**Computer Vision HW1 Report**

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**Part 1.**

* **Visualize the DoG images of 1.png.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | DoG Image (threshold = 5) |  | DoG Image (threshold = 5) |
| DoG1-1.png |  | DoG2-1.png |  |
| DoG1-2.png |  | DoG2-2.png |  |
| DoG1-3.png |  | DoG2-3.png |  |
| DoG1-4.png |  | DoG2-4.png |  |

* **Use three thresholds (1,2,3) on 2.png and describe the difference.**

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

(describe the difference)

These three images demonstrate the effect of different thresholds (2, 5, 7) when applying the **Difference of Gaussian (DoG)** for keypoint detection.

**Threshold = 2**

* Detects the most keypoints, covering almost the entire scene with red dots.
* A lower threshold allows more keypoints to be detected, including noise and weak features.

**Threshold = 5**

* The number of detected keypoints is significantly reduced, but important structures like the character’s face, outlines, and object edges remain.
* A higher threshold filters out weaker keypoints, retaining only stronger features.

**Threshold = 7**

* Further reduces the number of detected keypoints, leaving only the most critical regions, such as the character's eyes, nose, mouth, and high-contrast areas (e.g., cheese edges).
* A stricter threshold selects only the most prominent keypoints, improving feature quality but potentially missing some details.

**Part 2.**

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

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

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

* **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)

|  |  |  |
| --- | --- | --- |
| 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)

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