vs Correlation

Gaussian weighted SSD	Correlation
	

Gaussian weighted SSD	Correlation
	

Gaussian weighted SSD	Correlation
	

B. Enhanced Prediction

- We have applied all eight transformations to the input image as given in the paper and given them as an input to our SuperResolution Code.
- Then performed, reverse transformation on the HR images.
- In the end, We computed the average image from all eight images.

Example of the transformations in the input image 3:

			
original	rotated 90 °	rotated 180 °	rotated 270 °
			
flipped	90 ° & flipped	180 ° & flipped	270 ° & flipped

SR Code	SR Code with Enhanced Prediction
	

SR Code	SR Code with Enhanced Prediction
	

SR Code	SR Code with Enhanced Prediction
	

References:

- [1] D. Glasner, S. Bagon, and M. Irani, “Super-resolution from a single image,” in 2009 IEEE 12th international conference on computer vision. IEEE, 2009, pp. 349–356.
- [4] R. Timofte, R. Rothe, and L. Van Gool, “Seven ways to improve example-based single image super resolution,” in Proceedings of the IEEE conference on computer vision and pattern recognition, 2016, pp. 1865–1873.