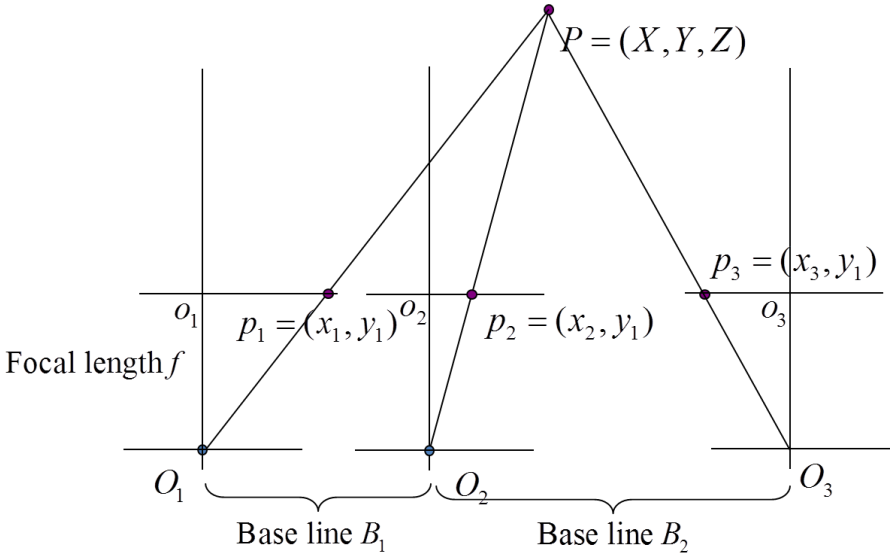
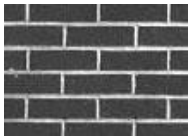
Computer Vision: Assignment #5

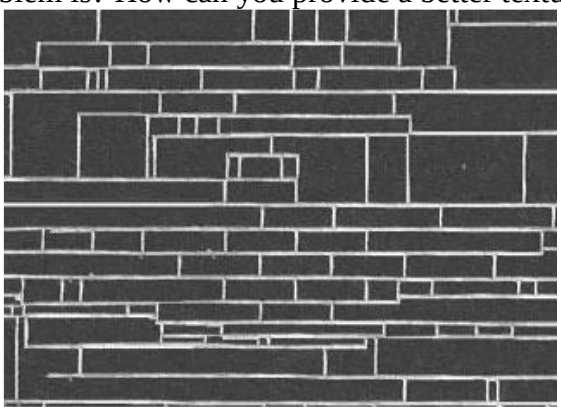
Due 8 JUN 2015

1. We have a three-camera system below. Express the relationship among the local coordinates x_1, x_2, x_3 as compactly as possible.



2. (15 points) Kim synthesized a texture image (on the right) using an example image on the left as a source of the probability model. To synthesize a pixel value, the algorithm matches its neighborhood to the example image, estimates the probability model, and fills in the pixel according to the probability model. (Do not ask the detailed procedure. It was explained in the lecture.) The texture image, however, is not satisfactory. What do you think the problem is? How can you provide a better texture image?





3. We have a knapsack, which has capacity 6. Five items are available, and each item has weight w_i and value p_i as follows.

i	1	2	3	4	5
w_i	2	4	1	1	1
p_i	10	20	5	6	4

   (a) Use the greedy criterion, which loads the lightest item first. Which items are selected? How much is the total value?
   (b) Use the dynamic programming method to maximize the total value. Which items are selected? How much is the maximum total value?

4. Consider a video signal $s(x, y, t)$ defined over the entire 3-D space (x, y, t), where $s(x, y, t)$ is generated from one object, which undergoes translational motion with uniform constant velocities of v_x and v_y along the horizontal and vertical directions, respectively. Suppose that $s(x, y, 0) = x + y + xy$.
   (a) Determine $s(x, y, t)$.
   (b) Show that in this case the following optical flow equation holds true.

$$v_x \frac{\partial s(x, y, t)}{\partial x} + v_y \frac{\partial s(x, y, t)}{\partial y} + \frac{\partial s(x, y, t)}{\partial t} = 0.$$