CSC476_2021S_Quiz1

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CSC 476 Quiz 1
Feb 9, 2021.
Duration: 15 mins.
Open book but independent work please.

You can directly answer in this document. Please write down equations carefully.

1. (2pts) In the block world, write down the equation of derivative along both vertical and horizontal edge of the cubes for Y. You can write down the derivative as a function of derivatives along the x and y image coordinates. (hint: derivative of Y over y and x).

   Vertical edges: $\frac{\partial Y}{\partial y} = \frac{1}{\cos\theta}$

   Horizontal edges: $\frac{\partial Y}{\partial t} = 0$ (t is the vector parallel to the edge) ⇒ $t(-n_y, n_x)$

2. True of False.

   a) (1pts) Using lens allows us to duplicate the pinhole geometry without having to use very small apertures. False

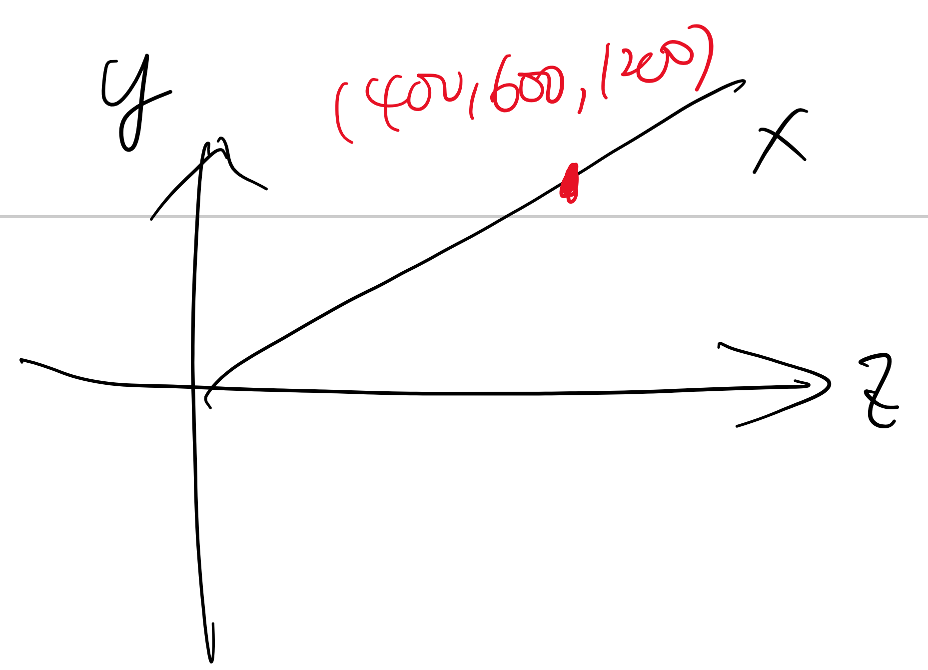
   b) (1pst) The numbers in an average filter (box filter) should always sum up to Zero. False

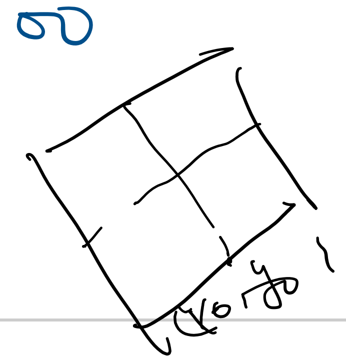
   c) (1pts) The orthographic projection of two parallel lines in the world must be parallel in the image. True.

3. (3pts) Short answer.
   A scene point at coordinates (400,600,1200) is prospectively projected into an image at coordinates (24,36), where both coordinates are given in millimeters in the camera coordinate frame and the camera's principal point is at coordinates (0,0,f) (i.e., u0 = 0 and v0 = 0). Assuming the aspect ratio of the pixels in the camera is 1, what is the focal length of the camera?

lens

$x = \frac{fx}{z} \Rightarrow f = \frac{uz}{x} = \frac{24 \times 1000}{400} = 72$





$x = 24$

$z = 1000$

$x = 400$.

(1)

Vertical

$\partial Y / \partial y$: $\cos(\theta) Y = \sin(\theta) Z + y - y_0$

$$Y = \frac{\sin(\theta) Z}{\cos(\theta)} + \frac{y}{\cos(\theta)} - \frac{y_0}{\cos(\theta)}$$

$$\text{So: } \frac{\partial Y}{\partial y} = \frac{1}{\cos\theta} \#$$

Horizontal: $t = (-n_y, n_x)$ $\quad Y = \frac{\sin(\theta) Z}{\cos(\theta)} + \frac{y}{\cos(\theta)} - \frac{y_0}{\cos(\theta)}$

$$\frac{\partial Y}{\partial t} = -n_y \frac{\partial Y}{\partial x} + n_x \frac{\partial Y}{\partial y} = 0 \#$$