Vision 8 - Uncertainty in Reconstruction

1. How are uncertainties commonly modelled in computer vision? Which model parameter quantifies the magnitude of the uncertainty?
2. In the lecture we made an approximation to the propagating function in order to let us propagate uncertainties using $\Lambda_y = \nabla f \, \Lambda_x \nabla f^T$ from input variable to output variables. Which approximation was used?
3. Propagate the uncertainties from uncertainties on vectors a and b to the uncertainty of $(a - b)^T (a - b)$. $a = [1,2]$ and $b = [3,3]$ The uncertainty on a and b are assumed independent. The covariance matrices corresponding to the vectors a and b are $cov_a = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ and $cov_b = \begin{bmatrix} 3 & 2 \\ 2 & 3 \end{bmatrix}$ respectively.
4. When do we need to use the implicit function theorem to propagate uncertainties? Why do we need it? What does it let us do?
5. Describe the Monte-Carlo uncertainty propagation method in your own words. Use e.g., pseudo code to describe it
6. Name pros and cons of using the analytic method versus using the Monte Carlo method.
7. How can you approximate the uncertainty in the input variable?