

T-61.5070 COMPUTER VISION, Exercise 1/08

Motivation

The purpose of this exercise is to be acquainted with digital image processing and illumination effects.

1. How can a hexagonal grid be represented in a computer memory in such a way that the image processing is fast? How can the nearest neighbours be found? Write a small program that computes an average in a small neighbourhood (distance=1) and replaces the center point with this average.
2. Consider a line-scan camera. Your intention is to use it in image capturing. You should compensate illumination, optics, and nonhomogenities between the sensors. Derive a formula for this purpose. Both the light and the dark calibration targets are available.
3. Consider the illumination problem with a plane and a sphere. Assume that the surface of the object is perpendicular to the observer and the illumination source. The object is either a plane or a sphere. Assume also that the surfaces are Lambertian ones. The light source is assumed to be a point source.
 - (a) How does the radiance vary on the plane?
 - (b) How does the radiance vary on the sphere?
4. Consider the illumination problem with a plane and two illumination sources. The surface of the plane can be assumed to be a Lambertian one. The object is illuminated by two point sources. The light sources are at the same distance from the plane. Determine the radiance on the plane.