

Computer Vision – E-Matrix

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Consider an ideal stereo camera system: The cameras are aligned such that their optical axes are parallel and corresponding point are located in the same image row. The intrinsic camera parameters are identical:

Pixel size:	5 μm x 5 μm
Focal length:	5 mm
Principal point:	(320, 240)
Baseline:	300 mm

We also consider a pair of image coordinates that originate as projections from one 3D point, at coordinates (left/right image): (310, 240), (330, 240)

- What is the most likely image size of these cameras?
- What is the 3x3 calibration matrix of the intrinsic camera parameters?
- Convert the pixel coordinates to normalized image coordinates
- We use the left camera as reference. What are the extrinsic camera parameters (rotation & translation) of both cameras?
- What do the complete 3x4 projection matrices look like for both cameras?
- Calculate the essential matrix. Is the epipolar constraint fulfilled for the point correspondence?
- Calculate the epipolar line (in the left image) that corresponds to the point in the right image. (Using normalized coordinates)
- Calculate the coordinates of the left image's epipole. You can obtain it from the nullspace of the essential matrix.