

Automatic preparation before competition

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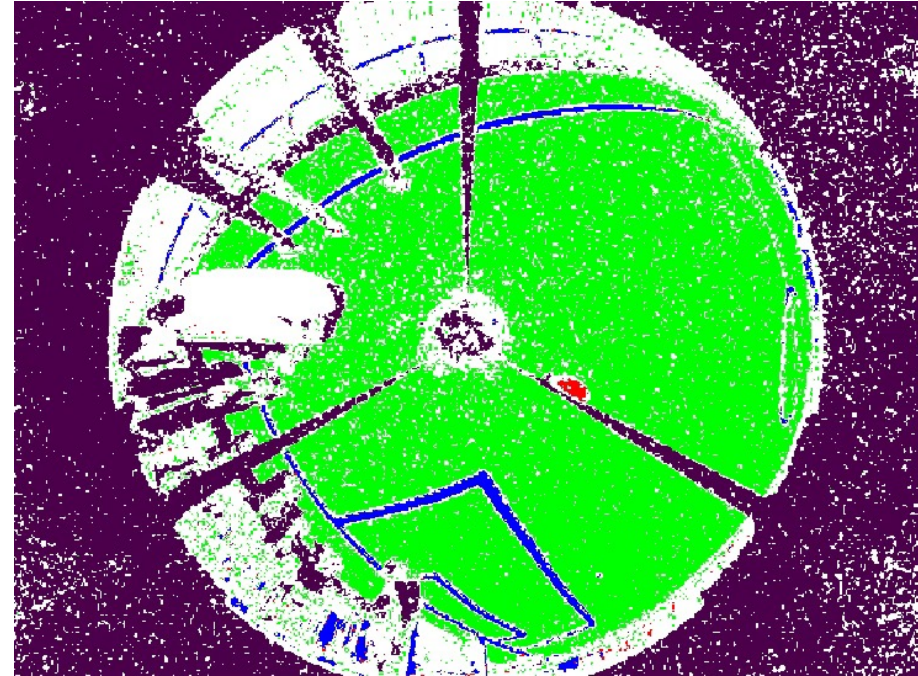
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- 1 Automatic image segmentation
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0 1 Automatic image segmentation

0 1 Automatic image segmentation

- We use HSI color space to realize The segmentation of the image
- We used to segment manually ,which Can consume a lot of time
- We have tried a lot of automatic segmentation in the past, but the results are not satisfactory



0 1

Automatic image segmentation

The screenshot displays a video analysis software interface for automatic image segmentation. The main window is divided into several sections:

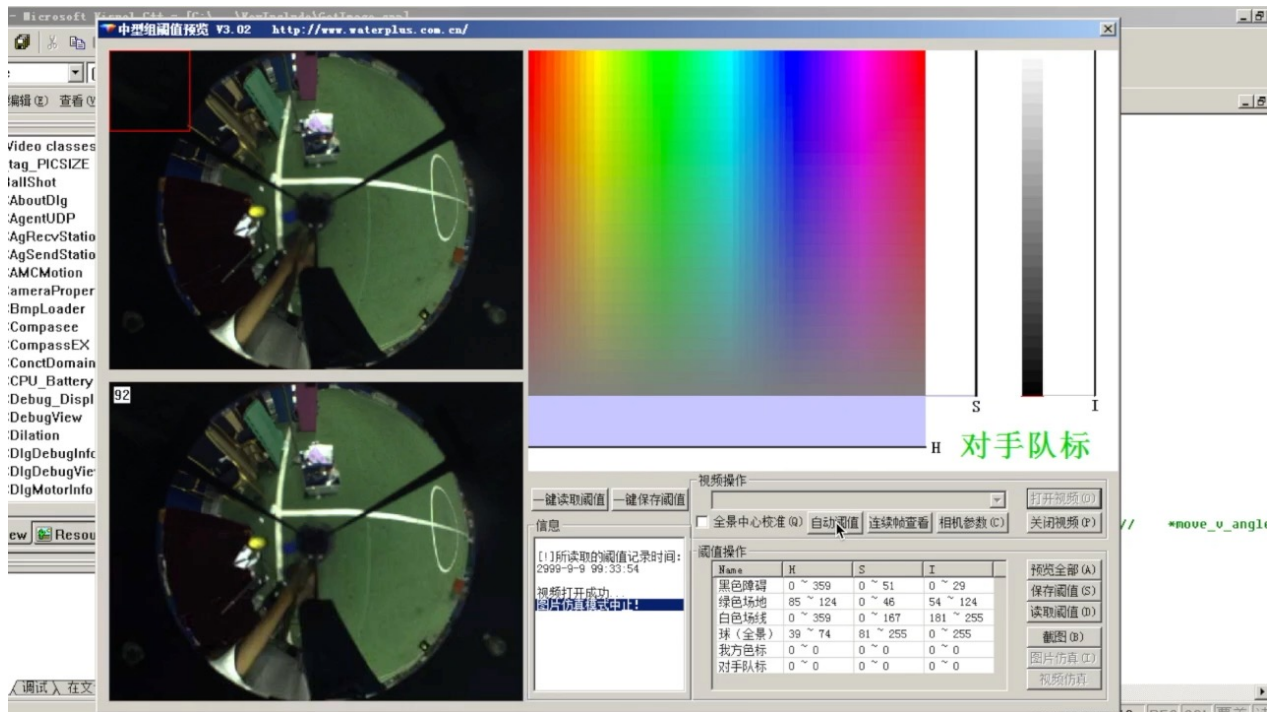
- Top Left:** A video frame showing a soccer field from an overhead perspective.
- Bottom Left:** The same video frame with a purple mask overlaid, representing the segmented objects.
- Top Right:** A color calibration tool showing the HSV color model. A cursor is positioned over the 'H' (Hue) channel, and the text "黑色障碍" (Black Obstacle) is displayed in green.
- Bottom Right:** A dialog box titled "阈值操作" (Threshold Operation) containing a table of threshold values for various objects.

The "阈值操作" dialog box includes the following table:

Name	H	S	I
黑色障碍	0 ~ 359	0 ~ 81	0 ~ 21
绿色场地	155 ~ 202	6 ~ 57	28 ~ 76
白色场线	0 ~ 359	0 ~ 129	181 ~ 255
球 (全景)	30 ~ 79	47 ~ 255	0 ~ 255
我方色标	0 ~ 0	0 ~ 0	0 ~ 0
对手队标	0 ~ 0	0 ~ 0	0 ~ 0

01 Automatic image segmentation

Now they don't exist any more!

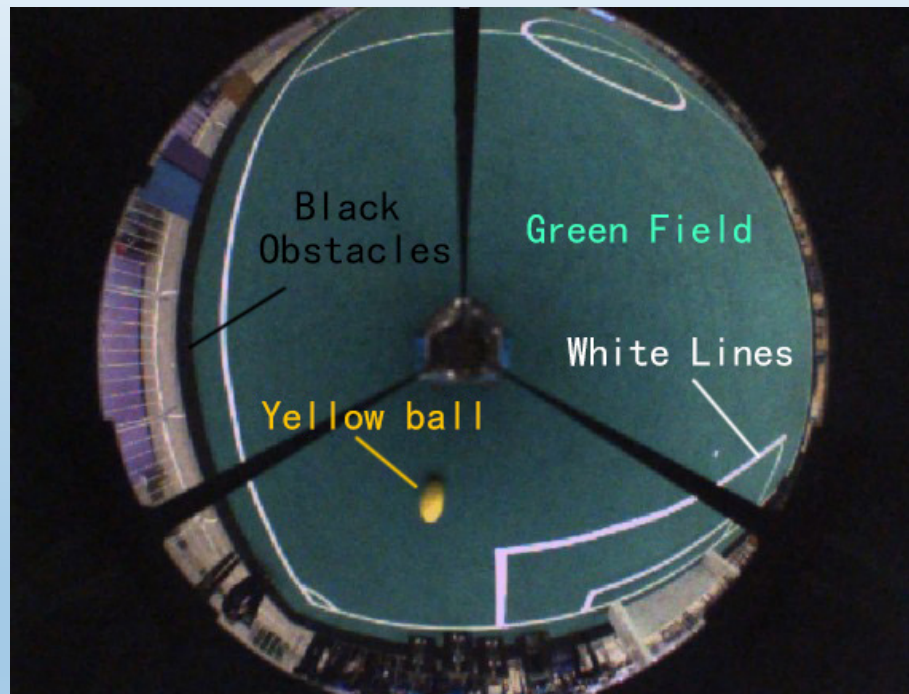


Effect of auto image segmentation in a complex situation

0 1

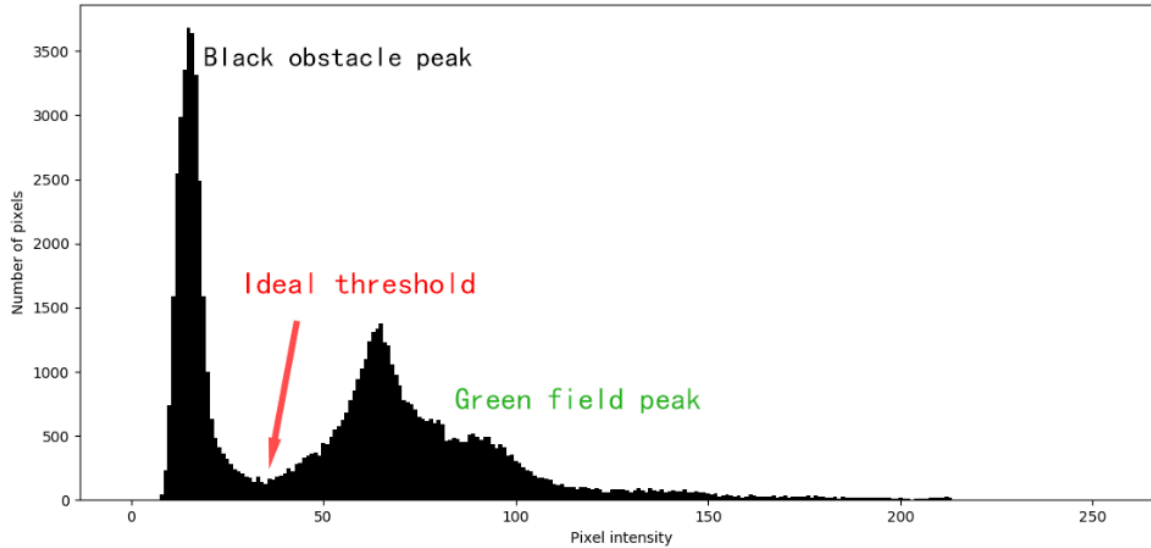
Automatic image segmentation

- Black Obstacles
- Green Field
- Yellow Ball
- White Lines



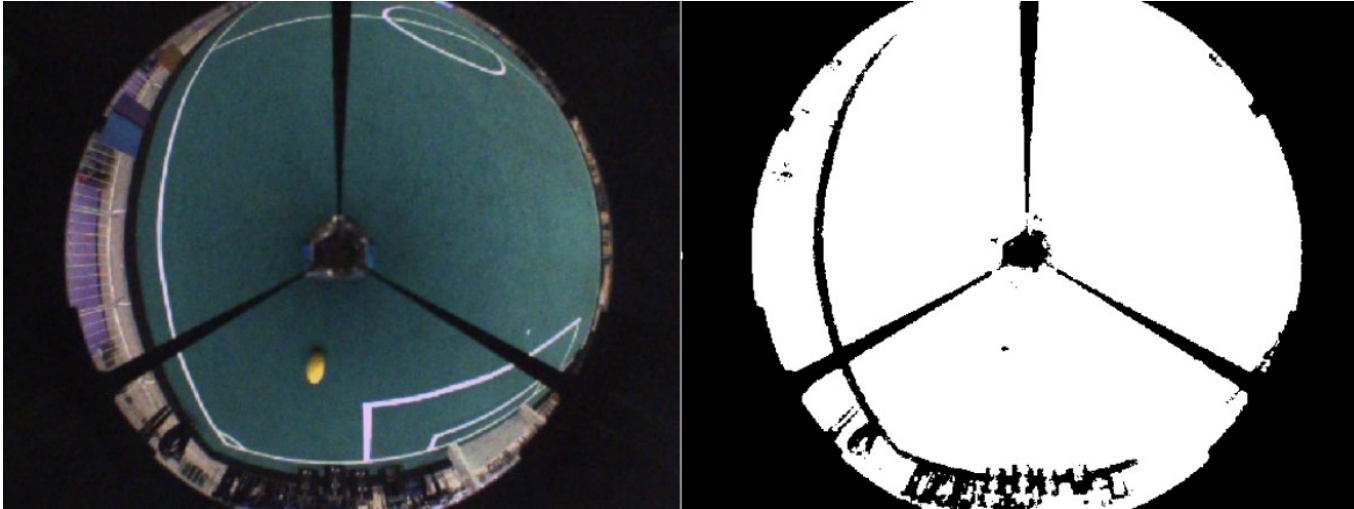
1.1

Black Obstacles



Intensity histogram of the image

1.1 Black Obstacles



Black obstacle segmentation results

1.2 Green field

$$X_{out} = \frac{\sum_{i=1}^{(2r+1)^2} \left[\left(1 - \frac{|x_i - x|}{2.5Y} \right) x_i \right]}{\sum_{i=1}^{(2r+1)^2} \left(1 - \frac{|x_i - x|}{2.5Y} \right)}$$

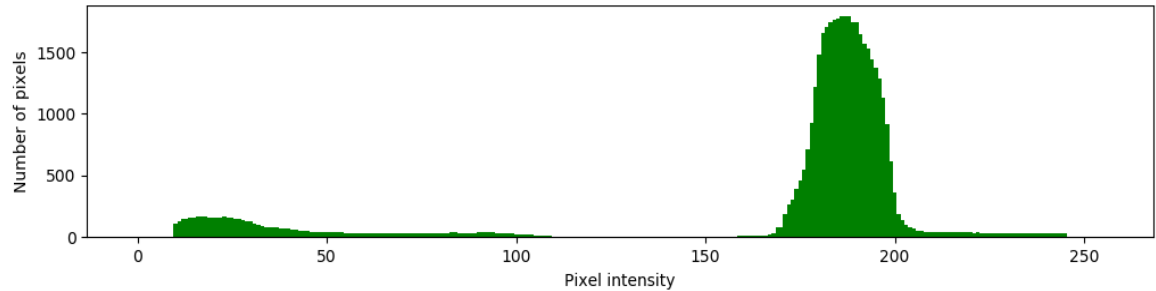
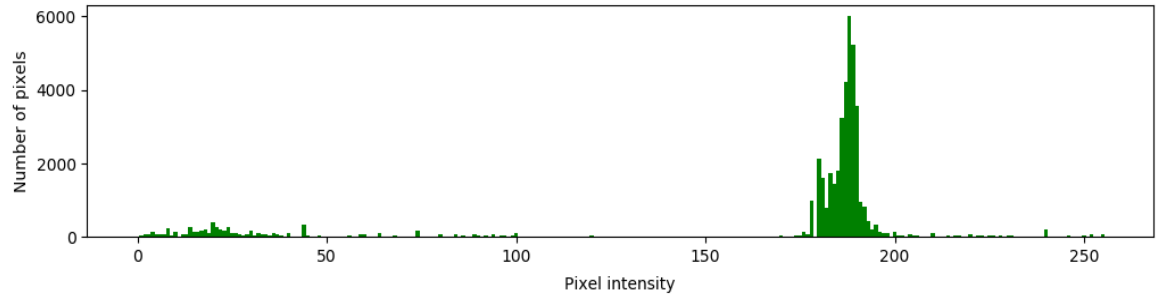


The result of the edge preserving filter

■ 1.2

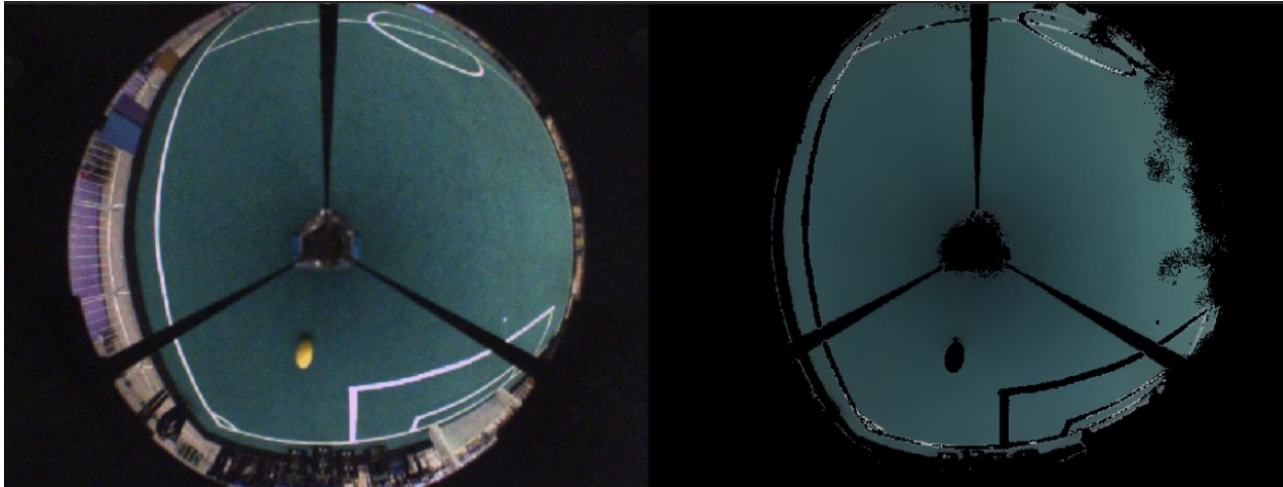
Green field

$$emp = \frac{1}{step} \sum_{i=-\frac{step}{2}}^{\frac{step}{2}} f(x + i)$$

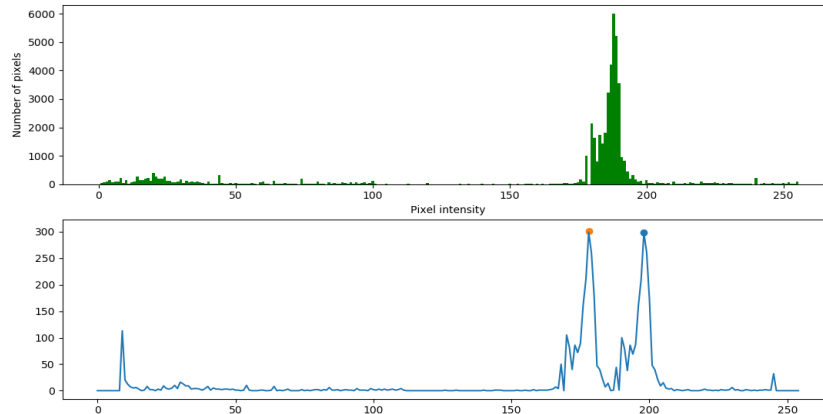


Hue histogram of filtering results (top)
and histogram smoothing results (bottom)

1.2 Green field



Green field extraction results

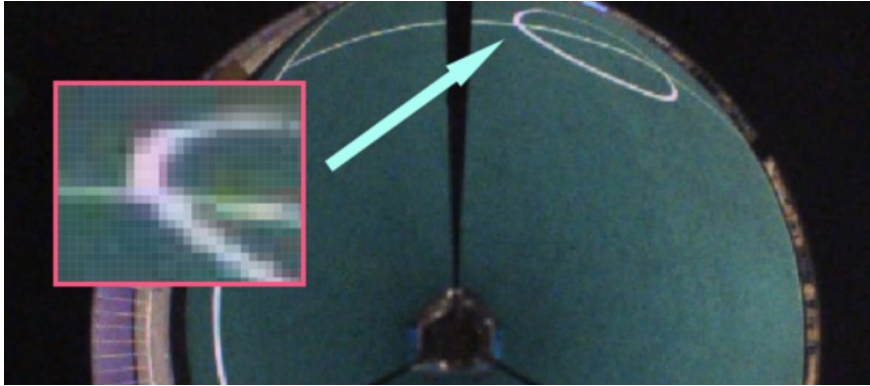


The peak of derivative matches the boundary of the peak of hue

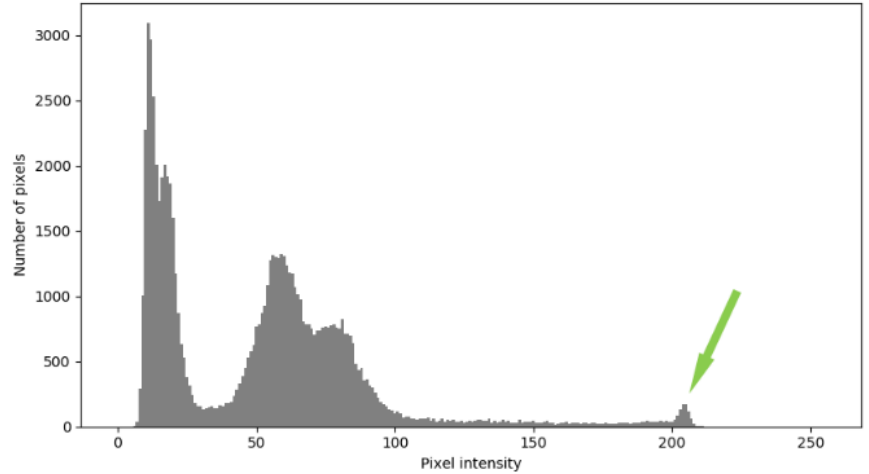


1.3

White lines



The white part of the image edge will show partial color

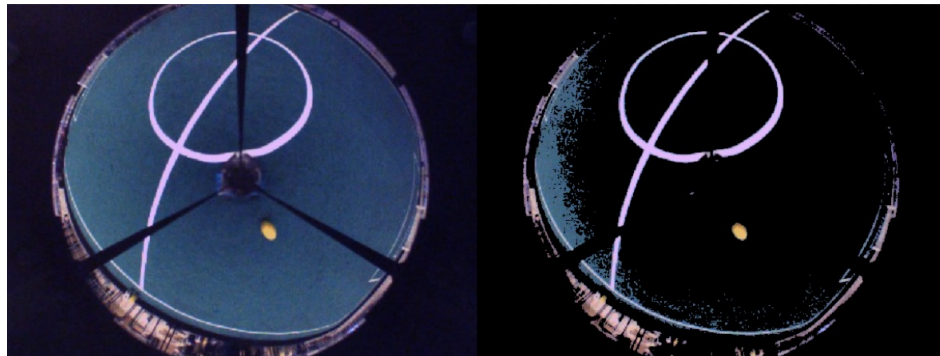
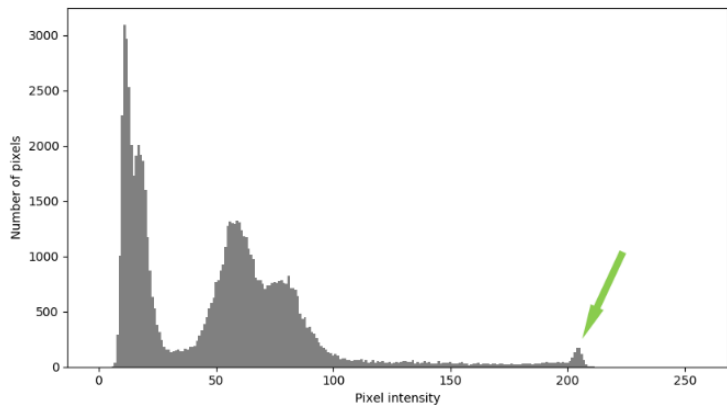


Distribution of white field lines in the intensity histogram

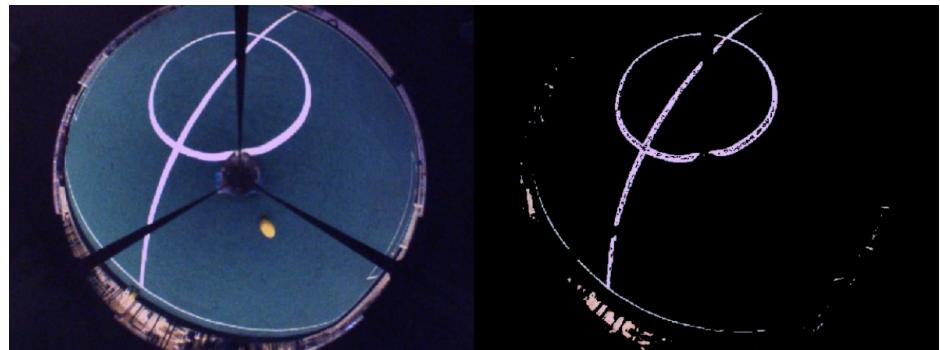


1.3

White lines



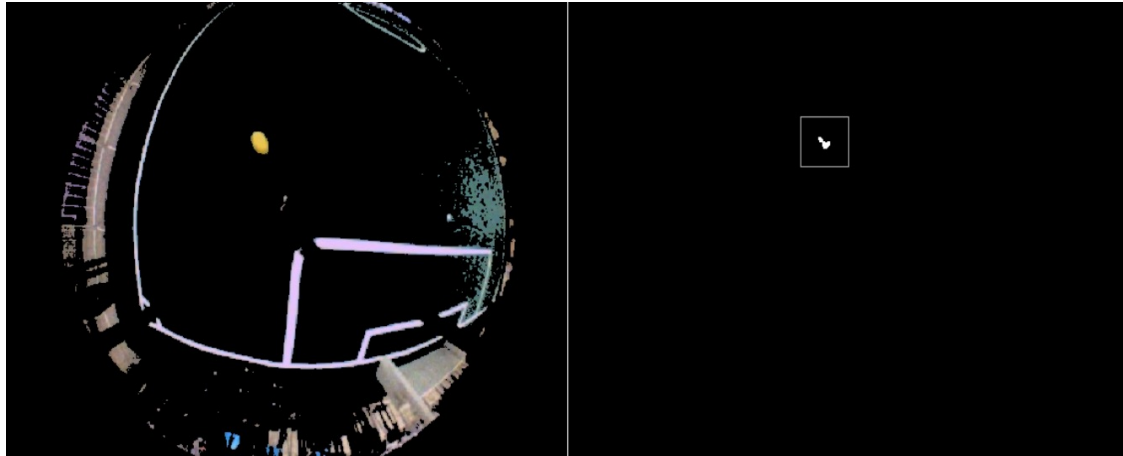
The brightness alone will extract the white line and there will be more



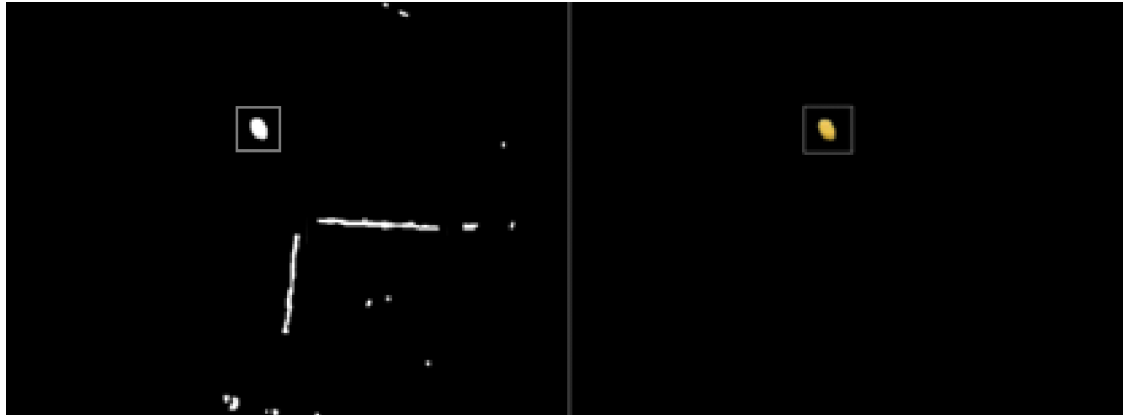
Field lines are extracted using both brightness and saturation

1.4

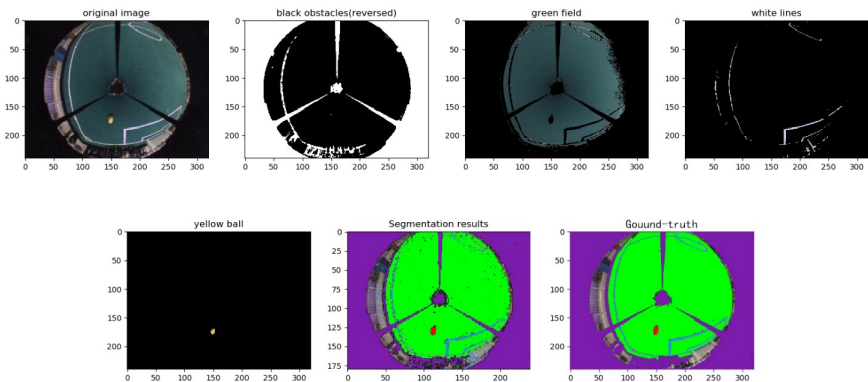
Yellow Ball



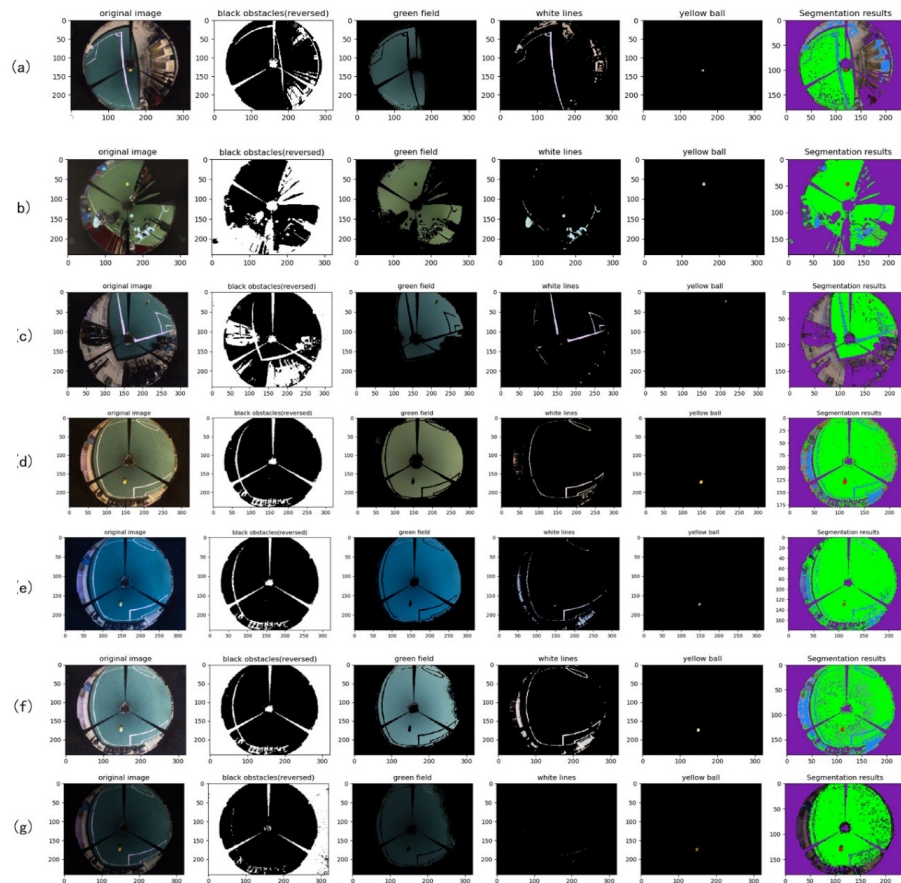
Before filtering (left), the first time the state of a valid pixel block appears after filtering (right, indicated by box)



Results after the iteration stops (left) and final results (right)



The segmentation result of a common situation



Result of multiple interference situations

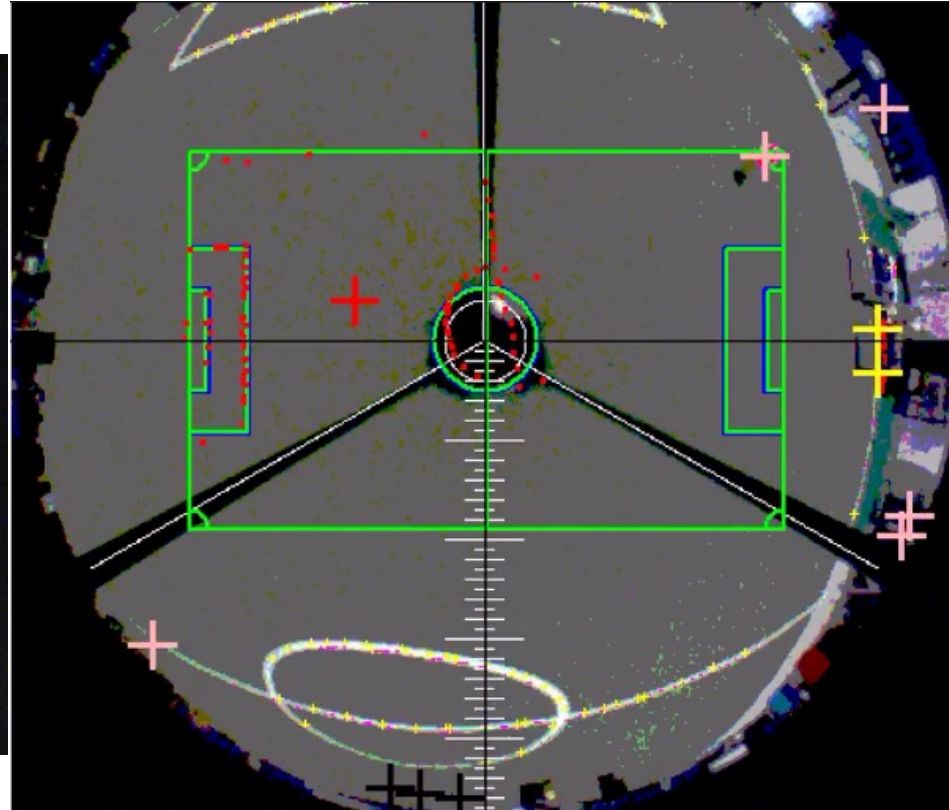
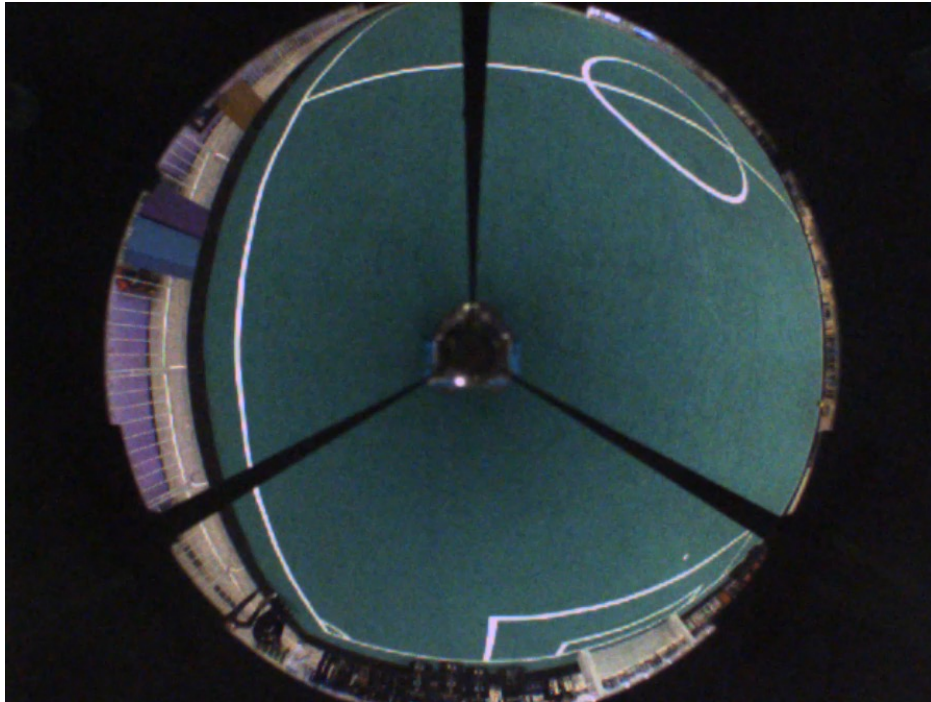
0 1 Automatic image segmentation

Condition	Black obstacle	Green field	White lines	Yellow ball
(a)	93.3%	97.4%	95.5%	61.0%
(b)	95.1%	91.5%	97.7%	96.6%
(c)	95.6%	97.3%	89.5%	73.5%
(d)	93.1%	78.9%	85.0%	81.1%
(e)	98.6%	65.7%	58.6%	97.3%
(f)	92.7%	65.4%	83.5%	96.0%
(g)	89.9%	73.1%	63.4%	83.1%

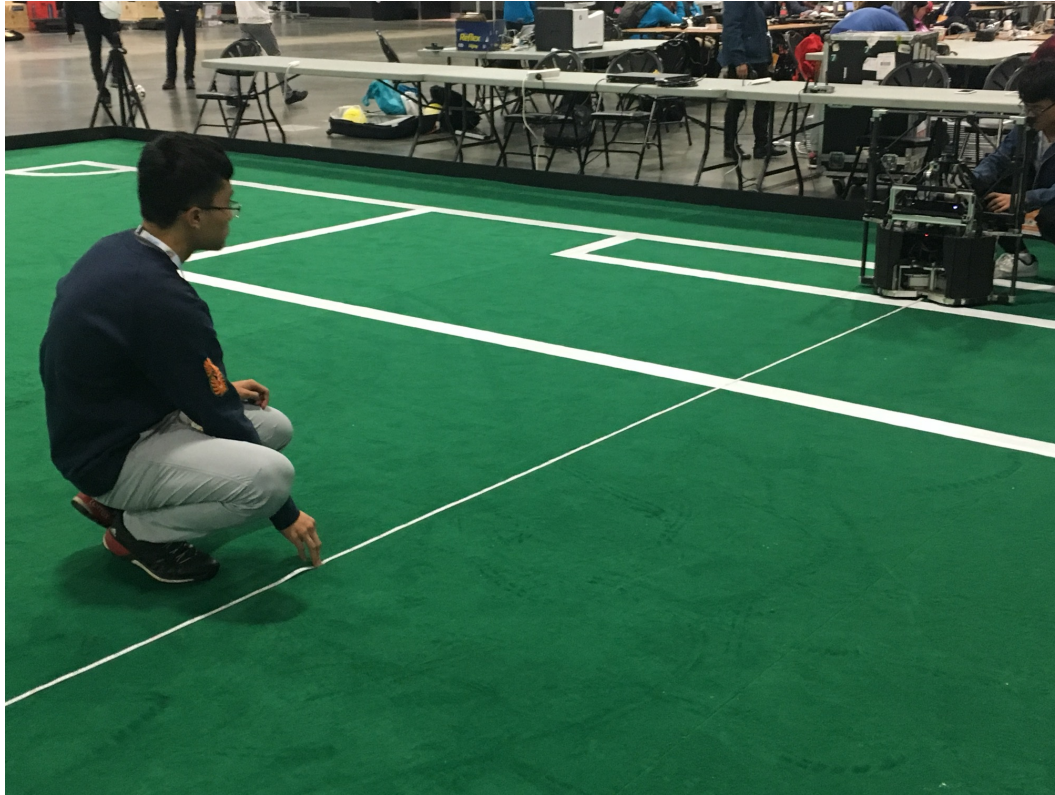
Accuracy of these situations

0 2 Automatic image distortion correction

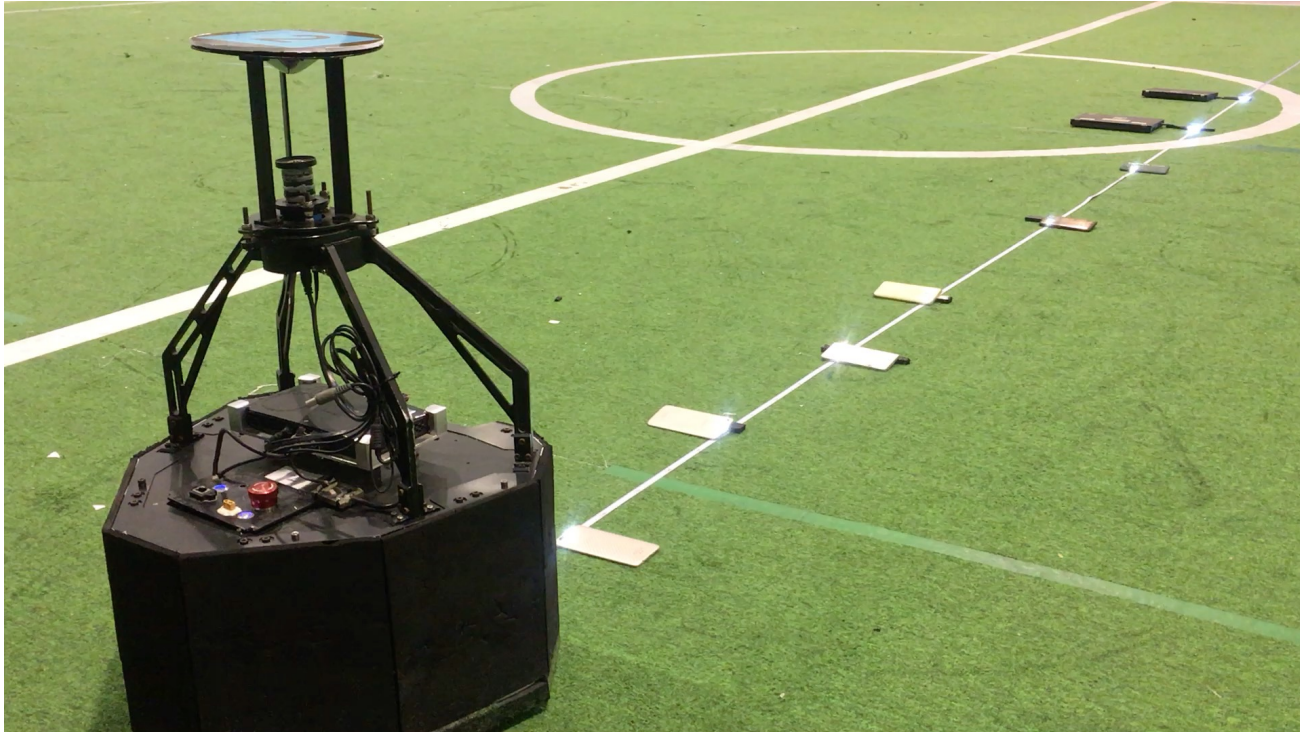
0 2 Image distortion correction



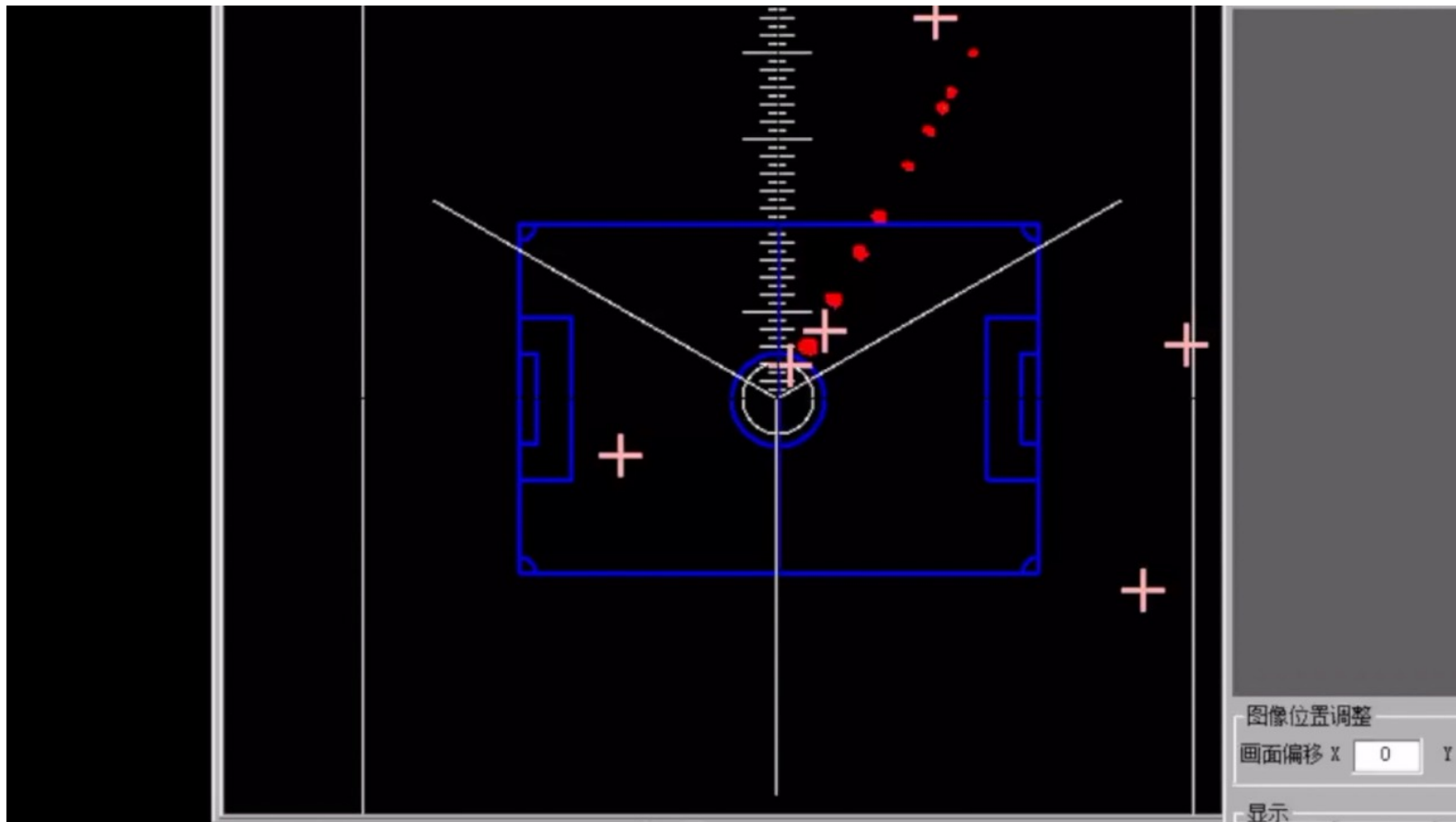
0 2 image distortion correction



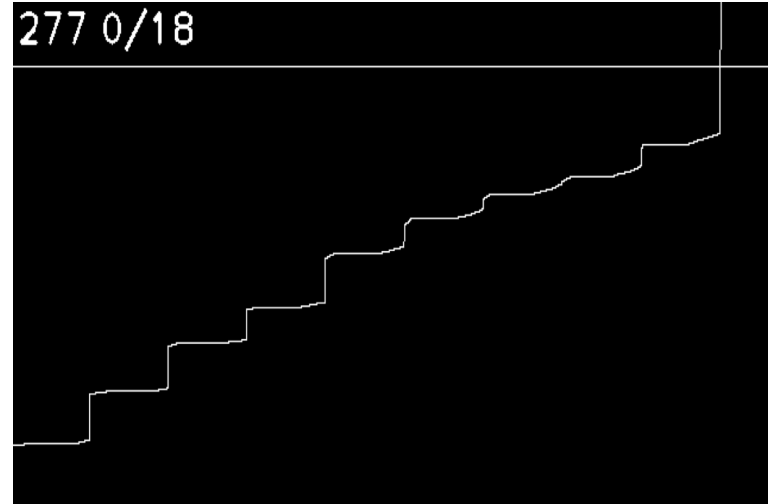
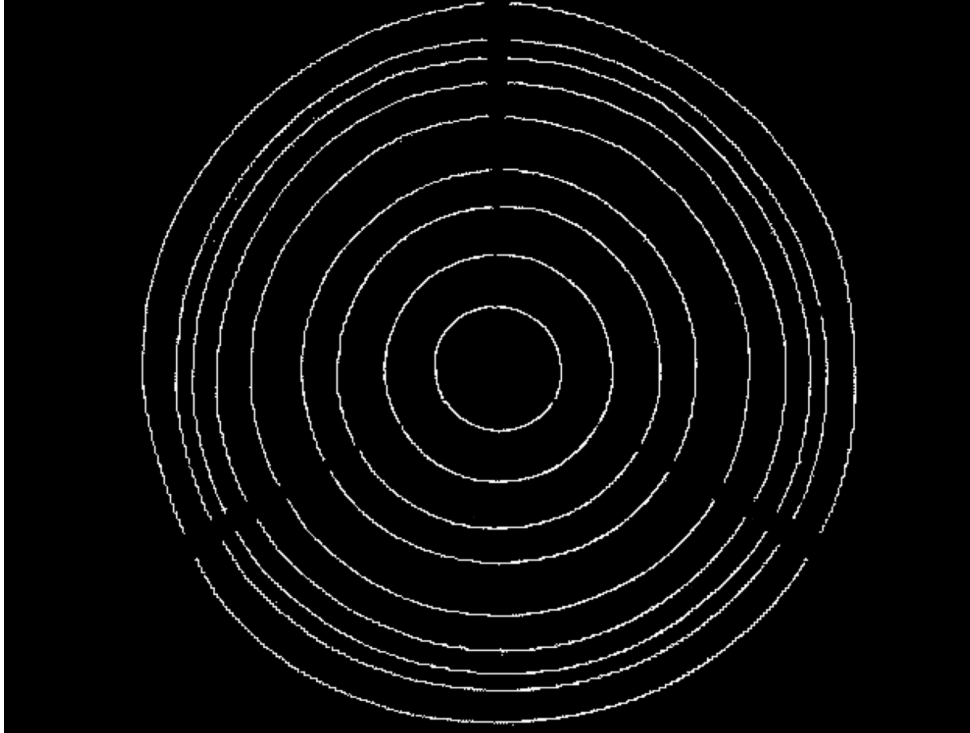
0 2 image distortion correction



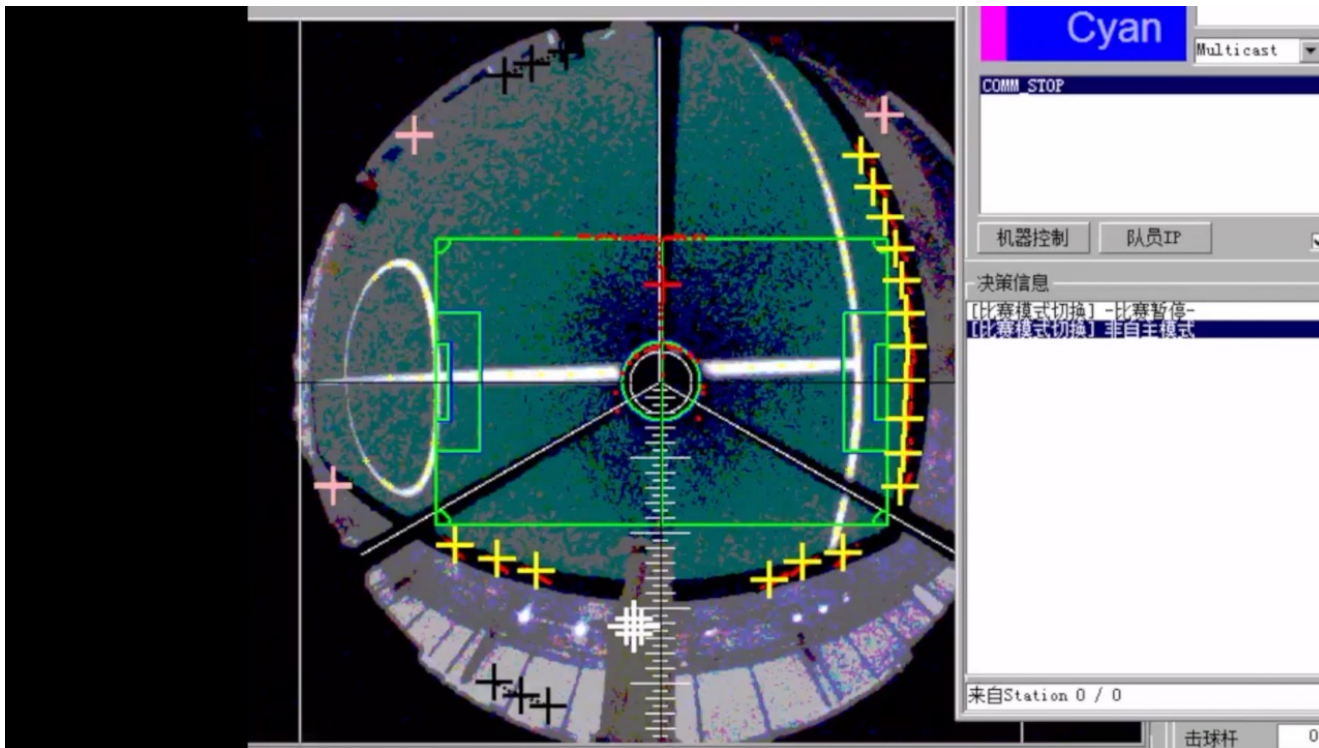
0 2 image distortion correction



0 2 image distortion correction



0 2 image distortion correction



Thank you

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