# CVision: A Navigator for the Visually Impaired

Weijing Wang, Jordan Prescott, Will Schiff, Darren Liu, Sayra Salgado, Vikram Iyer,
Rosstin Safavian, Angela Cai, David Zegarra, Mohammed Rehman, Theodore Hwang, Alperen Yilmaz

## What is CVision?

CVision is a deep learning based Python program designed to assist the visually-impaired in navigating their surroundings.

Real-time video from a portable camera is processed to generate directional sound cues to be heard on headphones. These sounds reflect the relative locations and distances of detected objects.

Potential dangers such as very close objects are alerted to the user.

## System

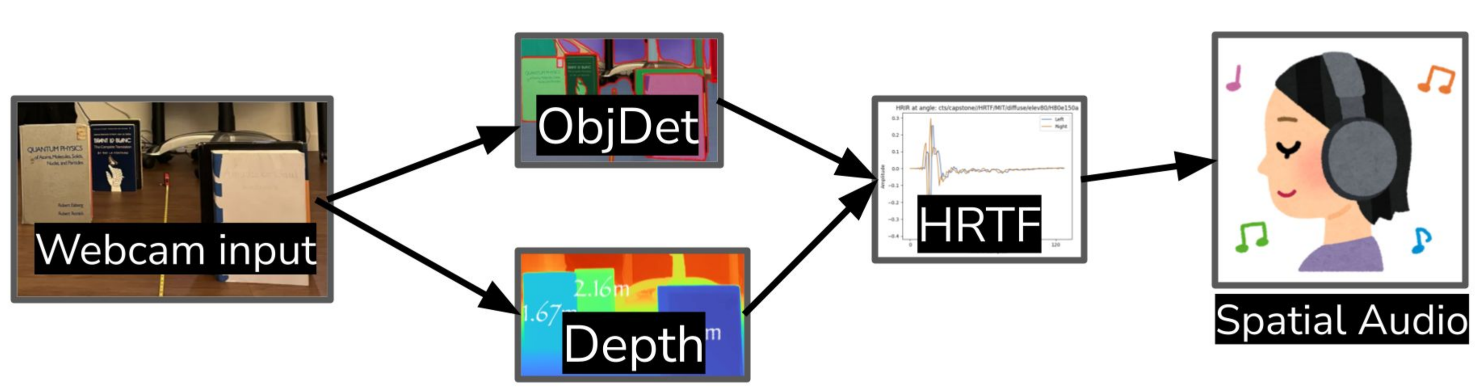


**Fig 1.** CVision data flow diagram

Our system captures real-time images and applies object detection in conjunction with depth mapping.

It uses head-related transfer functions (HRTFs) to generate spatial audio cues, enabling users to perceive the relative location of surrounding objects.

## Modes of operation

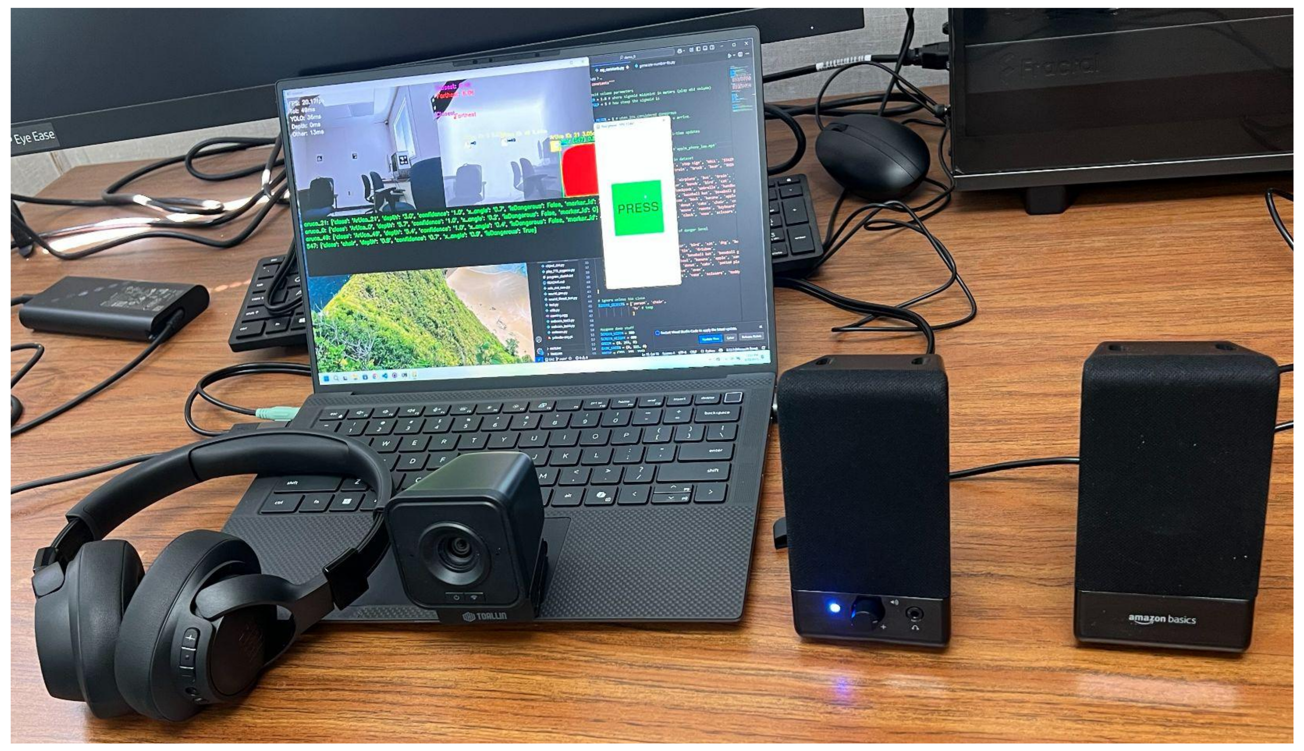

**Fig 2.** Uses GPU computer, webcam, and headphones (speakers for demo)

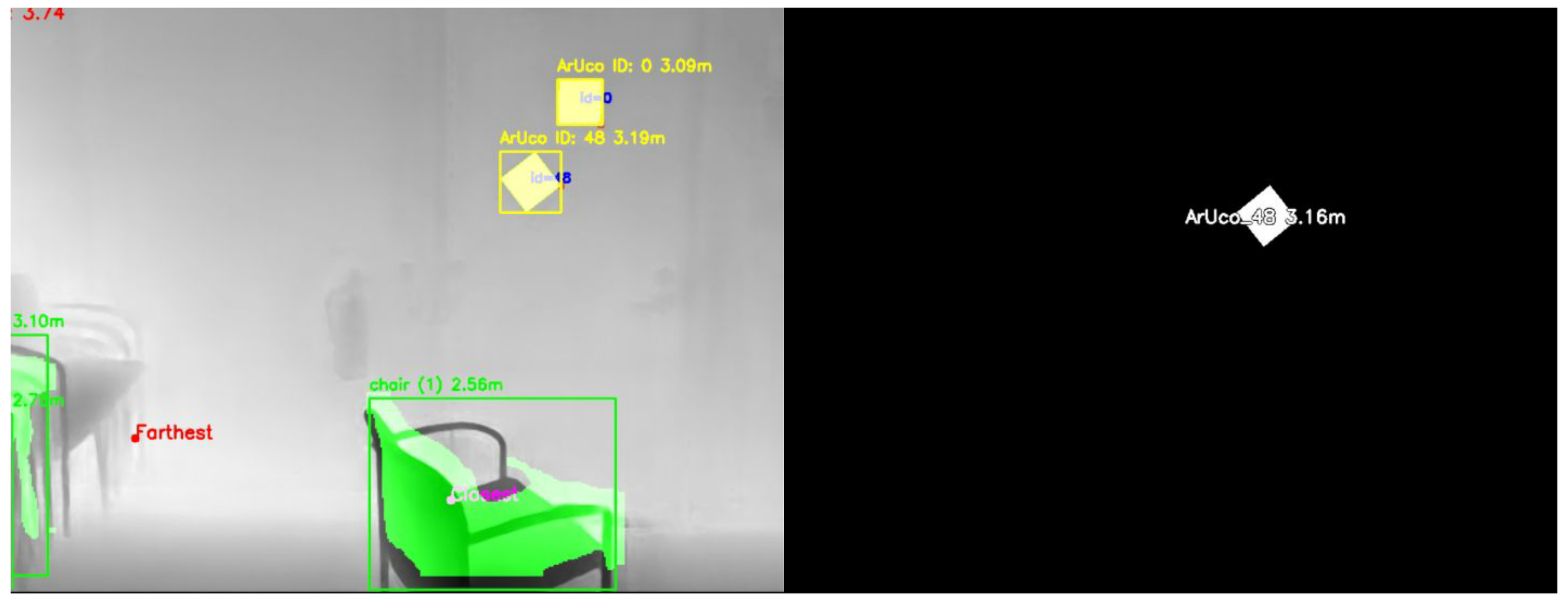

**Fig 3.** Tracking a specific object

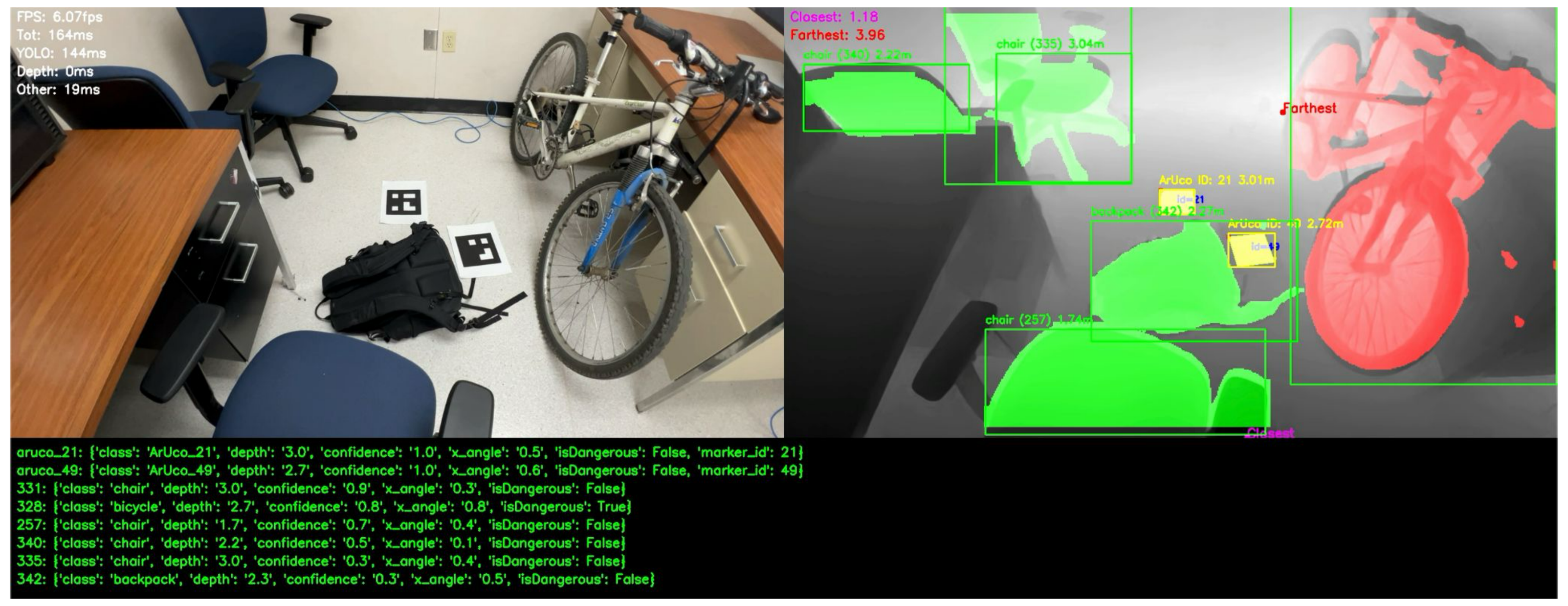

**Fig 4.** Showing normal, danger, and ArUco detections

## Monocular depth Maps

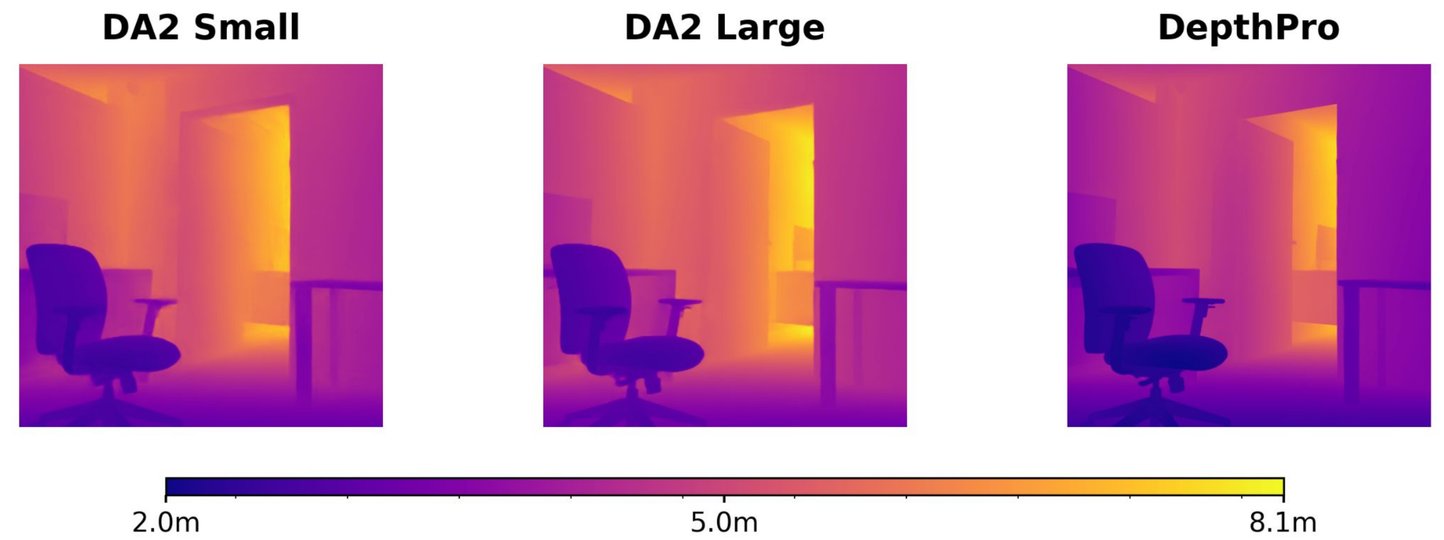


**Fig 5.** Monocular depth maps models (depth from one camera only) are the main bottleneck. Tried multithreading, frame skipping, low-res input, and smaller models. Used metric DepthAnything v2 small (DA2 small) in demo for speed.

## Object Detection

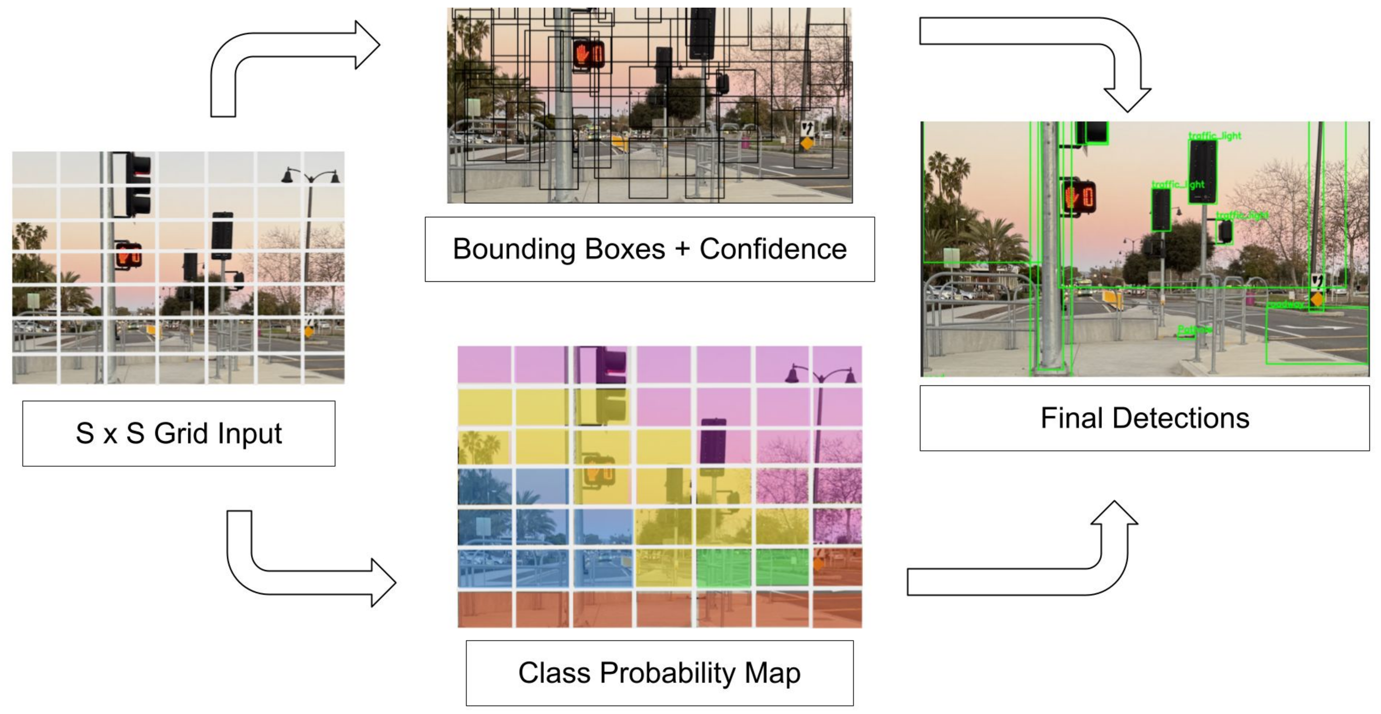


**Fig 6.** YOLO object detection. Used YOLOv8 for speed. Also trained fine-tuned version using a sidewalk dataset.

## Head related Transfer Function (HRTF)

- Microphone in right and left ears.
- Play a sound in each speaker, one at a time, to measure transfer functions using right and left mics.
- Used HRTFs measured by MIT media lab in 1994.

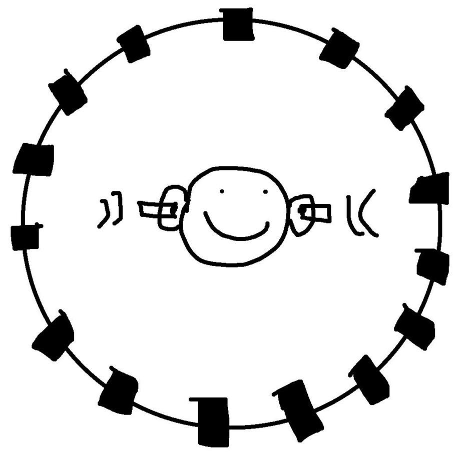

**Fig 7.** HRTF measurement. Black boxes are speakers. Two mics in human ear models.

**Acknowledgements:** Professor Shivkumar Chandrasekaran, Vamshi Chowdary, John Jacobs, Professor Ilan Ben-Yaacov, Eliana Petreikis

UC SANTA BARBARA
College of Engineering