PetWave: Interactive Robotic Arm for Human and Dog Interaction

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2024/3/26

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Summary

- Aims to develop a robotic arm capable of recognizing and interacting with humans and dogs by waving to humans and patting dogs on the head.
- This project addresses the challenge of enabling robotic systems to perceive and respond to different types of entities in their environment.
- The investigation will explore techniques in computer vision, deep learning, and ROS to achieve the desired functionality.
- The background literature will include studies on object detection and recognition, human-robot interaction, and literature on computer vision and deep learning methods applicable to object detection and recognition in ROS simulations
- The project will utilize image datasets containing annotated images of humans and dogs for training and evaluation purposes. Existing datasets such as COCO, ImageNet, and OpenImages may be leveraged, supplemented by additional data collection if necessary.
- The proposed method will involve developing a deep learning model for object detection and classification, combined with kinematics and control algorithms for the robotic arm's movement. Existing implementations of object detection algorithms such as YOLO, SSD, or Faster R-CNN may serve as a starting point, with modifications to suit the specific requirements of the project.
- Evaluation of the results will involve qualitative assessment through video demonstrations showcasing the robot's interaction capabilities with humans and dogs. Quantitative evaluation will include metrics such as detection accuracy, precision, recall, and F1-score for object recognition tasks.

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The problem under investigation

- Interactive Robotic Arm for Human and Dog Interaction
- Potential Applications: Human-Robot Interaction, Assistive Robotics, Pet Care
- Objective: Enhancing Robotic Systems' Capabilities in Recognizing and Interacting with Various Entities

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The scope of the literature review

- ROS architecture
- database management
- image processing algorithms
- robot modeling and simulation
- control algorithms
- robot perception
- path planning strategies within the ROS framework.

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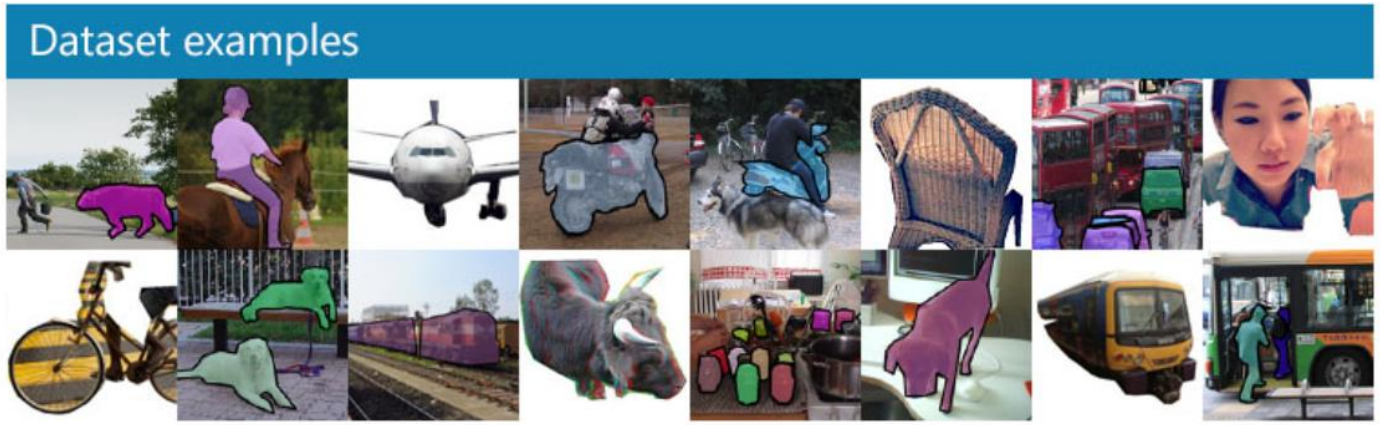
Database management

- COCO



- ImageNet

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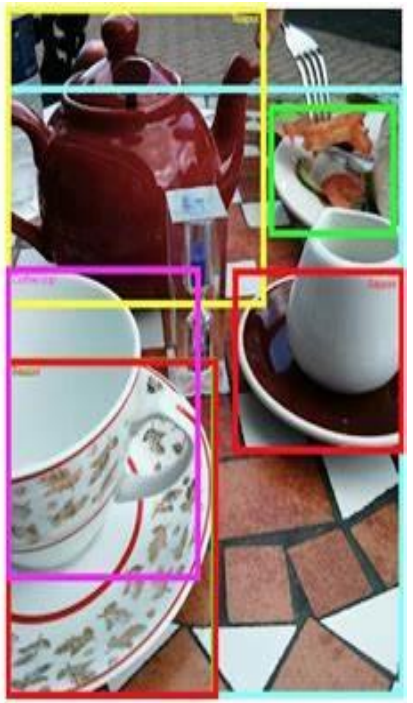
- Open Images



The method and algorithm

- A deep learning model for object detection and classification
  - YOLO
  - SSD
  - Faster R-CNN
- A robotic arm model
  - URDF
  - MoveIt
  - Gazebo
- A ROS-based path planning model
  - ROS Navigation Stack
  - MoveIt!(RRT、RRT*、OMPL)
  - SBPL
  - OMPL

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The system of evaluation

- Qualitative Evaluation:
  - Qualitative evaluation of the interaction capabilities between the robot, humans, and dogs demonstrated through video demonstrations.

- Quantitative Evaluation:
  - Object Detection Accuracy
  - Interaction Action Accuracy
  - Interaction Response Time

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Thank you for listening!

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