

Image Capture, Digital Image Representation

1. Explain why the length *in millimeters* of an image line of endpoints $[x_1, y_1]$ and $[x_2, y_2]$ is not simply $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. What does this formula miss?
2. Use the perspective projection equations to explain why, in a picture of a face taken frontally and from a very small distance, the nose appears much larger than the rest of the face. Can this effect be reduced by acting on the focal length?
3. Capture images from a camera. Demonstrate the effect on the final image of different illuminants:
 - fluorescent lights
 - dark room
 - outdoor light through windows
 - different f-stops
 - too dark (noisy) images
4. Go outdoors for homogeneous illumination, and capture a photo of a concrete wall (or any other homogeneous surface). Place the camera right in front of the wall, and capture the image so that the optic axis is approximately perpendicular to the wall. Since the wall is made of homogeneous material, the image intensities should on average be equal in all image regions. However, the intensities in the center of the image and on the image boundary differ. How much? And why?