Shoe Detection Using SSD-MobileNet Architecture

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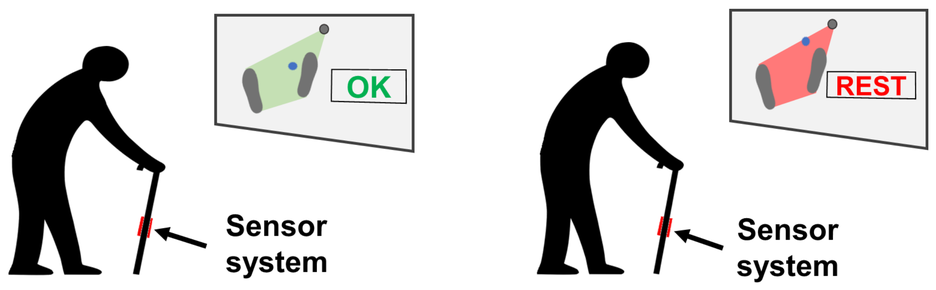
INTRODUCTION

It is estimated that about **20% of the elderly in Japan fall at least once a year [1]**.

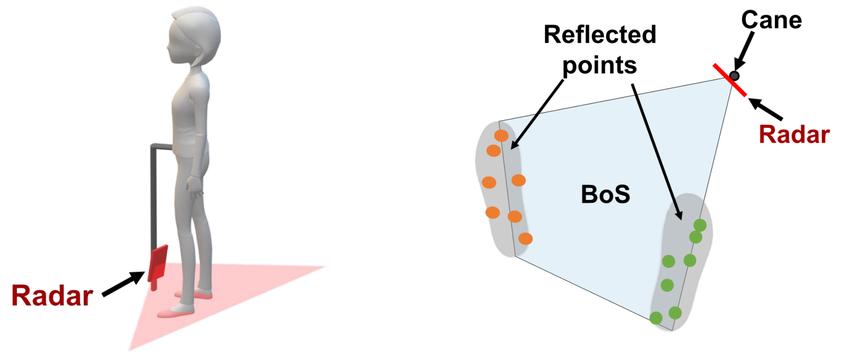
Despite the various efforts to reduce fall rates, such as the use assistive devices (cane or walker), **fall is still a global health problem**.

OBJECTIVE

To develop a real time **fall risk feedback system** for cane users by **continuously monitoring balance**.



In our previous research [2], we developed a **system to estimate the Base of Support (BoS) using a millimeter wave radar** attached to a cane.



However, it is **not possible to verify that the radar is really tracking the position of the feet**.

In this research, we present a **shoe detection model to detect the position of a shoe in an image** based on the SSD-MobileNetV2 architecture [3].

SHOE DETECTION MODEL

MODEL

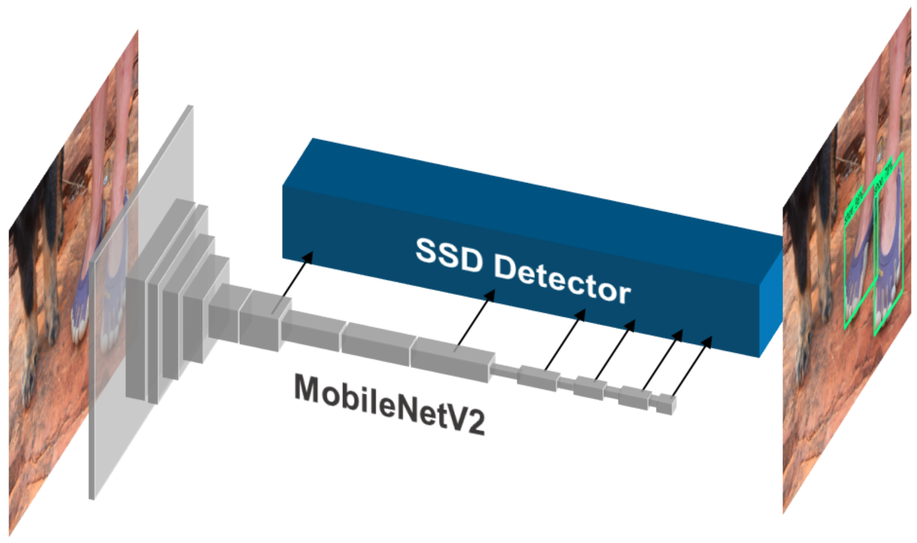
Our proposed model is based on the **SSD-MobileNetV2 architecture [3].**

- **Good detection accuracy.**
- **Fast, particularly for low cost embedded devices.**

DATA

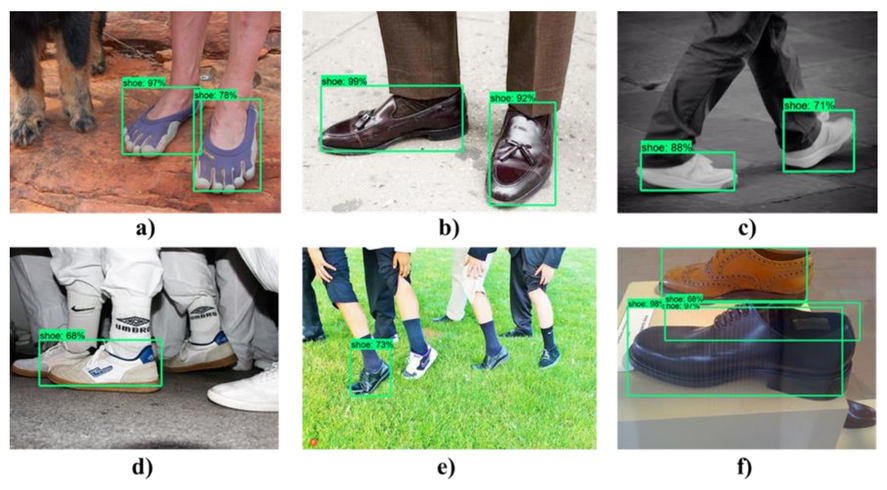
Labels of **10,000 shoe images from the OpenImages V5 dataset** were used.

- Data was divided into train and test sets with a 80/20 ratio.



RESULTS AND DISCUSSION

Our proposed model was able to achieve a 60.2% mean Average Precision (mAP) on the testing subset.

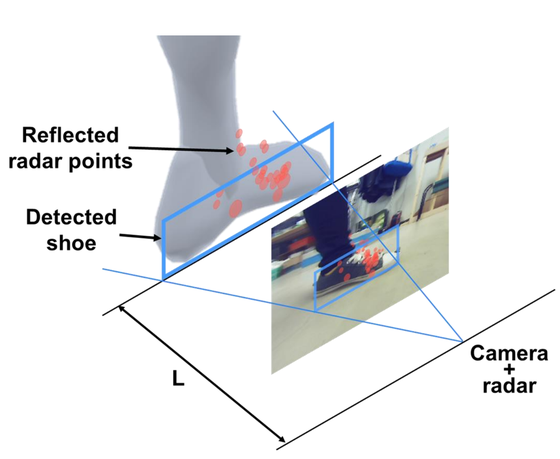


LIMITATIONS

- The model **fails in images with many shoes**.
- **False detections** when two shoes are close together.

CONCLUSIONS

- **The trained model was able to detect shoes with a state of the art accuracy.**
- **Real time detection** at 25 fps in a low cost device (Raspberry Pi 3 with the Google Coral USB Accelerator).
- **In future, the proposed model will be combined with a millimeter wave radar** for improved feet position estimation.



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[2] I. G. Fernandez and C. Wada, “MmWave Radar for BoS Measurement," *2019 IEEE 1st Global Conference on Life Sciences and Technologies (LifeTech),* 2019.
[3] M. Sandler et al., ‘‘MobileNetV2: Inverted residuals and linear bottlenecks,’’ *in Proc. Conf. Comput. Vis. Pattern Recognit. (CVPR),* 2018.