Homework1

Problem1:

Direct Linear Transformation function code:

```
function H = dlt( x, xt )
a=zeros(8,9);
for i = 1:4
    a(2*i-1,1:9)=[0 0 0 -x(i,1) -x(i,2) -1 xt(i,2)*x(i,1) xt(i,2)*x(i,2)
xt(i,2)];
    a(2*i,1:9)=[x(i,1) x(i,2) 1 0 0 0 -xt(i,1)*x(i,1) -xt(i,1)*x(i,2) -xt(i,1)];
end
a(9,9)=1;

J= zeros(9,1);
J(9,1)= 1;
H=a^-1*J;
H=reshape(H,[3,3])';
```

Main:

```
c=imread('basketball-court.ppm');
imshow(c);
height=940;
width=500;
result = zeros(height,width,3,'uint8');

%point for the result img
a11 = [1 1];
a12 = [width 1];
a13 = [1 height];
a14 = [width height];

%point for the origin img
b21 = [249 53];
b22 = [404 75];
b23 = [25 195];
b24 = [281 280];
x = [a11; a12; a13; a14];
xt = [b21; b22; b23; b24];


%calling the direct linear transformation to generate the h

h =dlt(x,xt);

%using bilinear interpolation to decide the pixel

for i=1:height
    for j=1:width
        t = [(h(1,1)*j+h(1,2)*i+h(1,3))/(h(3,1)*j+h(3,2)*i+h(3,3))
(h(2,1)*j+h(2,2)*i+h(2,3))/(h(3,1)*j+h(3,2)*i+h(3,3))];
```

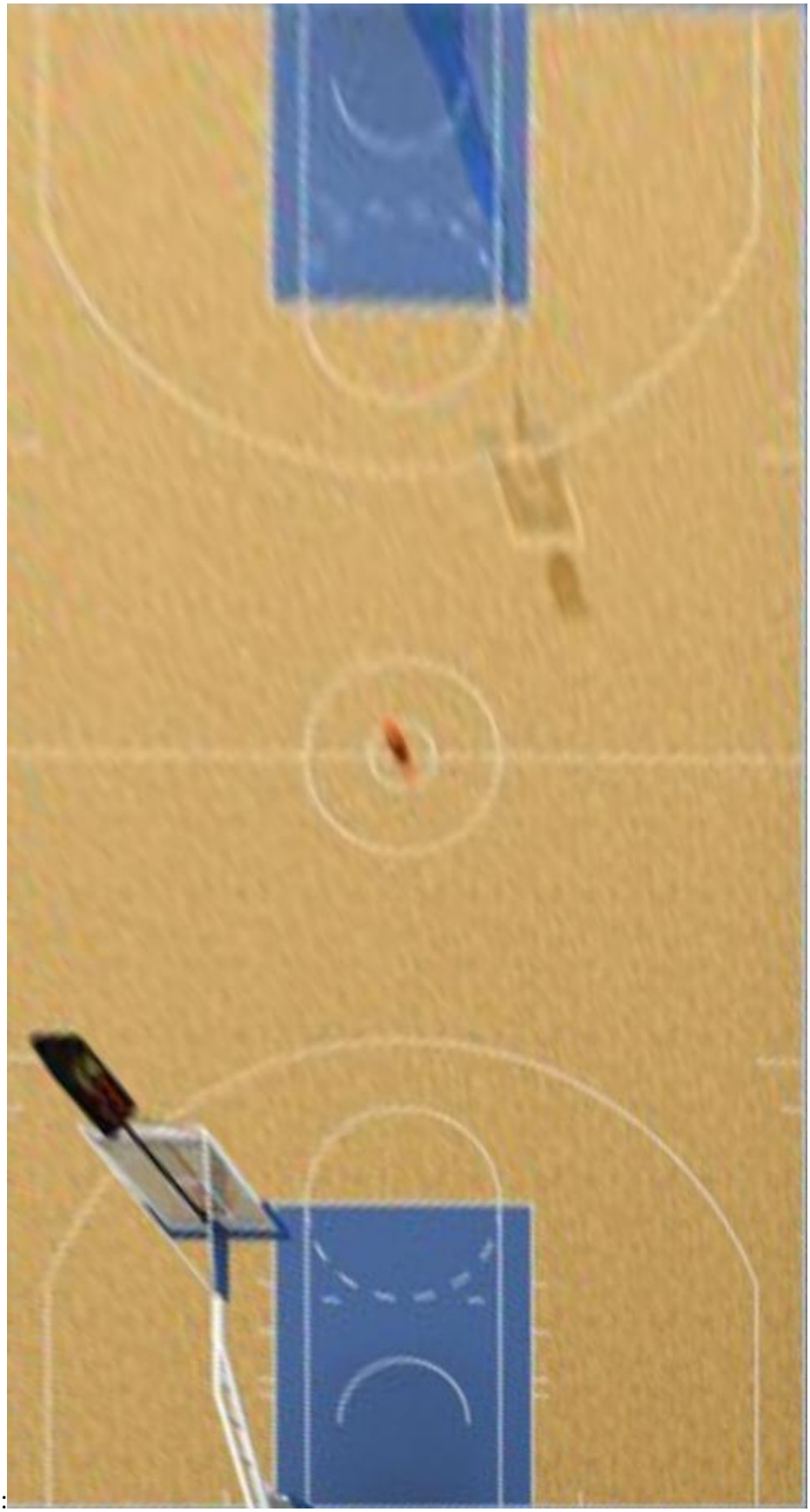
```
        a = t(1)-floor(t(1));
        b = t(2)-floor(t(2));
        ft1 =floor(t(1));
        ft2 = floor(t(2));
        result(i,j,:) =
c(ft2,ft1,:)*(1-a)*(1-b)+c(ft2,ft1+1,:)*(a)*(1-b)+c(ft2+1,ft1,:)*b*(1-a)+c(ft
2+1,ft1+1,:)*a*b;
    end
end

imshow(result);
imwrite(result,'problem1.jpg')
```

Points for using:

b21 = [249 53];
b22 = [404 75];
b23 = [25 195];
b24 = [281 280];

Result:



Problem2:

The artifacts are caused by the projection from 3D world to P^2 which would lose some information or detail. In problem 2. Using another part of the origin picture to fix the artifacts.

Code:

```
c=imread('basketball-court.ppm');
imshow(c);
height=940;
width=500;
result = zeros(height,width,3,'uint8');


%point for the result img
a11 = [1 1];
a12 = [width 1];
a13 = [1 height];
a14 = [width height];

%point for the origin img
b21 = [249 53];
b22 = [404 75];
b23 = [25 195];
b24 = [281 280];
x = [a11; a12; a13; a14];
xt = [b21; b22; b23; b24];

%calling the direct linear transformation to generate the h
h=dlt(x,xt);


%using bilinear interpolation to decide the pixel
for i=1:height
    for j=1:width
        t = [(h(1,1)*j+h(1,2)*i+h(1,3))/(h(3,1)*j+h(3,2)*i+h(3,3))
(h(2,1)*j+h(2,2)*i+h(2,3))/(h(3,1)*j+h(3,2)*i+h(3,3))];
        a = t(1)-floor(t(1));
        b = t(2)-floor(t(2));
        ft1 =floor(t(1));
        ft2 = floor(t(2));
        result(i,j,:) =
c(ft2,ft1,:)*(1-a)*(1-b)+c(ft2,ft1+1,:)*(a)*(1-b)+c(ft2+1,ft1,:)*b*(1-a)+c(ft
2+1,ft1+1,:)*a*b;
    end
end

%rectangle
a11 = [200 540];
a12 = [1 540];
a13 = [200 939];
a14 = [1 939];
%match rectangle
b21 = [300 540];
b22 = [499 540];
b23 = [300 939];
```

```
b24 = [499 939];
x = [a11; a12; a13; a14];
xt = [b21; b22; b23; b24];

h =dlt(x,xt);
%using bilinear interpolation again
for i=540:939
    for j=1:200
        t = [(h(1,1)*j+h(1,2)*i+h(1,3))/(h(3,1)*j+h(3,2)*i+h(3,3))
(h(2,1)*j+h(2,2)*i+h(2,3))/(h(3,1)*j+h(3,2)*i+h(3,3))];
        a = t(1)-floor(t(1));
        b = t(2)-floor(t(2));
        ft1 =floor(t(1));
        ft2 = floor(t(2));
        result(i,j,:) =
output(ft2,ft1,:)*(1-a)*(1-b)+output(ft2,ft1+1,:)*(a)*(1-b)+output(ft2+1,ft1,
:)*b*(1-a)+output(ft2+1,ft1+1,:)*a*b;
    end
end

figure,imshow(result);
imwrite(result,'problem2.jpg')
```

rectangle:
(200 540) (1 540) (200 939) (1 939)
Match rectangle:
(300 540) (499 540) (300 939) (499 939)

Resulting image is better: