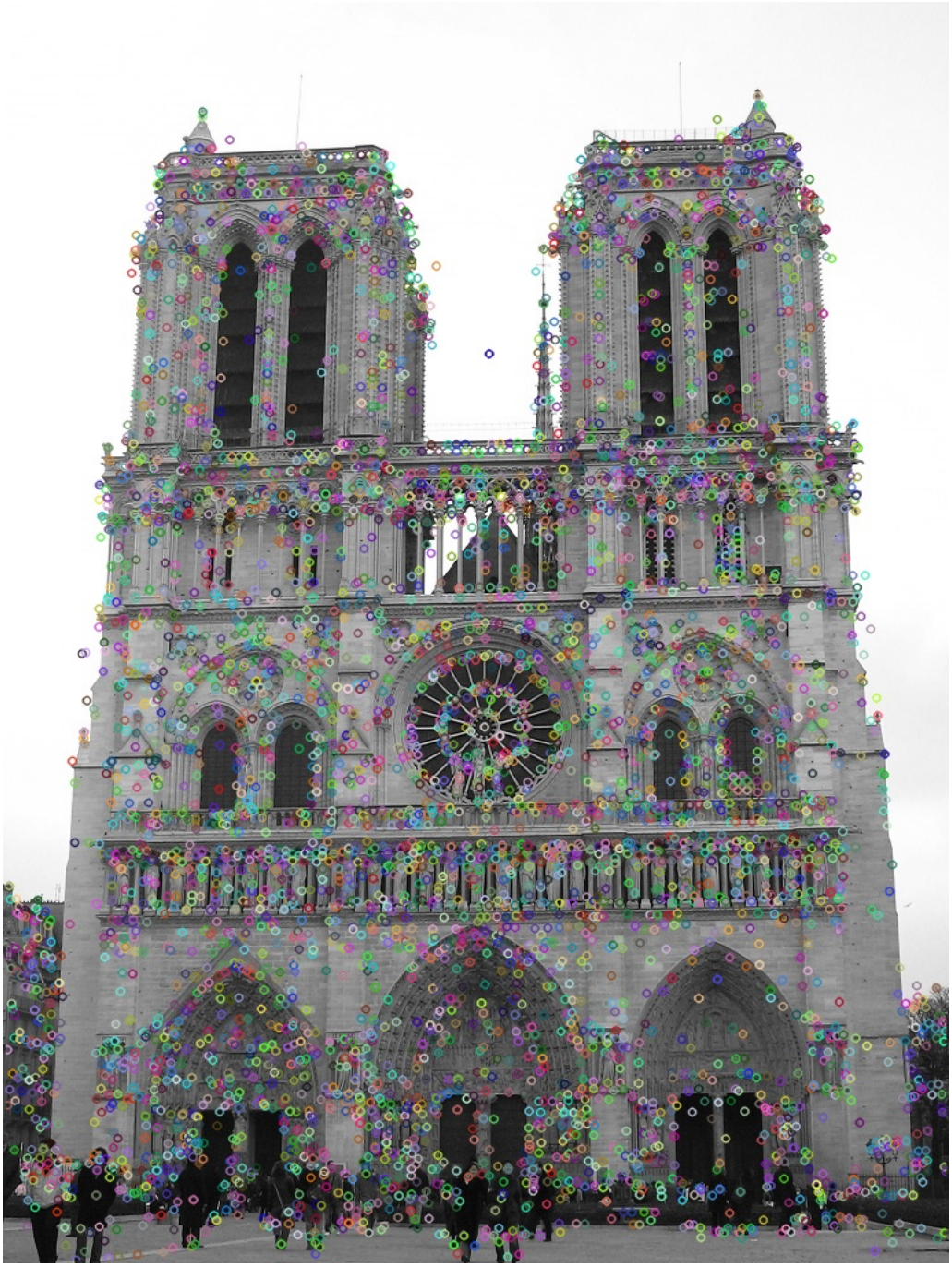
Task 1 a.

We get 6233 keypoints in original image using default parameters

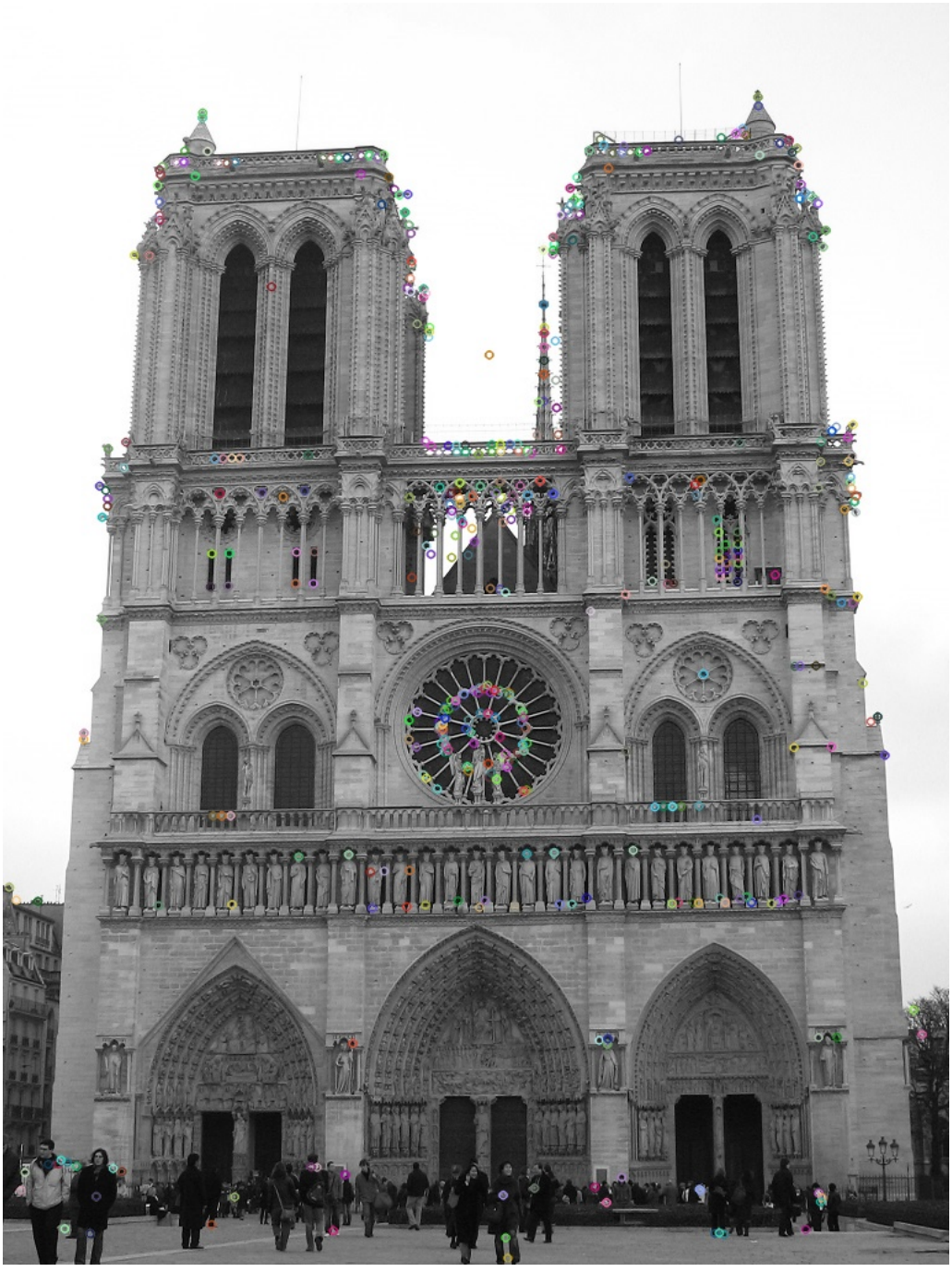


Task 1 b.

Using nfeatures = 0 and contrastThreshold = 0.1362, we get 620 keypoints which is 10% of keypoints that we got using default parameters.

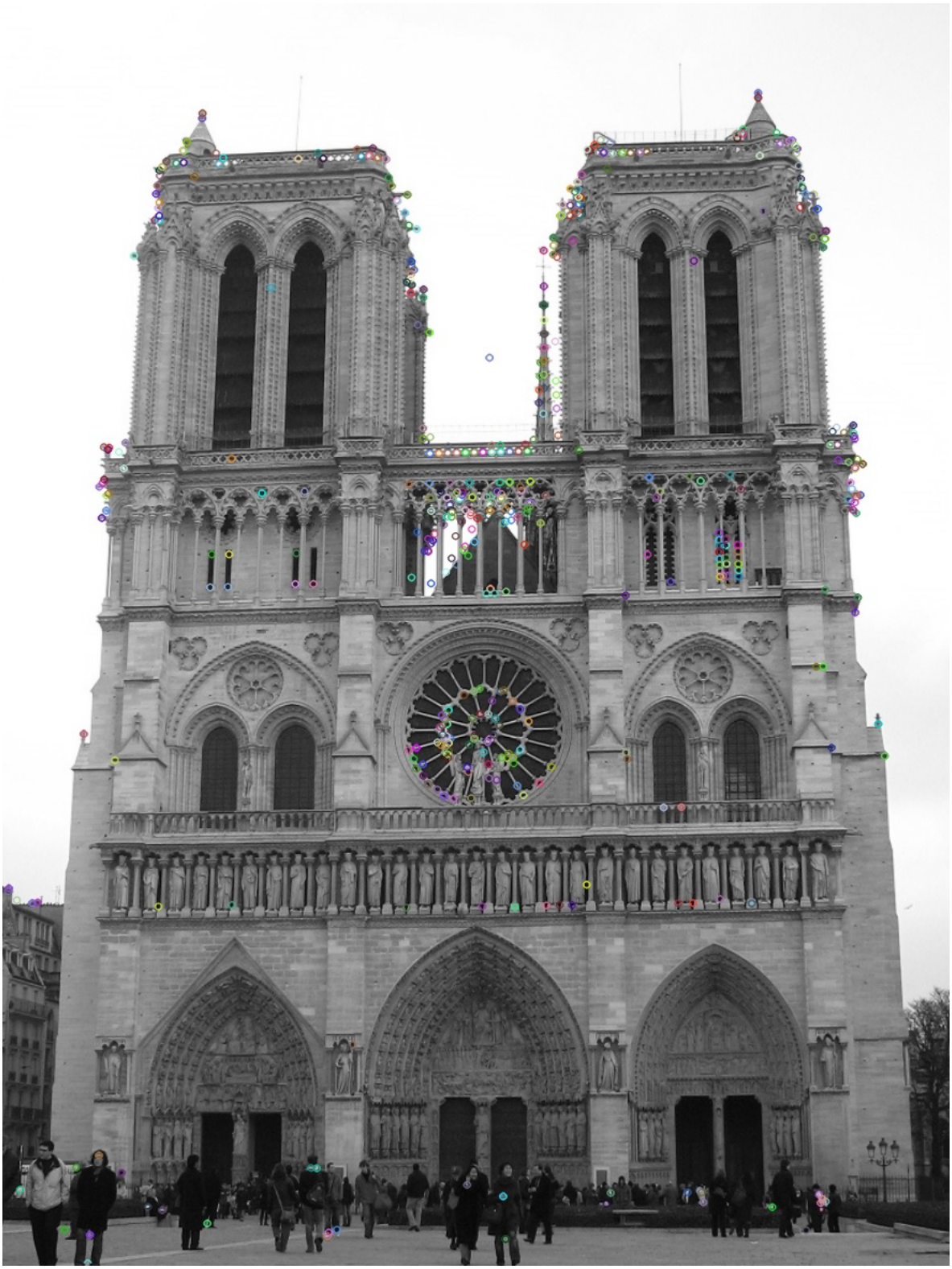
Using nfeatures=623 and contrastThreshold = 0.03, we get 623 keypoints which is 10% of keypoints that we got using default parameters.

I will be using nfeatures=623 and contrastThreshold = 0.03 for all the next tasks.



Task 2. a.
After scaling the image 115 percent
Resized Dimensions : (1177, 883, 3)

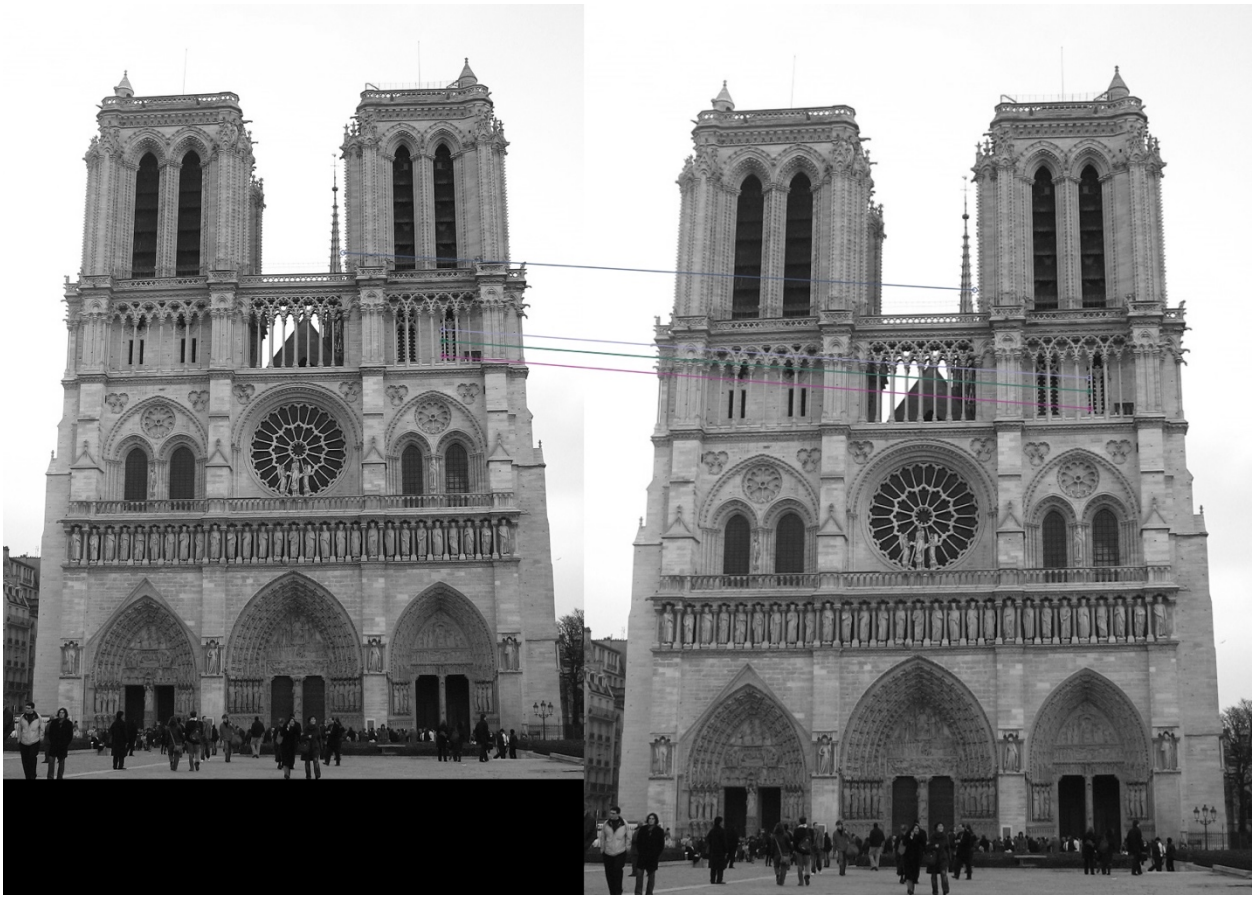
Task 2. b. Scaled image with 623 key points.



Task 2. c.
Yes, the keypoints are roughly same of scaled image and original image. SIFT is scale invariant. Scaling does not affect keypoints. Mostly concentrated in the center of image and top.

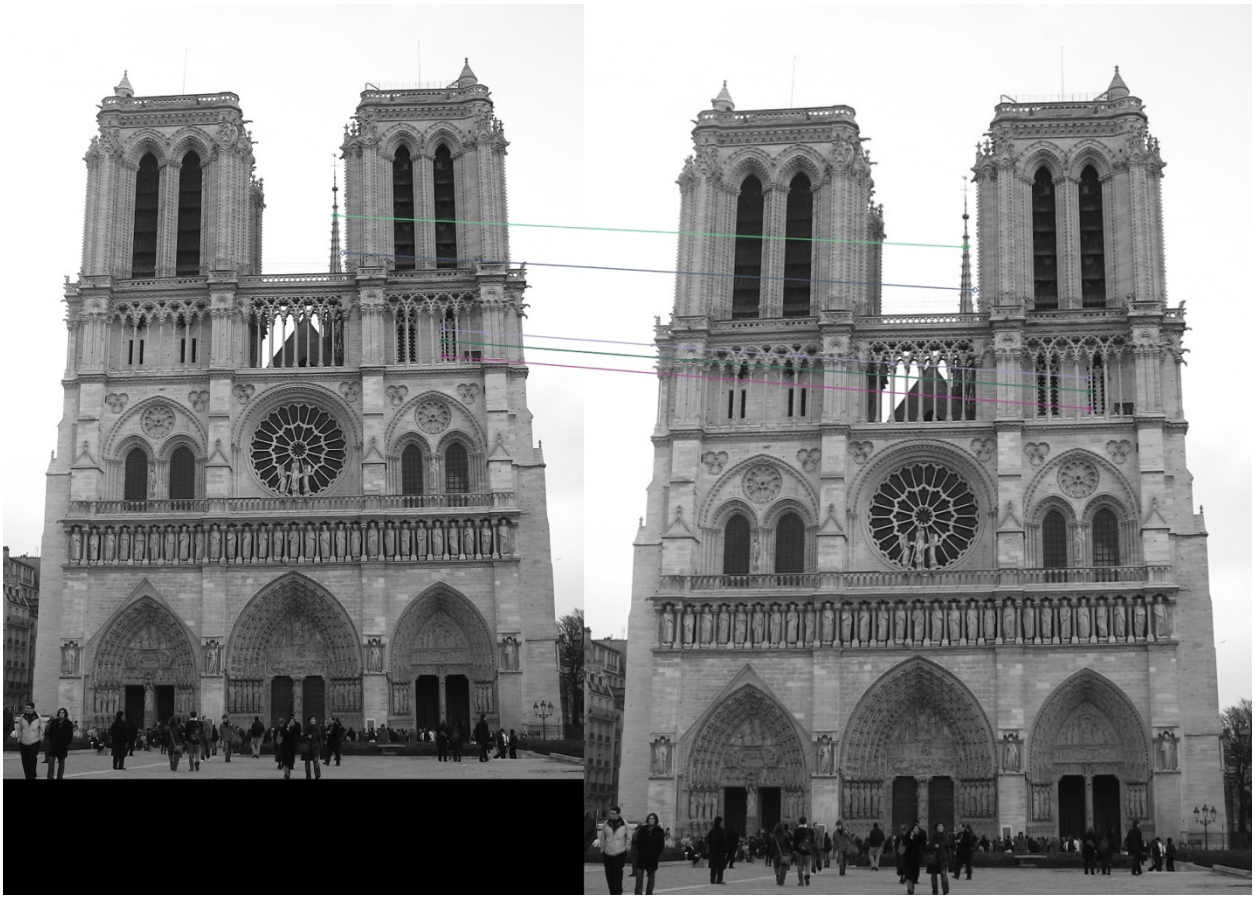
Task 2.d.
The 5 best matching descriptors after using the nearest-neighbour distance ratio method with ratio of 0.75, I get 4 visible lines but in actual there are 5 lines with different lengths. May be the coordinates for 2 keypoints are too close to each other that distinct lines are not visible. Below are 5 different lengths I get.

[(**26.191600799560547**, [<DMatch 0x110526db0>]), (**26.81417465209961**, [<DMatch 0x110526d70>]), (**30.133037567138672**, [<DMatch 0x110526d30>]), (**30.72458267211914**, [<DMatch 0x11051f0b0>]), (**33.763885498046875**, [<DMatch 0x1105269b0>])]



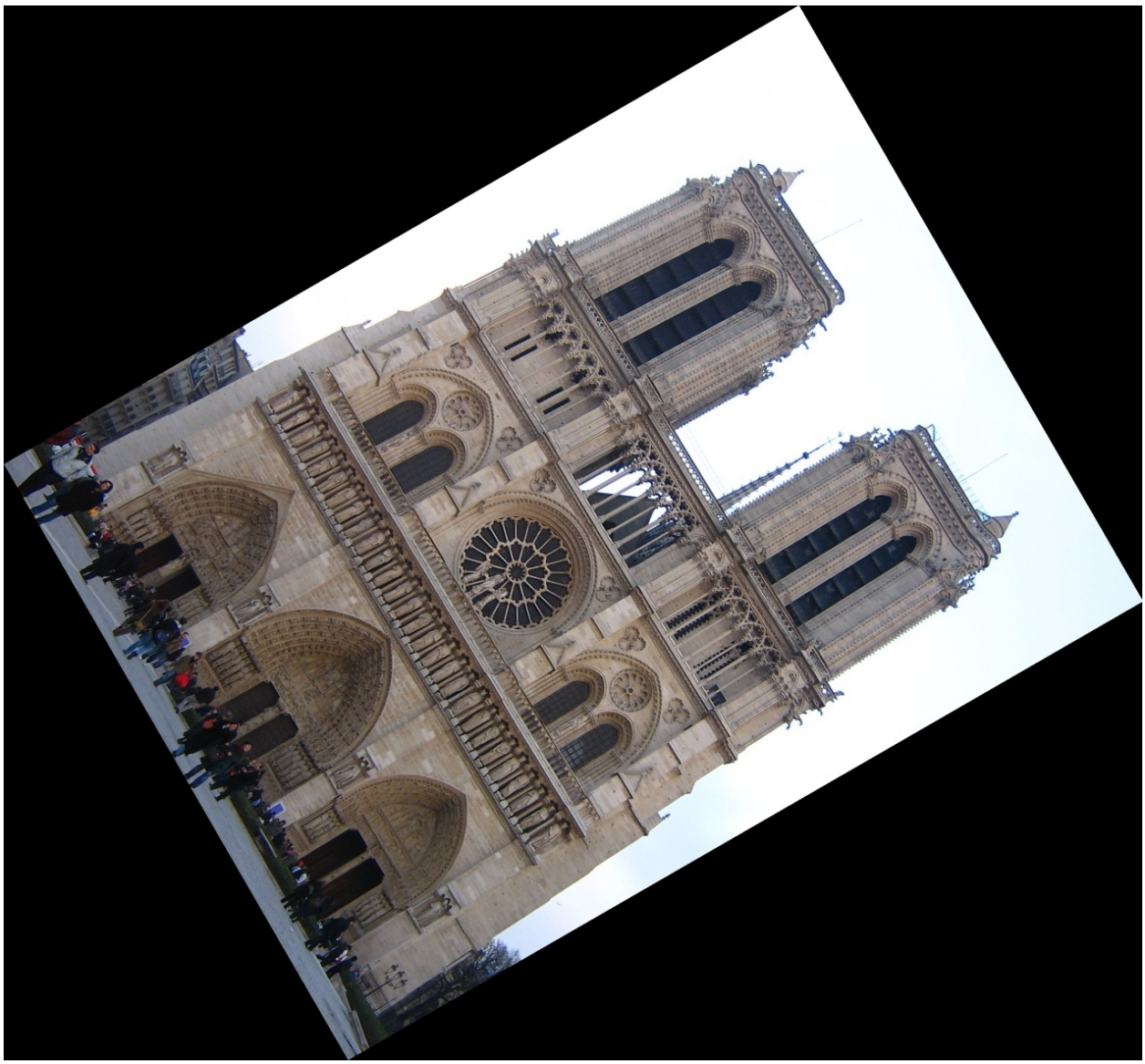
When I use best 6 matching descriptors then 5 lines are clearly visible. Below are 6 different lengths I get.

[(26.191600799560547, [<DMatch 0x110526db0>]), (26.81417465209961, [<DMatch 0x110526d70>]), (30.133037567138672, [<DMatch 0x110526d30>]), (30.72458267211914, [<DMatch 0x11051f0b0>]), (33.763885498046875, [<DMatch 0x1105269b0>]), (33.83784866333008, [<DMatch 0x1105210f0>])]

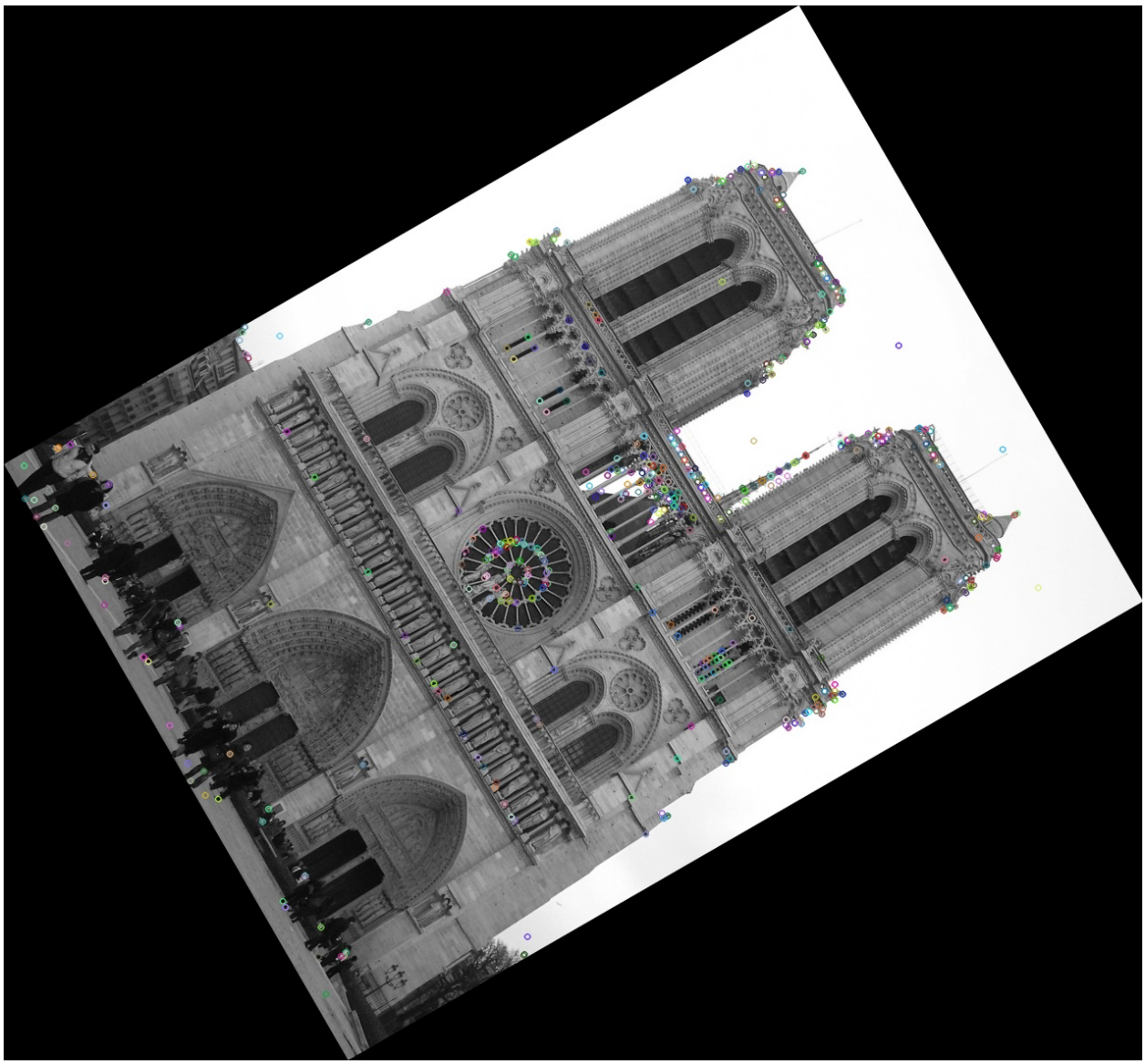


Task 3.a.
Rotated using imutils.rotate_bound

Rotated Dimensions : (1177, 1270, 3)



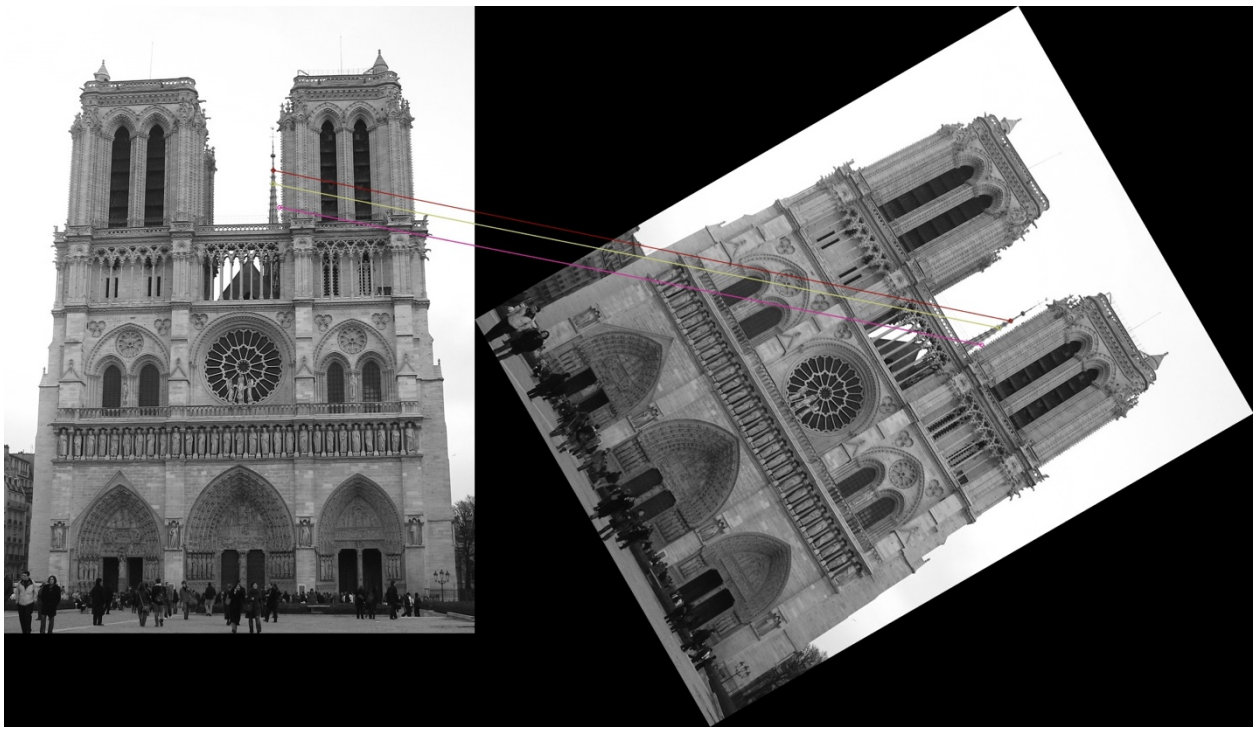
Task 3.b.
Rotated image with 624 key points.



Task 3.c.
Yes, the keypoints are roughly same of rotated image and original image. SIFT is rotation/orientation invariant. Rotation does not affect keypoints. Mostly concentrated in the center of image and top.

Task 3.d.
The 5 best matching descriptors after using the nearest-neighbour distance ratio method with ratio of 0.75, I get 3 visible lines but in actual there are 5 lines with different lengths. There may be overlapping of lines making them not visible. Below are 5 different lengths I get.

[(**7.416198253631592**, [<DMatch 0x10f9e7130>]), (**8.0**, [<DMatch 0x10f9e7070>]), (**9.380831718444824**, [<DMatch 0x10f0afe30>]), (**10.677078247070312**, [<DMatch 0x10f0afeb0>]), (**11.704699516296387**, [<DMatch 0x10f9e4e30>])]



When I use best 7 matching descriptors then 5 lines are clearly visible. Below are 7 different lengths I get.
[(7.416198253631592, [<DMatch 0x13996e130>]), (8.0, [<DMatch 0x13996e070>]), (9.380831718444824, [<DMatch 0x11bb45e30>]), (10.677078247070312, [<DMatch 0x11bb45eb0>]), (11.704699516296387, [<DMatch 0x13996be30>]), (12.369317054748535, [<DMatch 0x139974570>]), (12.489995956420898, [<DMatch 0x13996e3b0>])]