Congratulations! You passed!

Grade received	Latest Submission Grade	To pass
100%	100%	70% or higher

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1. Which of the following is NOT a desirable characteristic of an interesting point for SIFT detection? **1 / 1 point**

- It contains rich image content.
- It has a scale- and rotation-dependent signature.
- It is insensitive to lighting.
- It has a well-defined position.

Correct
For SIFT detection, we are not interested in a scale- and rotation-dependent signature. Instead, we seek a scale and rotation invariant signature: The second answer choice is correct. However, interest points should contain rich image content, be insensitive to lighting conditions, and have a well-defined position. Hence, the first answer choice, the third answer choice, and the last answer choice are desirable characteristics and therefore incorrect.

2. Which of the following statements about interest points is false? **1 / 1 point**

- Edges don't make great interest points, because many edges in a picture tend to look alike.
- The size of a blob is clearly defined by its boundary.
- Since corners are slightly more unique than edges, they would serve as better interest points than edges.
- Blobs have a well-defined, fixed position.

Correct

The size of a blob is more of an abstract concept, determined by its peak sigma: it has no clear connection to the blob's boundary. Hence, the second answer choice is correct. The first , second, and the last answer choices are true statements.

3. Select the correct expression for the 1D blob detection operator: **1 / 1 point**

- $\sigma \frac{\partial^2 n_\sigma}{\partial x^2} \times f(x)$
- $\sigma \frac{\partial^2 n_\sigma}{\partial x^2} * f(x)$
- $\sigma^2 \frac{\partial^2 n_\sigma}{\partial x^2} \times f(x)$
- $\sigma^2 \frac{\partial^2 n_\sigma}{\partial x^2} * f(x)$

Correct

See the lecture slides.

4. Imagine you have collected many pictures across a wide range of sigmas. What should be the effect on a blob detection algorithm? **1 / 1 point**

- The information about blob sizes is likely going to be more precise.
- The information about characteristic scale is going to be less precise.
- More uninteresting points will be mislabeled as interesting.
- The blob detection algorithm finishes sooner than it would if we used fewer images.

Correct

With more pictures across a wide range of sigmas, we can expect to get a better-sampled distribution of each blob across many sigmas and thus identify its peak characteristic scale (= size) more easily. Thus, the first answer choice is correct, and the second answer choice is incorrect. The third answer choice is incorrect, because there is no reason why uninteresting points would be mislabeled. The last answer choice is incorrect, because the effect will have the opposite effect: with more images to process, the algorithm will take longer.

5. Imagine you are designing a SIFT detector. Which of the following is NOT a useful tweak you should implement to improve performance (speed and/or accuracy)? **1 / 1 point**

- Approximate the Normalized Laplacian of Gaussian with Difference of Gaussian.
- Threshold interest points.
- Maximize only over the x, y coordinates.
- Use a sliding window to find interest point candidates.

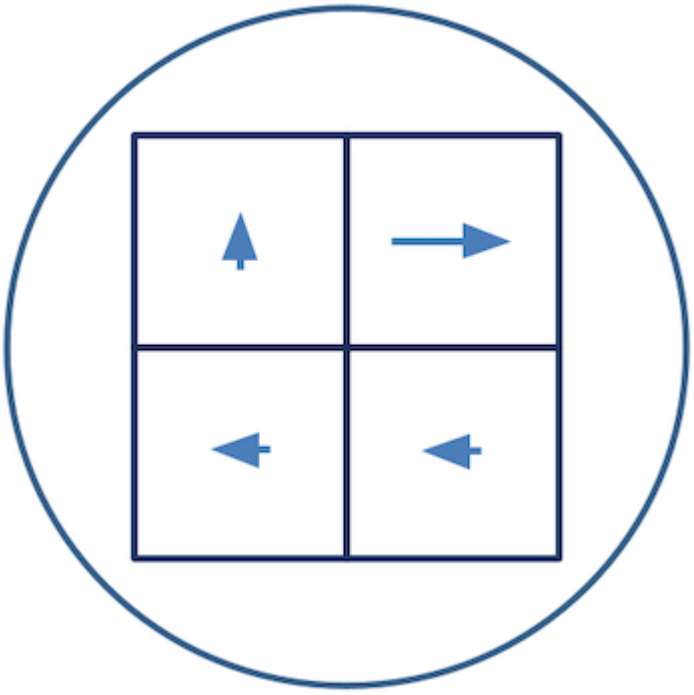
Correct
If we maximize only over the x, y coordinates, it is impossible to determine whether a point is truly an interest point, since we do not know whether its sigma is truly an extremum. All other tweaks serve to improve performance as discussed in the lecture.

6. How does a SIFT detector adjust for scale? **1 / 1 point**

- It adjusts for scale by approximating the Normalized Laplacian of Gaussian with a Difference of Gaussian.
- For the same blobs, the NLOG operator peaks at the same sigmas, regardless of scale.
- For any two interest points, their scale difference can be easily expressed as the ratio of their respective peak sigmas.
- It adjusts for scale by finding the principal orientation of each blob.

Correct
Two interest points I_1, I_2 at two different scales will have different peak sigmas (characteristic scales). Therefore, the difference in scale can be simply expressed as $\frac{\sigma_{I_1}}{\sigma_{I_2}}$ and can subsequently remove the effect of scale. Therefore, the third answer choice is correct, and the second answer choice is incorrect. Methods described in the first answer choice and the last answer choice are used in SIFT but not to adjust for scale, thus they are also incorrect.

7. **1 / 1 point**

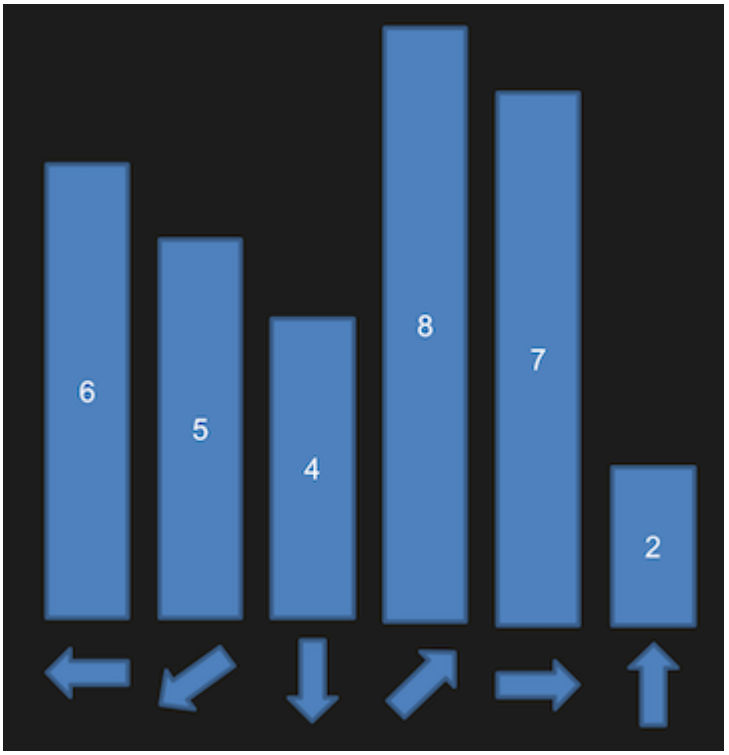


What is the principal orientation of the blob shown above? (Each short arrow's length is 1, the long arrow's length is 2)

- ○ Up
- ◉ Left
- ○ Right
- ○ Up-right

✓ **Correct**
Since most edges were orientated to the left, left must be the principal orientation of the blob.

8. **1 / 1 point**



What is the principal orientation of the blob based on its image gradient direction histogram shown above?

- ○ Bottom-left
- ○ Bottom
- ◉ Up-right
- ○ Right

✓ **Correct**
Since most edges were oriented the up-right, up-right is the blob's principal direction.

9. Which of the following statements about SIFT descriptor is false? **1 / 1 point**

- ○ The histograms are computed over blob quadrants instead of the entire blob.
- ○ Perfect match between two SIFT descriptors occurs if their normalized correlation is equal to 1.
- ○ When computing the SIFT descriptor, disregarding gradient magnitudes removes the effect of brightness.

- [x] L2 distance is like the Intersection metric in the sense that the smaller the metric, the better the match.

Correct
L2 distance moves in the opposite direction from the Intersection metric. That is, the smaller the L2 distance, the better the match. In contrast, the greater the Intersection metric, the better the match. Therefore, the last answer choice is a false statement. The first, second, and third answer choices are true statements.

10. Which of the following problems of object detection is difficult to handle for a SIFT detector? **1 / 1 point**

- [ ] Scale
- [ ] 2D rotation
- [ ] Occlusion
- [x] 3D rotation

Correct
The SIFT detector was designed to overcome scale, 2D rotation, and occlusion, all of which make the problem very hard for algorithms like template matching. However, as shown in the lecture, when the object in the scene is rotated in 3D, the interest point characteristics change. As a consequence, SIFT detector breaks down.