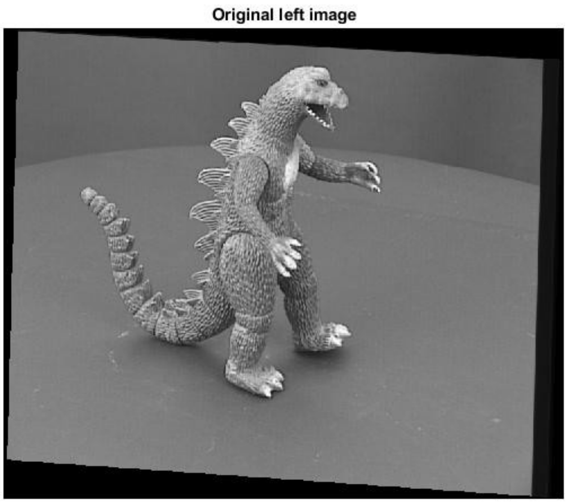
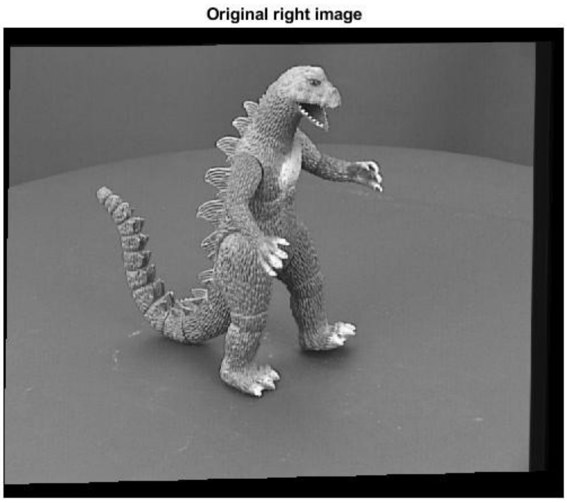
Computer Vision Lab session n. 7
27/05/2018

Disparity Computation

The aim of this lab session is to implement the a function similar to matlab function disparity(). This function computes the disparity between two stereo images (couple of image of the same subject but with different angles because they are taken by two near cameras).
The disparity can help, for example, to understand how much a point is near to the camera.


Original left image


Original right image

Sum of Squared Differences (my_ssd.m)
For the next steps, we need this function which computes the differences between 2 image patches (of the same size), to understand the similarity between them.

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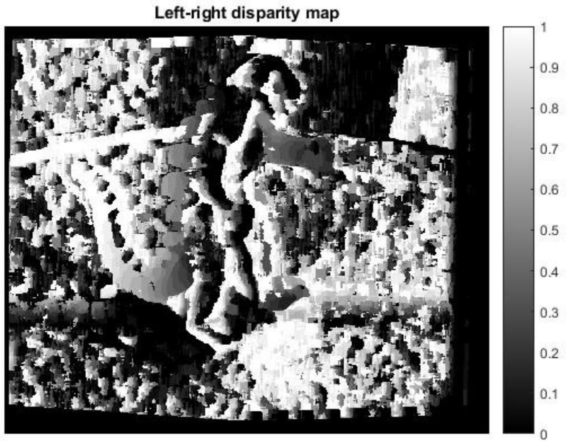
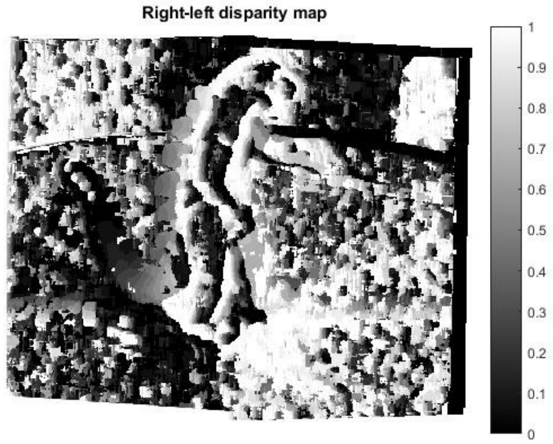
Disparity Map (my_disparity.m)





The disparity map is a matrix in which for every pixel of the first image, we put the column (respect to that point) of the most similar point in the second image.
Es if (5,5) has the most similarity point in (5,9) → disparity(5,5) = 4
Note that we check the disparity only on the rows: this because the two camera are at the same height (almost) (they are left and right camera, not up and down camera!) so the shifting is only (almost) horizontal.

To compute the disparity we need (in addition to the two images):
- A window W which says how many near pixel are taken into consideration when we computes the ssd.
- The drange [dmin, dmax] where to search for the similarity point in the second image.

When computing the right-left disparity we can use the same function, but with dmin and dmax exchanged and with opposite sign (drange = [-dmax -dmin]) to be consistent with the previous disparity map.

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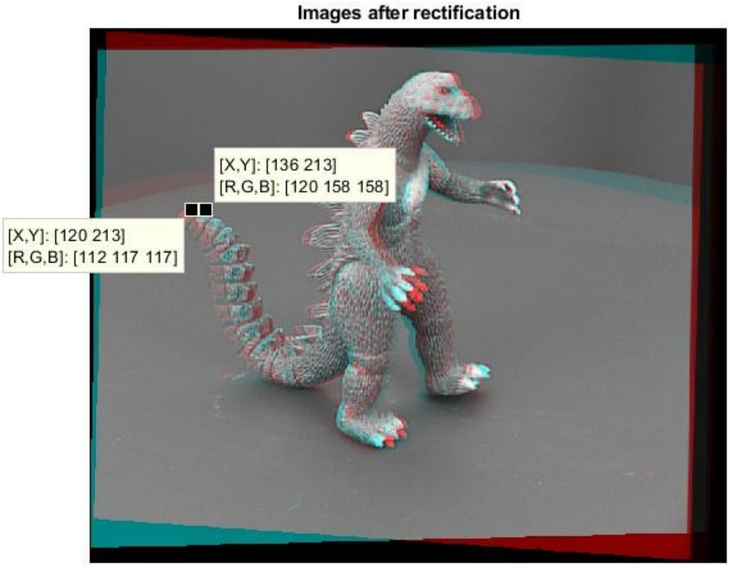
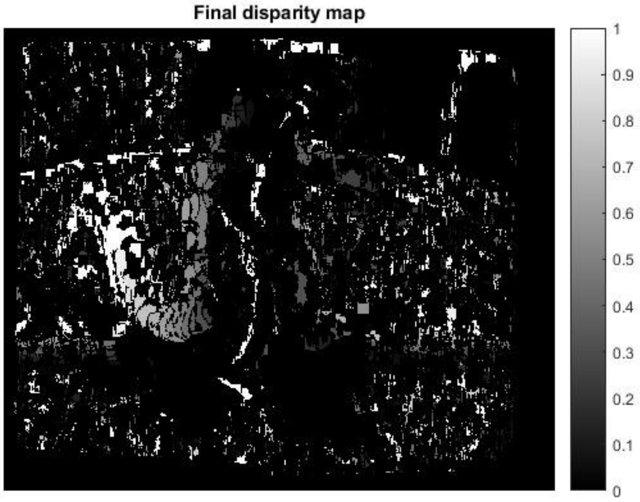
The choice of drange value is crucial: too low value and we don’t find the right correspondence point in the second image, too big value and we put too much noise (correspondence point could be a wrong distant point).
To find nice values for this is useful a rectified images, which plots the 2 image one above the other with different colors. This could help to understand how much the two images are shifted:



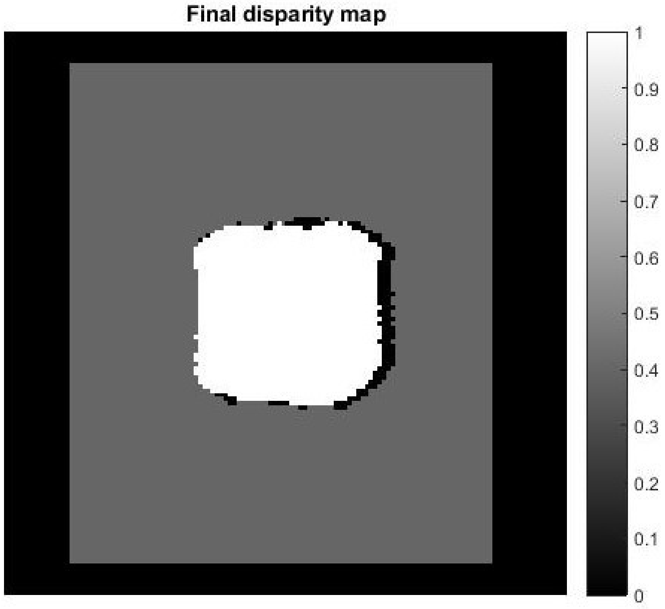
Left-Right consistency of Disparity maps (my_disparity_final.m)
The problem with to compute only the disparity between one image and another is that we can have no consistency, so we need also to combine the disparity from left to right and the disparity from right to left to find the right consistency.

Having both the maps, we check if Dlr(i,j) == Drl(i,j+Drl(i,j)).
If this is true then the consistency is confirmed and we put Dfinal(i,j) = Drl(i,j).
If this is false we put in Dfinal(i,j) the minimum floating point (-realmax(‘single’)) as matlab do with t consistent points.

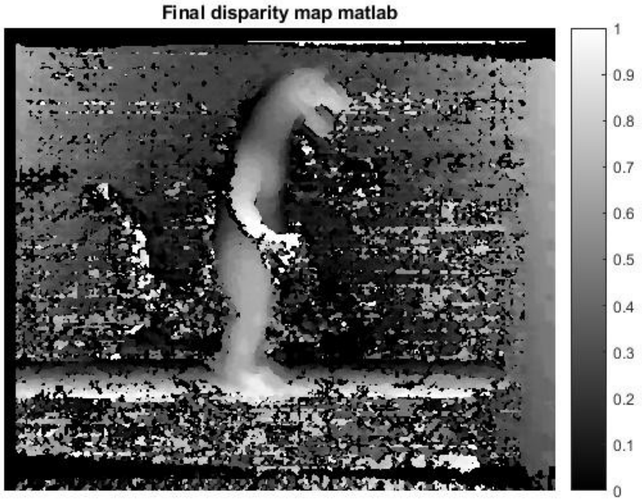


Conclusion

Our result are good with only the first couple (as we can see below). It is the most simple because it is a synthetic image create for the scope.



In real case images, matlab function is a lot better: for the result but also for the computation time: our takes like 2 minutes, matlab a few seconds.



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