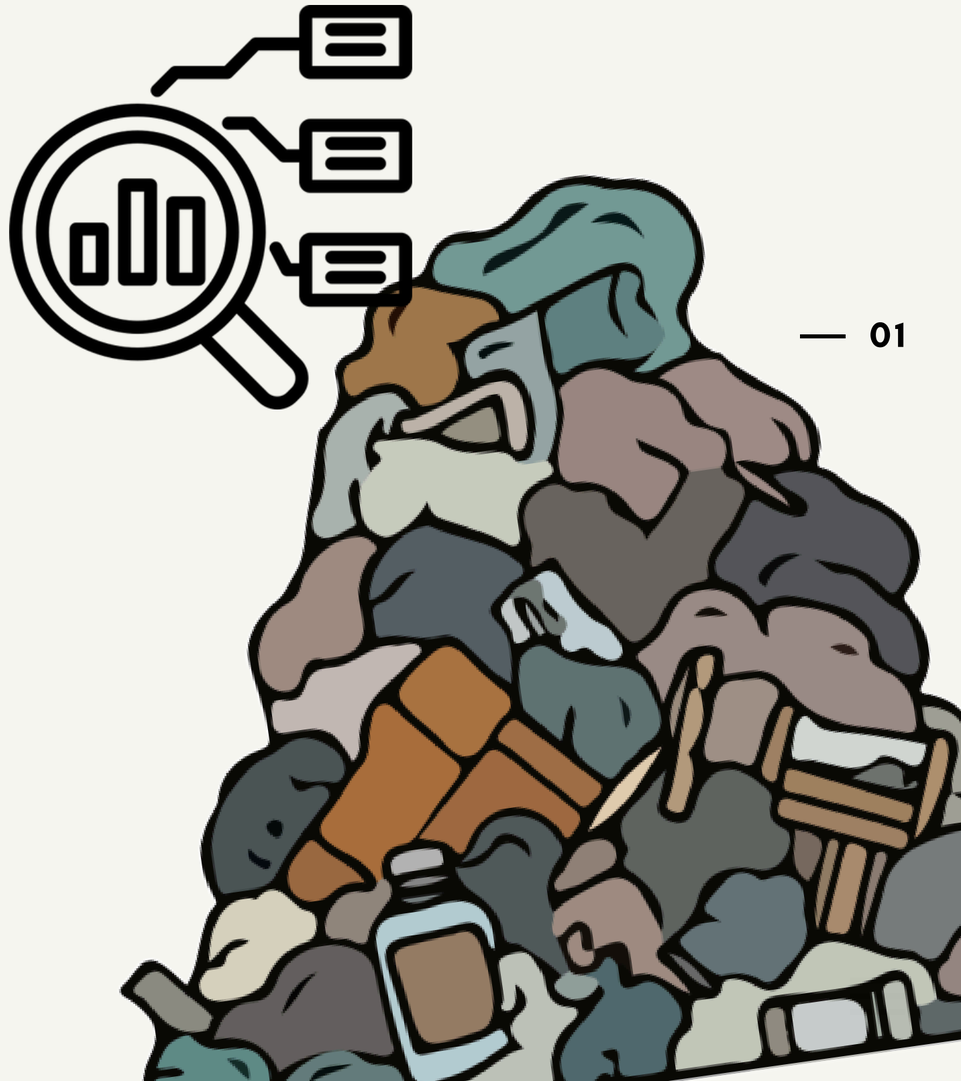
Real-Time Trash Detection and Classification System

A Smart Waste Sorting

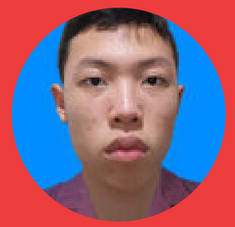


— 01

Group Members

Johannes
Jourdan Triadi

Alan Nabiel



Nathanael Wijaya

Project Timeline

01 Dataset

02 Preprocessing

03 Model Training

04 Evaluation & Analysis

05 Deployment

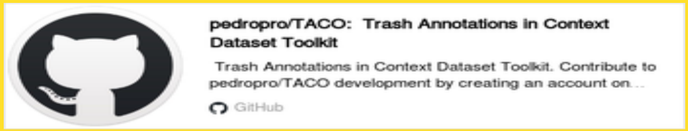
Latar Belakang

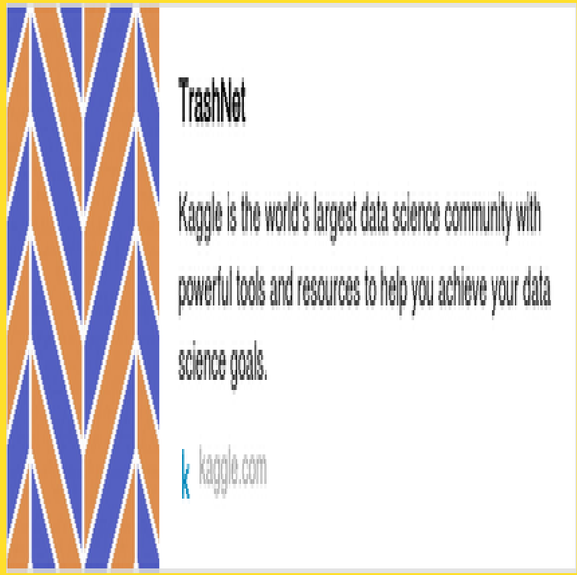
Why are we making this?

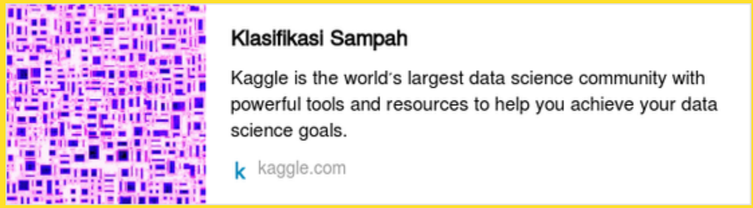
Kesalahan manusia dalam memilah sampah sering kali menghambat proses pengolahan limbah. Memanfaatkan kecepatan dan akurasi arsitektur YOLO (You Only Look Once), sistem ini mampu mendeteksi dan mengklasifikasikan jenis sampah seketika, sehingga sampah dapat disortir secara otomatis tanpa intervensi manusia.

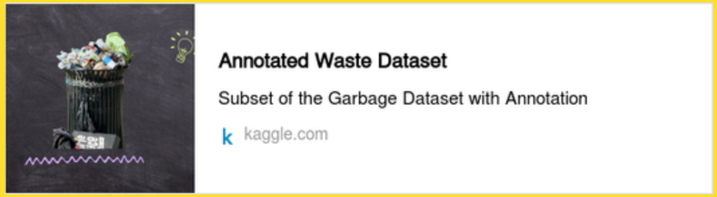
Trouble Of Finding A **Perfect Dataset**

Before that, we also tried:









Dataset

Garbage Classification V2

Total Images: 20,212

Total Classes: 10

Garbage Dataset

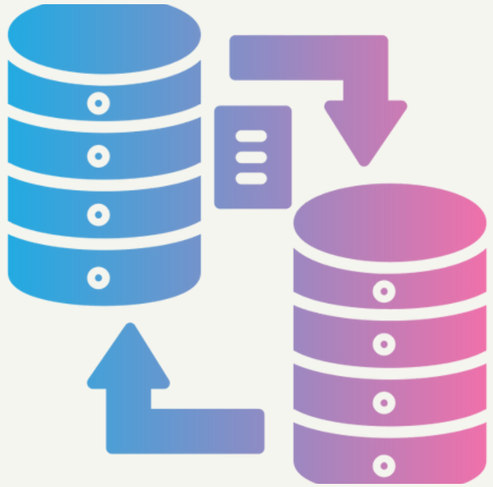
A Comprehensive Image Dataset for Garbage Classification and Recycling

k kaggle.com

Class List

Battery, Biological, Cardboard, Clothes, Glass, Metal, Paper, Plastic, Shoes, Trash.

Covers common household!



Additional Info

Dataset ini Non-Annotated untuk Object Detection.

Preprocessing

Auto-Labeling

Creating “Fake” Bounding Boxes

Directory Restructuring

For it to Be Acceptable to YOLO Standard

Image Transformation

Changing Images Size to 640x640

Model Training

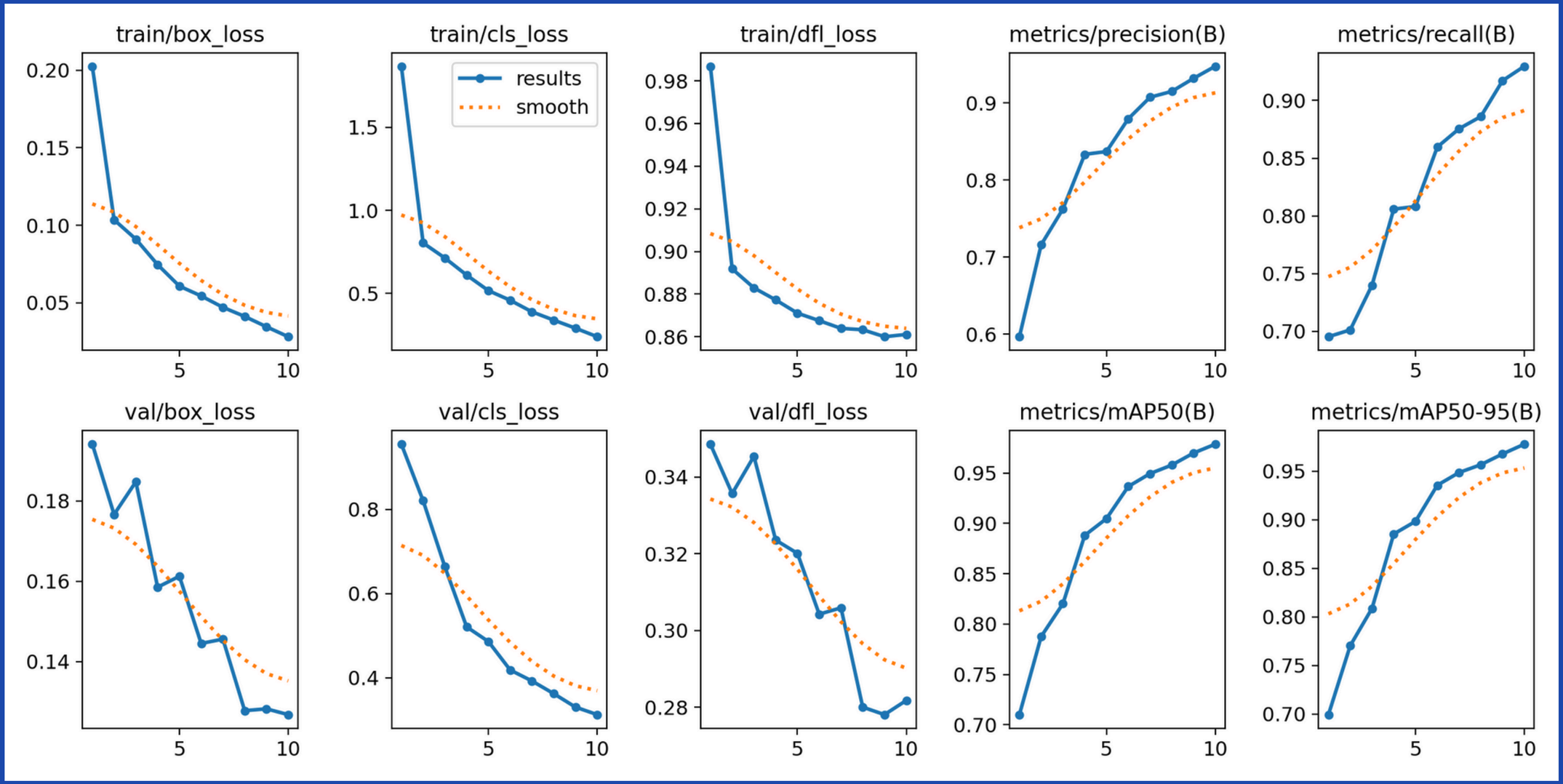
Intial Approach: MobileNetv2Custom CNN

Second Approach, and final one. **Pretrained Model**

We’re Using Yolov8n & Yolov8s

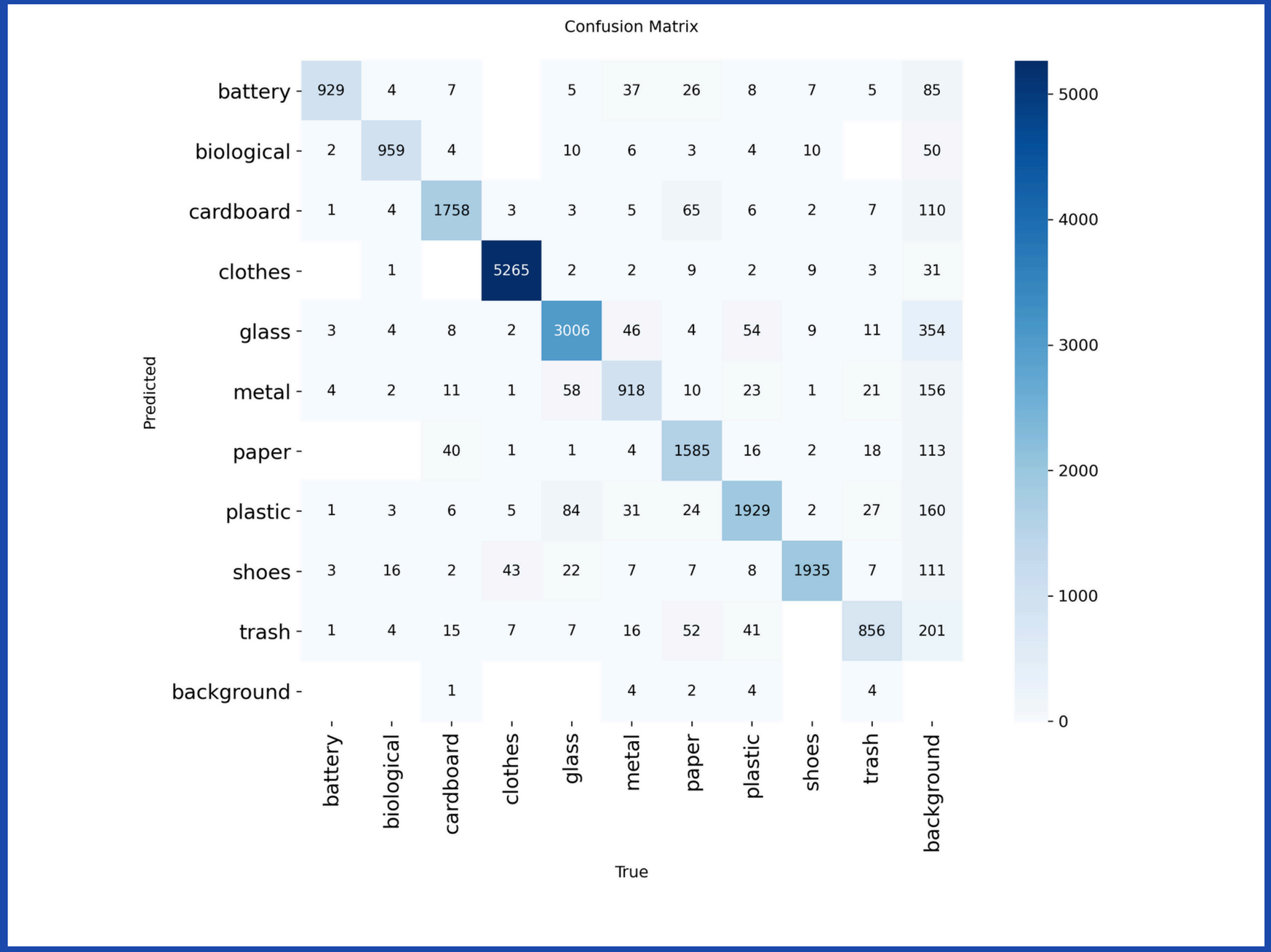
Evaluation!

94.8% 93.0%

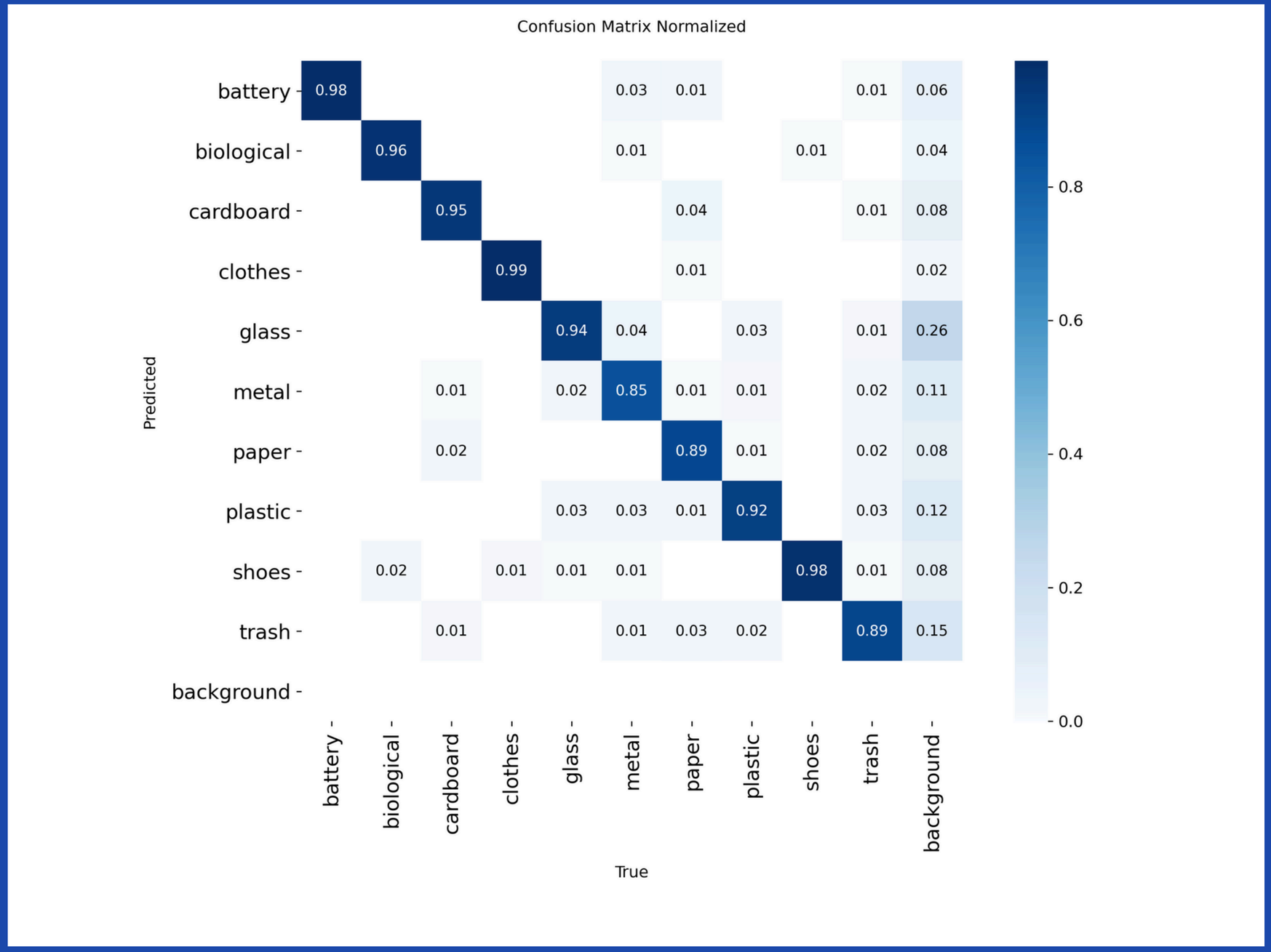


97.9% 97.8%

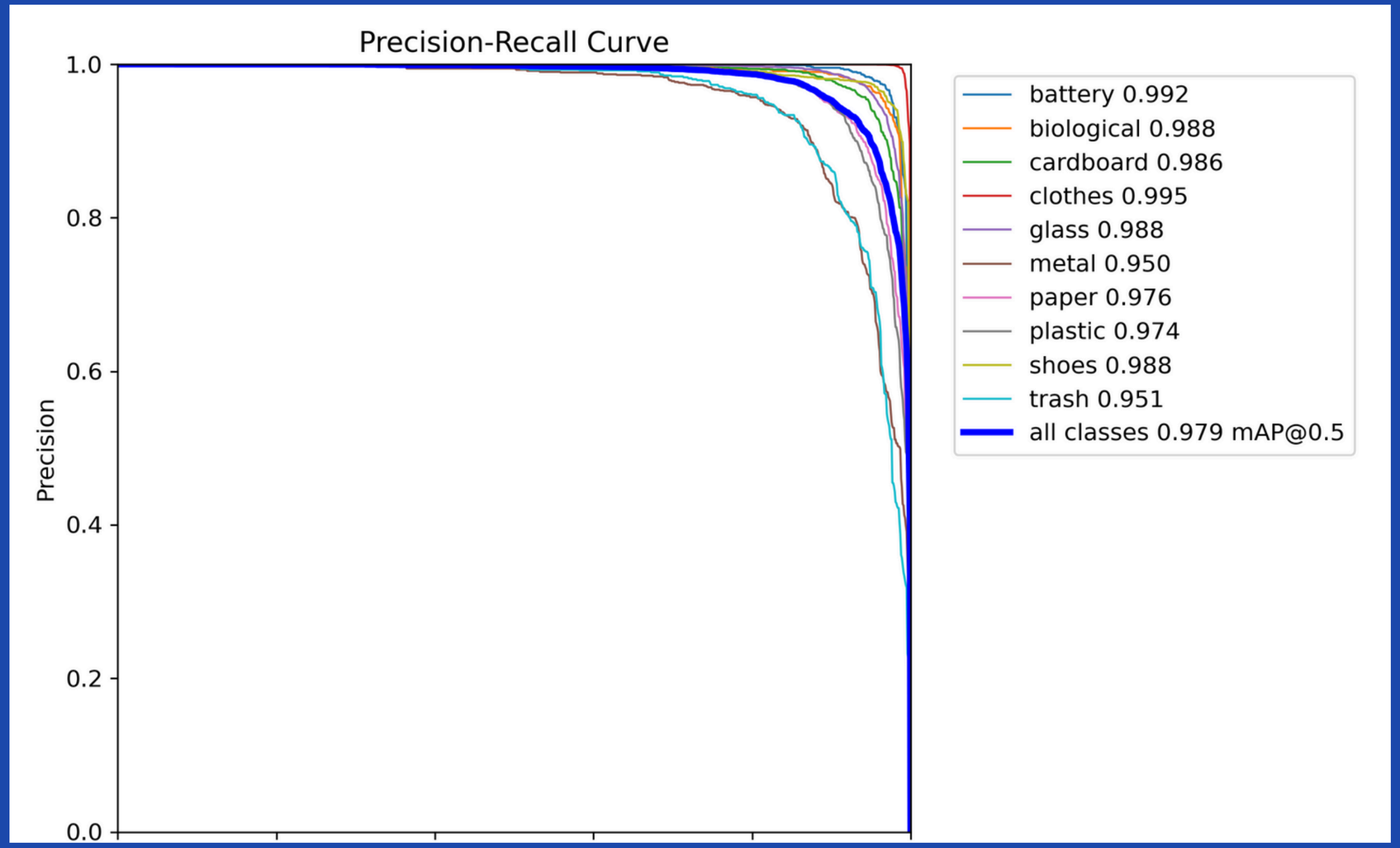
Evaluation!


Confusion Matrix
Predicted
True
battery
biological
cardboard
clothes
glass
metal
paper
plastic
shoes
trash
background
929 4 7 5 37 26 8 7 5 85
2 959 4 10 6 3 4 10 50
1 4 1758 3 3 5 65 6 2 7 110
1 5265 2 2 9 2 9 3 31
3 4 8 2 3006 46 4 54 9 11 354
4 2 11 1 58 918 10 23 1 21 156
40 1 1 4 1585 16 2 18 113
1 3 6 5 84 31 24 1929 2 27 160
3 16 2 43 22 7 7 8 1935 7 111
1 4 15 7 7 16 52 41 856 201
1 4 2 4 4
5000
4000
3000
2000
1000
0

Evaluation!


Confusion Matrix Normalized
Predicted
True
battery
biological
cardboard
clothes
glass
metal
paper
plastic
shoes
trash
background
0.98 0.03 0.01 0.01 0.06
0.96 0.01 0.01 0.04
0.95 0.04 0.01 0.08
0.99 0.01 0.02
0.94 0.04 0.03 0.01 0.26
0.01 0.02 0.85 0.01 0.01 0.02 0.11
0.02 0.89 0.01 0.02 0.08
0.03 0.03 0.01 0.92 0.03 0.12
0.02 0.01 0.01 0.01 0.98 0.01 0.08
0.01 0.01 0.03 0.02 0.89 0.15
0.8
0.6
0.4
0.2
0.0

Evaluation!

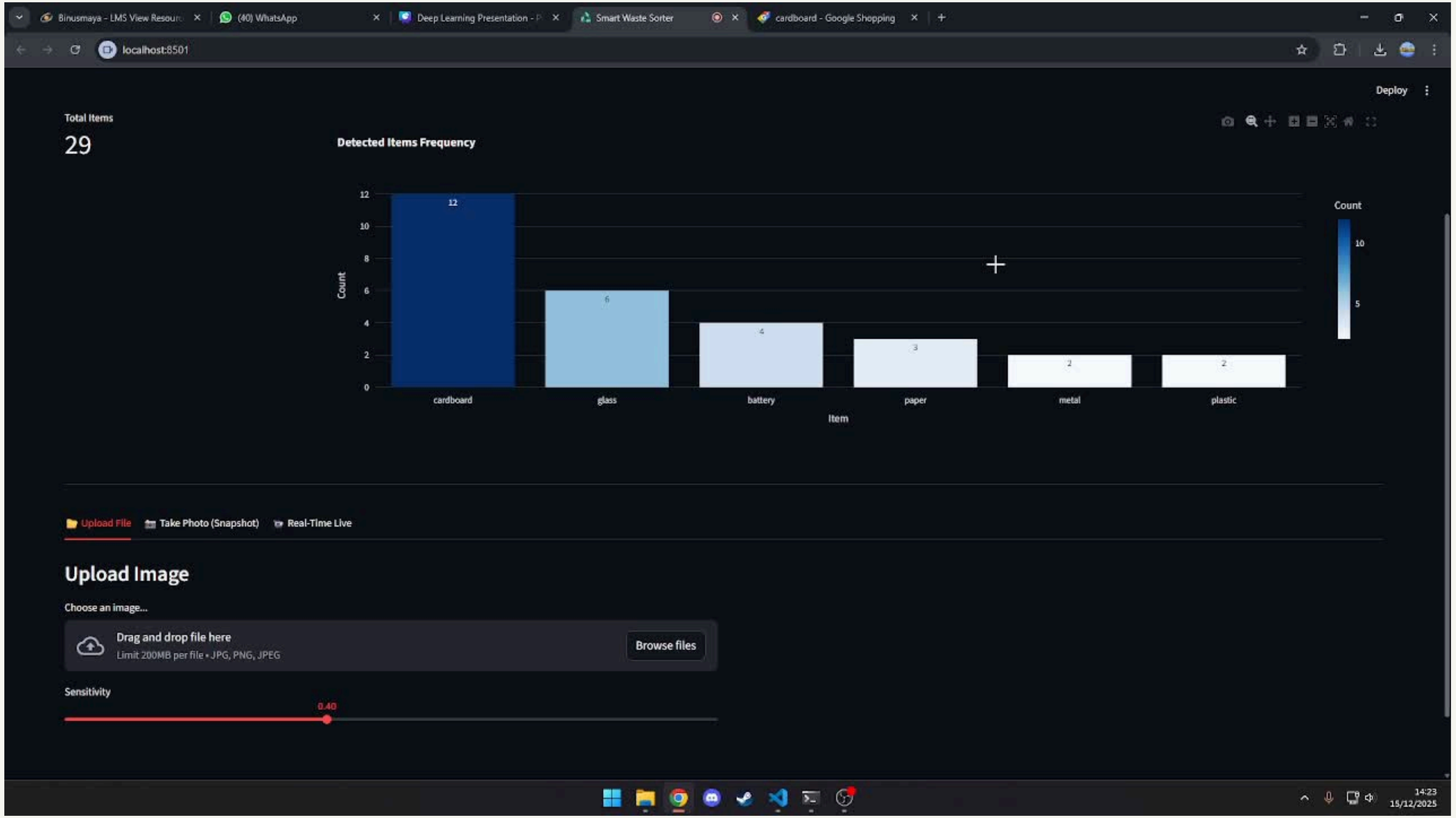

Precision-Recall Curve
Precision
1.0
0.8
0.6
0.4
0.2
0.0
battery 0.992
biological 0.988
cardboard 0.986
clothes 0.995
glass 0.988
metal 0.950
paper 0.976
plastic 0.974
shoes 0.988
trash 0.951
all classes 0.979 mAP@0.5

Evaluation!

battery
glass
cardboard
plastic
battery
paper
biological
metal
metal
paper
biological
cardboard
shoes
plastic
plastic
plastic
battery 0.9
plastic 0.3
cardboard 1.0
plastic 0.7
battery 0.9
paper 0.9
biological 1.0
plastic 0.4
shoes 0.7
paper 0.9
biological 0.8
cardboard 0.6
shoes 0.9
plastic 0.8
plastic 0.8
plastic 0.8

plastic
battery
biological
paper
plastic
battery
biological
paper
metal
biological
glass
paper
metal
battery
battery
cardboard
paper
cardboard
plastic
paper
shoes
shoes
shoes
metal
metal
trash
battery
shoes
metal 1.0
battery 1.0
battery 0.9
cardboard 1.0
paper 0.9
cardboard 1.0
plastic 1.0
paper 0.9
shoes 0.8
shoes 0.8
shoes 0.9
plastic 0.6
metal 0.9
trash 1.0
battery 1.0
battery 0.7

We’re using Streamlit



Reflections...

dan curhatan

Thank you

For Hearing Us