Assignment 7

This assignment is due on November 9th; marks will be deducted for late homework. Remember to include all references and the names of students in your study group.

1. Arrange the given linear transformations in a hierarchal order, with the most general case listed first (Affine, Euclidean, Similarity, Projective). For each of these transformations, list two permissible operations, one preserved quantity, and the degrees of freedom (in both 2D and 3D).

2. The following equation demonstrates how an image can be mapped from the (x, y) co-ordinate system to a transformed co-ordinate system (x, y)

$$[u\ v] = [x\ y\ 1] * T$$

With reference to the above equation, derive a T matrix (3X2) to perform the following operations:
a) Scale an image by 1.7 times
b) Rotate an image by 21°
c) Translate an image by (50, 60) pixels in (x, z) directions respectively.
d) All the above together
Explain all the steps used in this exercise.

3. a) Transform an image from its original plane (x, y) to a new plane (u, v), using the following second-order polynomial equations:

$$u = 21xy + 2x + 3y + 5$$

$$v = 12y^2 + 9x^2 + 7xy + 2x + y + 99$$

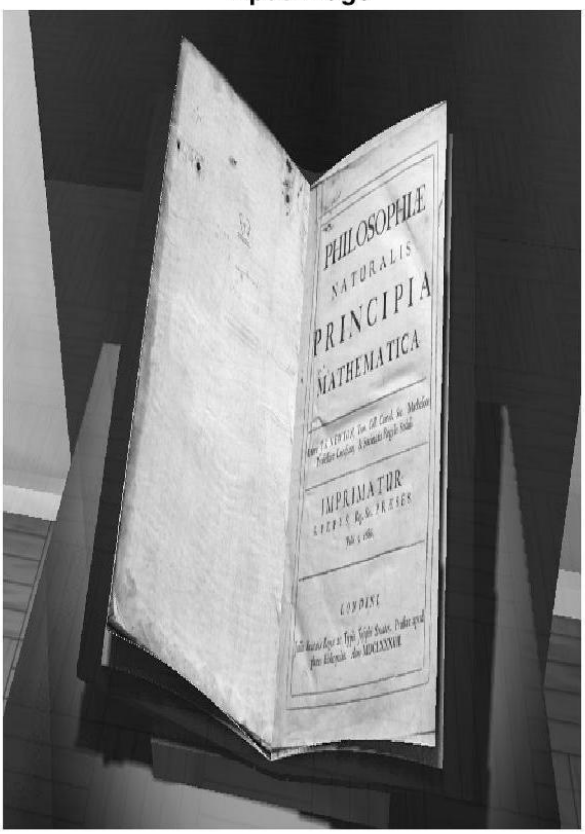
b) Use the following set of equations to transform an image from (x, y) co-ordinates to a new co-ordinate system (u,v):

$$u = 0.5\sin(x) + 0.01\cos(y) - \log(1 + x)$$
$$v = 0.1\sin(x) + 0.08\cos(y) - \log(1 - y)$$

Use a 10 X 10 checkerboard image to demonstrate your results for both parts of the question. Explain all the steps used in this exercise.

4. Use projective transformation to generate the following output image from the given input image. Include explanation for all the steps used in this exercise.

Input Image



Output Image