

Mobile Robot Design and SRVC

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July 26, 2007

Fully Vision Guided Design without Laser/Sonar Range Finders

- Range Finder Based Systems
 - Advantages:
 - Disadvantages:
- Vision Based Systems
 - Advantages:
 - Disadvantages:

Requirements for Fully Vision Guided Mobile Robots

1. Fully controllable camera parameters
2. Enormous computing power
3. Ample power source
4. Sturdy structure
5. Powerful motors

Availability of Robots for Our Purposes

- None on the market
- We designed and built

Objectives of Our Robot

- Vision research
- Human-Robot interaction research
- Future enhancement
 - Arms
 - Innovative hands
 - All made possible by the sturdy structure and the ample computing power and fully computer controllable camera parameters

Analysis of SRVC Problems

- Comparison to the state-of-the-art computer vision research
- Why hard
- Can be hard or impossible to humans

Our Approach

- **First step:** Pruning of the collected images by the type of background
- **Second step:** Detection by the feature set learned in the first step
 - Elongated axis ratio
 - Existence of straight lines and their relations
 - Repetition of certain properties (sharp corners)

Comparison with Class Instance Detection

- **Examples**
 - Human detection
 - Vehicle detection
 - Airplane detection
 - Face detection
 - Tank detection
- **Common characteristics of the Class Instance Detection Systems**
 - Use of good/appropriate training sets (Still the performance of the state of the art is far below the humans')

Characteristics of SRVC

- Unstructured training set
 - Images are collected by the text information attached to them not by the contents of the images
 - Can contain irrelevant regions and objects in the training sets
- Can make impossible problems even to humans
 - Examples: Obidome,

Suggestions for the Next SRVC

- Inclusion of easier problems (multi-level system)
 - Example:
 - Level 1 --- simple object recognition of given particular objects
 - Level 2 --- class instance detection of the classes that are announced months before the competition
 - Level 3 --- similar to the current SRVC
 - Will make the game more fun
- Inclusion of problems closely related to the widely studied computer vision problems
 - Will attract more participants