Persuading Visual Attention Through Low-Level Image Features

## Vikash Kumar, IIT Hyderabad
Guided by – Dr. R. Pal

MOTIVATION

➢ Attention is one of the most important component of primate vision. It is the mechanism to rapidly focus gaze to some selected portions of the visual input.

➢ Visual saliency is closely related to attention.

➢ Now-a-days almost every device has the ability to capture images on the go. But some times, the portion user want to draw attention in the image may fail to do so, instead some other thing may draw user attention.

➢ In this project, a step has been taken to address this problem.

➢ Visual saliency of required part has been tried to improve .

WHAT IS VISUAL SALIENCY

- Saliency of an item - be it an object, a person, a pixel, etc. is the state or quality by which it stands out relative to its neighbours.

- Visual Saliency is the distinct subjective quality which makes some item stand different from other objects in its vicinity.

- Our attention is mostly attracted towards most salient object in the field of view.

- Visual salience is mostly driven by two models:

  ☐ *Bottom-up, stimulus-driven*
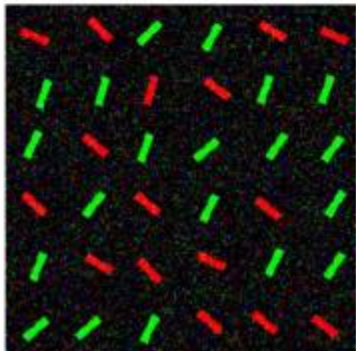
  ☐ *Top-down, memory or conscious driven*

VISUAL SALIENCY IN ACTION
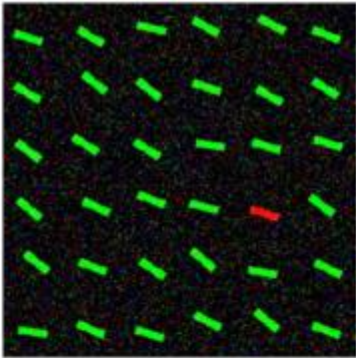
One item in many items strongly pops-out and immediately attracts attention. Hence this item is said to be salient.
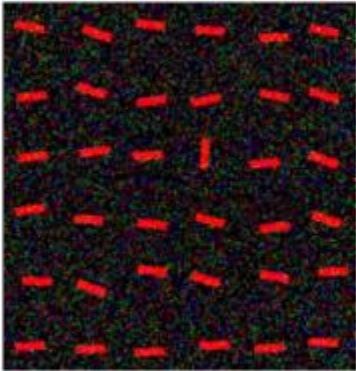
The vertical bar is visually salient. Though there are other bars which are salient too but they are less salient. **Can You Spot Them?**

There is again one bar that is different and unique but one's find it difficult to find it because it is not that salient.

COMPUTING SALIENCY

Qtdecomp( )

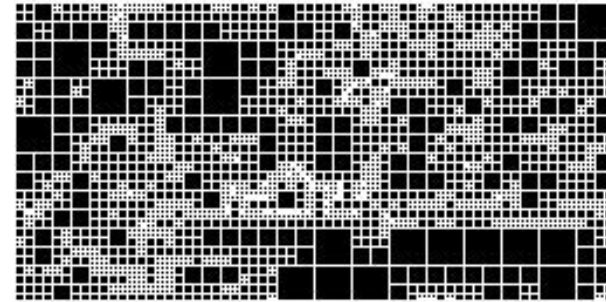Original Image   Image After qtdecomp
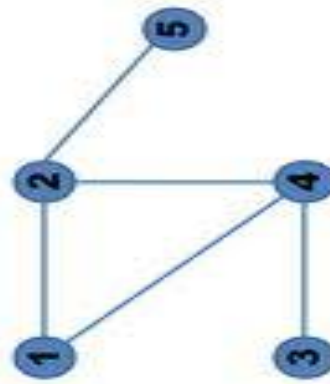
- A graph based approach based on degree centrality is used to calculate the saliency.

- A network where nodes represent similar pixels and the dissimilarity in terms of features between any pair of such accumulations is encoded as edge-weight between corresponding nodes.

- The homogeneity across a block of pixels in terms of a feature is determined by estimating the difference between maximum and minimum feature values with in the block .

- If the difference between the max and min feature value is more then the threshold and then the block is not homogenous and is further decomposed.

- Thus each block above represent a node in the graph

	A	B	C	D	E
A	0	1	1	0	1
B	1	0	0	0	0
C	1	0	0	1	1
D	0	0	1	0	0
E	1	0	1	0	0
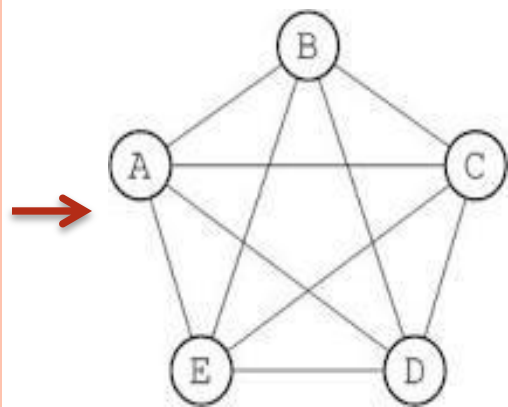
Graph → Based on threshold → Binaried Graph → Calculating the degree → 3 1 3 1 2

- Edge-weight is proportional to the diff. between the features of the nodes.
- Feature Dist. is the abs. difference of the mean feature values of these nodes and normalized with respect to the max. value of feature distance.

$$D_{f,j} = |\mu_{f_i} - \mu_{f_j}| / \max_{\forall k, \forall l}(|\mu_{f_k} - \mu_{f_l}|)$$

- Edge-weight is inversely proportional to spatial distance between
- A Gaussian function is used to simulate the decay of feature influence with spatial distance

- Spatial distance is the cartesian distance between the mid-points of the two blocks and normalized with respect to max. possible value.
- So, final edge weight function is

$$F(V_i, V_j) = D_{f_{ij}} e^{-D_{c_{ij}}^2 / 2\sigma^2}$$

- Since edge weights are proportional to feature dissimilarities, so edges with higher weight are taken.
- Degree of a node, which is a centrality measure is the number of nodes to which it is connected.
- It is estimated by row/column-wise summation of the adjacency matrix.

$$DC_i = \sum_j A_{i,j}$$

- Hence the saliency map based on intensity is formed.

CHANGING THE SALIENCY OF THE IMAGE

- From the degree centrality matrix, node with the max degree and hence the most salient node is found.

- Its feature value i.e mean of all intensities of pixels in the particular block is noted.

- User is given the choice to selected a point in the region he wants to be salient.

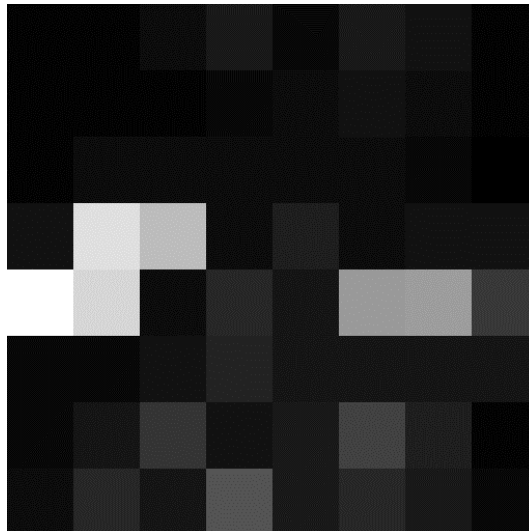- User selected point is then used to find the node in which the point lies.
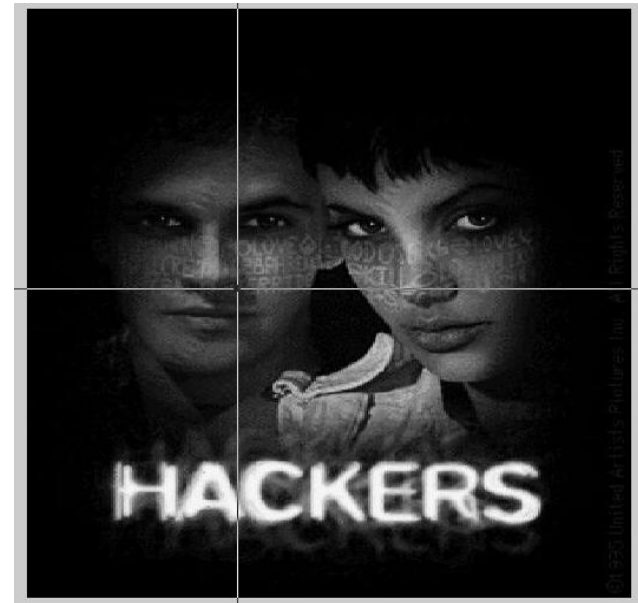
CONT...

- Difference between their feature value is calculated

$$\Delta fvalue = fvalue(salient\ node) - fvalue(node\ to\ be\ made\ salient)$$

- Use this difference to increase the feature value of the node to be made salient

IMAGE	SALIENCY MAP	MODIFIED IMAGE