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Thumbnail Generation Based on Global Saliency

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Contents

- Visual Saliency: an overview
- An information-theoretic view of saliency
- Evaluations

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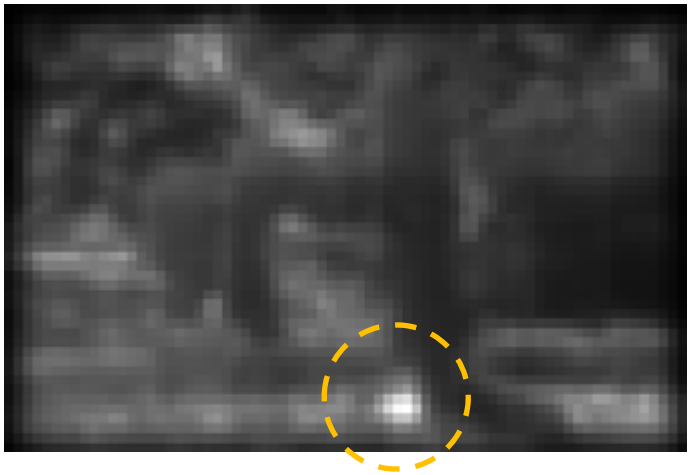
Visual Saliency

- Attention implies allocating resources, low-level or high-level, to certain things at a certain context.
- Fast detection of potential targets:
  - Foraging foods
  - Spotting predators



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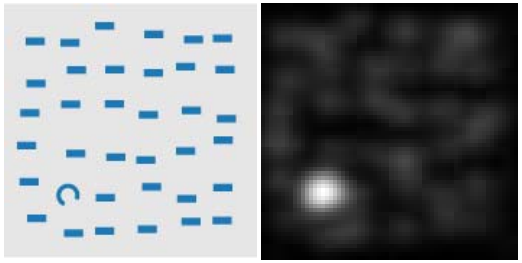
Saliency: Top-down VS bottom-up

- Top-down attention requires an knowledge of a specific task, such as face detection.

- Bottom-up attention is free from the high-level knowledge, and the saliency is generated from low-level representations, such as feature map.



Computational Models

- A Feature-Integration Theory of Attention (Treisman, Gelade, 1980).
  - Proposed a framework for bottom-up attention
- A Model of Saliency-based Visual Attention for Rapid Scene analysis(Itti, Koch, Niebur, 1998).
  - Implemented a computational saliency model with color, density and orientation features
- Biologically inspired saliency map model for bottom-up visual attention.(Park, Shin, Lee)
  - Implementation the saliency with other features like edges, symmetry and color differences

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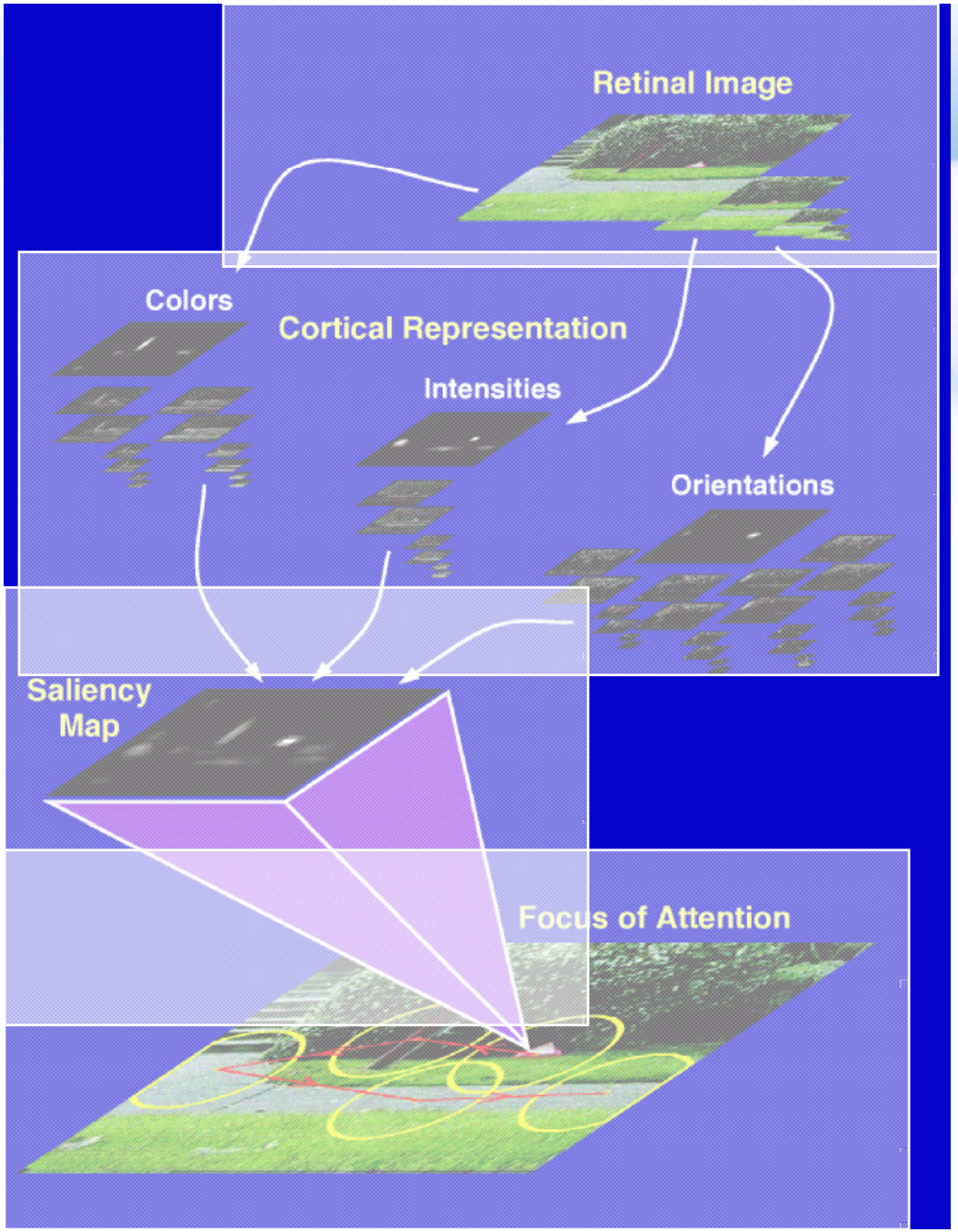

L. Itti, C. Koch, and E. Niebur, 1998

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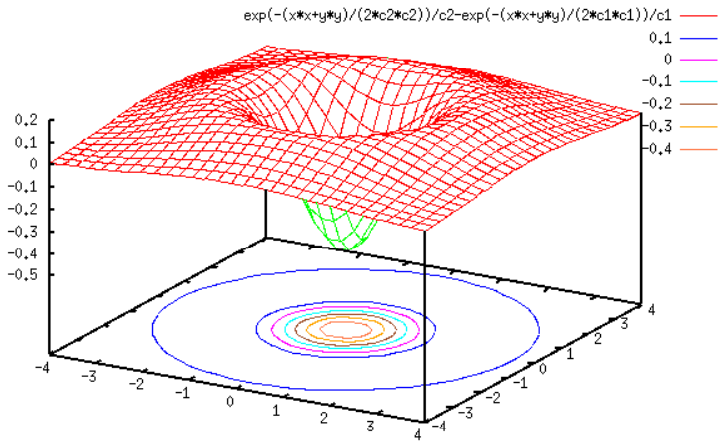
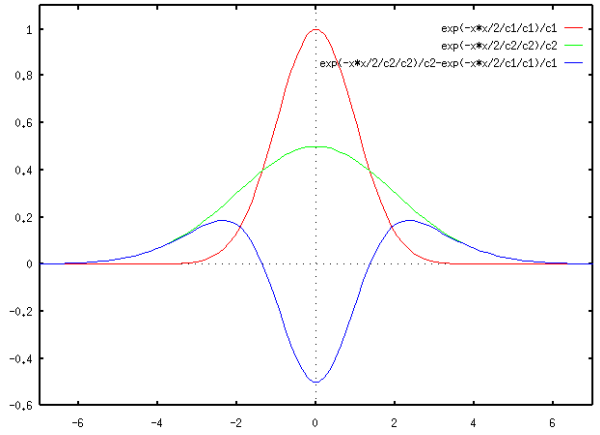
What is saliency?

❖ Feature Integration Theory:

- Local disturbance of features captures our attention
- Using Difference of Gaussian filters, we can quantify this difference:

$$DoG \triangleq G_{\sigma_1} - G_{\sigma_2} = \frac{1}{\sqrt{2\pi}}\left[\frac{1}{\sigma_1}e^{-(x^2+y^2)/2\sigma_1^2} - \frac{1}{\sigma_2}e^{-(x^2+y^2)/2\sigma_2^2}\right]$$





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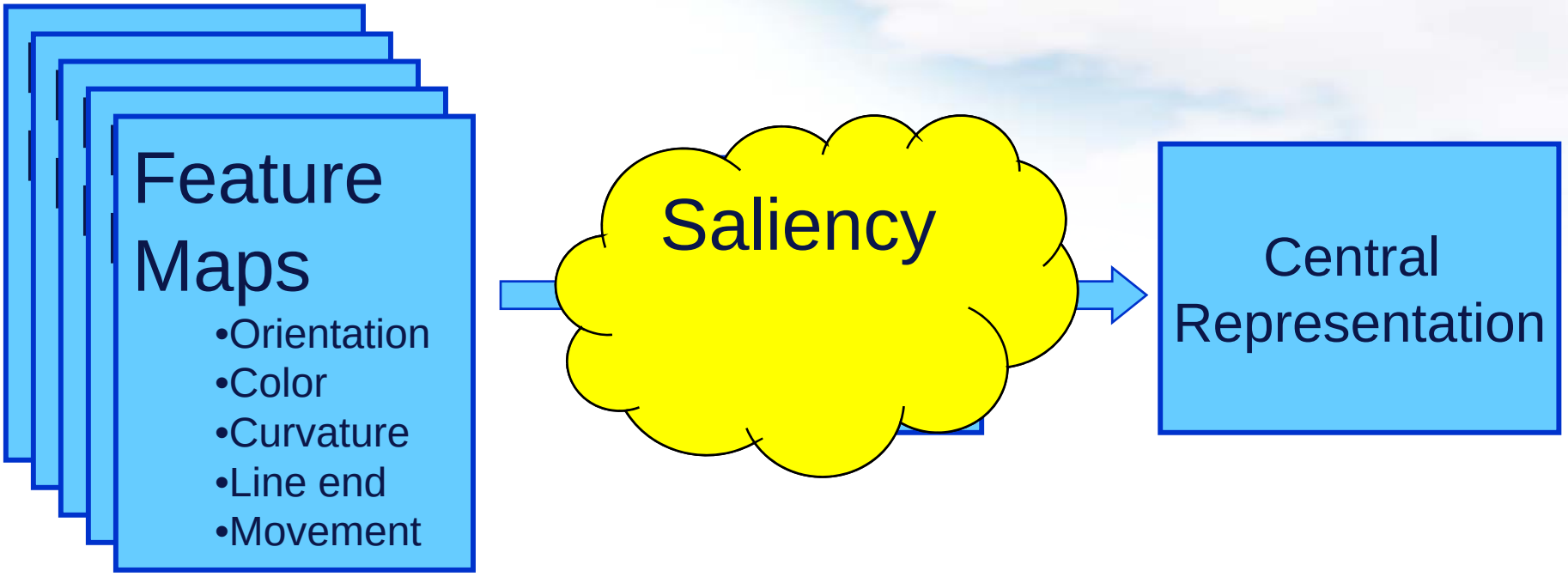
What is saliency?

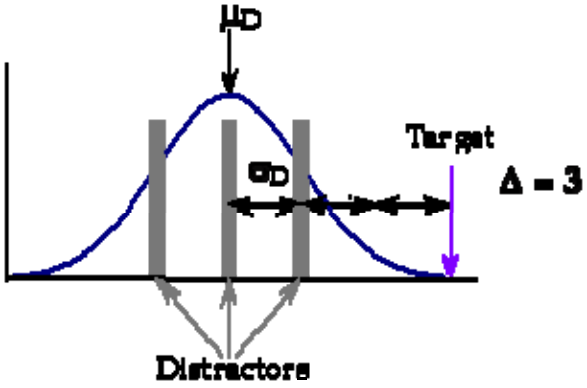


Feature itself is correlated to saliency detection:

RED is more salient than BLUE

Statistical Saliency

- **The visual system looks for outliers**
  - The intuition behind much of my work on visual search is that the visual system has an interest in noticing "unusual" items, where "unusual" can mean "unlikely to have been drawn from the same statistical process as the stuff in the surrounding regions," or it might also mean the more general, “It goes beyond expectation”



Ruth Rosenholtz, 2001

Coding-length Saliency

- Consider the feature map as a distribution of different feature values
- The Entropy of the feature map is:

$$H(X) = -\sum p(x)\log_2 p(x)$$

- The coding length of a particular feature value is:

$$L(x_i) = -\log p(x_i)$$

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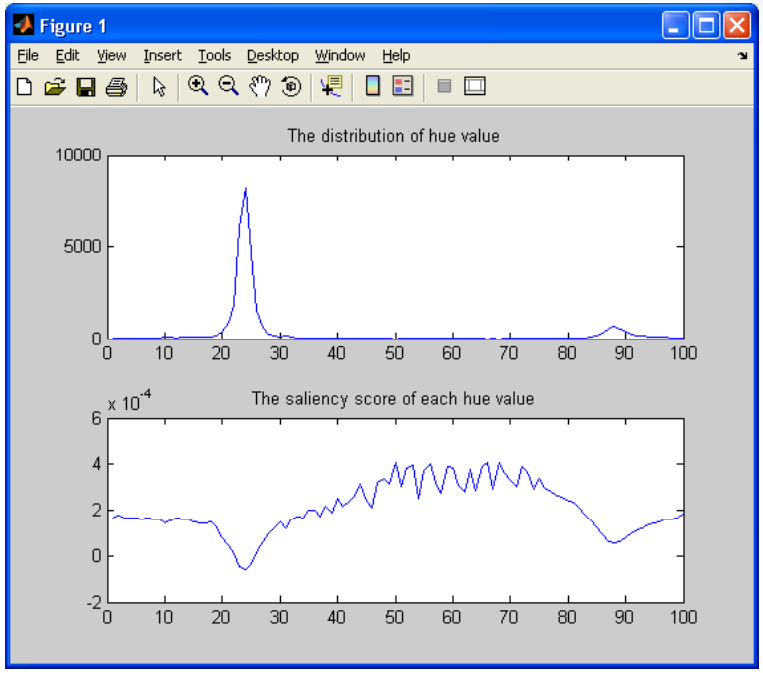
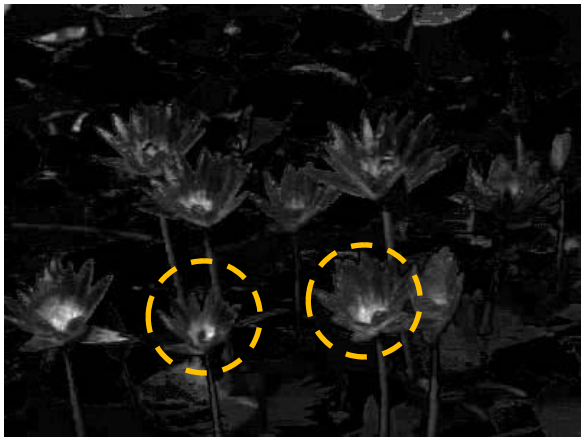
Color feature distribution and their corresponding saliency





Saliency: yellow > pink > green

The Coding-length saliency

- Is a global approach, it considers the overall distribution of the feature map, not their local coherence.
- Is applicable to video and other analysis, since the distribution could be accumulated
- Is fast (compute each coding-length map from feature map in O(N) time)
- Is a regional algorithm, better performance than pixel based algorithms.

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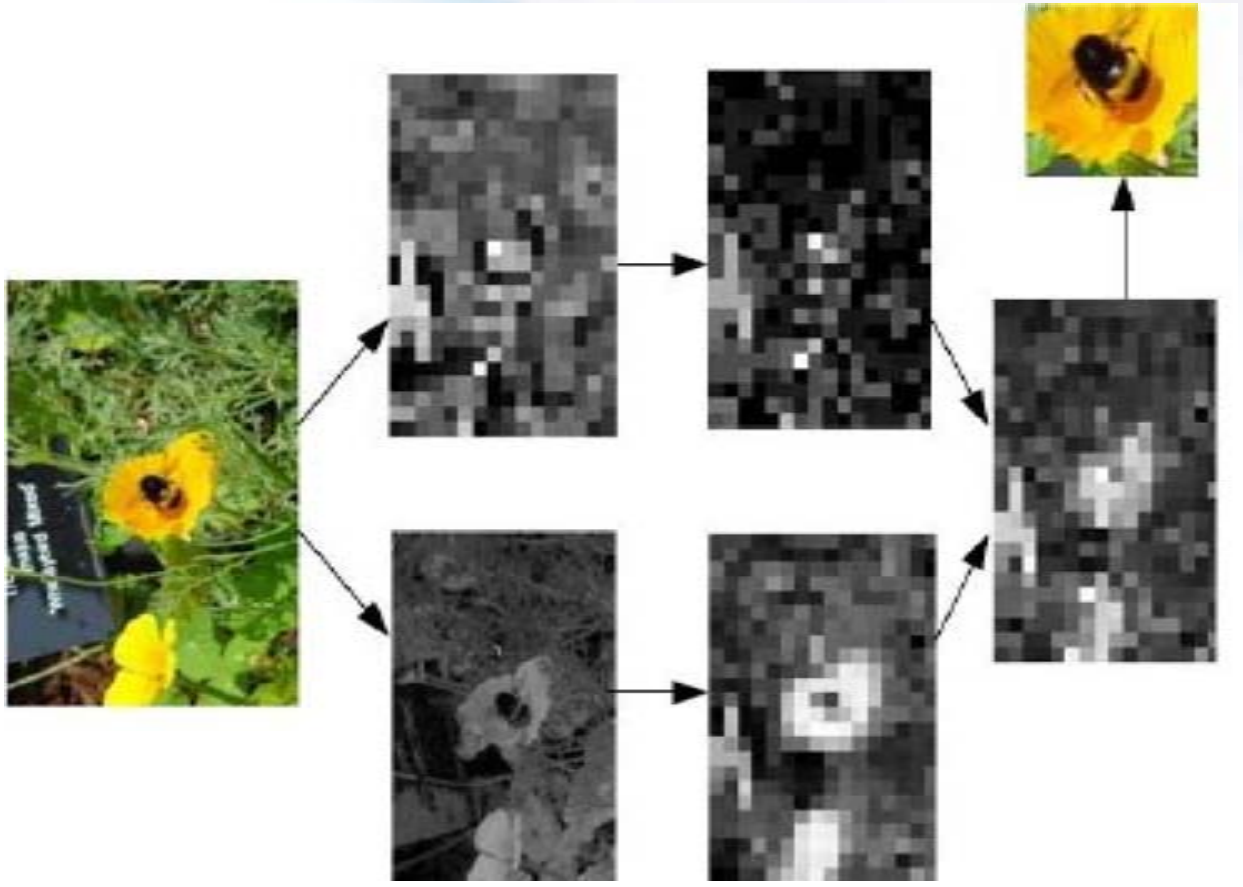
The Implementation

Combining Color and texture features



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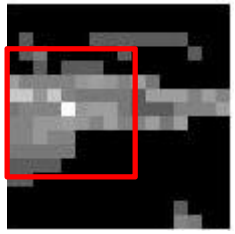
Defining saliency by coding-length

Image

Color feature map



Color coding length map

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Result show

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Future works

- **Visual attention is the basis for autonomy**

- **To see whatever a robot wants…**

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Thanks for Your Attention