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Autonomous robotics

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Exercise 5

Dynamic Field Theory (DFT) represents information through peaks of activation that are localized along the continuous metric dimensions over which an activation field is defined. Use the concepts of DFT to describe what a system must achieve to detect a target, estimate target parameters, and track a target. To make this concrete, think of targets for a vehicle that is moving in a plane. The sensory channel could be a camera. Every pixel with sufficient brightness that has a particular color (lies in a particular hue interval) votes for its visual direction as the direction of a particular target (the direction from the vehicle to the point in the world that this pixel represents).

1. Over which dimensions would you represent the targets? Make that dimension invariant under rotation of the vehicle on the spot. Discuss how the pixel coordinates can be transformed into locations along these dimensions.

2. Take only one of those dimensions for now (a horizontal dimension). Make a drawing each of the state of the activation field when no target has been detected versus when a target has been detected.

3. Describe in words and make a drawing of how the camera pixels could be linked into the field to induce such a peak. Would each pixel provide input to a whole range of values along the dimension? How would you treat pixels that have the same horizontal position? What kinds of targets would give the strongest input, e.g., depending on the size/height of an object.

4. Illustrate the selection of one among multiple targets in the activation field by making a drawing of the input pattern and of the possible activation profiles in the field. What factors would bias the system toward selection of one particular target over the other?