

The background of the entire image is a dark blue field filled with a pattern of red dots of varying sizes. These dots are arranged to form a large, stylized arch or bridge shape that spans the top half of the image, framing the central text.

HUST

ĐẠI HỌC BÁCH KHOA HÀ NỘI
HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY

ONE LOVE. ONE FUTURE.



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MINI PROJECT

SUBTITLE. SUBTITLE. SUBTITLE.
SUBTITLE. SUBTITLE.

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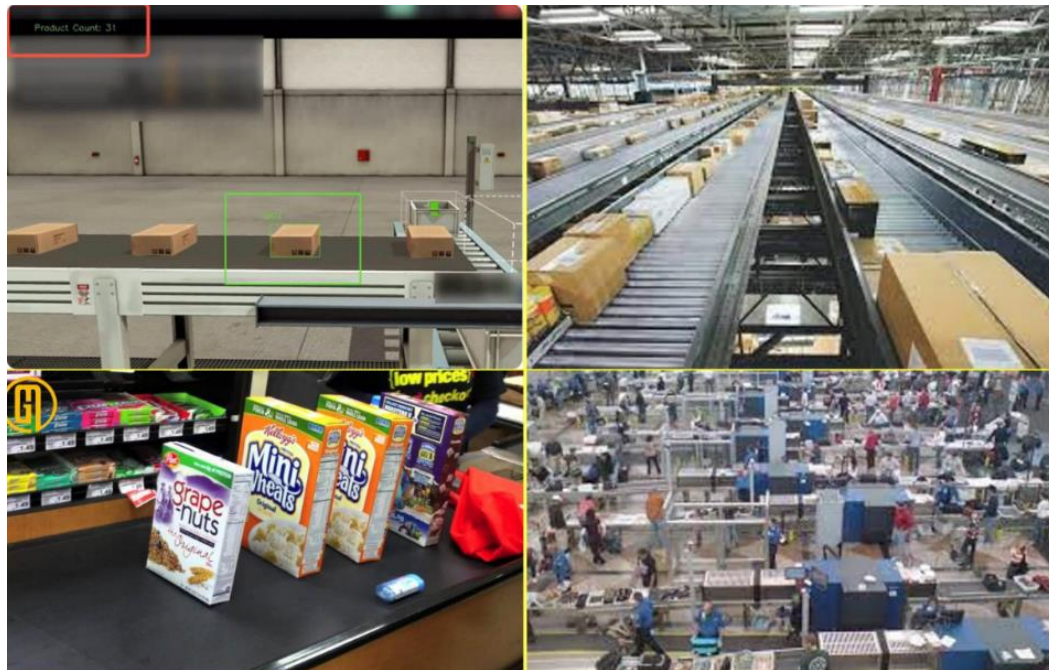
OUTLINE

1. Problem
2. Method
3. Details
4. Test and Evaluate
5. Conclusion
6. Improvement

1. Problem

MINI PROJECT : Solve the object detection problem:

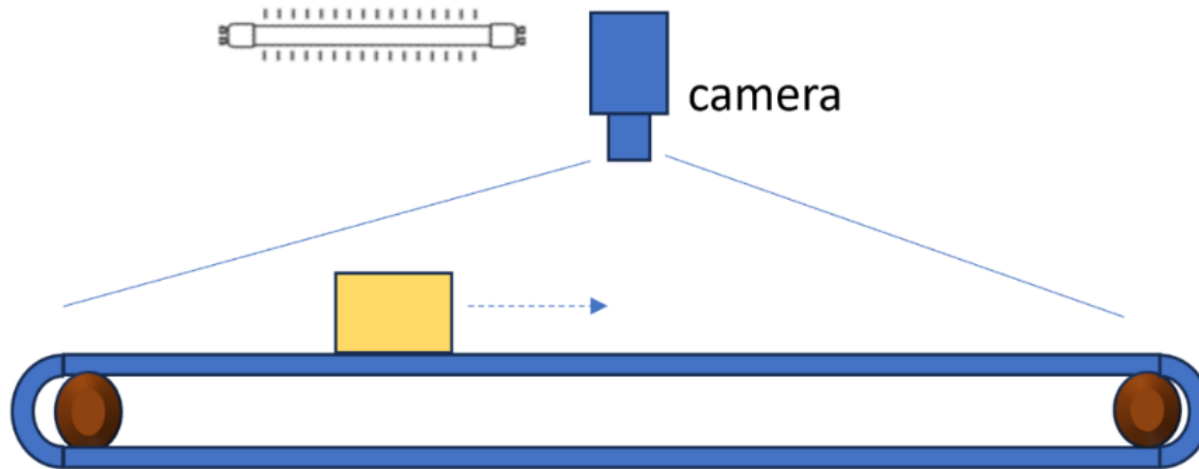
- Identify goods
- Counting number of products moving on the conveyor



1. Problem

DESCRIBE the Problem:

Image below represents the components of the problem



- ☐ Conveyor transport objects
- ☐ Fixed cameras
- ☐ Products : goods, confectionarys

1. Problem

TARGET

1. Classify the goods
2. Count the number of each class
3. Show results



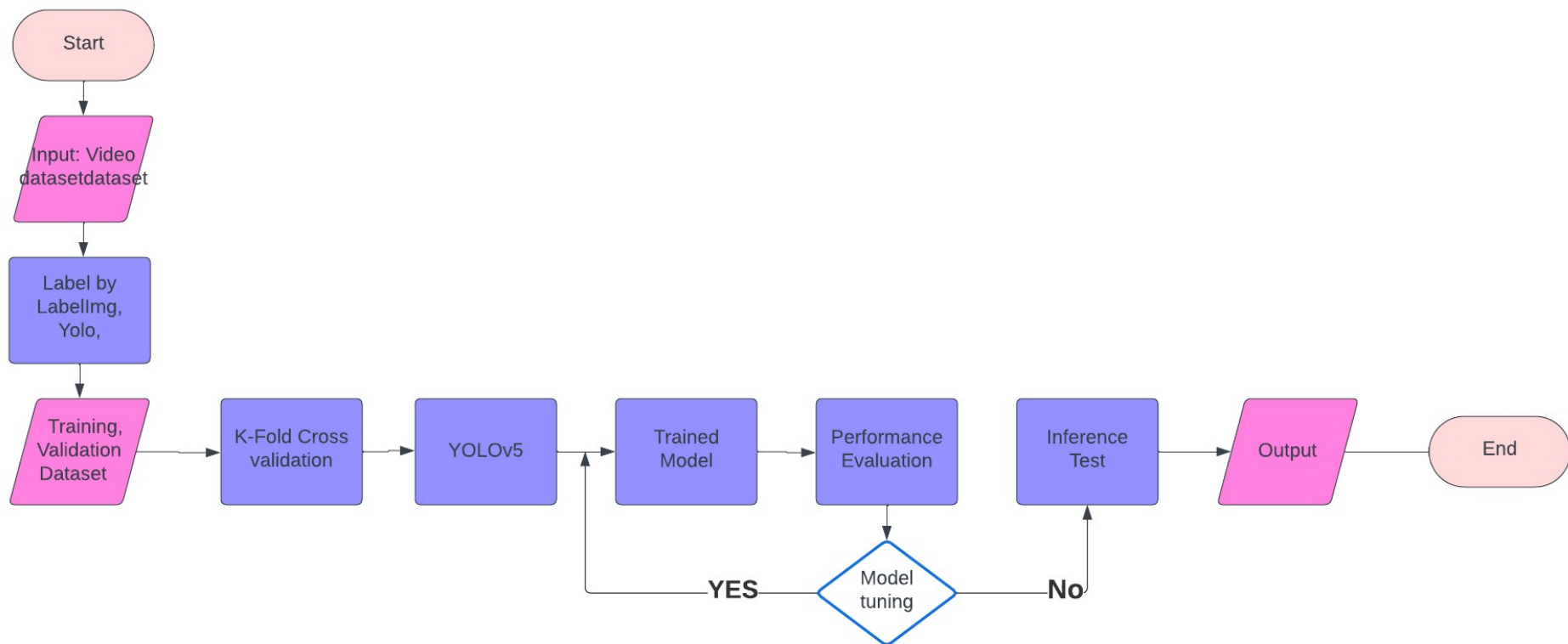
1. Problem

CHALLENGES :

- Speed and time processing
- Diversity in Size and Shape
- Complex and Noisy Background
- Changes in Lighting Conditions
- ❖ **In actual problem**, we can face additional problem such as :
 - Object interaction
 - High throughput
 - Continuous Operation Mode
 - Resource Limitations

2. Method

FLOWCHART about method proposed



3. Details

DATA PROCESSING

- Data : conveyor_video_for_train, cellphone_video_for_train
- Data preparation : Label each object in the frames. Split data into training and validate sets, using tool Labelling or YOLOv5 for auto labeled images
- Data augmentation : Enhance the diversity of training data by creating variations of original images, using OpenCV for this.

3. Details

- This is **object detection** problem, there are many models used for this problem include:
 - FASTER_RCNN
 - CENTERNET
 - YOLO
 - DETR
 - SSD
 - Etc...

3. Details

How to select best Model for this Problem?

➔ Survey of recent research on the **performance** and **inference speed** of object detection models

[GLE-Net: A Global and Local Ensemble Network for Aerial Object Detection](#)

JiaJia Liao, Yujun Liu

Method	Params (MB)	inference time (ms)
Yolov5	89.0	6.6
CenterNet	74.99	28

[Detection of Tip-Burn Stress on Lettuce Grown in an Indoor Environment Using Deep Learning Algorithms](#)

Muniyah Harati Hamidon, Tofael Ahamed

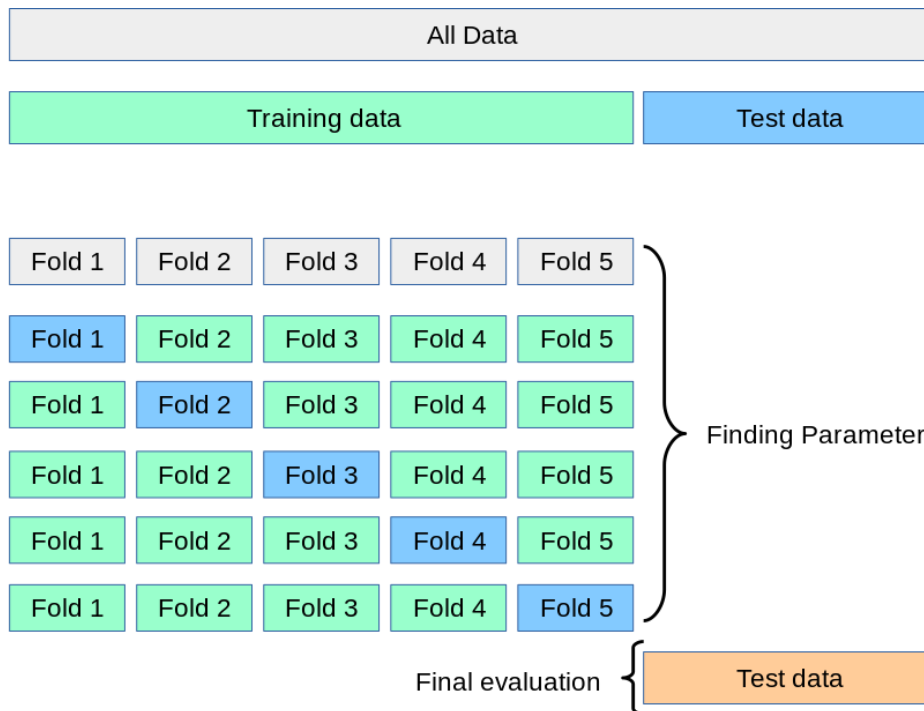
Model	Recall (%)	mAP (%)
CenterNet	58.0	81.2
YOLOv4	74.0	76.2
YOLOv5	79.4	84.1

3. Details

Choose YOLOv5 for this project

→ K-Folds cross validation for YOLOv5n

→ Overall evaluate about performance of YOLOv5



3. Details

Model Tuning (Optional)

Fine-tune hyperparameters of the model to optimize performance on custom data

3. Details

Model Training

- Train the YOLOv5n model on the prepared dataset
- On the period of training time with train and val dataset, evaluate model's performance by mAP, precision, recall

Inference

- Use the trained model for inference test data

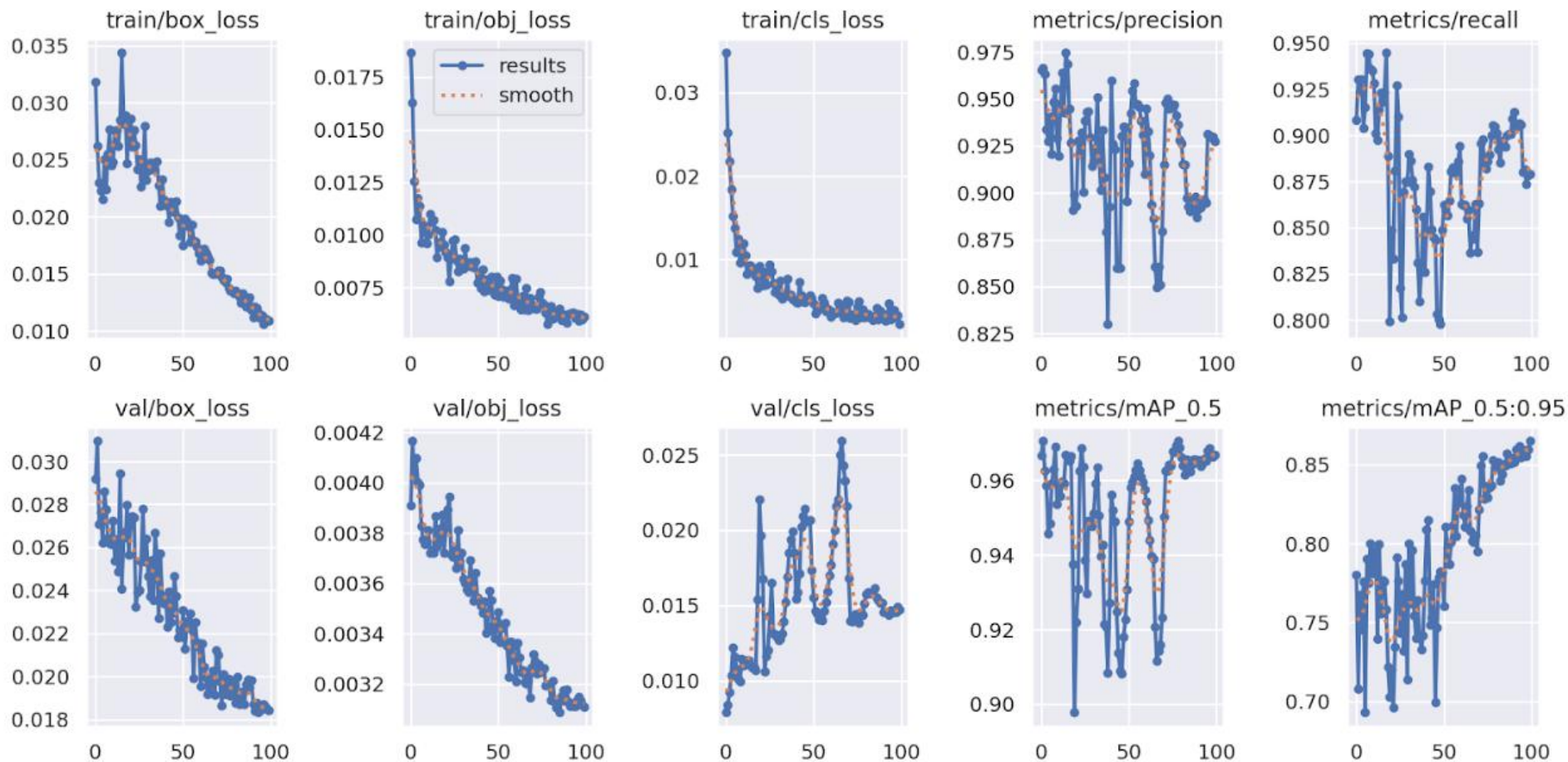
3. Details

Optimization

- Improve inference speed by resize image to 320x320, but this can affect to the model's performance

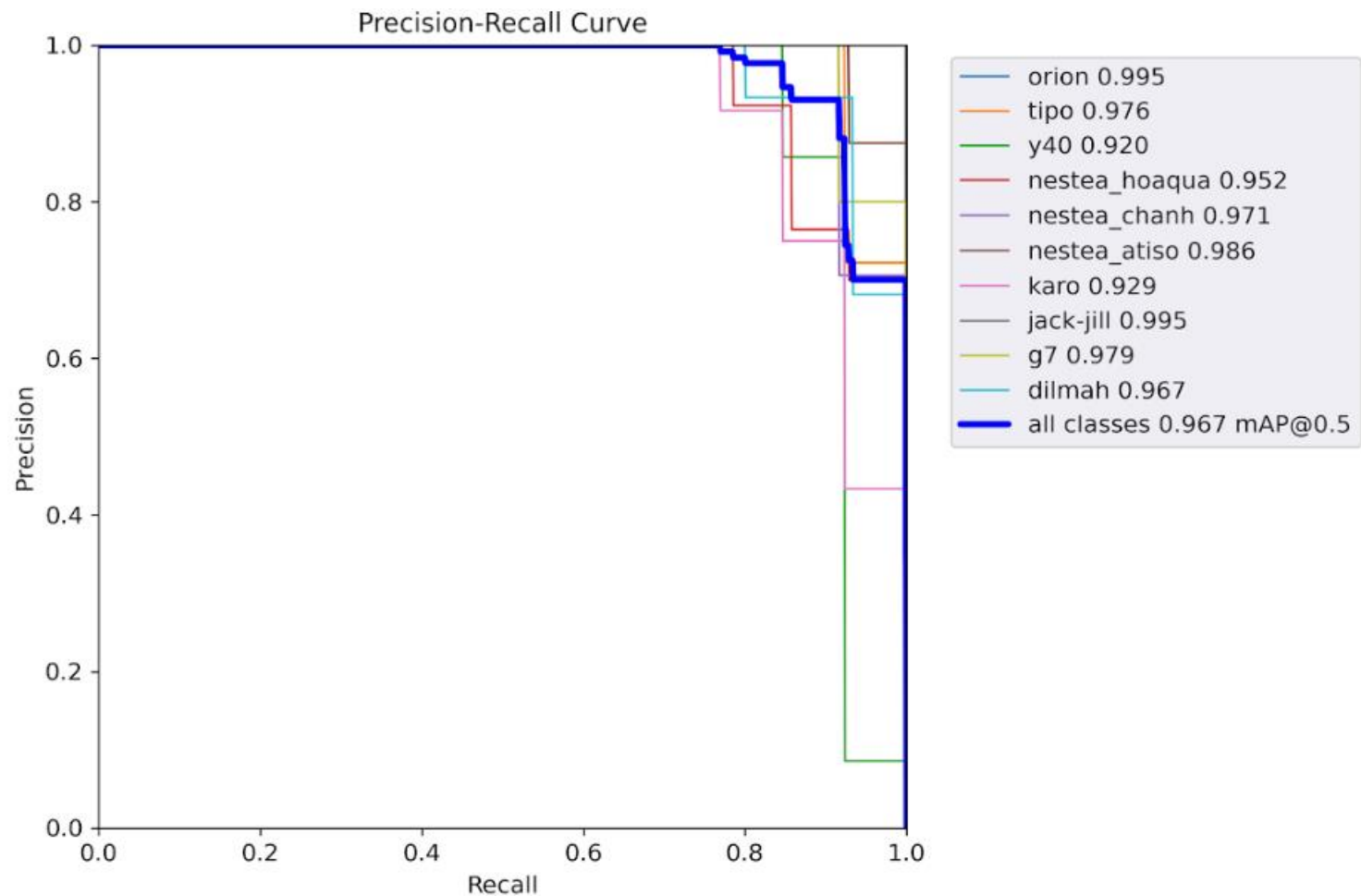
4. Test and Evaluate

Performance Evaluate (Precision, Recall, mAP)



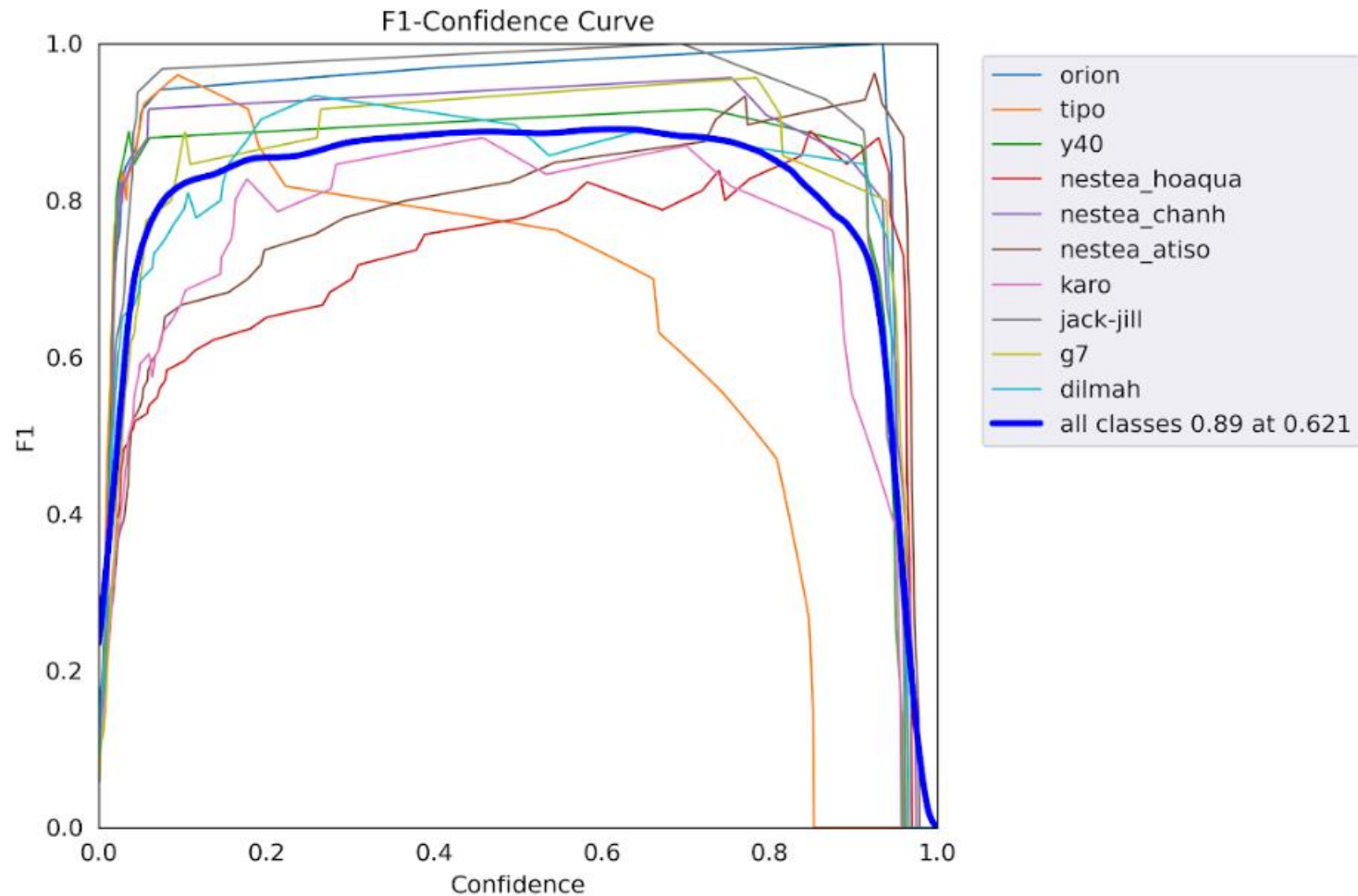
3. Details

• Precision-Recall Curve



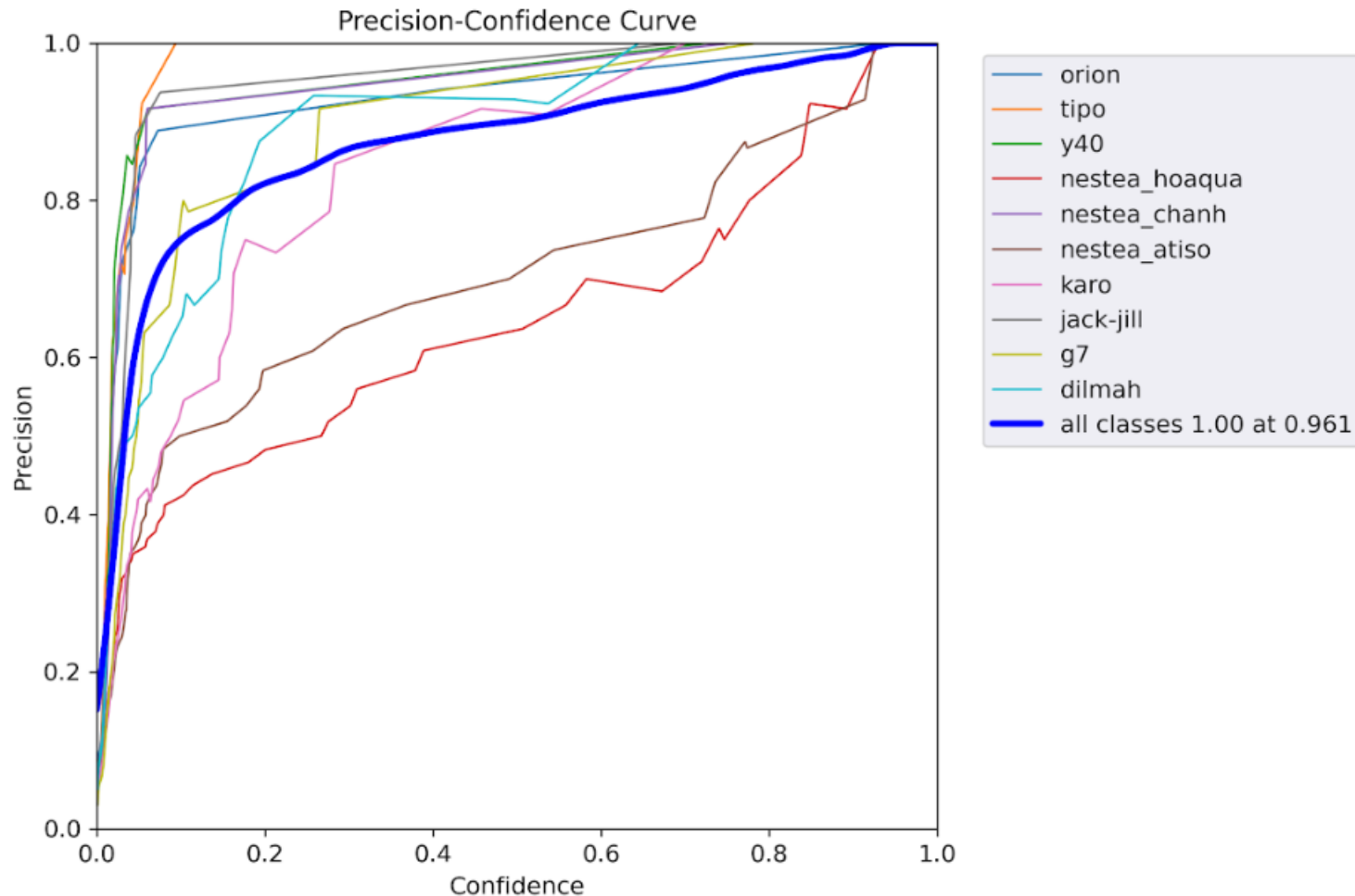
4. Test and Evaluate

F1-Score



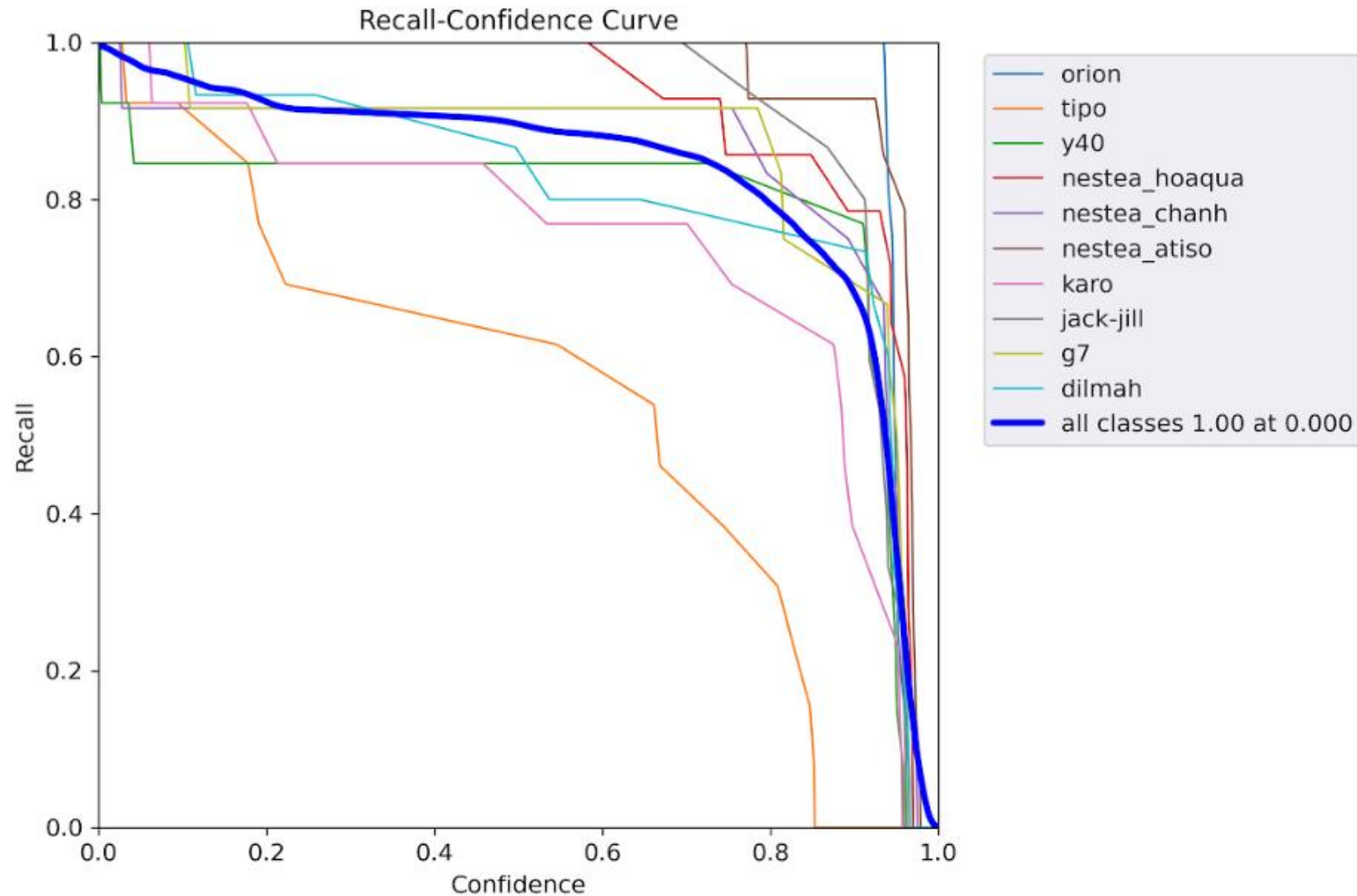
4. Test and Evaluate

Precision-Confidence Curve



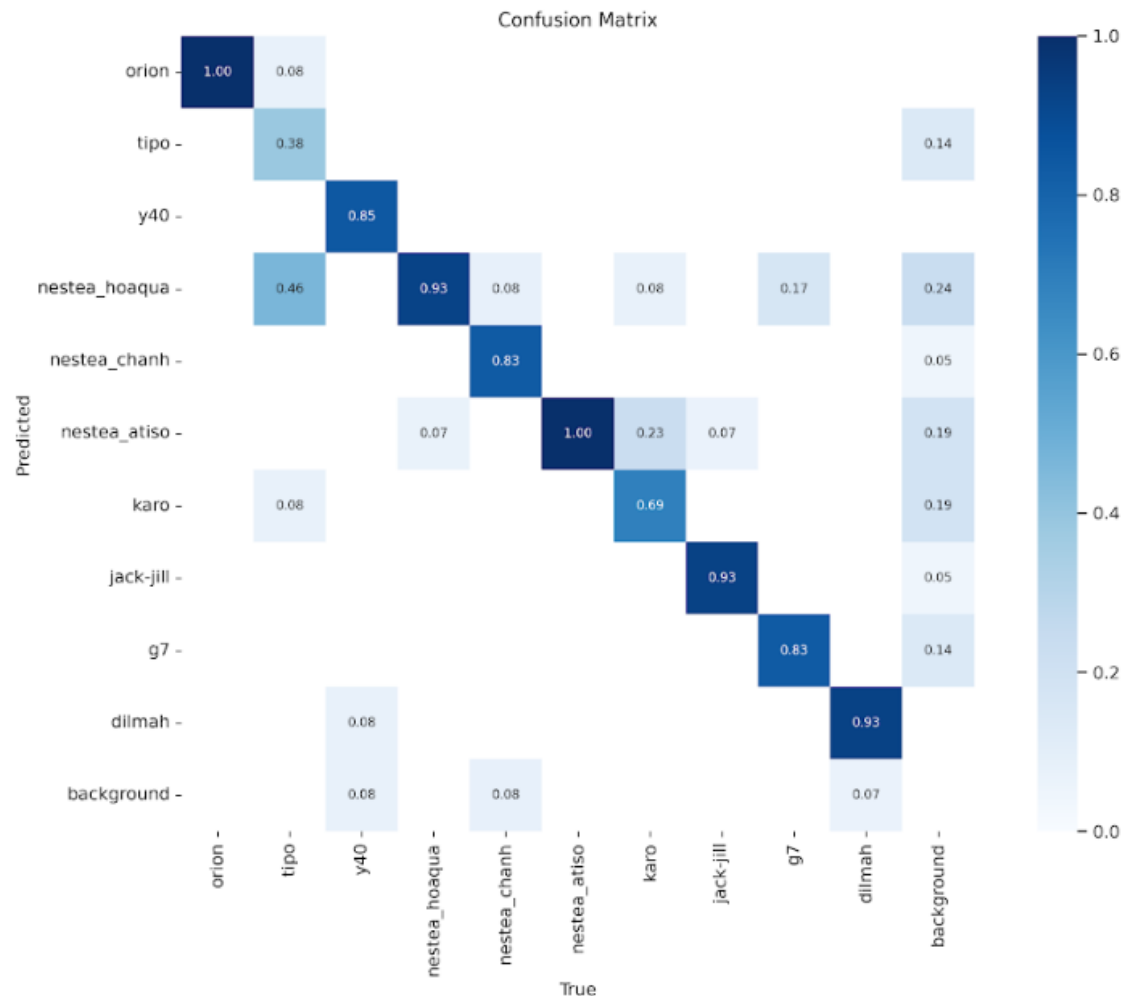
4. Test and Evaluate

Recall-Confidence Curve



4. Test and Evaluate

Confusion Matrix



5.Conclusion



6.Improvement

- Object Tracking (Yolov5 + DEEPSORT, SORT)
- Quantization
- Ensemble Learning

The graphic features a dark blue background on the left side of the slide. Overlaid on this background is a large, stylized circular pattern composed of numerous small red dots. The dots are arranged in concentric, slightly irregular rings, creating a sense of depth and movement. In the center of this dot pattern, the word "HUST" is written in a bold, white, sans-serif font.

HUST

A decorative graphic on the left side of the slide. It features a dark blue background with a large, stylized circular shape composed of many small red dots. The dots are arranged in a way that creates a sense of depth and movement, with some dots appearing larger and more concentrated than others, forming a spiral-like pattern.

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THANK YOU !