



Detection of Bus Number in Bus Panel

Project By: Wenna Loo Yan Ying



Today's Agenda

- 01** Problem Statement
- 02** Data Collection
- 03** Development of Object
Detection Model

- 04** OCR Pipeline
- 05** Demo
- 06** Conclusion



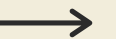


Problem Statement

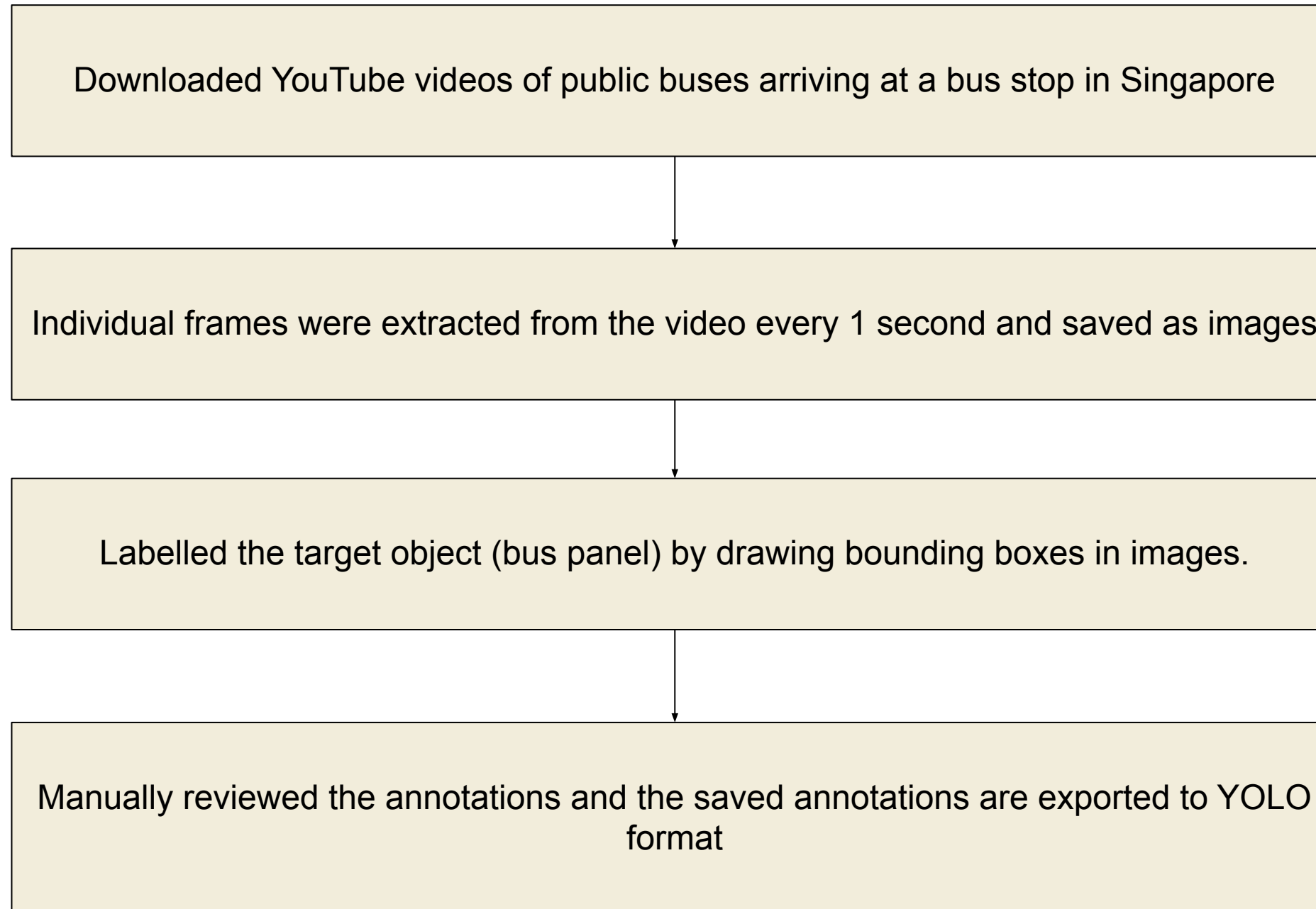
Mobility and orientation are the biggest challenges for people with visual impairments. This includes walking, taking public transportation, or even getting a ride on buses. Developing assistive technologies to help them navigate outdoor environments could potentially improve their quality of life. Since public transportation, such as buses, is a main tool for people with visual impairments to navigate outdoor, this project aims to **create a proof of concept (POC) that can help people with visual impairment to determine if it's the right bus they need through Optical Character Recognition (OCR) for the text on the bus.**



Data Collection Process



Data Collection



**Final dataset contains 500 labelled images of bus panels
(Training: 350, Validation: 100, Testing: 50)**

Image labelling using CVAT



Photo of an image in my labelling task at <https://cvat.org/>

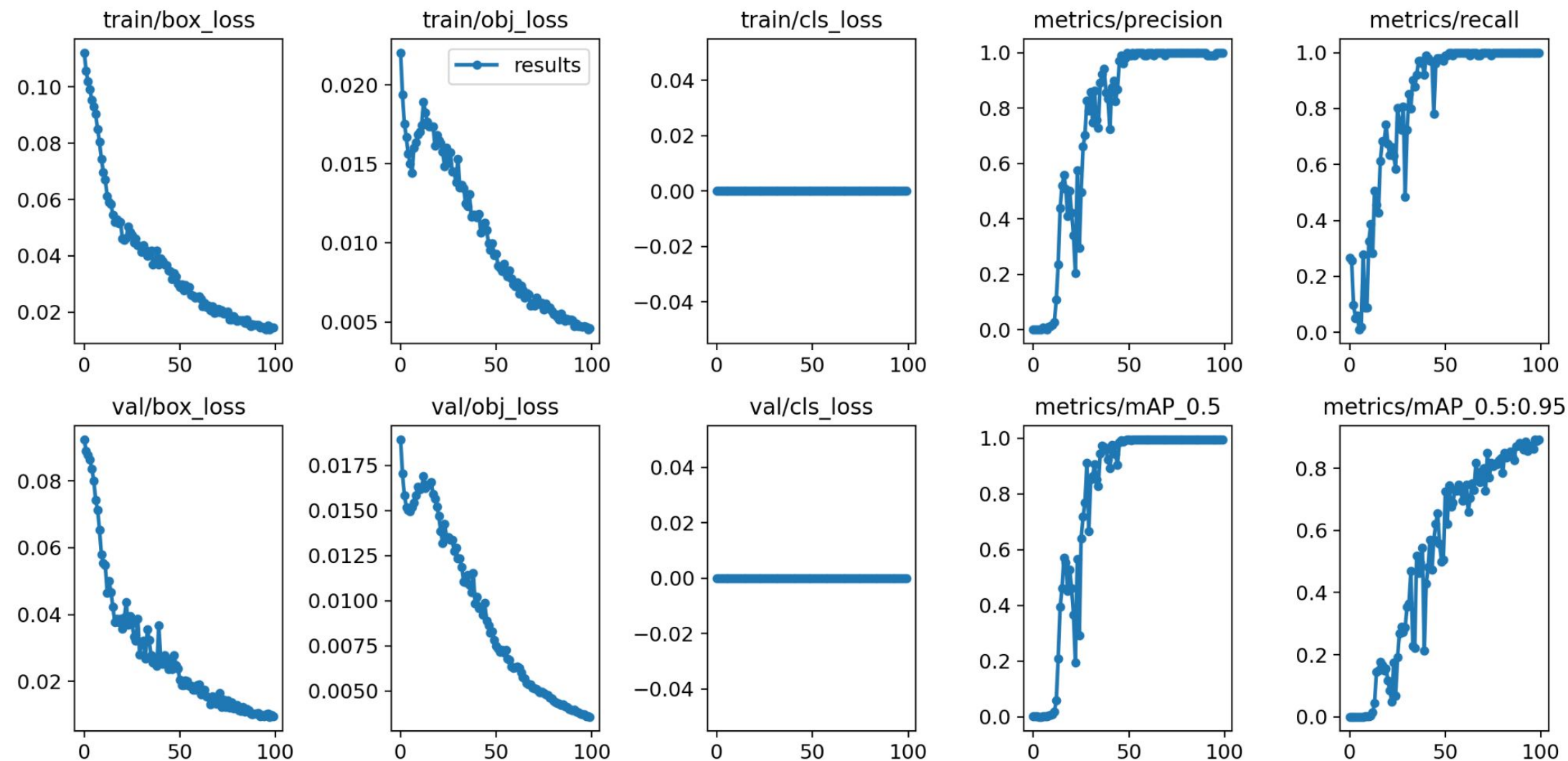
Development of Object Detection Model



Model Training and Evaluation



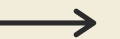
- Model training conducted on Google Colab environment. Google Colab is a free cloud service that supports free GPU.
- **You Only Look Once version 5 (YOLOv5)** model used for transfer learning.
- The model's performance was evaluated using the **mean Average Precision (mAP)** metric. The mAP score was **89.2%**. The closer our mAP score is to 100%, the better.



Inference on test set



OCR Pipeline

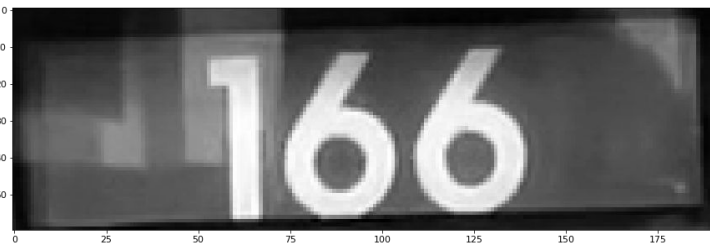


OCR Pipeline

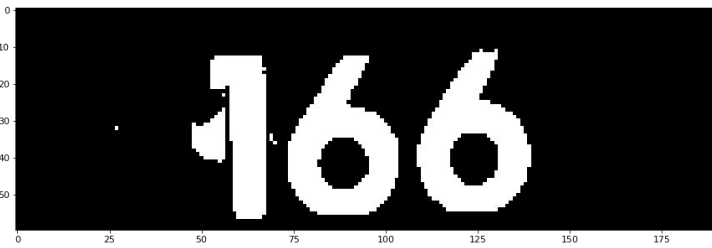
1. Object Detection:



2. Preprocess ROI:

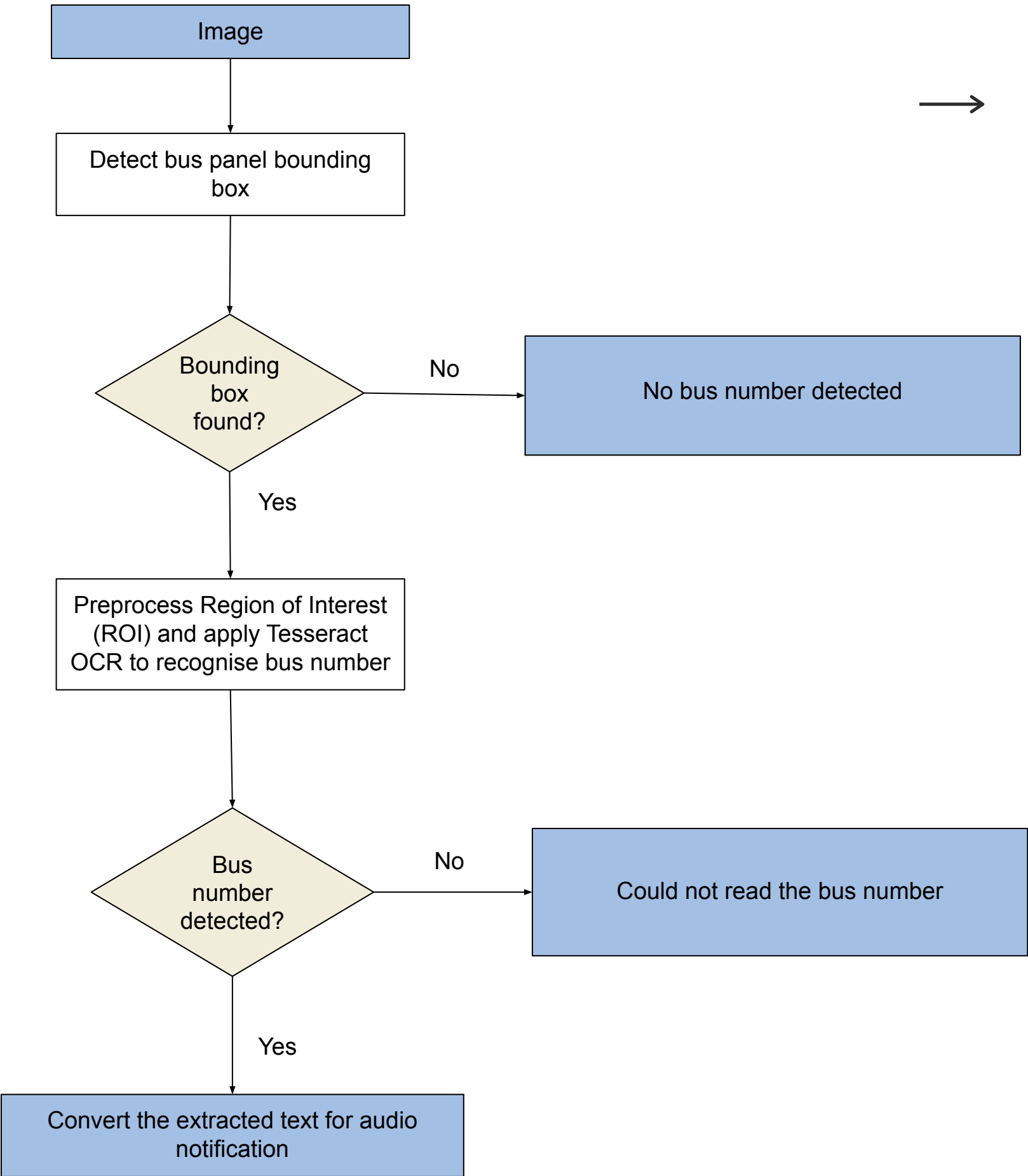
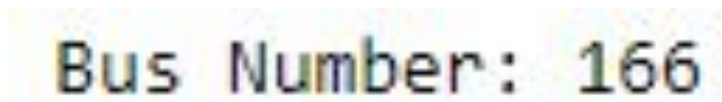


Convert to grayscale



Apply thresholding

3. Text extraction using Tesseract OCR:



Flow diagram of OCR Pipeline

Demo



Demo (Streamlit App)



← → ↻ 🔒 share.streamlit.io/crushedmonster/streamlit_bus_number_detector ☆

×

Select an image to upload.

Drag and drop file here

Limit 200MB per file • PNG, JPG, JPEG

Browse files

[Find additional images here.](#)

Parameters

Inference Setting:

Confidence threshold: What is the minimum acceptable confidence level for displaying a bounding box?

0.50

0.001.00

[Source code in Github](#)


Bus Number Detector

This web app made use of a combination of Object Detection (using YOLOv5) and Optical Character Recognition (OCR), to extract bus number from bus panel and convert the extracted text to audio.

Instructions:

- 📁 Feel free to upload any image you want on the side bar.
- 📷 Scroll down to view demo.

Inferenced Image



Result

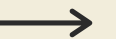
Bus Number: 105

▶ 0:00 / 0:01

🔊 ⋮

https://share.streamlit.io/crushedmonster/streamlit_bus_number_detector

Conclusion



Conclusion

- Successfully created a POC for deployment and tested that it is indeed tangible to make use of computer vision-based system to solve our problem.
- Trained YOLOv5 on our custom dataset and found that YOLOv5 trains quickly, inferences quickly, and performs really well in detecting the bus panel contained in an image.
- But, OCR is not without its challenges. There were some limitations found when applied to recognize the bus number from the bus panel. Eg. Not being able to read the bus number within the region of interest (ROI).

Future Exploration:

- Try out different OCR software
- Better ways of preprocessing the images before feeding into the OCR software
- Train the object detection model on images of buses at night since the current model is largely trained on images of buses in the day
- Test the OCR pipeline on a video or on a live camera





Thank you!