

CIS 580 Machine perception HW2

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1. Barcelona

The transformation matrix can be obtained by implementing the homography formula. I used matrix multiplication to simplify the coding work. The detailed math check is shown below.

$$a1 = \begin{bmatrix} x' \\ y' \end{bmatrix} * \begin{bmatrix} x & y & 1 \end{bmatrix} = \begin{bmatrix} x' * x & x' * y & x' \\ y' * x & y' * y & y' \end{bmatrix}$$

Then the projection points of goal frame onto logo can be obtained by using the homography in previous step, and divided by the third component of each column(which is lambda). And the projection of logo to video is completed.

```
H = [];

video = video_pts';
A = [];

for i = 1: size(video_pts, 2)
    a1 = logo_pts(:, i) * [ video(i,:), 1];

    ax = [ -video(i,:), -1, zeros(1,3), a1(1,:)];
    ay = [ zeros(1,3), -video(i,:), -1, a1(2,:)];

    A = [A; ax; ay];
end

[U, S, V] = svd(A);
h = V(1:9, size(V, 2));
h = reshape(h,3,3);
H = h';
```



2. Invictus vs Harleysville

The intersection point and line programs can be completed by using cross production then projection onto the image plane.

Since the four corner points of field are given, the vanishing point can be obtained. And the line of referee and vertical sideline of field are parallel, intersection of line of referee to vanishing points between horizontal sideline of the field is the upper projection of position of the referee, vise versa, the lower point can be get by the intersection of line of referee to vanishing point between lower horizontal sideline of the field.

