

Robot Vision: A Holistic View

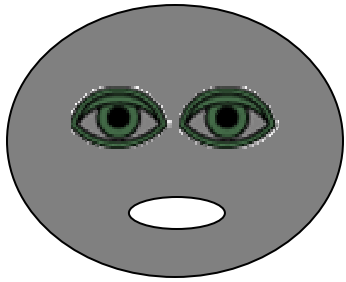
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- Why is vision important to robots?

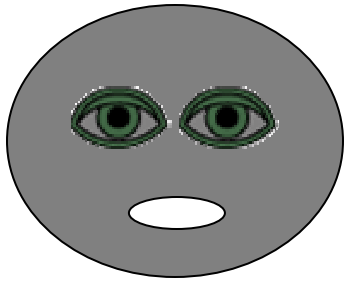
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- What is robot vision?

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- How should a robot vision be?

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Why is vision important to robots?

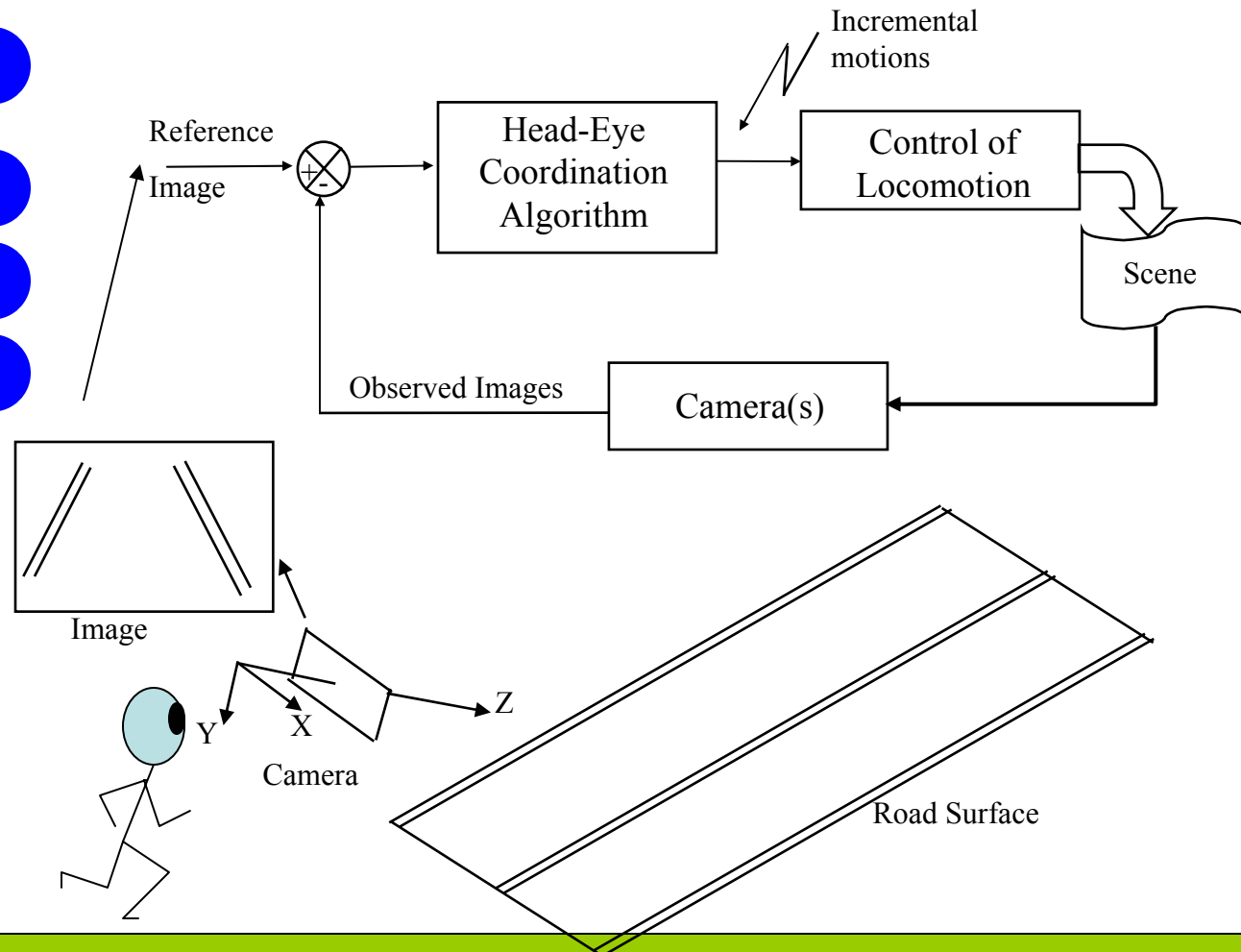
Vision is able to output signals for robots to act.

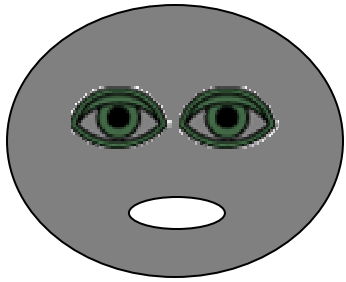
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Why is vision important to robots?

Vision is able to provide information for robots to act.

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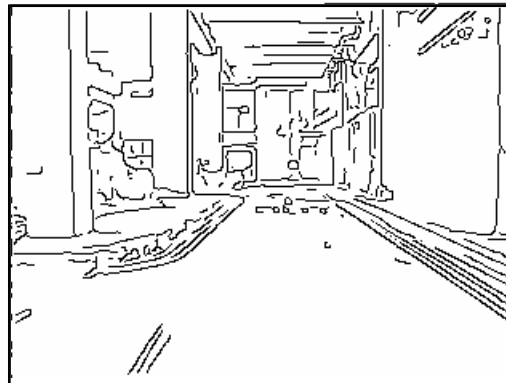
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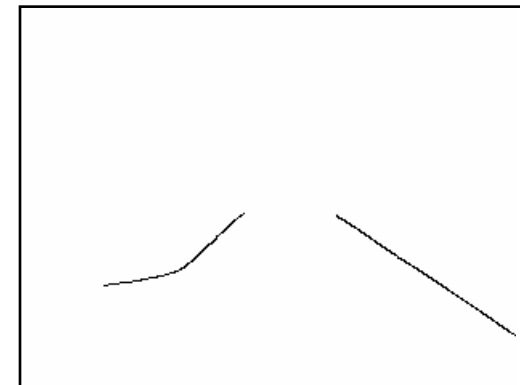
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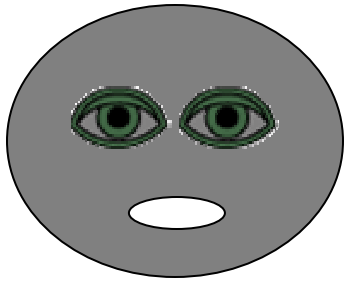
Image



Edgemap

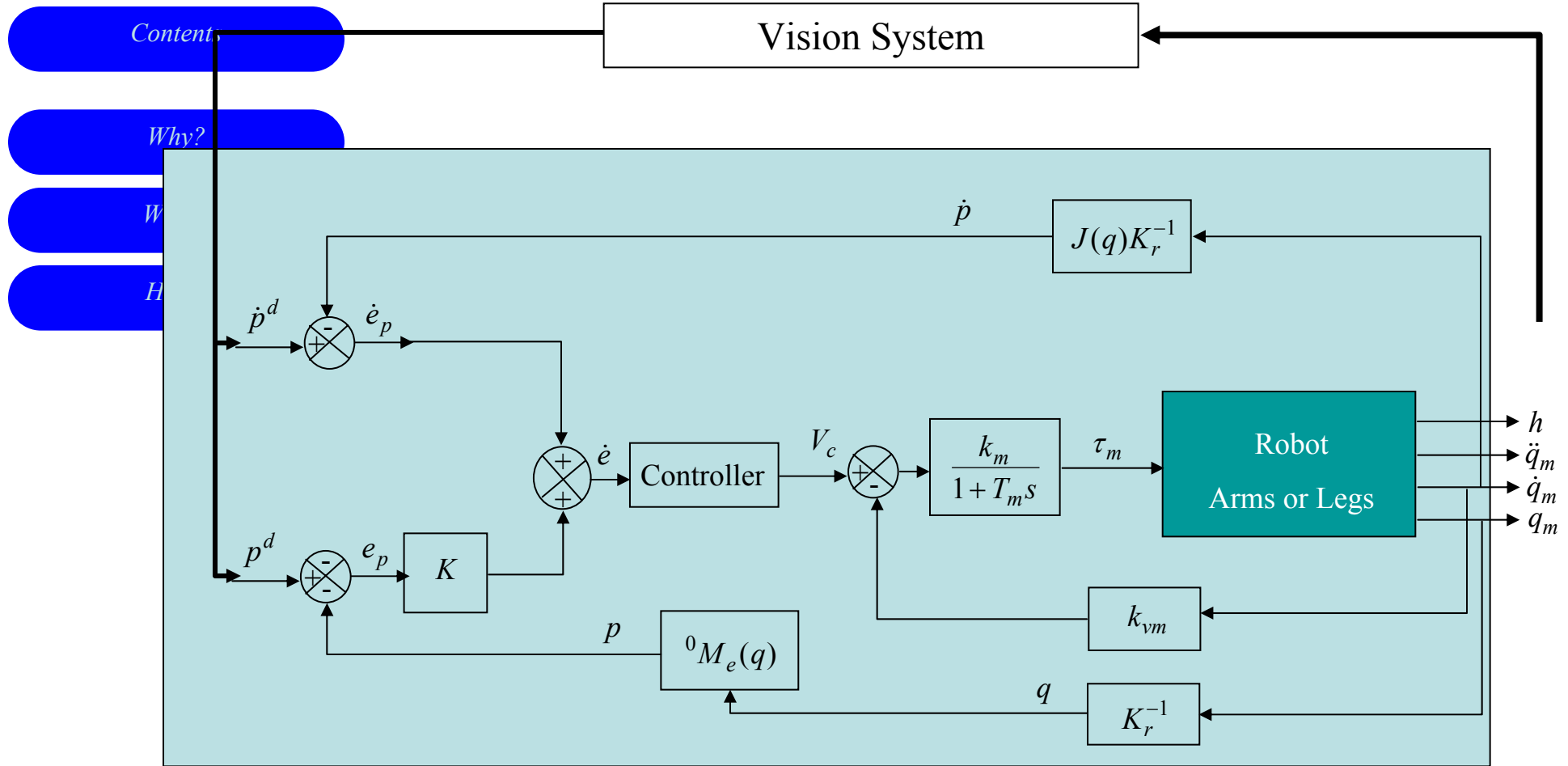


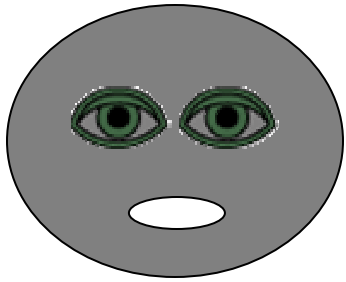
Boundary of Road Surface



Why is vision important to robots?

Vision is able to enable a robot to make its own decision.





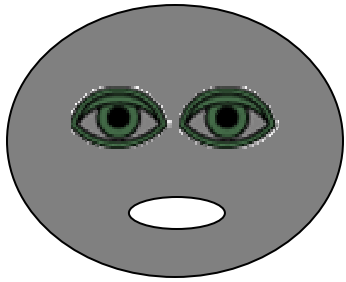
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Why is vision important to robots?

- Therefore, a robot must have vision, if it has to evolve from an automated machine to an intelligent and autonomous machine.
- We know that an automated robot responds to signals (i.e. analogue or digital values).
- And, an intelligent robot responds to information or knowledge.
- However, an autonomous robot will respond to (its own) decisions.
- Clearly, vision will enable a robot to become intelligent and autonomous in undertaking manipulation, locomotion and social interactions.



What is robot vision?

Vision is a process for a robot to acquire Signal, Information and Knowledge about an external world.

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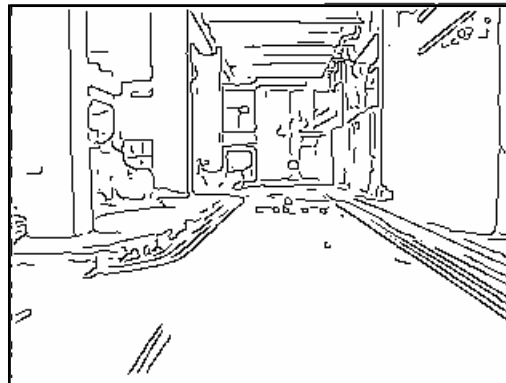
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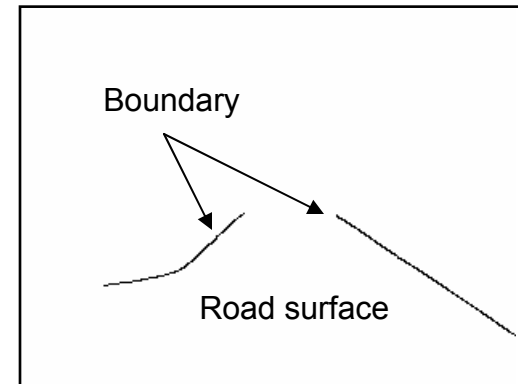
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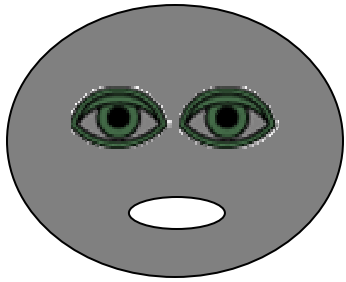
Image



Signal



Information and Knowledge



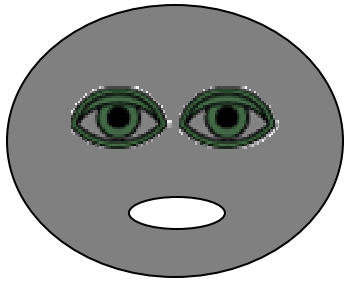
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What is robot vision?

- We can say that vision is the window, through which a robot could sense and understand the outside world.
- In other words, vision enables a robot to derive the meanings of a visually perceivable object, or scene, from its images, or videos.
- The meaning of an object encompasses: a) its identity, b) its category, c) its properties, and d) its constraints.
- And, the meaning could be manifested in the forms of: a) signals, b) information, and c) knowledge.



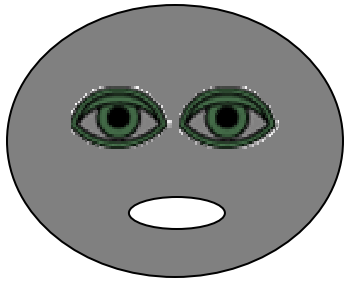
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How should a robot vision be?

- Robot vision is not simply image processing, which focuses on: a) image filtering, b) image transformation, and c) image compression.
- Robot vision is not simply pattern recognition, which focuses on: a) pattern detection, b) pattern learning (or training), and c) pattern classification.
- Robot vision is not simply computer vision, which focuses on: a) low-level vision (e.g. feature extraction and grouping), b) intermediate-level vision (e.g. pose estimation, feature matching, tracking, 3D reconstruction), and c) high-level vision (e.g. object recognition).
- Robot vision is much more complex, and covers the aspects of: a) instrumental vision, b) behavior-based vision, c) reconstructive vision, d) model-based vision, and ultimately, e) cognitive vision.
- To a great extent, robot vision integrates image processing, pattern recognition and computer vision for a well-focused objective of deriving meanings of scenes from images or videos.



How should a robot vision be?

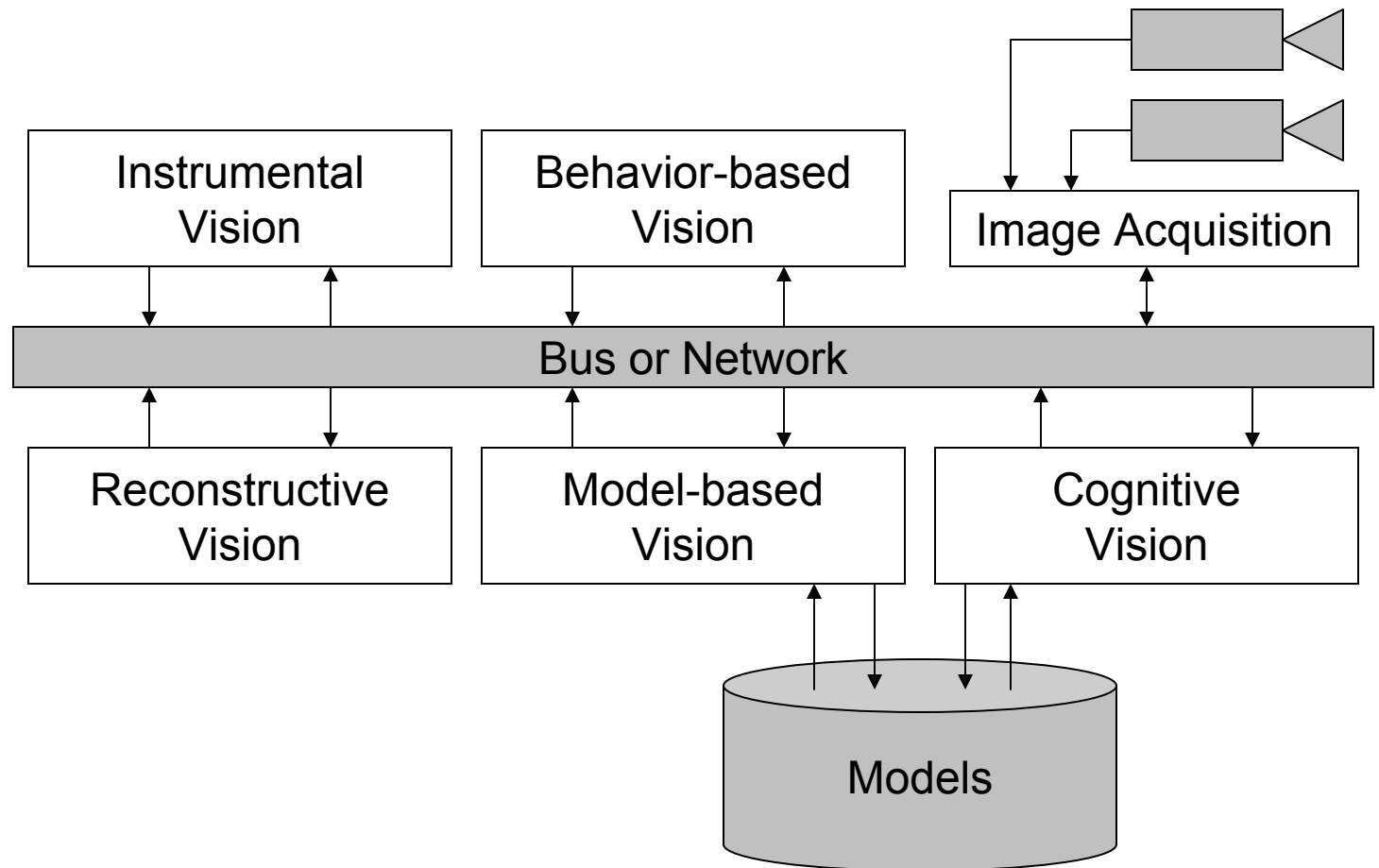
A landscape of robot vision

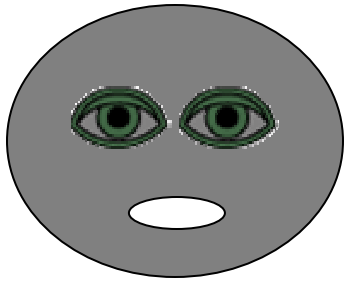
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