Helping the Visually Impaired Navigate at Bus Stops

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Introduction

Outlined in the Land Transport Authority's "Land Transport Master Plan 2040" is the concept of "transport for all". The visually impaired (VI) form a sizeable subset of commuters who face considerable difficulties in taking public transport. These difficulties stem from infrastructural barriers like the lack of audio cues at bus stops and social barriers such as the VI being afraid of asking for help from sighted commuters.

In this project, we develop a proof of concept for an all-in-one system to enable the VI to independently gather information on the identify of buses that arrive at bus stops. It takes a video feed, detects the bus number of buses that come to the bus stop and reports this via audio.

Our implementation uses objection detection[1], optical character recognition[2] (OCR) and speech synthesis algorithms[3] from Microsoft Azure.

Methodology

Preparing Algorithms

- **Understanding the Azure Services**
  - Read documentation
  - Experiment with proof of concept scripts
- **Preparing Custom Vision Model**
  - Video arrival of buses
  - Splice videos into individual frames
  - Annotate bounding box of bus numbers & destinations
- **Train Custom Vision Algorithm**
- **Choose OCR Algorithm**
  - Compare Algorithms
    1. Read API
    2. OCR API
    3. Recognize Text API (Chosen)
  - Compare Speed
  - Compare Accuracy

Flow of Final Script

- **Detect Bus Numbers in Frame**
- Call custom vision API
- Crop image to bounding box
- Call OCR API
- Synthesize speech output

Results & Discussions

Table 1.0: Performance of Custom Vision Model

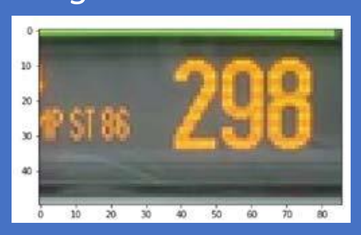
No. of Labelled Images	386
No. of Negative Images	572
Training Time	572
Precision	100.0%
Recall	93.5%
mAP	96.1%

Example of Successful Attempt

Figure 1.0: Raw Image

Figure 1.1: Crop of Predicted Bounding Box

Figure 1.2: Further Cropped Image Sent to OCR API



Response from OCR:

298

Conclusion

We have implemented a proof of concept for the use of object detection, OCR and speech synthesis algorithms in the use bus number identification to aid the visually impaired in using public buses.

Future Work:
1. Put software into standalone wearable device
2. Implementation for different transport types
3. Help VI locate bus stop key features (bench, bollard)

References
[1] Custom Vision | Microsoft Azure (2019, December 09).
Retrieved from https://azure.microsoft.com/en-us/services/cognitive-services/custom-vision-service/
[2] Computer Vision | Microsoft Azure (2019, December 09).
Retrieved from https://azure.microsoft.com/en-us/services/cognitive-services/computer-vision/
[3] Text to Speech | Microsoft Azure (2019, December 09).
Retrieved from https://azure.microsoft.com/en-us/services/cognitive-services/text-to-speech/