

# WASTES CLASSIFICATION FOR REVERSE VENDING MACHINE

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# WASTES CLASSIFICATION

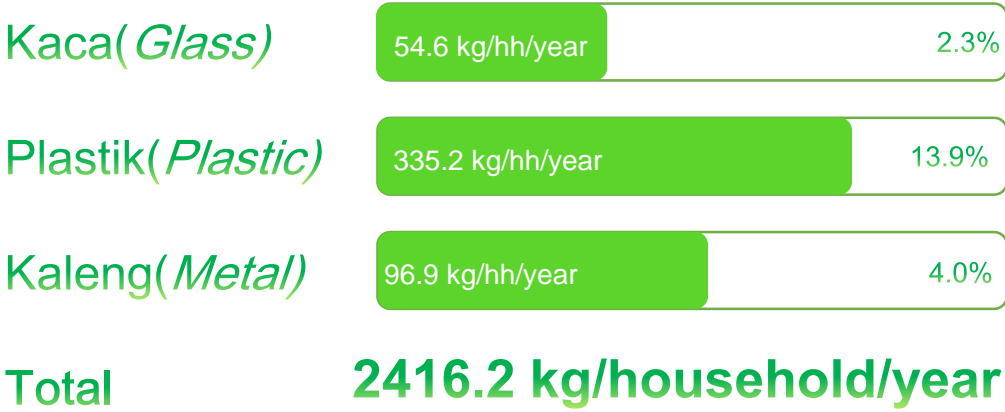




# Background

“*Jakarta is pumping out between 1900 and 2400 tons of plastic thrash everyday*”

## 2013 WASTES DATA IN JAKARTA



	Waste categories (Average, kg/household/year)											Total household waste generated per year
	Food scraps (kitchen waste)	Garden (yard) & park waste	Paper & card-board	Wood	Textile	Disposable diapers	Rubber & leather	Plastic	Metal	Glass (pottery & ceramics)	Other (ash, dirt, dust, soil, e-waste)	
Kg/household /year	1260.0	167.6	284.6	34.7	24.8	96.9	14.9	335.2	96.9	54.6	46.4	2416.2
Avg./household/ year	252	33.5	56.9	6.9	5.0	19.4	3.0	67.1	19.4	10.9	9.3	483.3
Percentage	52.1%	6.9%	11.8%	1.4%	1.0%	4.0%	0.6%	13.9%	4.0%	2.3%	1.9%	100.0%



# DATASET

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419

Glass Bottle Images



376

Metal Can Images



344

Plastic Bottle Images



# DATASETS



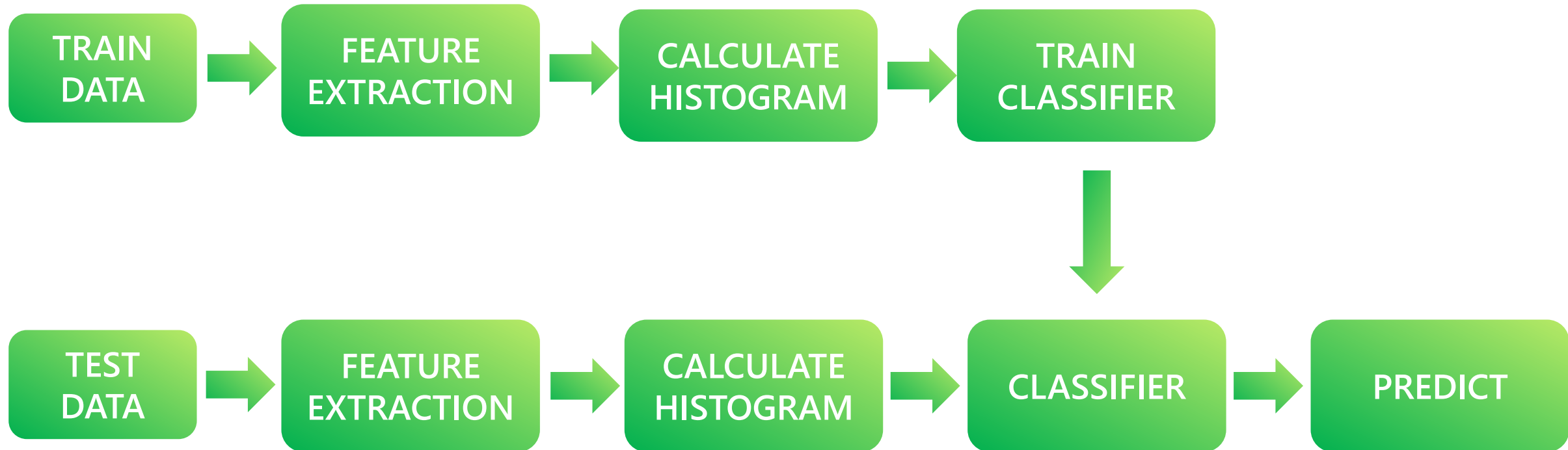
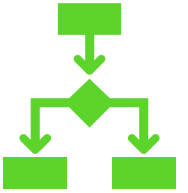
Glass Bottle Images



REMOVED

# IMAGE CLASSIFICATION

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# Features Extraction

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## Speeded Up Robust Features (SURF)

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To find similarity between images with box filter

- Feature Extraction
- Feature Description

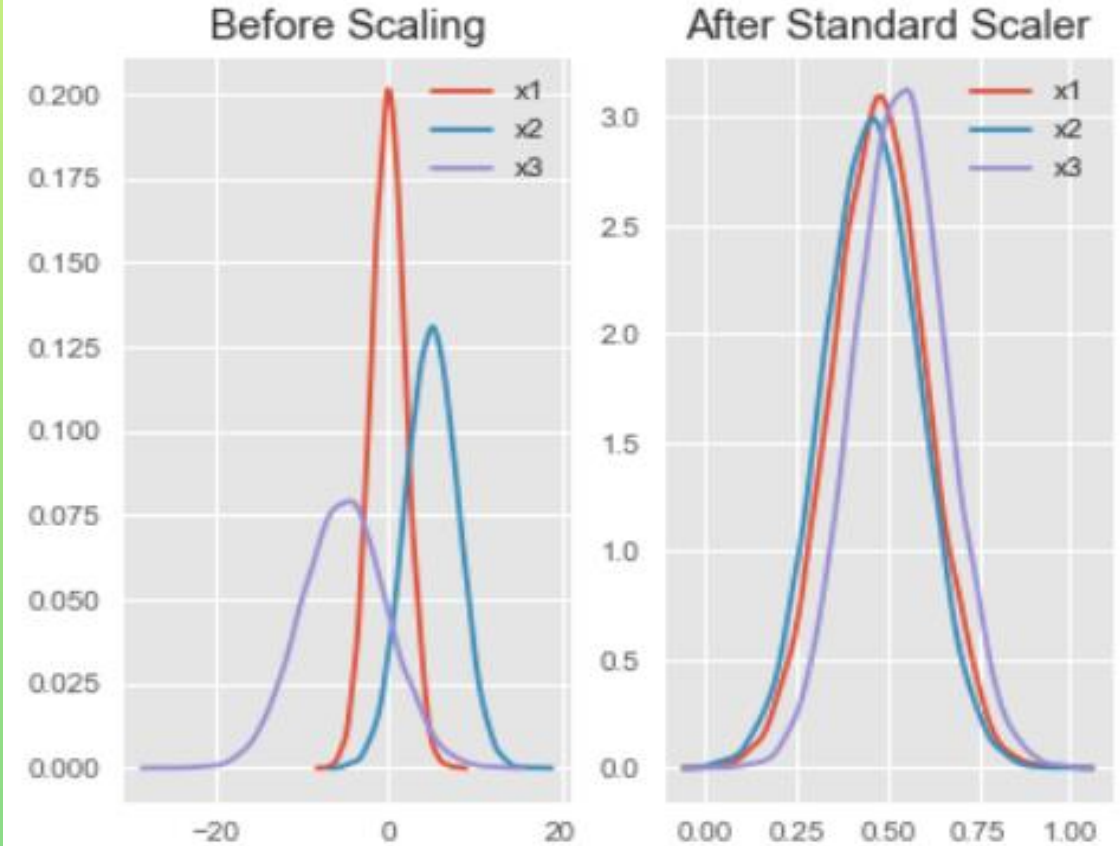




# Histogram Normalization

## Standard Scaler

Transform the data that its distribution will have a mean value 0 and standard deviation of 1. Then scaling to unit variance means dividing all the values by the standard deviation.





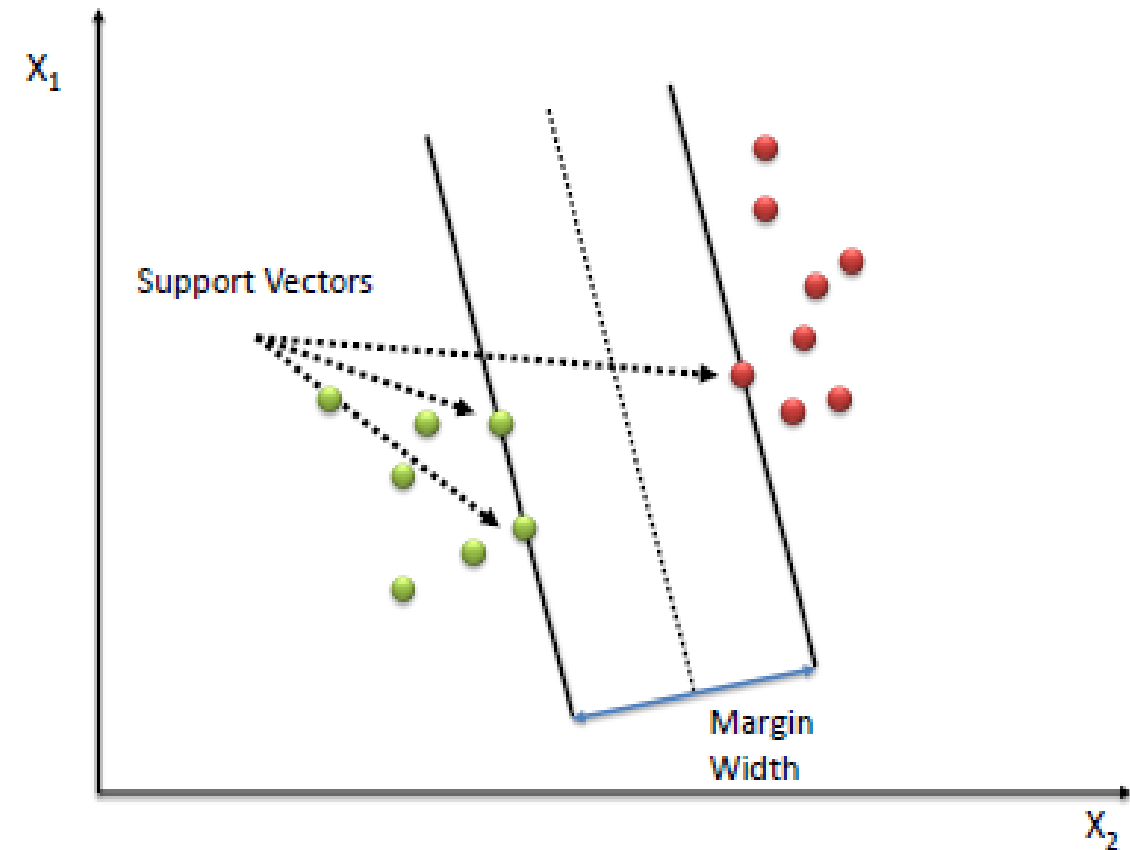


# Classifier Model

## Support Vector Machine

Supervised machine learning algorithm to solve classification or regression problems.

- Find the points closest to the line from both classes
- compute the distance between the line and support vectors
- maximize the margin to make the boundaries between two classes as wide as possible





# Reverse Vending Machine

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## Automatic Wastes Sorting

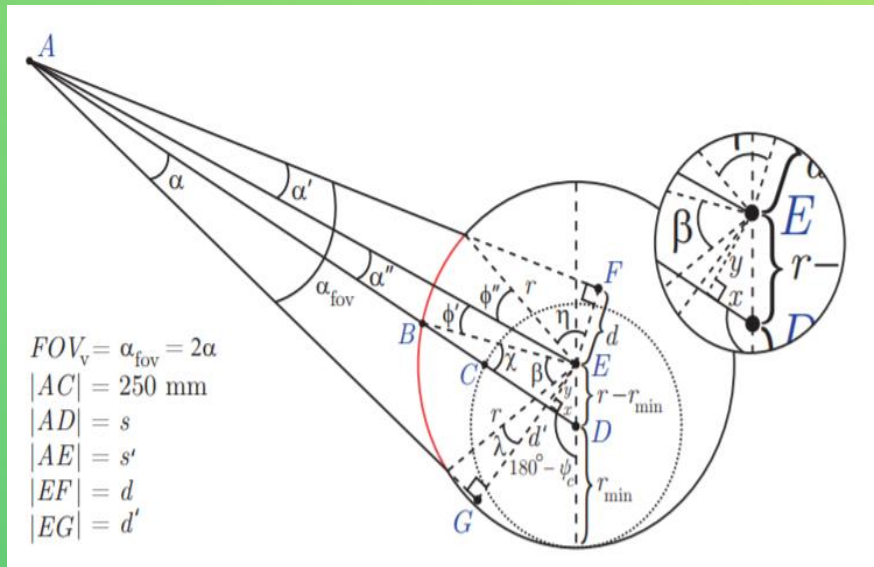
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Using image classification to classify between wastes, then automatically sort the wastes to their own container.



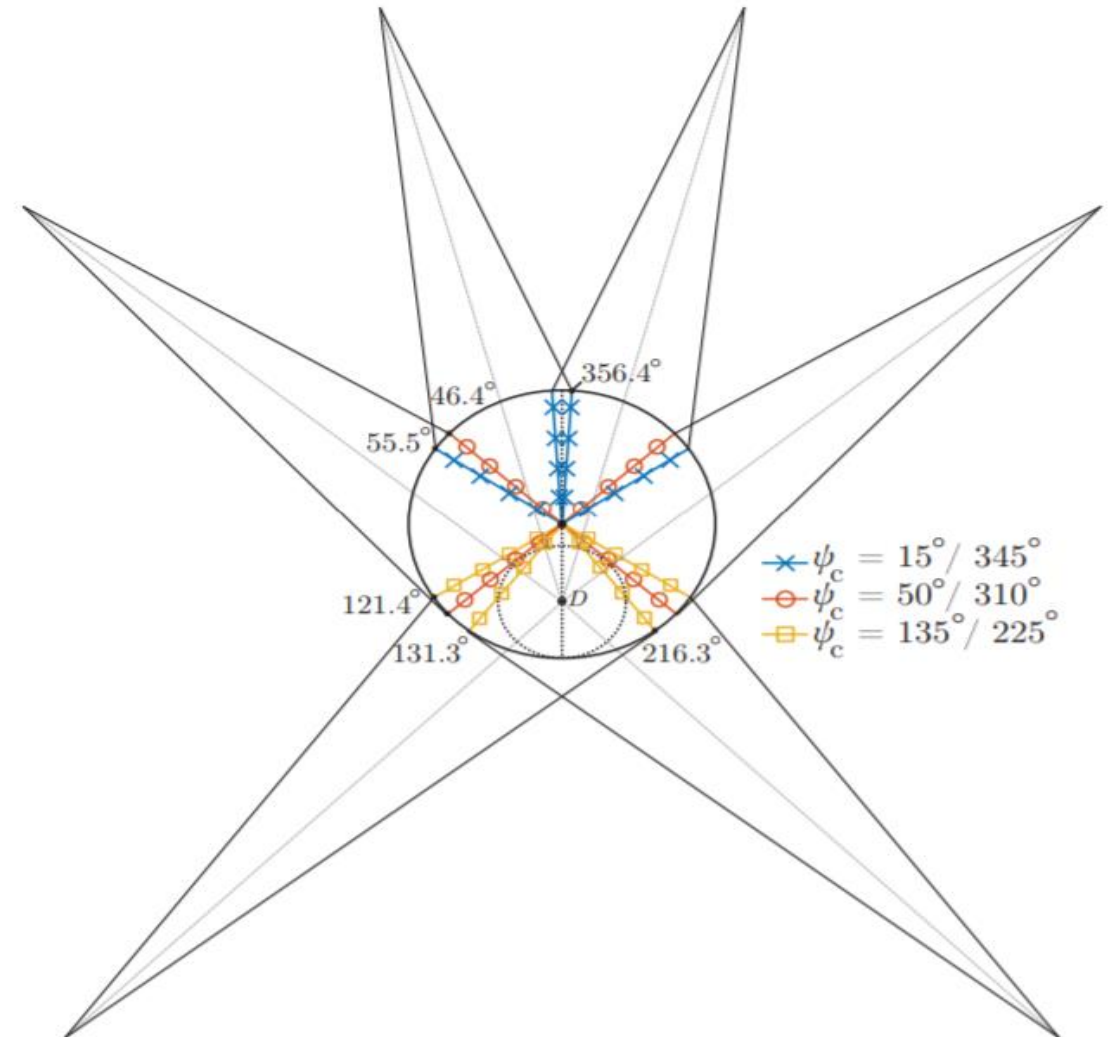


## Camera Placement



Implementing image classification  
in the camera inside the reverse  
vending machine.

Using multiple camera to validate  
the object as the qualified object.





# Parameter Tuning

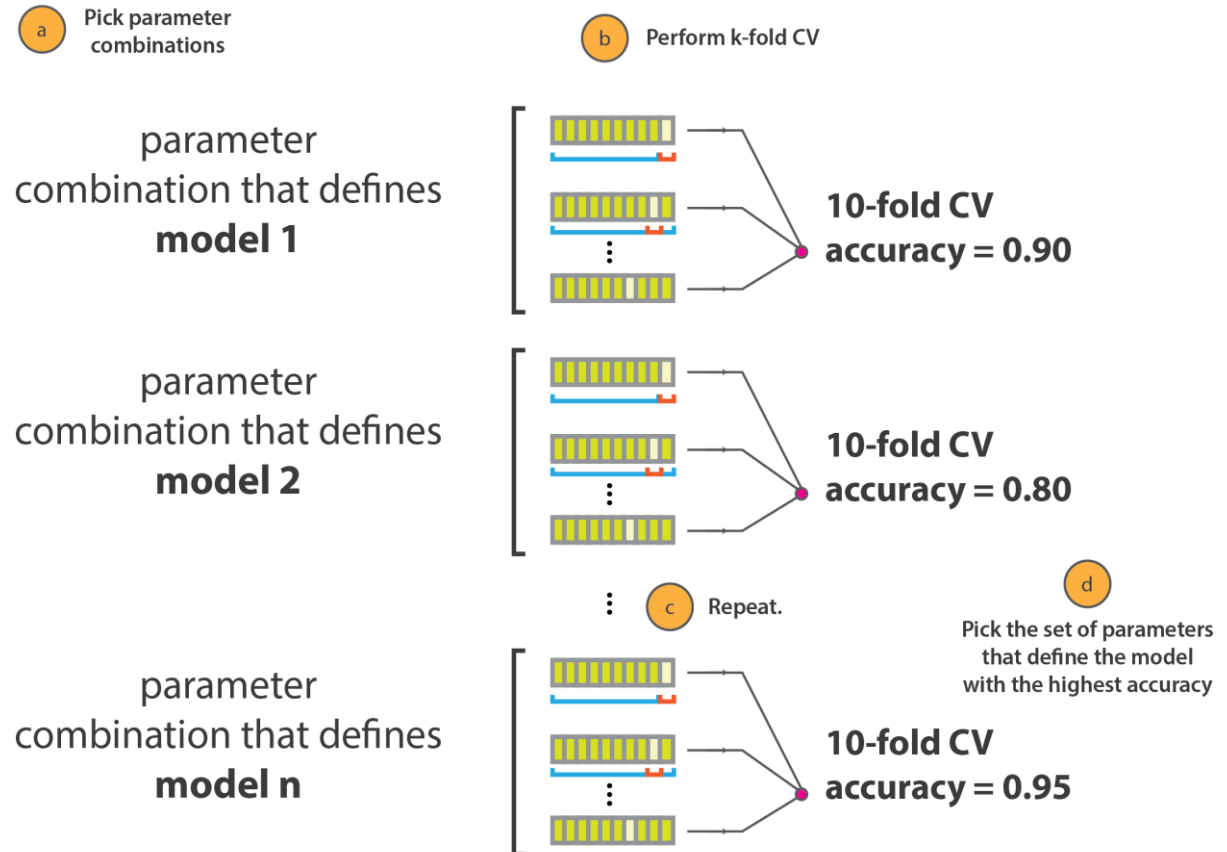
## Grid Search Cross Validation

Choosing a set of optimal hyperparameters for learning algorithm.

List of the parameters:

- C Value:
- Gamma Value
- Kernel

Lastly select the architecture which produces best result







# RESULT

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Glass Bottle

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Metal Can

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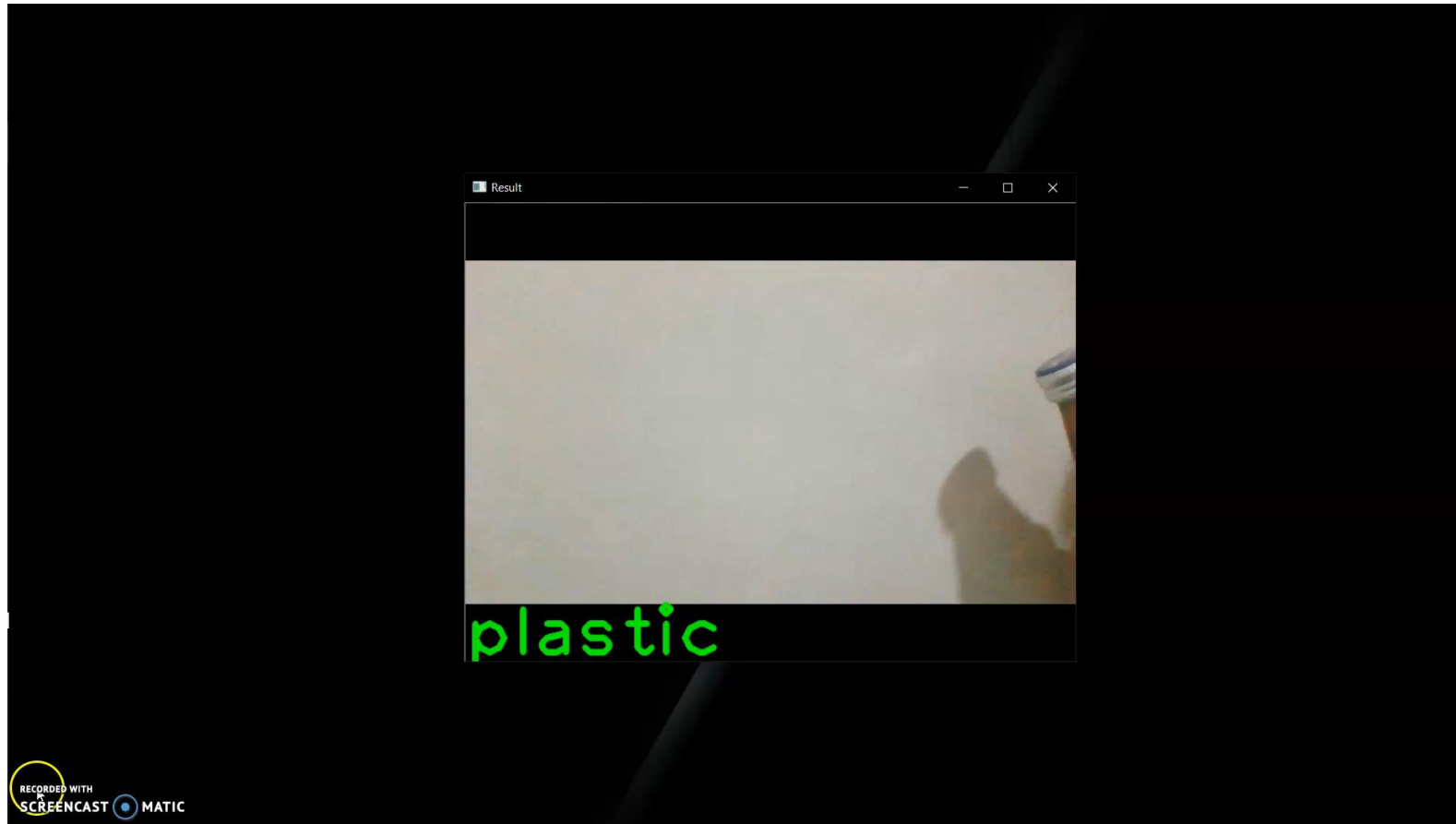


Plastic Bottle

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# DEMO

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# REFERENCES

<https://scikit-learn.org/stable/modules/generated/sklearn.svm.SVC.html>

<https://www.kaggle.com/ishivinal/model-tuning-grid-random-search-and-baysian-op>

<https://pdfs.semanticscholar.org/9cf4/3b88c08acac634665822cdf34dcad5c43e68.pdf>

[https://opencv-python-tutroals.readthedocs.io/en/latest/py\\_tutorials/py\\_feature2d/py\\_surf\\_intro/py\\_surf\\_intro.html](https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_feature2d/py_surf_intro/py_surf_intro.html)

<https://towardsdatascience.com/https-medium-com-pupalerushikesh-svm-f4b42800e989>

<http://benalexkeen.com/feature-scaling-with-scikit-learn/>

[https://scikit-learn.org/stable/auto\\_examples/applications/plot\\_face\\_recognition.html#sphx-glr-auto-examples-applications-plot-face-recognition-py](https://scikit-learn.org/stable/auto_examples/applications/plot_face_recognition.html#sphx-glr-auto-examples-applications-plot-face-recognition-py)

<https://www.thejakartapost.com/news/2018/08/10/jakarta-generates-up-to-2400-tons-of-plastic-waste-daily.html>

# DATASET SOURCE

<https://github.com/garythung/trashnet/blob/master/data/dataset-resized.zip>

[http://www.slipguru.unige.it/Data/glassense\\_vision/](http://www.slipguru.unige.it/Data/glassense_vision/)

<http://www.multimediauts.org/dataset/WSID-100.html>