

A Smattering of 152

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1 Rotation

1.1 Rotation Exercises

1. *True or false:* every rotation matrix includes at least one element which is a 0.
2. Are rotation matrices always symmetric? If not, are rotation matrices ever symmetric?

2 Filtering

2.1 Filtering Exercises

1. Why is convolution associative, but correlation is not?
2. Why is convolution commutative, but correlation is not?
3. In the context of image filtering, why is it useful for convolution to be associative?
4. In the context of image filtering, why is it useful for convolution to be commutative?
5. If you implement convolution between an image and a kernel by zero-padding the image so that the output is the same size as the original image, the routine will not be commutative. Why not? Provide a simple counterexample. How can you make the operation commutative?

3 Epipolar Geometry

3.1 Epipolar Geometry Exercises

1. The epipole is the vanishing point of all lines in the direction of camera motion. Given what you know about the locations of vanishing points, can you provide justification for this fact?
(Hint: see page 16 of the Lecture 2 slides.)
2. Why, based on its definition $\mathbf{E} = [\mathbf{t}]_{\times} \mathbf{R}$, is the rank of the essential matrix 2? What does this imply about the mapping it performs on 2D points in projective space?