

Determining Patch Saliency Using Low-Level Context

Devi Parikh¹, Larry Zitnick² and Tsuhan Chen¹

¹ Carnegie Mellon University (Pittsburgh, PA) ² Microsoft Research (Redmond, WA)

Role of Context

Traditional



High-level reasoning

New perspective...

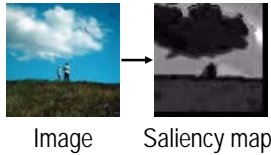


Image Saliency map

Low-level task ?

Computing Saliency Map

Co-occurrence based

$$S_{x_i}^o = \frac{1}{n} \sum_{j=1}^n \phi(x_j | x_i) = \frac{1}{n} \sum_{j=1}^n \sum_{a=1}^m \sum_{b=1}^m p(w_a | y_i) p(w_b | y_j) p(w_b | w_a)$$

Association of patch i to word a
Association of patch j to word b
Likelihood of word b given word a

Normal distribution
Normal distribution
MLE counts from images

Relative location based

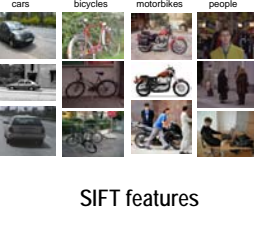
$$S_{x_i}^l = \frac{1}{n} \sum_{j=1}^n \sum_{a=1}^m \sum_{b=1}^m \sum_{u=1}^c \sum_{v=1}^c p(l_u | l_i) p(l_v | l_j) p(w_a | y_i) p(w_b | y_j) p(w_b, l_v | w_a, l_u)$$

Experiments

Outdoor scene categories [Oliva et al., IJCV 2001]



Object categories (Pascal-01)



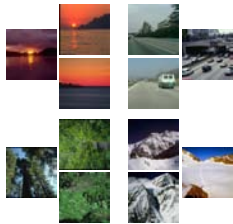
SIFT features

Saliency Measures

Interest-points

Discriminative

Contextual



A patch is salient if it well predicts the rest of the image.

Sampling Strategies

1. Sorting

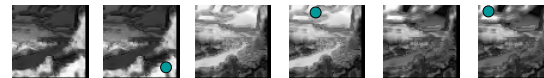
2. Random sampling

3. Sequential sampling



$$S_{x_i}(x'_1, \dots, x'_i) = \frac{1}{n} \sum_{j=1}^n \max(\phi(x_j | x_i), \phi(x_j | x'_1), \dots, \phi(x_j | x'_i))$$

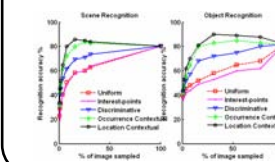
$$x'_{i+1} = \arg \max_{x'_i} S_{x_i}(x'_1, \dots, x'_i)$$



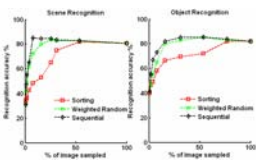
Results



Saliency measures

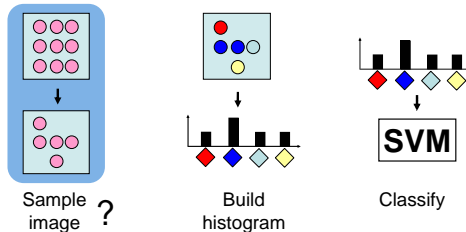


Sampling strategies



Set-up

Bag-of-features paradigm



Sample image ?

Build histogram

Classify

Discussion



Discriminative vs. contextual

Subjectivity of the notion of saliency

Unsupervised but dataset dependent

- A patch is salient if it can predict the rest of the image well
- Outperform existing saliency measures on image classification

- Proposed occurrence and location based contextual saliency measures
- Higher accuracies at sparse representations

- Discussed three sampling strategies
- Use of context for a low-level task