Exploiting Local and Global Patch Rarities for Saliency Detection

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CVPR 2012

Bora Çelikkale
General Idea

Saliency Model based on local and global salient points
Previous Work

**Feature Integration Theory** (1980 by Anne Treisman and Garry Gelade)

When perceiving a stimuli:

Features (color, intensity..) are registered early, automatically and in parallel,

Objects are identified separately at a later stage of processing

**Guided Search Model** (1989 by Wolfe JM, Cave KR, Franzel SL)

Information from top-down and bottom-up processing of the stimulus is used to create a ranking of items in order of their attentional priority
Saliency-Based Visual Attention for Rapid Scene Analysis

Compute saliency for simple features: color, intensity, orientation

Laurent Itti, Christof Koch, Ernst Niebur
PAMI 1998
Previous Work

Symmetry feature for saliency (2008)

Motion feature for saliency (2003)

Texture contrast (2002), Curvedness (2009)
Previous Work

Probabilistic Models

Graph Based Visual Saliency (Torralba – 2006)
Graph Algorithms and a dissimilarity measure

Saliency Using Natural Statistics (SUN) (Zhang – 2008)
Combine top-down and bottom-up info for real world object search

Saliency as Maximizing Classification Accuracy (Gao & Vasconcelos – 2003)
Measure mutual information between features
Previous Work

**Saliency in Frequency Domain**

Spectral Residual Approach (Hou & Zhang – 2007)
Relating extracted spectral residual features in the spectral domain

Multiresolution Spatiotemporal Saliency Detection Model (Gou– 2010)
Incorporating Phase spectrum of the Quaternion Fourier Transform (PQFT)
Details

Image Representation

Dictionary of 200 basis functions – from natural images

\[ \alpha^*(x, D) = \arg \min_{\alpha \in \mathbb{R}^n} \frac{1}{2} \| x - D\alpha \|_2^2 + \lambda_1 \| \alpha \|_1 \]
Details

Local Saliency

\[ S_i^c(p_i) = \frac{1}{L} \sum_{j=1}^{L} W_{ij}^{-1} D_{ij}^c \]

**Avarage weighted dissimilarity**

- \( W_{ij} \): Euclidean distance of patches
- \( D_{ij} \): Euclidean distance of coeff vectors

Further patches have less influence.
Global Saliency

$$S_g^c(p_i) = P(p_i)^{-1} = \left( \prod_{j=1}^{n} P(\alpha_{ij}) \right)^{-1}$$

Inverse of probability of patch over scene

\(\alpha_{ij}\): coeff \(j\) of patch \(i\)

\(P(\alpha_{ij})\): probability density function
Experiments & Results

AUC (Area Under Curve) Metric

Positive Set: human selected saliency points
Negative Set: uniform random chosen points
shuffled AUC: all human fixations – positive set

Saliency Map: binary classifier

ROC Curve: threshold over map and plot true positive rate vs false positive rate
## Experiments & Results

<table>
<thead>
<tr>
<th>Dataset</th>
<th>AIM</th>
<th>GBVS</th>
<th>SRM</th>
<th>ICL</th>
<th>Itti</th>
<th>Judd</th>
<th>PQFT</th>
<th>SDSR</th>
<th>SUN</th>
<th>Surprise</th>
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<th>Gauss $S_t$</th>
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Thank You