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Vision Aid

Intro to Machine Learning

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Team

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Project Objective

Our program aims to assist the visually impaired by enabling safe navigation through indoor spaces while identifying and alerting them of potential obstacles and hazards in their path.

- **Problem Context**: Many visually impaired individuals struggle to form a mental image of their surroundings.
- **Objective**: Provide an auditory-friendly description of scenes to assist with navigation and environmental awareness.
- **Relevance**: Addresses the real-world challenge of aiding the visually impaired with spatial understanding.

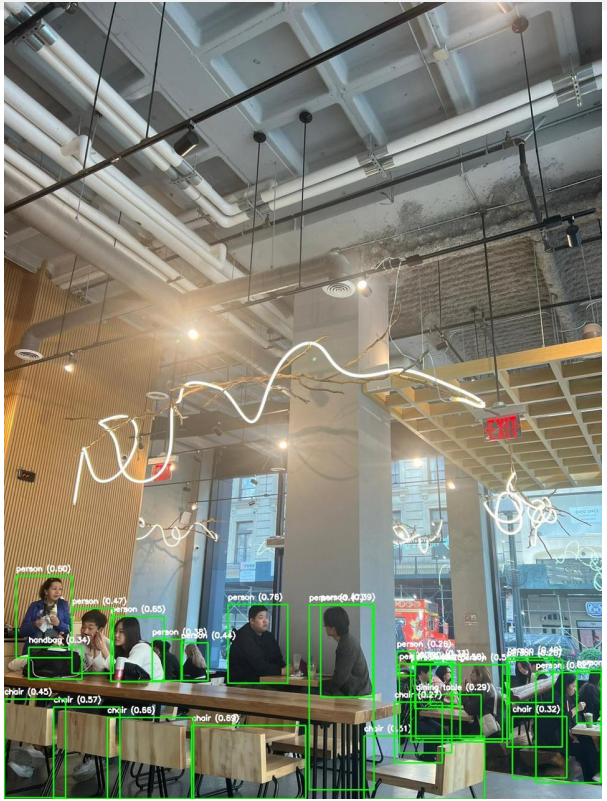
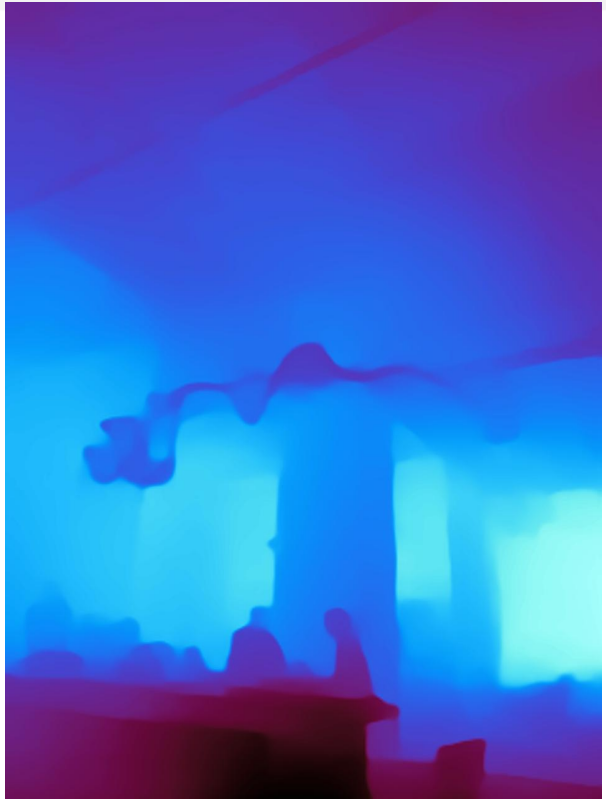
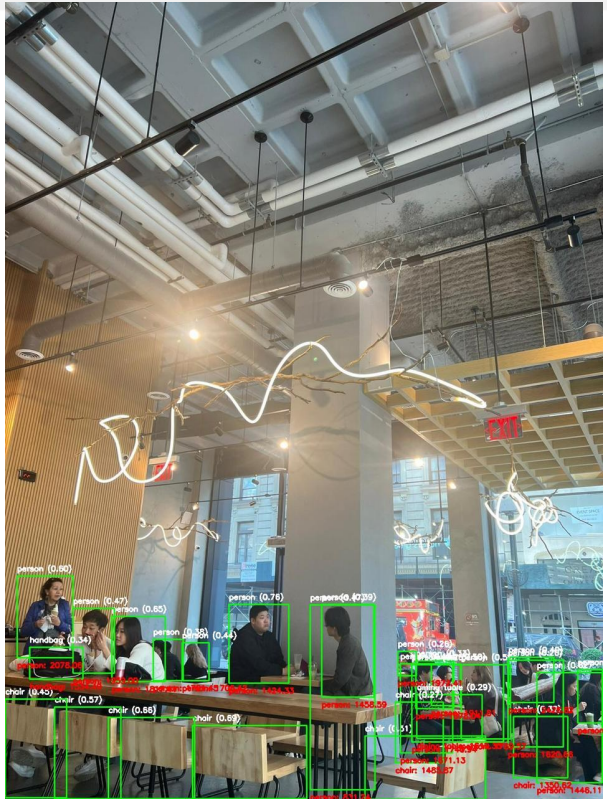
Approach and Key Features

Key Components:

- **YOLOv5** for Object Detection: Identifies objects like people, cars, signs.
- **MiDaS** for Depth Estimation: Estimates distances, giving spatial context.
- **OpenAI GPT** for Language Generation: Converts object positions and depths into natural, directionally-aware language.
- **Text-to-Speech (TTS):** Converts the GPT-generated description into spoken words, offering direct auditory feedback.

Workflow:

1. Input Image/Video
2. Detect Objects (YOLOv5)
3. Estimate Depth (MiDaS)
4. Generate Descriptive Output (GPT)
5. Read Aloud (TTS)

Example of indoor scene test images

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Demo!

Future Improvements

- **Model Fine-Tuning**:
  - Fine-tune YOLOv5 and MiDaS on custom datasets not previously seen.
- **Experiment with Different Models**:
  - Test alternative object detection or depth estimation models.
  - Incorporate more advanced language models or specialized visual question answering (VQA) techniques.
- **Extended Scope**:
  - Real-time deployment on mobile or AR devices.

Challenges & Reflections

Technical Challenges:

- Prompting GPT to use only the provided scene information was challenging. It often attempted to fill in details not given.
- Utilizing Streamlit for visualization was tricky due to how Streamlit handles asynchronous tasks.
- Getting depth map of a particular object detected by YOLO was slight difficult

Reflections:

- Highlight the importance of prompt engineering and careful model tuning.
- Recognize that integrating multiple models (vision + language) requires balancing complexity and clarity.
- Consider iterative refinements in model selection and prompt design for more reliable outputs

Thank You!

Any questions?