CS 558: Quiz 5

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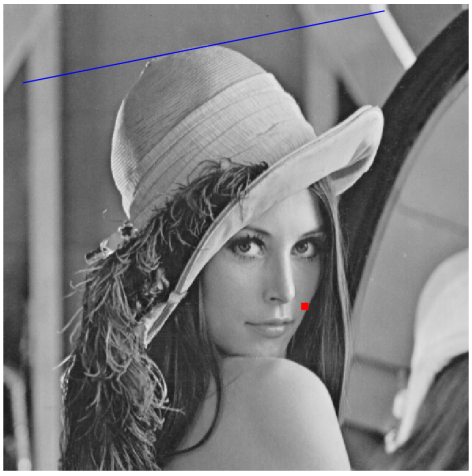
3/2/2016

1 First problem

Here are three images for problem 1:



1.1 Matlab code

```
im = rgb2gray(imread('lena.png'));
[s1,s2] = size(im);
h1 = imshow(im);

% blue line
p1x = round(rand(1)*s1); p1y = round(rand(1)*s2);
p2x = round(rand(1)*s1); p2y = round(rand(1)*s2);

hold on;
lin = line([p1x p2x], [p1y p2y], 'Color', 'b', 'LineWidth', 1.5);

% red square
p3x = round(rand(1)*s1); p3y = round(rand(1)*s2);
halfwin = 1;

[xx,yy] = meshgrid(p3x-halfwin:p3x+halfwin, p3x-halfwin:p3x+halfwin);
hold on;
sq = scatter(xx(:),yy(:),'filled','square','r');
```

2 Second problem

The line format is $ax + by = d$, with $a^2 + b^2 = 1$. So I selected b in terms of a, instead of dividing the distance equation by the norm of the vector (a, b).

2.1 Matlab code

```
p0x = rand(1); p0y = rand(1);
a = rand(1);
b = sqrt(1 - a.*a);
d = rand(1);

dist = abs(a*p0x + b*p0y - d);
```

3 Third problem

Here, I used the fact that both points $P_1 = (x_1, y_1)$ and $P_2 = (x_2, y_2)$ lie on the line, so $\rho = x_1 \cos\theta + y_1 \sin\theta$ and $\rho = x_2 \cos\theta + y_2 \sin\theta$. Then, $(x_1 - x_2)\cos\theta = (y_2 - y_1)\sin\theta$, and finally $\tan\theta = \frac{x_1 - x_2}{y_2 - y_1}$. To find ρ, we just need to plug θ in one of the equations.

3.1 Matlab code

```
p1x = rand(1)*100; p1y = rand(1)*100;
p2x = rand(1)*100; p2y = rand(1)*100;

th = atan((p1x-p2x)/(p2y-p1y));
rho = p1x*cos(th) + p1y*sin(th);
```