Take-home questions

1. Write down a 3x3 filter that returns a positive value if the average value of the 4-adjacent neighbors is less than the center and a negative value otherwise

2. Write down a filter that will compute the gradient in the x-direction:

```
gradx(y,x) = im(y,x+1)-im(y,x) for each x, y
```

Take-home questions

Filtering Operator

3. Fill in the blanks:

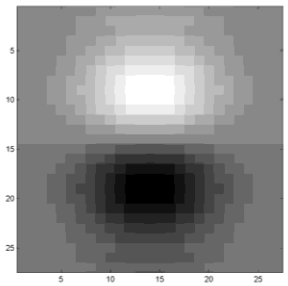
a) _ = D * B

b) $\bar{A}$ = _ * _

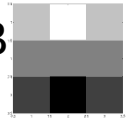
c) F = $\bar{D}$ * $\bar{\ }$

d) $\bar{\ }$ = D * $\bar{D}$

A

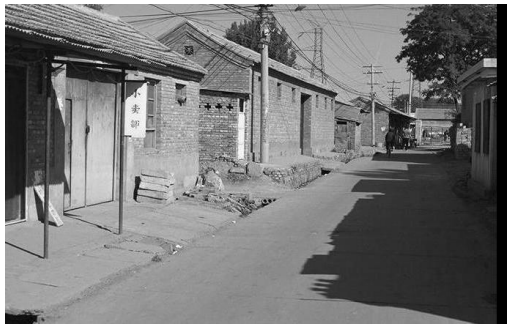


B

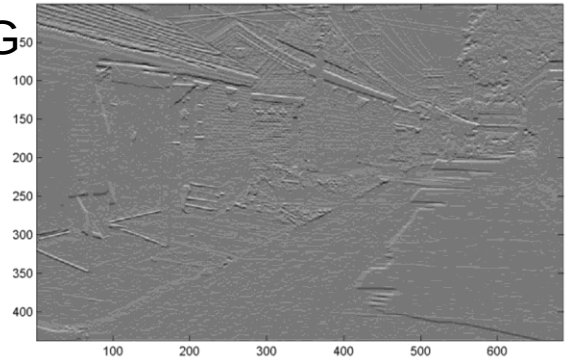


E

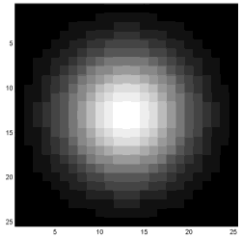
F



G

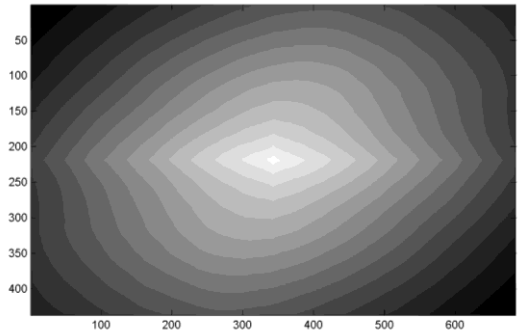


C

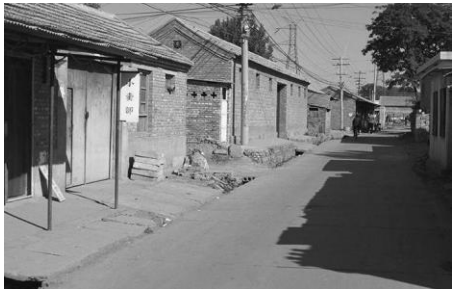


H

I

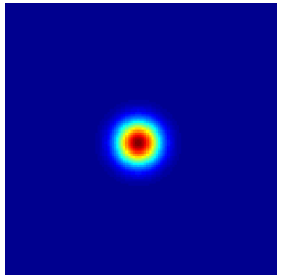


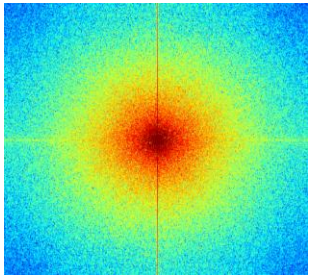
D

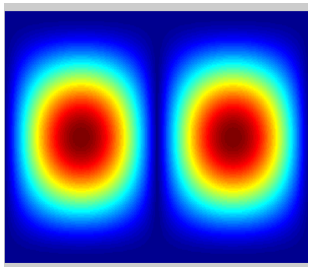


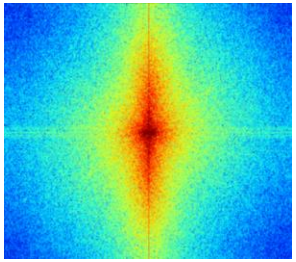
Take-home question

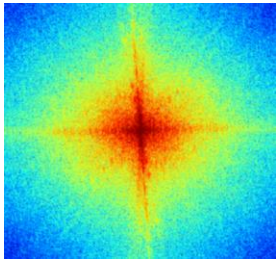
1. Match the spatial domain image to the Fourier magnitude image

1


2


3


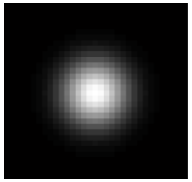
4


5


A

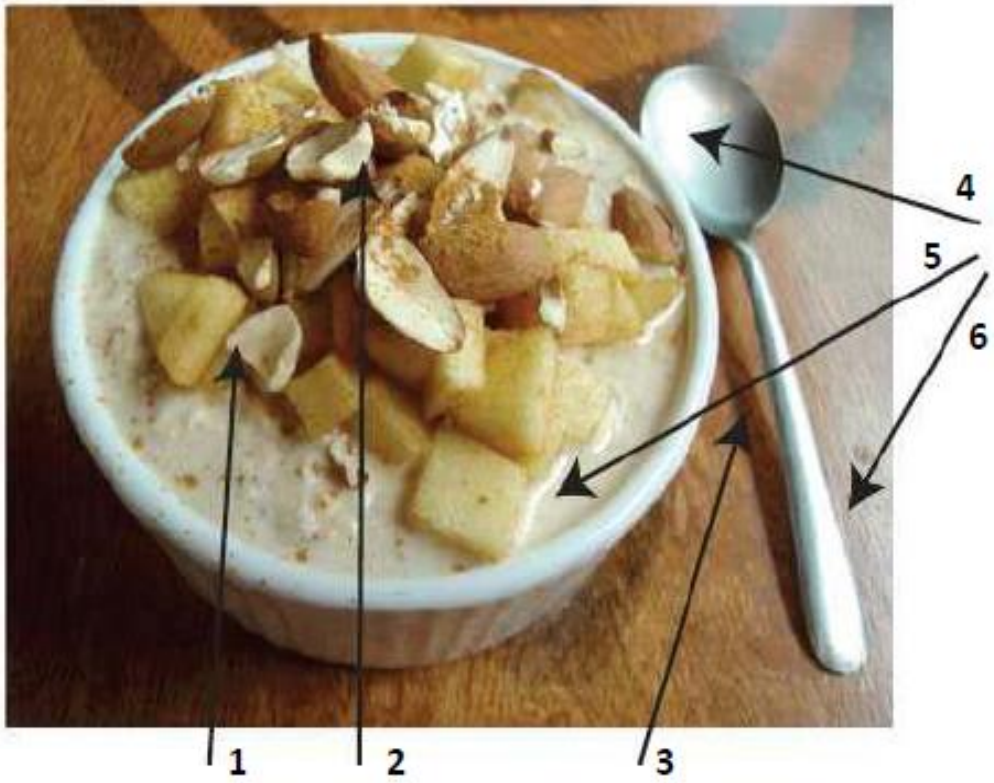

B


C


D


E


Take-home questions



A. For each of the arrows in the above image, name the reasons the pixel near the end of the arrow has its brightness value and explain very briefly. The arrow pointing to milk is pointing to the thin bright line at the edge of the piece of apple; the arrow pointing to the spoon handle is pointing to the bright area on the handle.

Possible factors: albedo, shadows, texture, specularities, curvature, lighting direction

Take-home questions

1. What would be the result in “Intelligent Scissors” if all of the edge costs were set to 1?

2. Typically, “GrabCut” will not work well on objects with thin structures. How could you change the boundary costs to better segment such objects?

Take-home questions

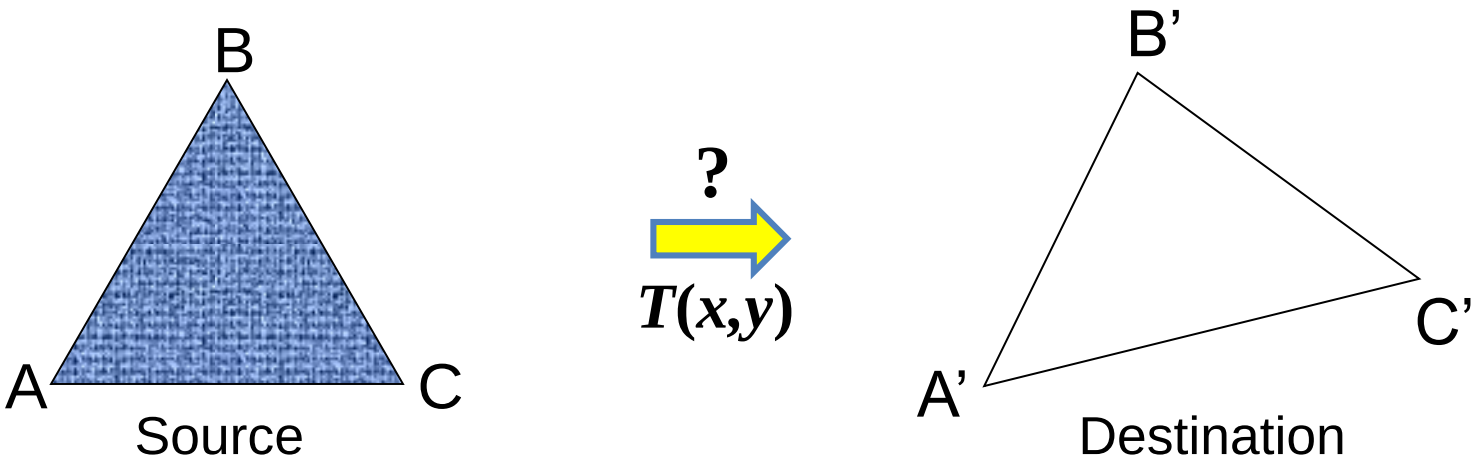
1) I am trying to blend this bear into this pool. What problems will I have if I use:
   a) Alpha compositing with feathering
   b) Laplacian pyramid blending
   c) Poisson editing?

Take-home questions

2) How would you make a sharpening filter using gradient domain processing? What are the constraints on the gradients and the intensities?

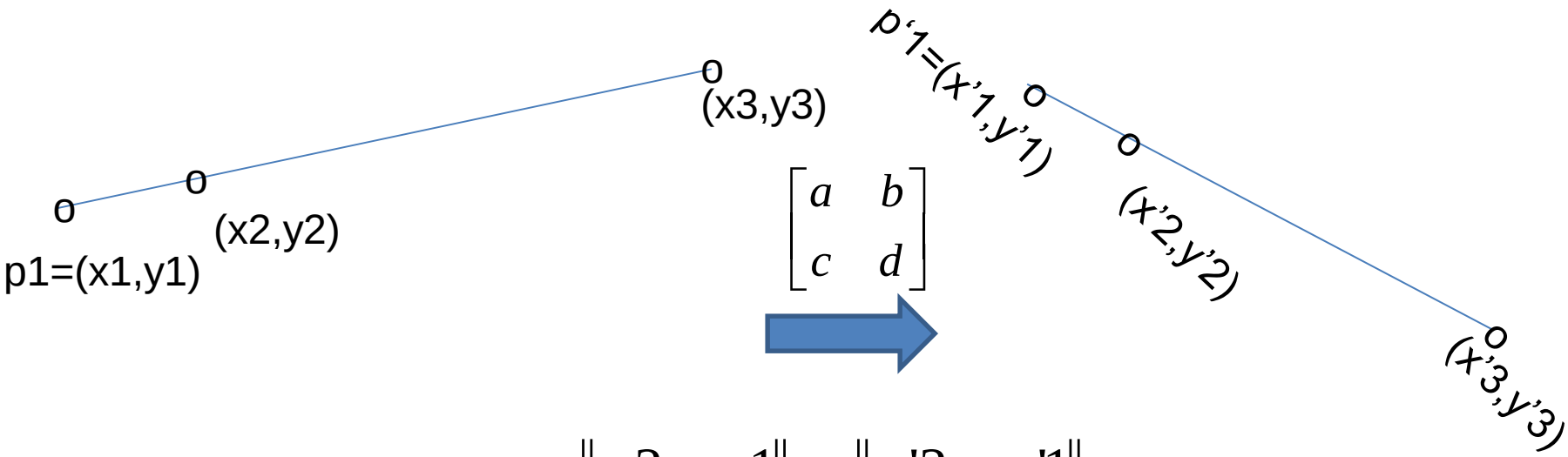
Take-home Question

1) Suppose we have two triangles: ABC and A'B'C'. What transformation will map A to A', B to B', and C to C'? How can we get the parameters?



Take-home Question

2) Show that distance ratios along a line are preserved under 2d linear transformations.



$$\frac{\|p2-p1\|}{\|p3-p1\|}=\frac{\|p'2-p'1\|}{\|p'3-p'1\|}$$

Hint: Write down x2 in terms of x1 and x3, given that the three points are co-linear

Take-home question

Suppose we have two 3D cubes on the ground facing the viewer, one near, one far.

1. What would they look like in perspective?
2. What would they look like in weak perspective?

Photo credit: GazetteLive.co.uk

Take-home question

Suppose you have estimated finite three vanishing points corresponding to orthogonal directions:

1) How to solve for intrinsic matrix? (assume K has three parameters)
   - The transpose of the rotation matrix is its inverse
   - Use the fact that the 3D directions are orthogonal
2) How to recover the rotation matrix that is aligned with the 3D axes defined by these points?
   - In homogeneous coordinates, 3d point at infinity is (X, Y, Z, 0)

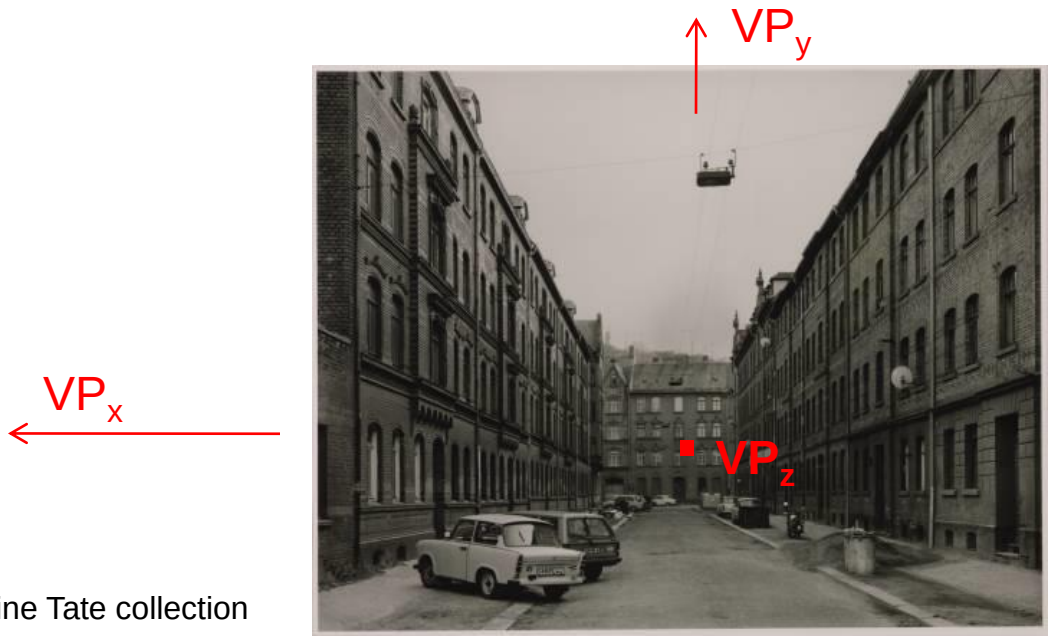


Photo from online Tate collection

Take-home question

Assume that the man is 6 ft tall.

- What is the height of the front of the building?
- What is the height of the camera?