3D Data Processing - Stereo Matching Lab

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1 Main Goal

The goal of the homework is to compute disparity maps of stereo images using Patch Matching algorithm.
I extend and provided C++ software with the patch match core functionalities: disparity propagation and random search.

2 Implementation

The goal is to extend the *process*() method to perform:

1. **Spatial propagation**
2. **Random search around the current disparity**
3. **View propagation**

Let's now focus on the idea applied for each of the aforementioned method.

2.0.1 Spatial propagation

spatial_propagation(): we evaluate whether assigning to p the disparity d_q of spatial neighbor pixel q decrease the matching costs.
If $m(p, d_q) < m(p, d_p)$, accept the new disparity.

2.0.2 Random search around the current disparity

disp_perturbation(): we should perturb the disparity at position (x,y) by a factor of $delta_z$ where $delta_z \in [end_{dz}, max_{delta_z}]$.
In this method I decide to iterate n times (n is a ranodm value between 1 and $max_{delta_z} - end_{dz}$) and for each iteration I randomly compute $delta_z$ and If we get a smaller cost with the new disparity we accept the new one.

2.0.3 View propagation

view_propagation(): we check all pixels $p^{'}$ of the second view that have our current pixel p as a matching point according to their current disparity.
If $m(p, -d_p^{'}) < m(p, d_p)$ accept the new disparity.

3 Results

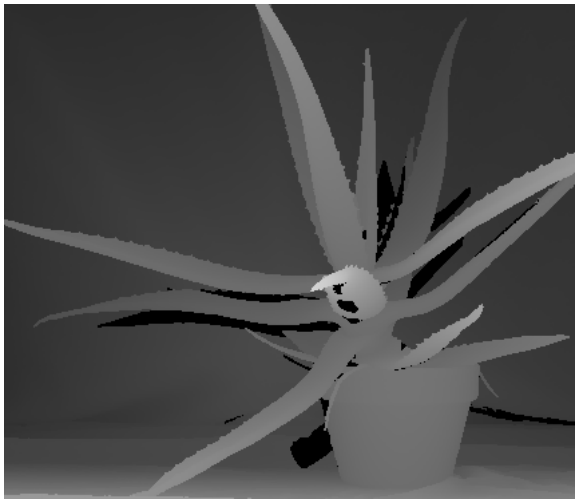
In this section we report the results obtained for all the 3 datasets:

- Aloe
- Cones
- Rocks1

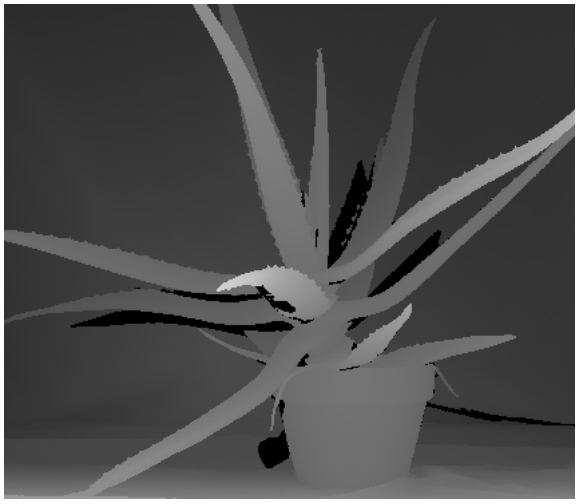
3.1 Aloe Dataset

a) Left View

b) Right View

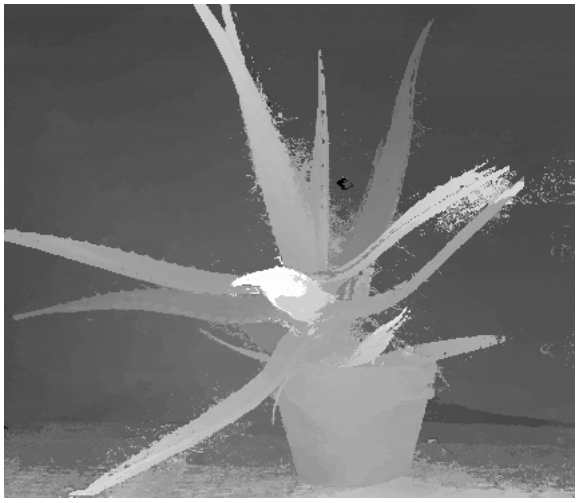


c) Left Ground Truth



d) Right Ground Truth

e) Left Disparity



f) Right Disparity

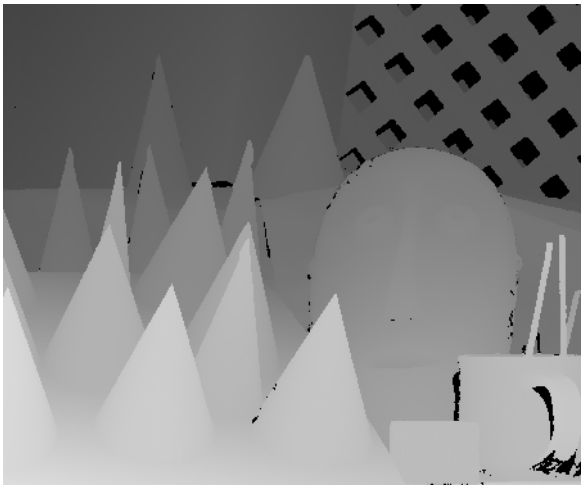
Left Image MSE error: **19.0764**

Right Image MSE error: **25.74**

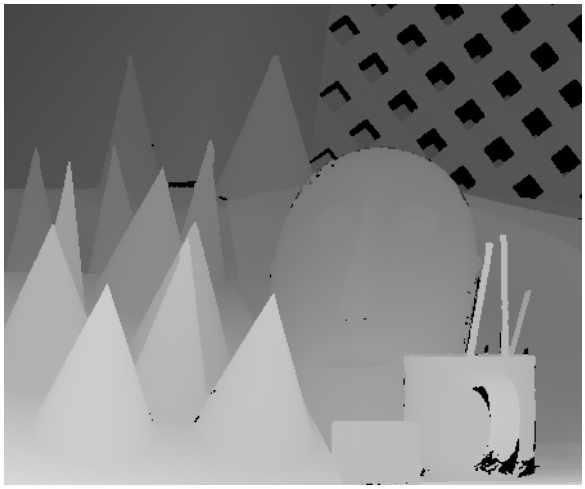
3.2 Cones Dataset

a) Left View

b) Right View

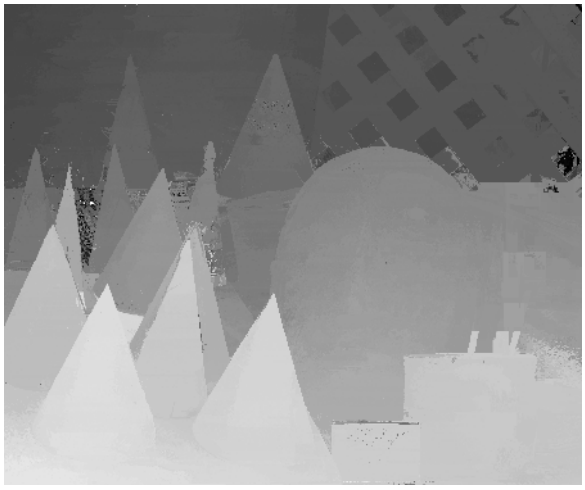


c) Left Ground Truth



d) Right Ground Truth

e) Left Disparity



f) Right Disparity

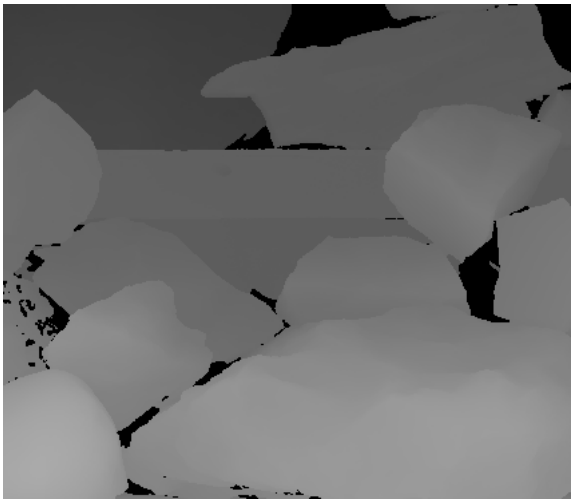
Left Image MSE error: **34.2922**

Right Image MSE error: **37.8383**

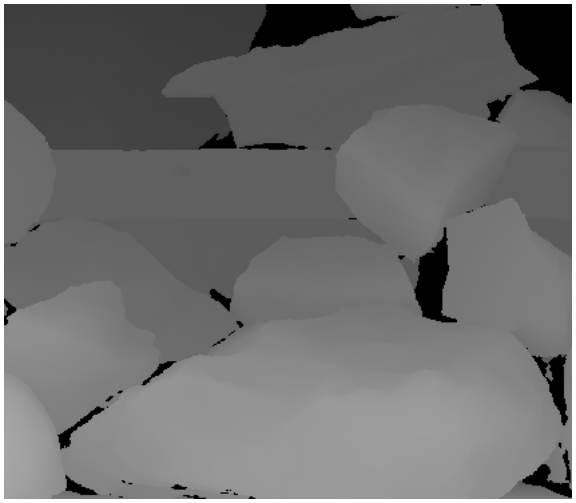
3.3 Rocks Dataset

a) Left View

b) Right View



c) Left Ground Truth



d) Right Ground Truth

e) Left Disparity
Left Image MSE error: **19.9633**

f) Right Disparity
Right Image MSE error: **25.1564**