Traffic Sign Detection and Recognition
Module 1

G5
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Objective

- Build a Traffic Sign Detection and Recognition System.

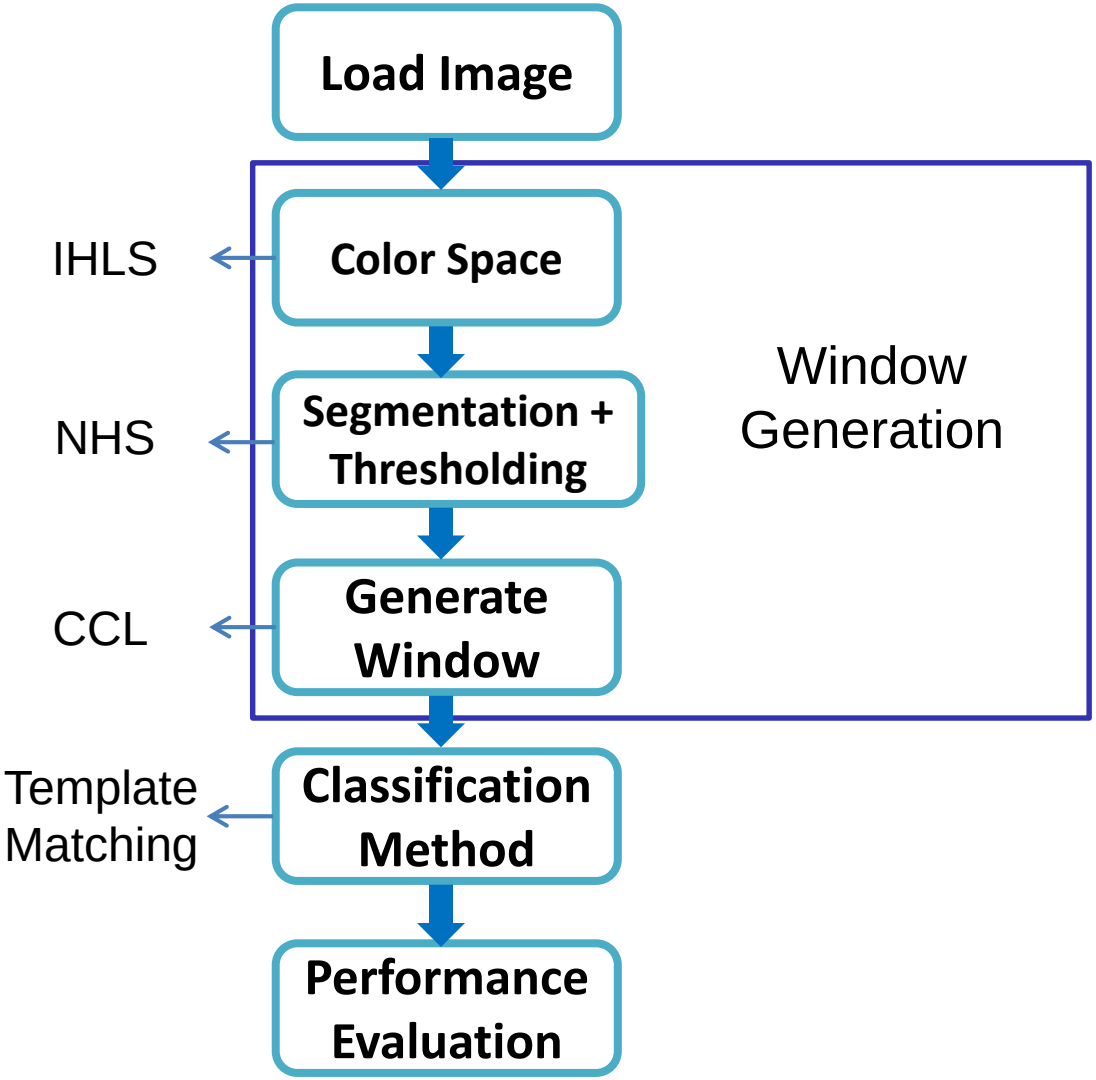
Constraints:

- Different colors and shapes.
- Every place in the image.
- Various scales.
- Different lightning conditions.
- The viewpoint frontal or oblique.

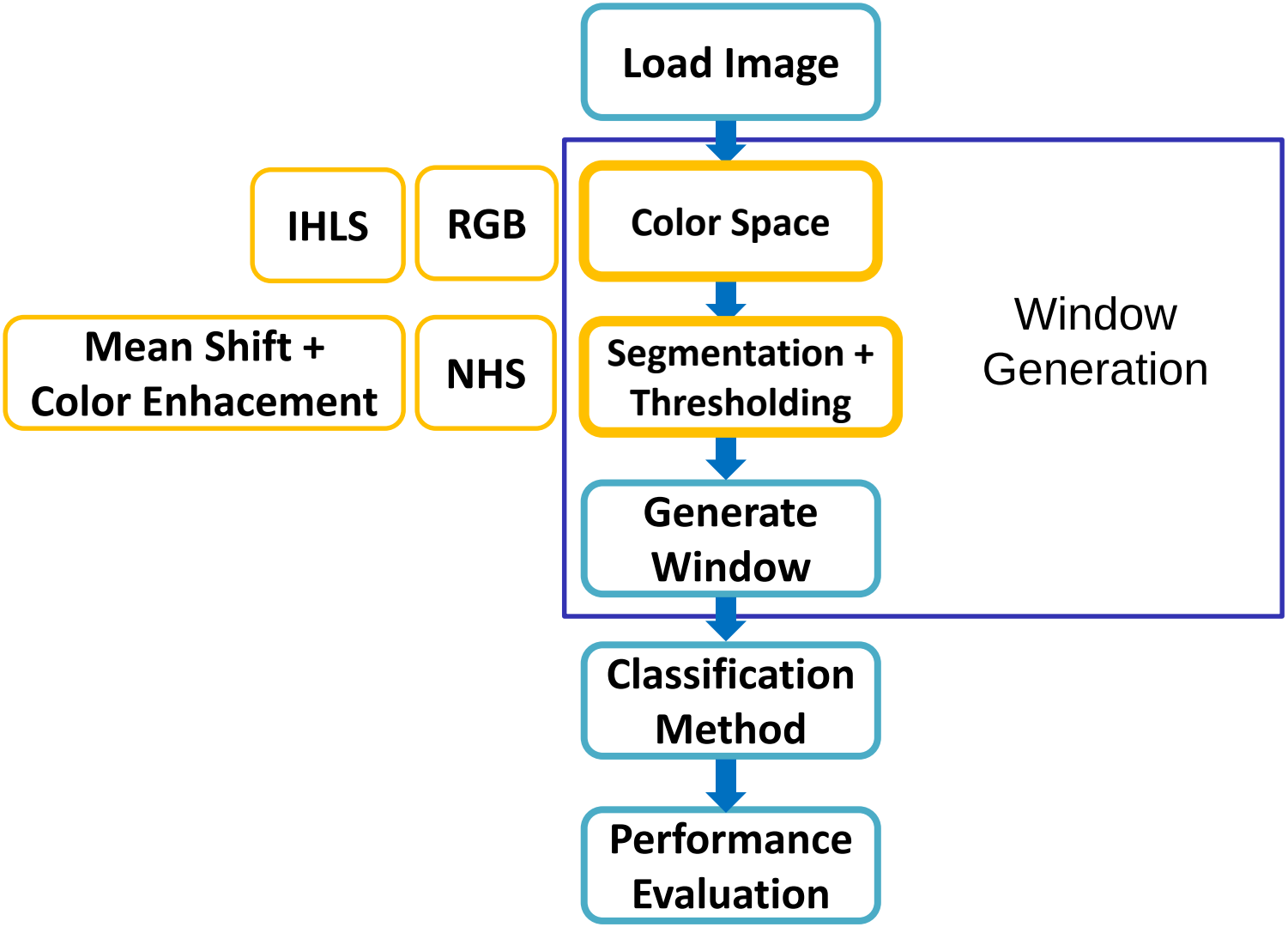
↓↓ Computational Cost

↑↑ F1 Measure

System Overview



Color Space + Segmentation



Color Space + Segmentation

- 1st Approach: **Mean Shift + RGB Color enhancement**



$$f_R(x) = \max\left(0, \frac{\min(x_R - x_G, x_R - x_B)}{s}\right)$$

$$f_B(x) = \max\left(0, \frac{\min(x_B - x_G, x_B - x_R)}{s}\right)$$

Where $s = x_R + x_G + x_B$.


Improved binary mask


Huge computational cost

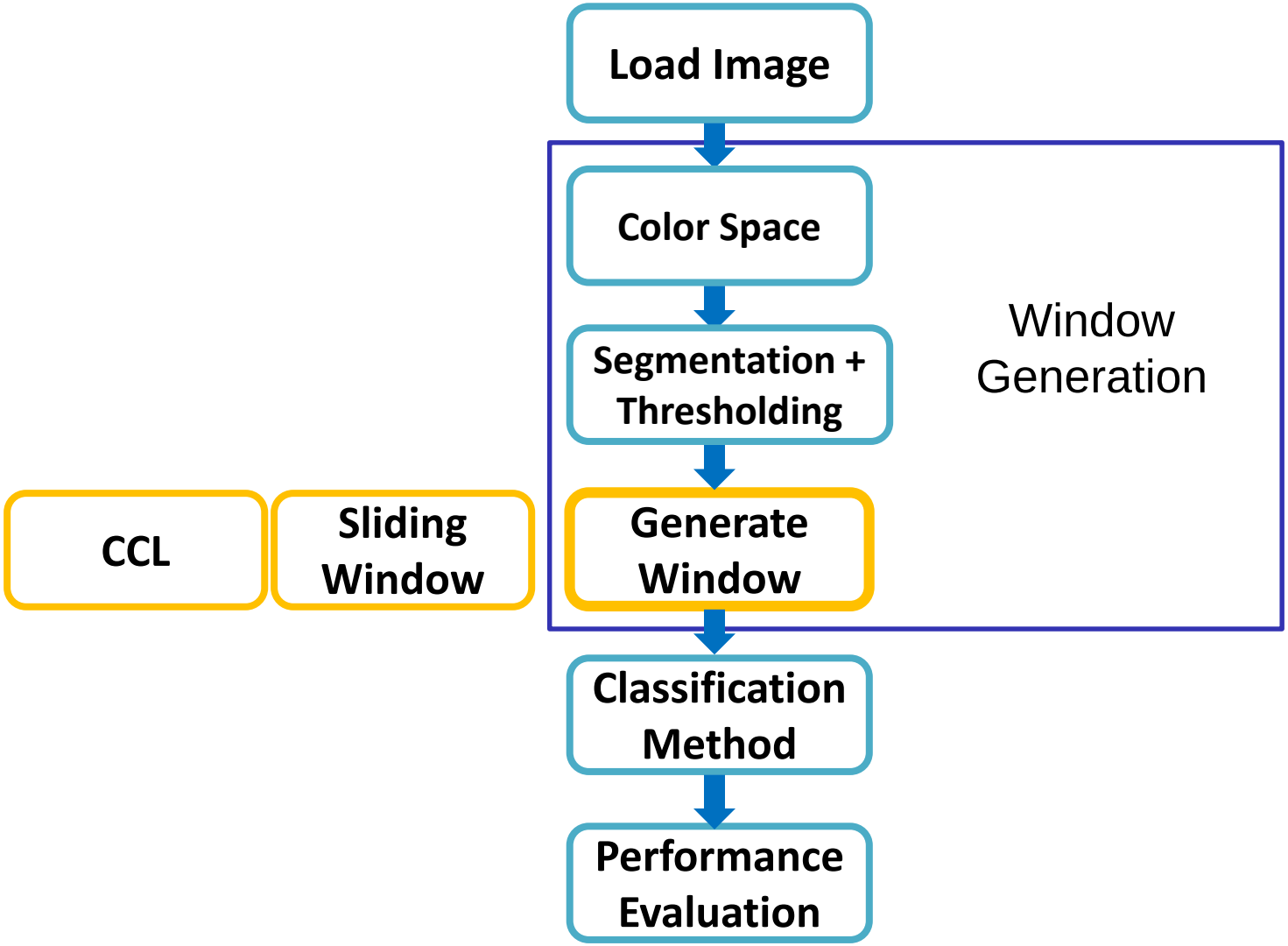
- 2nd Approach: Improved Hue Luminance Saturation (**IHLS**) + Normalized Hue-Saturation (**NHS**)



Low computational cost

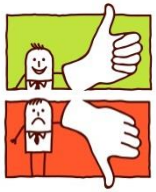

More objects are detected

System Overview Generate Window



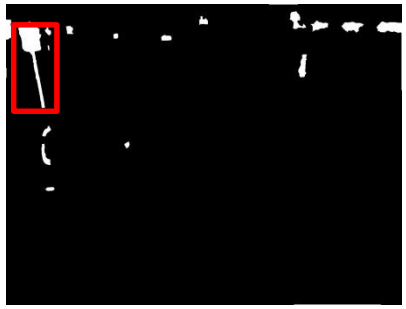
System Overview Generate Window

- 1st Approach: **Connected Component Labeling (CCL)**
  - Detect connected components
  - Obtain a bounding box for each connected component
  - Discard regions that are not signals

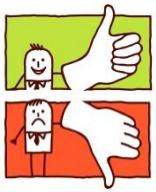


Low computational cost

Discard bounding boxes containing signals



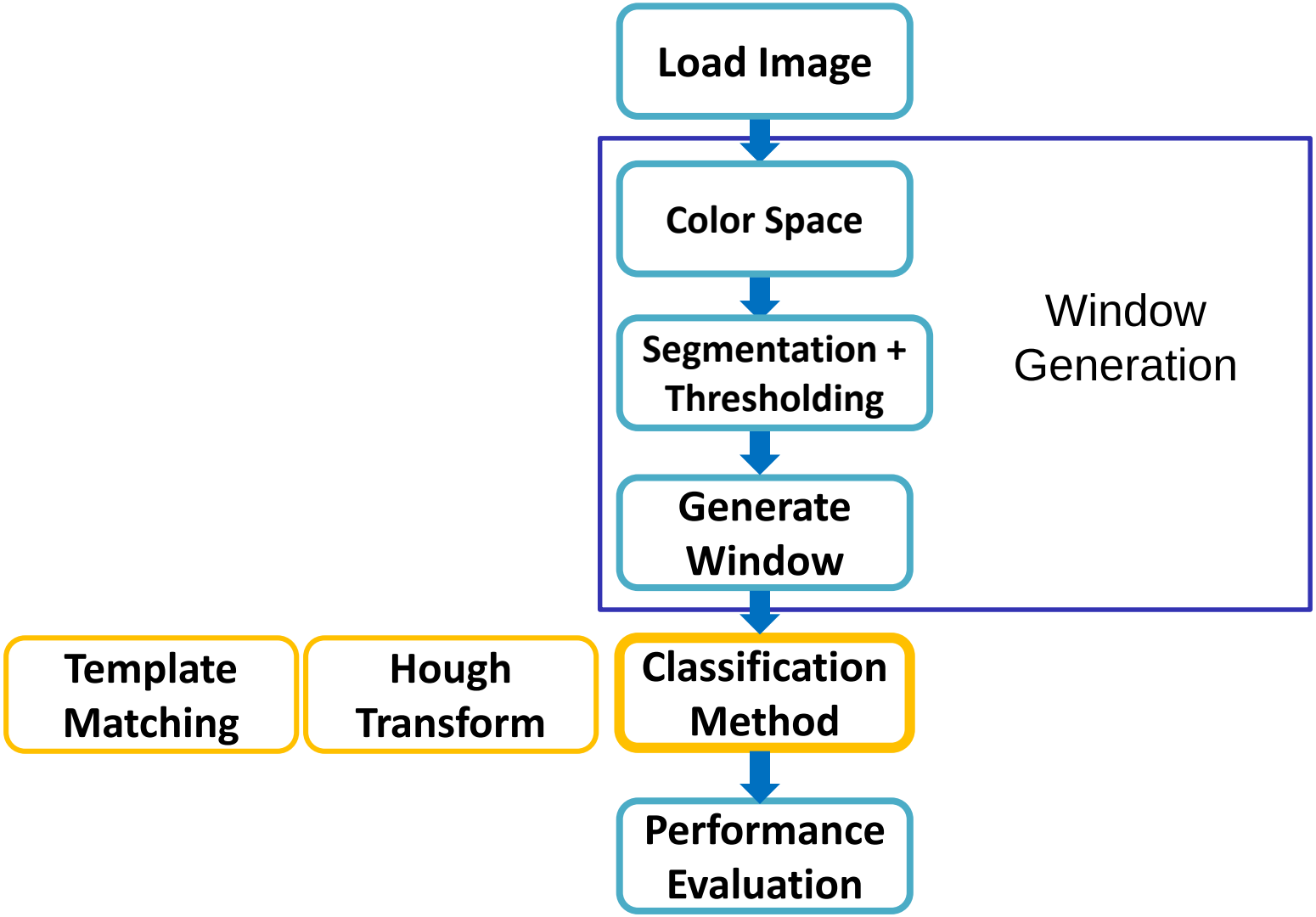
- 2nd Approach: **Sliding Window**
  - Slide a window over the image
  - Join the overlapped windows
  - Discard regions that are not signals



Easy to implement

Huge computational cost

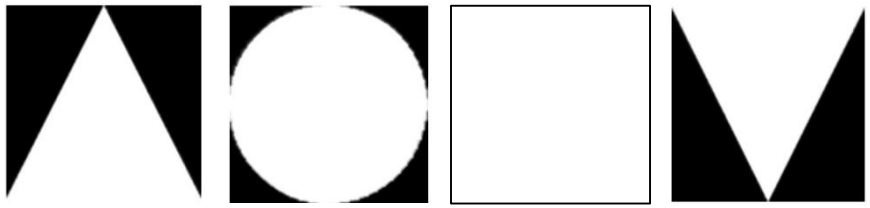
System Overview Classification Method



Classification Method

Template Matching

- Generate Templates:



- 1st Approach: **Grayscale**

Easy implementation

Medium performance

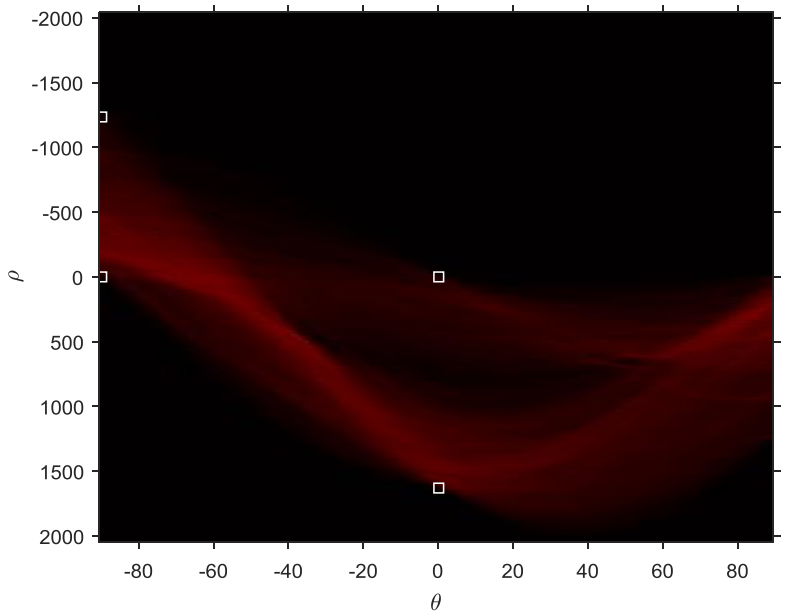
- 2nd Approach: **Chamfer**

Complex implementation and less performance

- 3rd Approach: **Correlation**

Highest performance

Hough Transform



Tolerance = 7

||α| – 90 |<= Tolerance, |α|<= Tolerance

||α| – 30 |<= Tolerance

Detected maximum lines and CircularHough_Grd.m find a centre

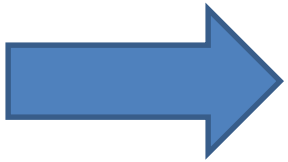
Detect shape directly

Difficult to fix a threshold

Results & Conclusions

Performance Evaluation	Precision	Accuracy	Recall	F1 Measure	TP	FP	FN
Pixel Based	0.30	0.99	0.94	0.46	724035	1664308	49784
Window Based	**0.72**	**0.63**	**0.83**	**0.77**	**118**	**46**	**24**

- IHLS
- imfill
- CCL
- CORRELATION



- Not most powerful techniques
- Good results!

Performing Demostration

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