VISION

Practical work 4 : GCDisparity

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RESULTS

1. Original parameters

Figure 1 : 3D mask, disparity mask (normal and blurred)

Parameters: d=10…55, **win=3**, **lambda=0.1**, sigma=3, zoom=2
Time: 52 seconds

2. NCC neighborhood size (win):

• A **larger** neighborhood size often leads to **smoother and more continuous disparity maps**. This is because it incorporates more context, reducing the impact of local noise or outliers in the disparity estimation.

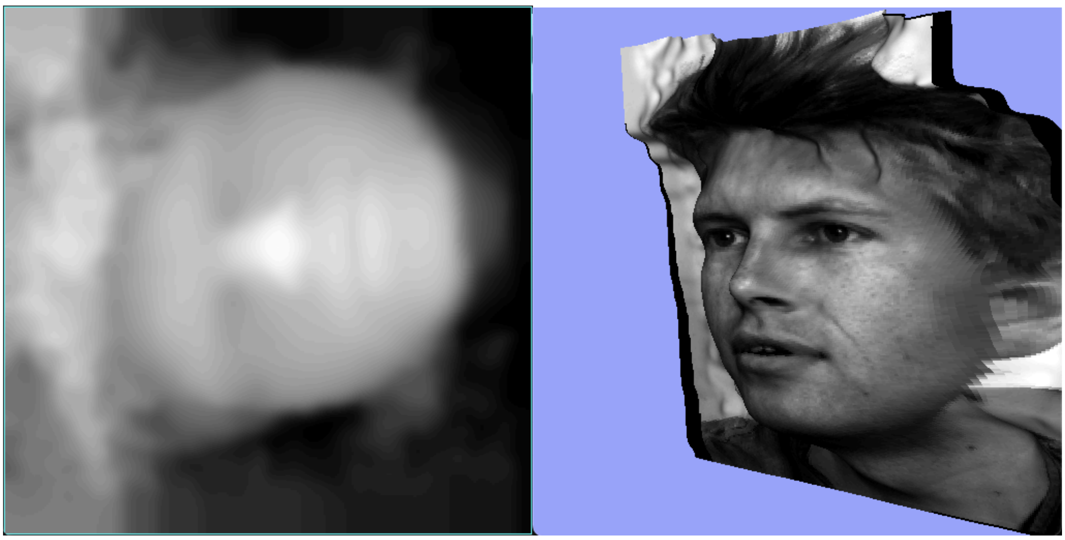
• Larger neighborhoods can help mitigate boundary effects. When using smaller neighborhoods, the matching process near the edges of the images can be influenced by partial information from one image. In contrast, a larger neighborhood includes more pixels from both images, which can **reduce errors near the image borders**.

However, there are trade-offs to consider:

• Larger neighborhood sizes require more computations, which can significantly increase the computational cost of disparity estimation.

• Using excessively large neighborhoods can lead to the **loss of fine details** and result in **overly smoothed** disparity maps (figure 4). If objects in the scene are close together or have fine details (i.e. a face), a smaller neighborhood size may be necessary to handle such cases effectively.

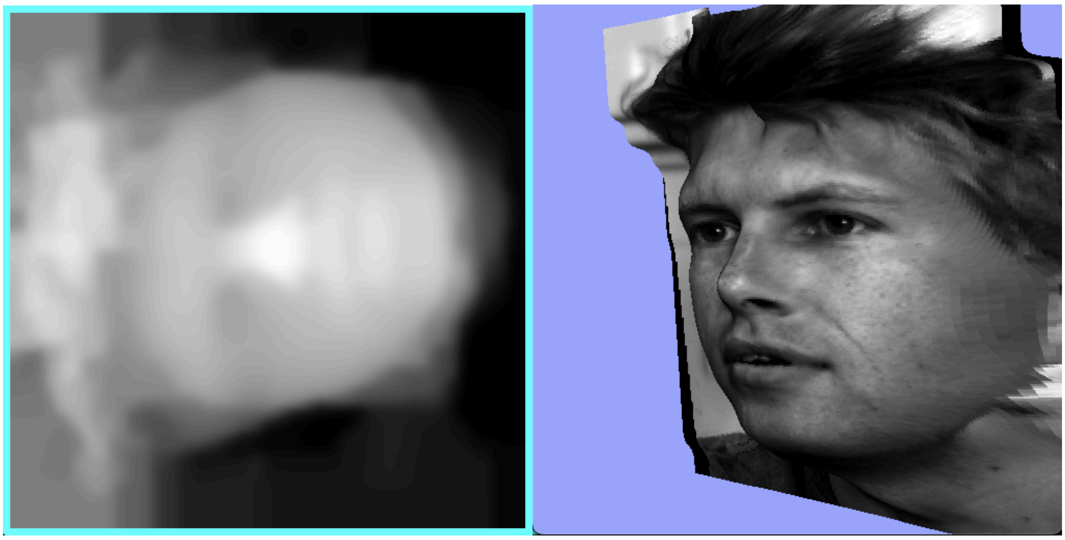
Figure 2 : Blurred disparity map, 3D Mask



Parameters: d=10...55, **win=1**, lambda=0.1, sigma=3, zoom=2

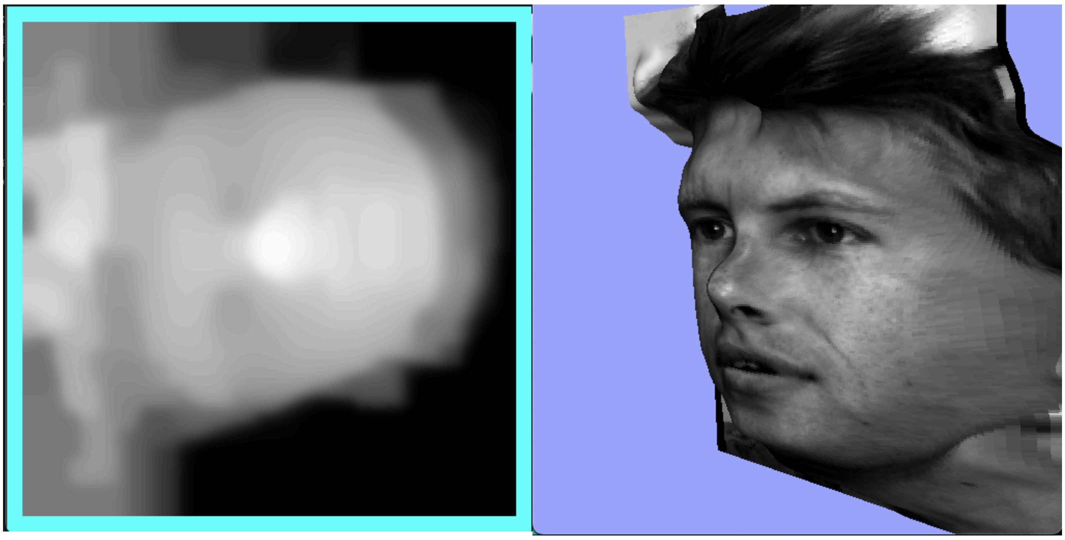
Time: 24 seconds

Figure 3 : Blurred disparity map, 3D Mask



Parameters: d=10...55, **win=7**, lambda=0.1, sigma=3, zoom=2
Time: 251 seconds

Figure 4 : Blurred disparity map, 3D Mask



Parameters: d=10...55, **win=15**, lambda=0.1, sigma=3, zoom=2
Time: 731 seconds

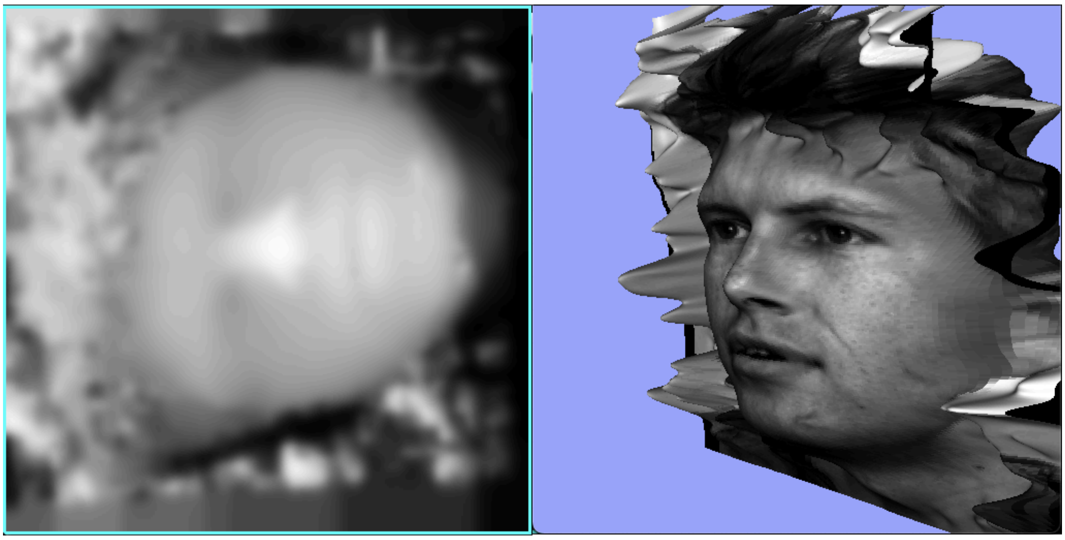
3. Regularization term (lambda):

• The lambda parameter controls the strength of the smoothness constraint in the optimization process. A **small lambda** means the smoothness term has relatively less influence compared to the data term. This can lead to the algorithm being **overly sensitive to local variations** in the data and cause oscillations or noise in the final result (figure 5).

However, If the lambda parameter is set too large, it can have several consequences:

• A **large lambda** gives strong emphasis to the smoothness constraint, which encourages spatial continuity and uniformity in the output. This means the algorithm will prioritize producing a very smooth result at the expense of fitting the data
• Fine details and small-scale variations in the data may be suppressed or completely ignored. The output may become relatively insensitive to local variations in the input data, causing a **loss of spatial structure and local information** (figure 6).

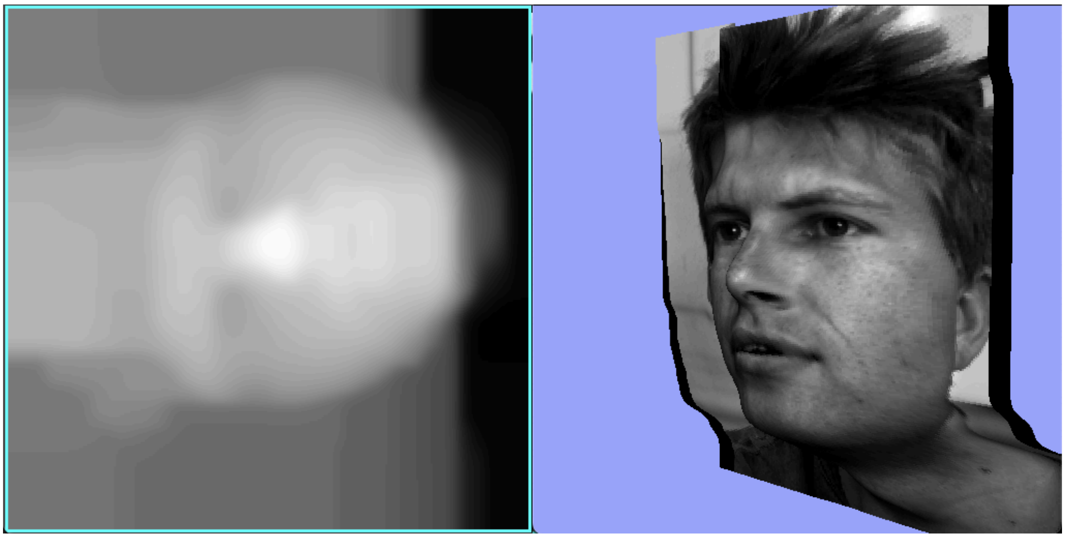
Figure 5 : Blurred disparity map, 3D Mask



Parameters: d=10...55, win=3, **lambda=0.01**, sigma=3, zoom=2
Time: 53 seconds

In summary, setting lambda to a very large value can lead to overly smooth and unresponsive results that may not effectively capture the details and nuances present in the input data. The optimal value for lambda should strike a balance between data fidelity and smoothness, and it often requires careful tuning and experimentation to achieve the desired results for a specific application.

Figure 6: Blurred disparity map, 3D Mask



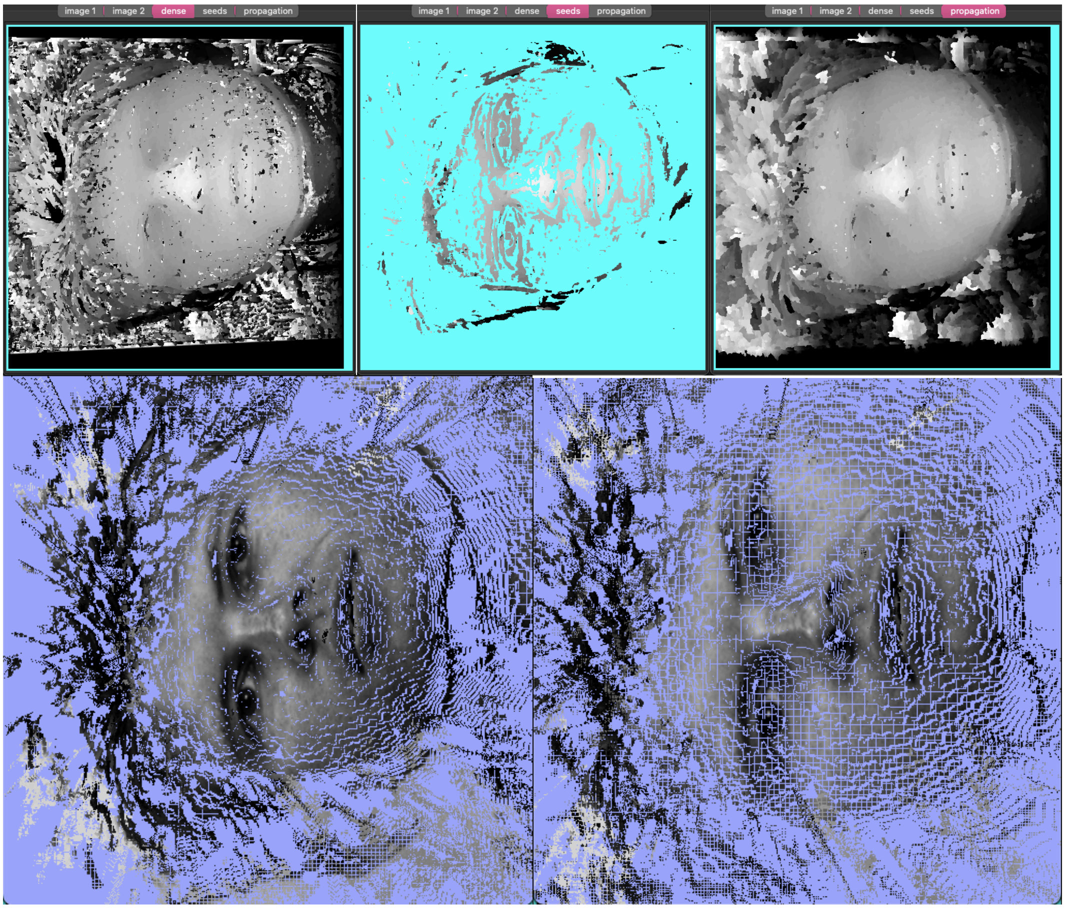
Parameters: d=10...55, win=3, **lambda=0.5**, sigma=3, zoom=2
Time: 100 seconds

COMPARISON WITH REGION GROWING METHOD

Region-growing methods are more suitable for situations where **simplicity**, **speed**, and **local information** suffice. They can be useful for quick, approximate results or when the image features naturally lead to region-based segmentation.

In our case, the region growing method doesn't perform well (figure 7). It may improve if the **parameters** were optimized.

Figure 7: Region-growing method



Parameters : d = 10..55, win = 3

Time: 128 seconds