Homework 1

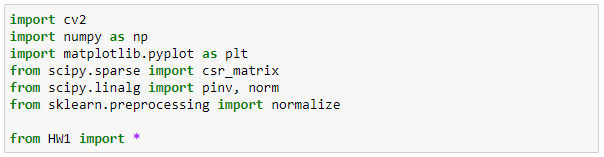
Computer Vision 2022 Spring

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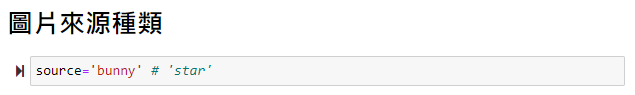
Github: https://github.com/frankye1000/NYCU-ComputerVision/tree/master/HW1

* **Preprocess**

1. Import package



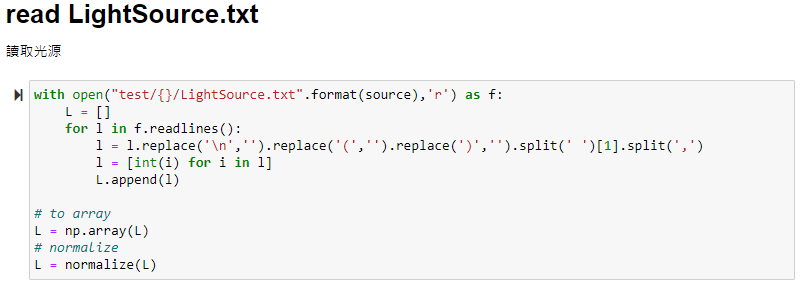
1. Set image source(‘bunny’、’star’)



* **Normal Estimation**

1. Read LightSource.txt

記得光源要做normalization!(圖1、圖2)



1. Read images

Use numpy.vstack to stack the image vectors



1. Use pseudo inverse calculate KdN



1. Visualize Normal map

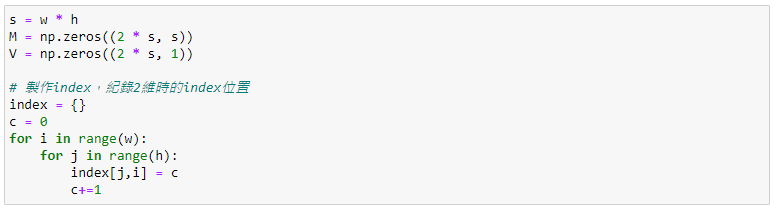
|  |  |
| --- | --- |
| 圖1、LightSource with normalization | 圖2、LightSource without normalization |
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|  |  |

1. Set Mask



* **Surface Reconstruction**

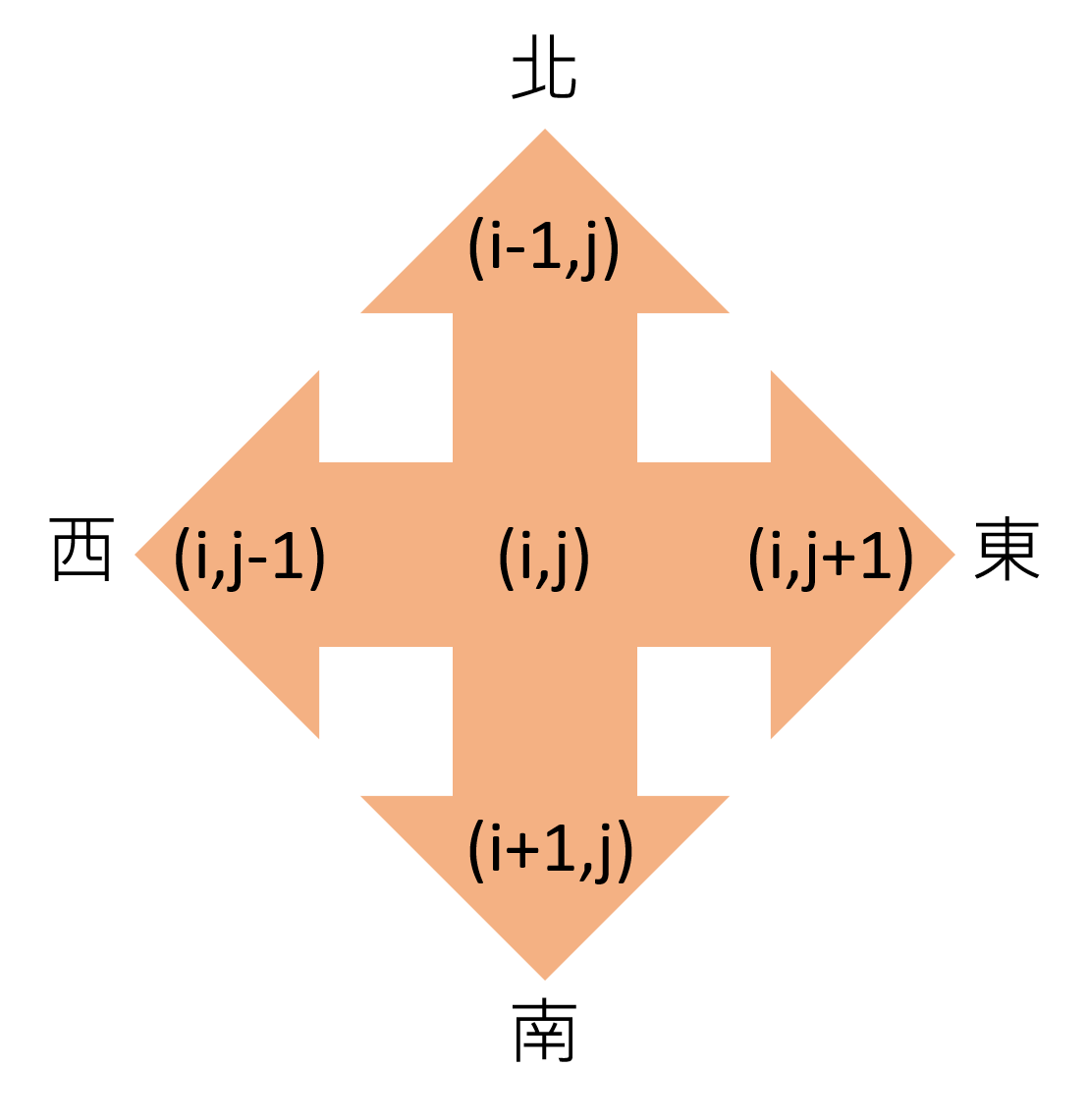
1. Set M、V, and set index dictionary to record 2D->1D index



1. Use Mask to determine vector direction and fill in M & V

To fill in the M and V matrices according to the following matrix orientation diagram (圖 3) and Mask, the rules are as follows:

* 1. 如果東北有向量，就用東北向量
  2. 如果西北有向量(東沒有向量)，就用西北向量
  3. 如果東南有向量(北沒有向量)，就用東南向量
  4. 如果西南有向量(東北都沒有向量)，就用西南向量
  5. 如果東南西北都沒有向量，就把z設成0



(圖3)



1. Use pseudo inverse calculate z, and reshape z



1. Visualize Depth map

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1. Save 3D ply
2. Show 3D ply

Set different baseline value

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| --- | --- | --- |
| baseline\_val = min(Z\_map) | baseline\_val = mean(Z\_map) | baseline\_val = max(Z\_map) |
|  |  |  |
|  |  |  |

* **Discussion and improve**

1. When reconstructing the surface, you can use Mask to only calculate patterns such as rabbits and stars, and reduce sparse matrix operations, thereby reducing time and memory usage.

For example, the star was originally calculated to be s=240\*240=57600, but if only the N part is counted, s=16626



1. Bonus- venus

If you don't deal with anything, you will find that **outliers** appear when you directly count the venus images.

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So I use statistical formula to calculate IQR, then find the upper and lower bounds, and set the z of the outlier outside the boundary to 0. The 3D image presented will not have the outlier phenomenon.

IQR = Q3 - Q1

Lowerbound = Q1 - 1.5\*IQR

Upperbound = Q1 - 1.5\*IQR

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另一個嘗試先對圖片進行高斯模糊，降低噪點，再進行運算。

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* **Conclusion**

In the previous attempt, bunny is the most suitable for 3D images, and venus is the least suitable. The initial observation should be that the position of the light source affects 3D imaging.