**Computer Vision HW1 Report**

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**Part 1.**

* **Visualize the detected corner for 1.png.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | DoG Image (threshold = 5) |  | DoG Image (threshold = 5) |
| DoG1-1.png |  | DoG1-1.png |  |
| DoG1-2.png |  | DoG1-2.png |  |
| DoG1-3.png |  | DoG1-3.png |  |
| DoG1-4.png |  | DoG1-4.png |  |

* **Use three thresholds (5, 10, 15) on 2.png and describe the difference.**

|  |  |
| --- | --- |
| Threshold | Image with detected keypoints on 2.png |
| 2 |  |
| 5 |  |
| 7 |  |

(describe the difference)

可以從上圖看到，keypoints皆出現在顏色落差的邊緣處，並且當thresholds越來越大時，極值點數目則越來越少。正如同前面所說的keypoints出現在落差處，而點數目下降正是因為落差不夠明顯，因此被閥值過濾掉了。換句話說，thresholds提高時，只會減少原有的keypoints，並不會產生新的點。

**Part 2.**

* **Report the cost for each filtered image.**

|  |  |
| --- | --- |
| Gray Scale Setting | Cost (1.png) |
| cv2.COLOR\_BGR2GRAY | 1207799 |
| R\*0.0+G\*0.0+B\*1.0 | 1439568 |
| R\*0.0+G\*1.0+B\*0.0 | 1305961 |
| R\*0.1+G\*0.0+B\*0.9 | 1393620 |
| R\*0.1+G\*0.4+B\*0.5 | 1279697 |
| R\*0.8+G\*0.2+B\*0.0 | 1127913 |

|  |  |
| --- | --- |
| Gray Scale Setting | Cost (2.png) |
| cv2.COLOR\_BGR2GRAY | 183850 |
| R\*0.1+G\*0.0+B\*0.9 | 77882 |
| R\*0.2+G\*0.0+B\*0.8 | 86023 |
| R\*0.2+G\*0.8+B\*0.0 | 188019 |
| R\*0.4+G\*0.0+B\*0.6 | 128341 |
| R\*1.0+G\*0.0+B\*0.0 | 110862 |

* **Show original RGB image / two filtered RGB images and two grayscale images with highest and lowest cost.**

|  |  |  |
| --- | --- | --- |
| Original RGB image (1.png) | Filtered RGB image and Grayscale image of  Highest cost | Filtered RGB image and Grayscale image of  Lowest cost |
|  |  |  |

(Describe the difference between those two grayscale images)

可以先明顯看到兩張grayscale images圖整體的深淺很不一樣，但這並無法直接斷言哪一張的結果更好。接著注意到的是內部的一些細節，整張照片的重點應該是楓葉，因此我們應該把焦點放在楓葉的明顯(對比)度，可以看到右邊的楓葉相對與草地是更顯眼的。相反地，左邊楓葉與草地都屬於較深的灰階。這也符合計算出來的cost，左邊為Highest cost、右邊為Lowest cost。

|  |  |  |
| --- | --- | --- |
| Original RGB image (2.png) | Filtered RGB image and Grayscale image of  Highest cost | Filtered RGB image and Grayscale image of  Lowest cost |
|  |  |  |

(Describe the difference between those two grayscale images)

正如前一部分所提到，無法直接用深淺程度來斷言哪一張照片更好。這部分就與前一部份剛好相反，右邊的圖比左邊的更深，但在整體的輪廓線條上，有更強烈的對比，因此得到了較低的cost，也更能呈現原始圖片的顏色差異。

* **Describe how to speed up the implementation of bilateral filter.**

在運算spatial kernel和range kernel時，由於牽扯到exponential的計算，因此會比較費時。所以在運算時，以look up table的方式來避免在for迴圈中，做過多的反覆運算。並再加上平行計算的方式，來減少for迴圈的使用，讓矩陣運算時更省時間。