REAL-TIME TRASHCAN RECOGNIZER AND LOCALIZER FOR THE BLIND AND VISUALLY IMPAIRED

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ABSTRACT

With 324 million people blind and visually impaired in the world and the cane still being the primary assistive device used, we approached this problem by looking at it through a different lens. Quite literally a lens. Through involvement with the National Federation of the Blind, we learned that trivial tasks such as finding a public trash can is almost impossible with merely a cane. Using cameras to help the blind is a pre-existing domain, however, we decided to attack this subproblem of navigating the user to public trash cans. Although seemingly trivial, this concept can be expanded to solve larger, problems such as steering the blind away from hazardous construction, reading signs, and perhaps one day driving (unless self driving cars are prominent by then).

***Index Terms*—** Image processing, object detection, assistive technology

1. INTRODUCTION

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2. RELATED WORK

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The first paragraph in each section should not be indented, but all the following paragraphs within the section should be indented as these paragraphs demonstrate.

3. PROCESS

Major headings, for example, "1. Introduction", should appear in all capital letters, bold face if possible, centered in the column, with one blank line before, and one blank line after. Use a period (".") after the heading number, not a colon.

3.1. REALSENSE CAMERA

For this device, we used an Intel Realsense D435 camera to use to detect the trash cans. We chose this because of its relatively small size and since it had two lenses that we could extrapolate depth from. The camera also had depth sensing capabilities, but we chose not to use that and instead use triangulation properties to infer depth because if this device were to become an actual product, the cost of obtaining a camera with depth capabilities are significantly more expensive than using two cameras side by side. The horizontal FOV (field of vision) for the Realsense camera is 86 degrees and the vertical is 57 degrees. We used the librealsense python interface

to capture the individual frames to use for processing. We did not have the capabilities to change the frame of the camera, but we instead modulated the rate at which we sampled the frame in software.

3.2. FRAME PRE-PROCESSING

Ultimately, this device is supposed to be a wearable device, and we kept that in mind as we determined the frame image pre-processing. From training our model, discussed in the model section, we realized that we did not need such a high

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resolution for the model to work and detect the trash can, so we experimented with downsampling

3.3. DATA PRUNING AND CONNECTED COMPONENT LABELING

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3.4. THE MODEL

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3.5. BOOSTING ACCURACY VIA POST TRAINING IMAGE PROCESSING

Subheadings should appear in lower case (initial word capitalized) in boldface. They should start at the left margin on a separate line.

3.6. BINOCULAR CAMERA GEOMETRY AND TRIANGULATION FOR DEPTH APPROXIMATION

Subheadings should appear in lower case (initial word capitalized) in boldface. They should start at the left margin on a separate line.

3.7. THE DEVICE

The device is in the form of a wrist band that contains a 2-dimensional array of haptic motors to relay angular position and distance feedback to the user corresponding to the found trash can. The corresponding LED grid was only for demo purposes so that the audience can view which haptic motors are being activated. We decided on a wrist cuff since the study from the paper, Guiding Blind People with Haptic Feedback, found that the wrist and spine were the best places to detect vibrational impulses

. In their study they used 2 wristbands, but we decided to go with one wristband representing 86 degrees since this was the horizontal FOV (field of vision) of the Intel Realsense camera.

4. RESULTS

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5. CONCLUSION

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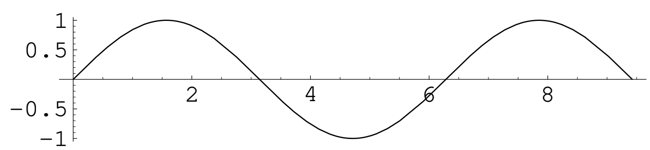
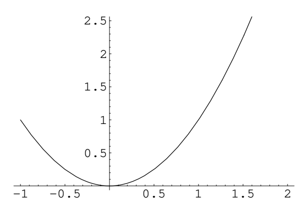
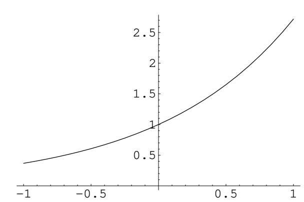


(a) Result 1



(b) Results 3



(c) Result 4

Fig. 1. Example of placing a figure with experimental results.

7. REFERENCES

[1] A.B. Smith, C.D. Jones, and E.F. Roberts, "Article title," *Journal*, vol. 62, pp. 291–294, January 1920.