Exploiting Local and Global Patch Rarities for Saliency Detection

Ali Borji and Laurent Itti
{borji, itti}@usc.edu

Introduction

One color system does not work for all images.

Contributions

- **First contribution** is to propose a unified saliency model that benefits from the advantages of local and global approaches, which thus far have been treated independently.
- Note that the ideas of local and global context have been separately considered in the past by salient object detection/segmentation approaches, but the contributions presented here have not yet been tested with human fixation prediction, which is the goal of most models including ours.
- **Second contribution** is combining saliency maps from both color spaces.

Acknowledgements

Supported by the National Science Foundation (grant number BCS-0827764), and the Army Research Office (W911NF-08-1-0360 and W911NF-11-1-0046), and U.S. Army (W81XWH-10-2-0076).

Proposed Saliency Model

Block Diagram

Image Representation

Measuring Visual Saliency

**Step 1: Local Saliency**

\[ S_{local}(p) = -\log\left(\frac{1}{|I|} \sum_{j \in I} p(x_j)\right) \]

**Step 2: Global Saliency**

\[ S_{global}(p) = \log\left(\frac{1}{|I|} \sum_{j \in I} q(x_j)\right) \]

**Step 3: Combined Saliency**

\[ S_{combined}(p) = S_{local}(p) + S_{global}(p) \]

Measure visual saliency

Illustration of global and local saliency for an image patch. Global saliency measures the rarity of a patch in the entire scene while local rarity measures the difference between a patch and its surrounding context.

Performance Evaluation

Model comparison.

Fixation prediction accuracy of our saliency operations (Local, Global, LG (Local + Global)) along with 10 state-of-the-art models over 4 benchmark datasets. X-axis indicates the α of the Gaussian kernel (in image width) by which maps are smoothed. Only 412 images of the NUSEF dataset are used here.

We used the shuffled AUC score for discounting center-bias in model comparison.

Visual comparison of our combined saliency model and 10 state-of-the-art models over samples from TORONTO (top) and MIT (bottom) datasets.

We conclude that integration of local and global saliency operators works better than just using either one, which encourages more research in this direction. Similarly, combining both color systems strongly benefits saliency detection and eye fixation prediction.