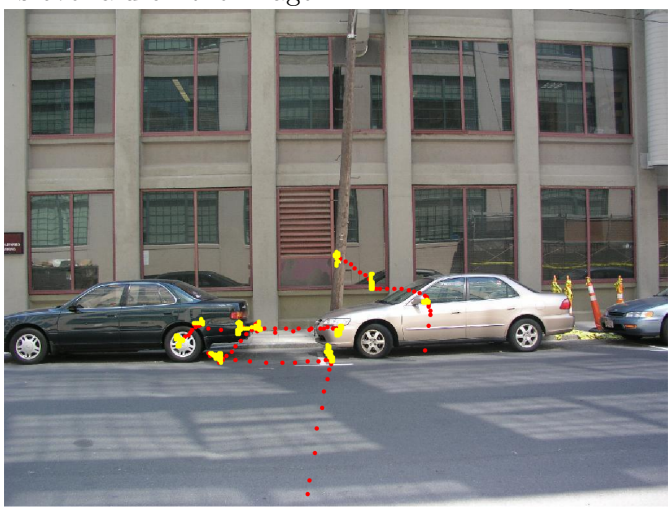
Student Name: Mohammad Mohammad Beigi
Student ID: 99102189
Subject: Visual Attention

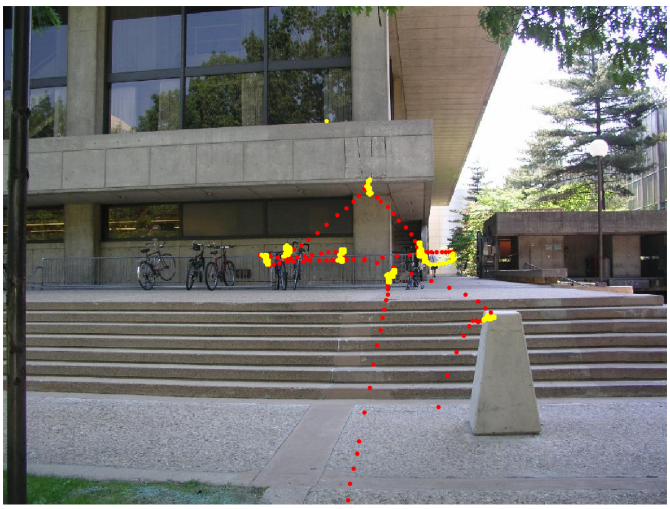
Advanced Topics in Neuroscience - Dr. Ali Ghazizadeh
Assignment 8

---

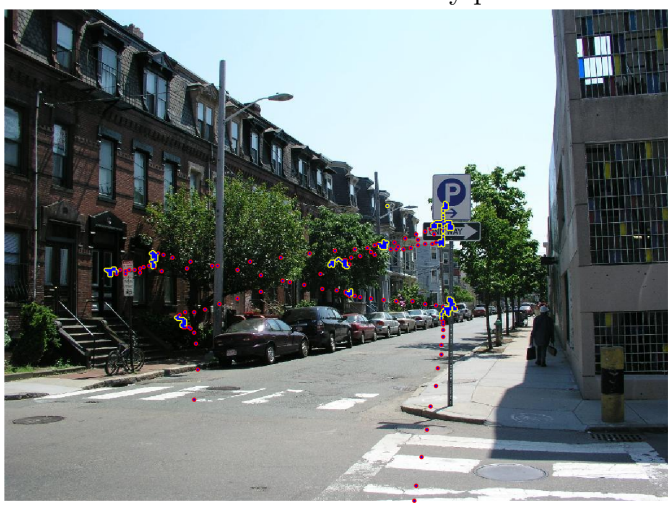
part 1:

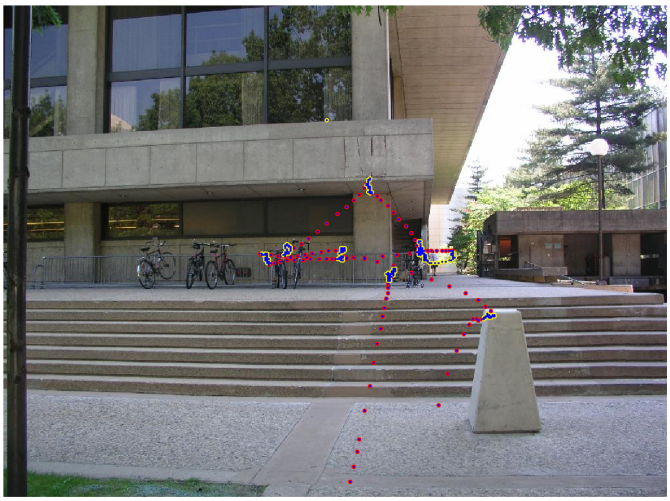
We plot clusters of fixation locations and see the locations overlaid on the image:



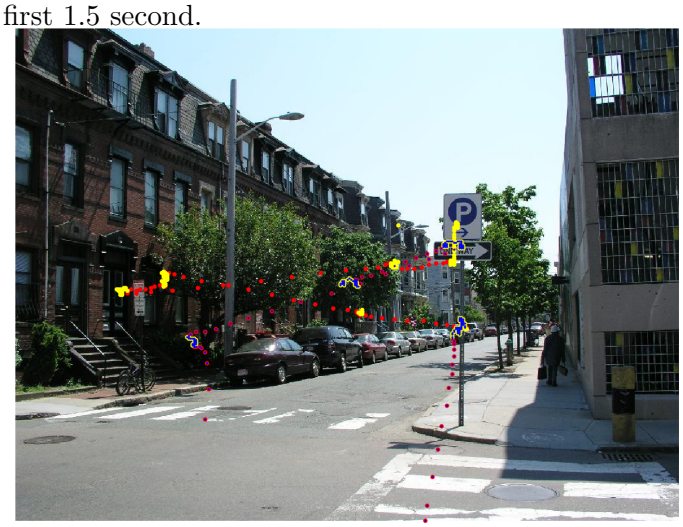


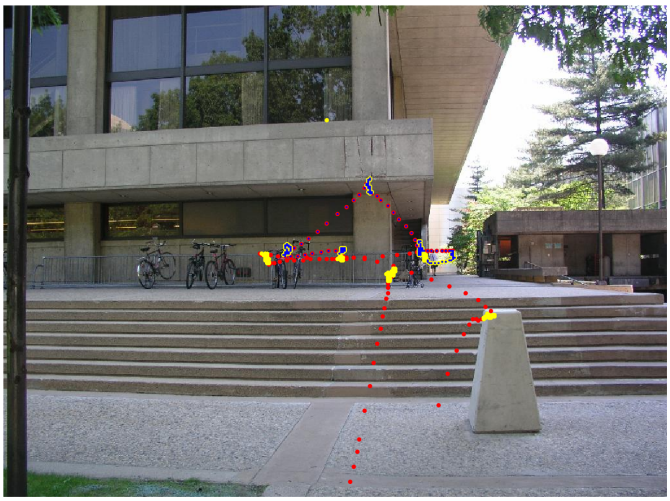
Now we will add the raw x and y pixel locations of the eye for every sample that the eye tracker took.



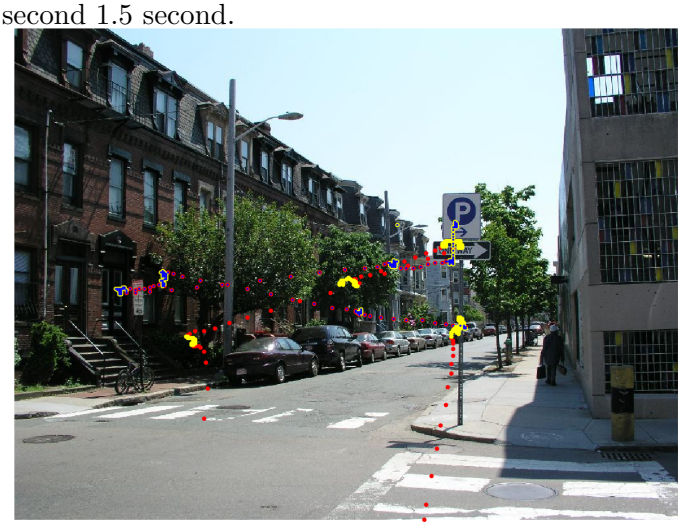


Now we will add the raw x and y pixel locations of the eye for every sample that the eye tracker took in first 1.5 second.

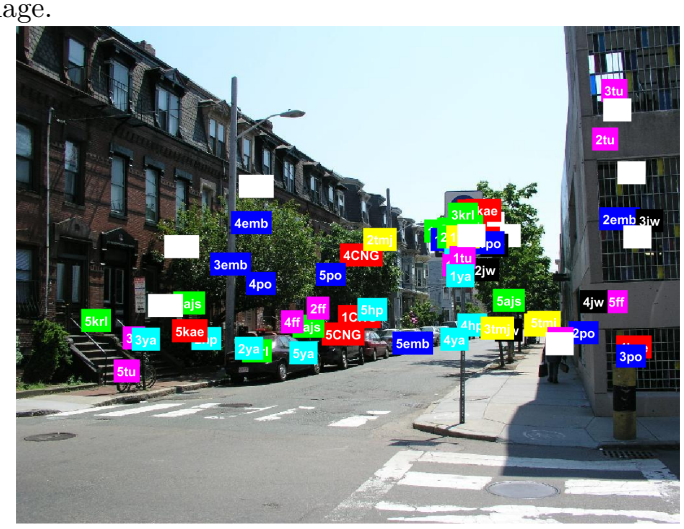


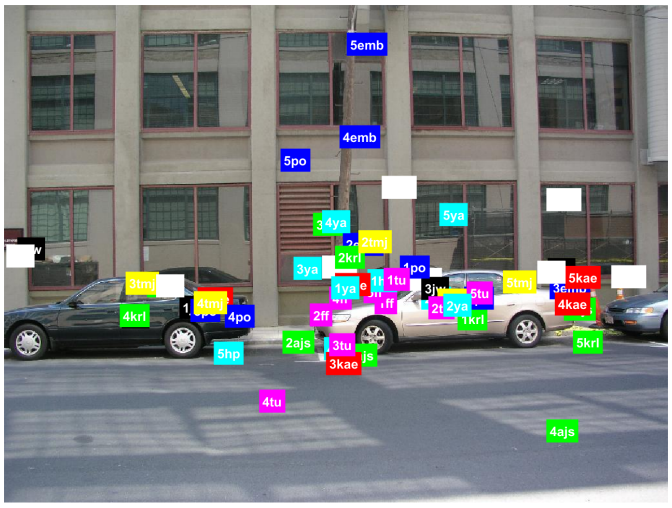


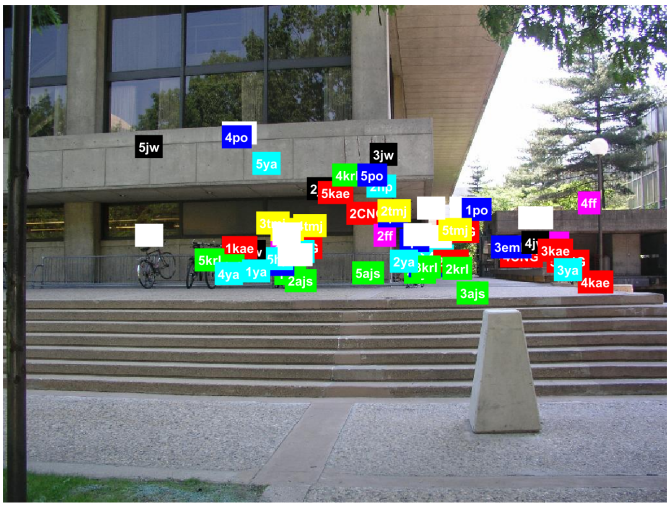
Now we will add the raw x and y pixel locations of the eye for every sample that the eye tracker took in second 1.5 second.



Now we plot the eye tracking center of the eye tracking fixations for all users on a specific image. The fixations are color coded per user and indicate the order of fixations. Press space to continue to the next image.



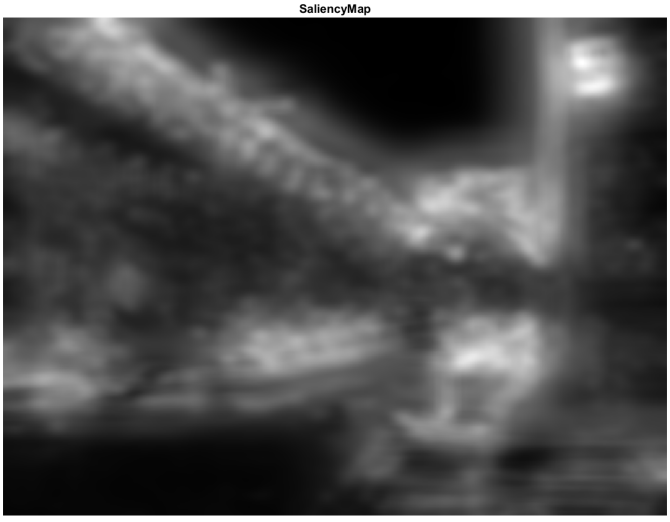




part 2:

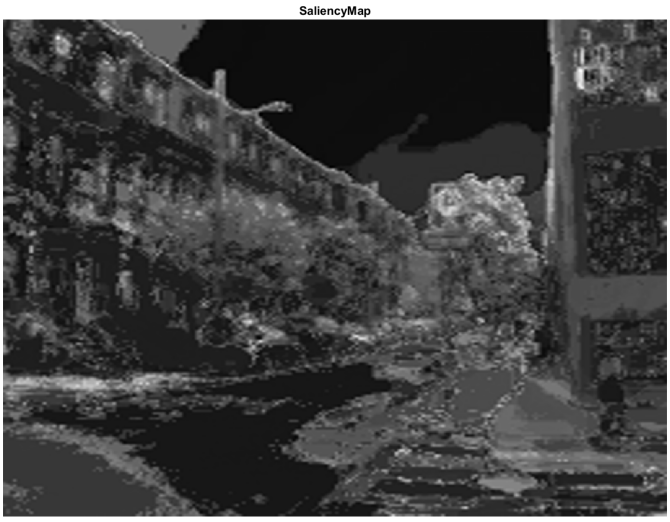
Now we plot features for the following image:

feature 1:



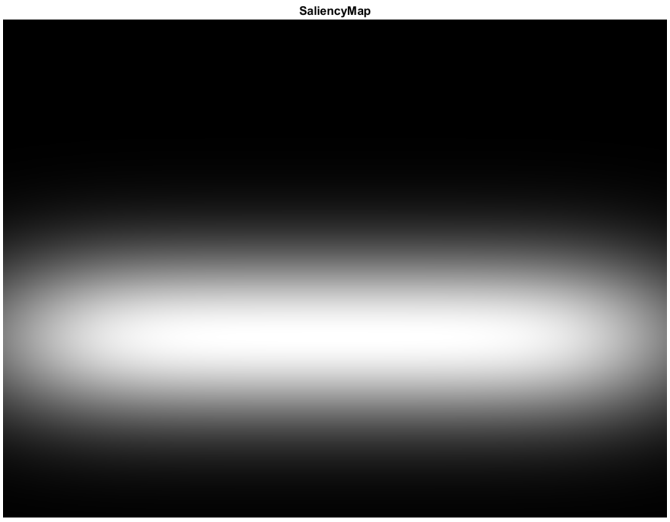
feature 2:

feature 3:

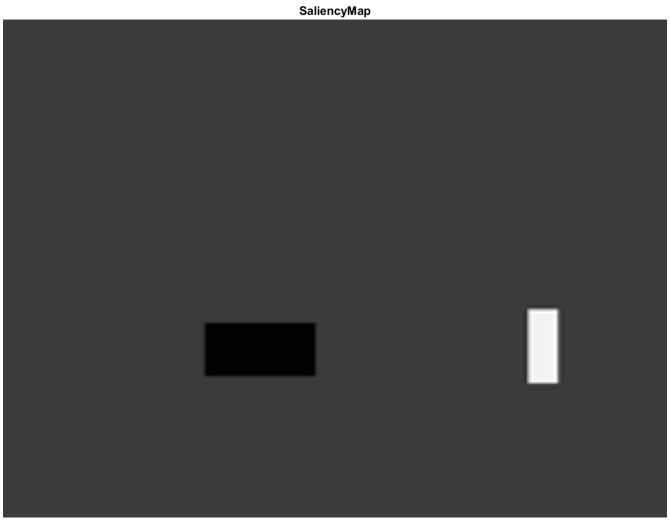


feature 4:

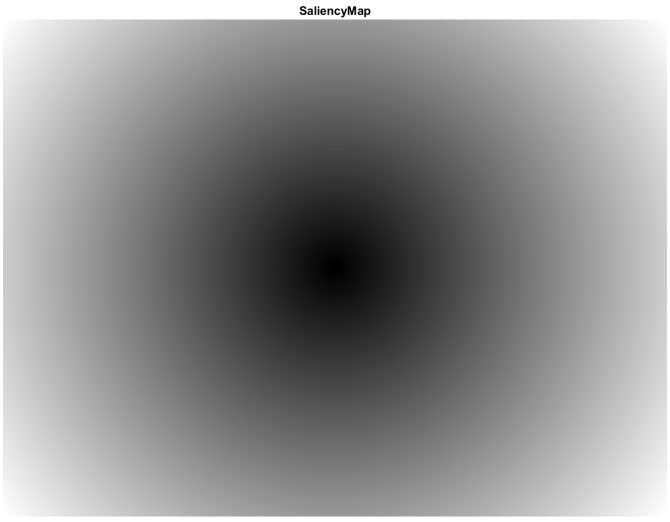
feature 5:



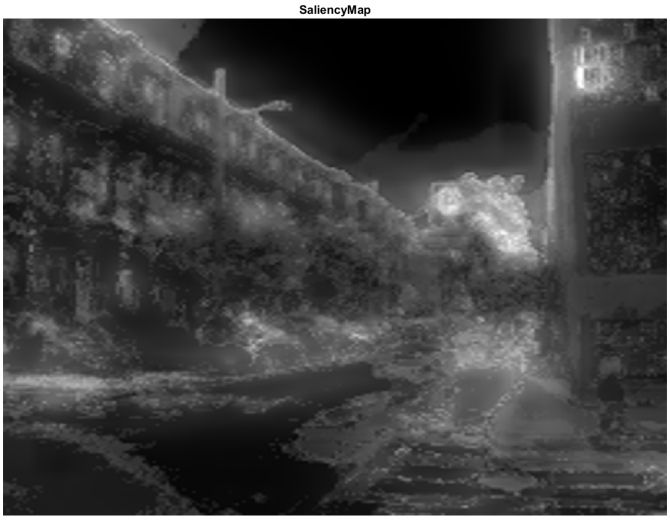
feature 6:



feature 7:

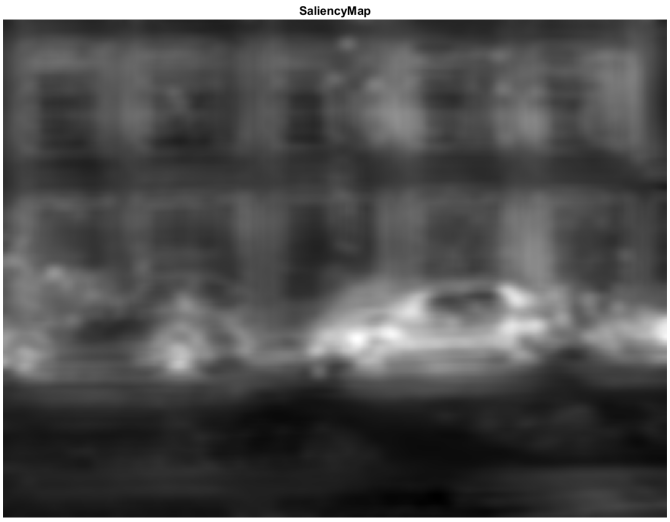


All features :

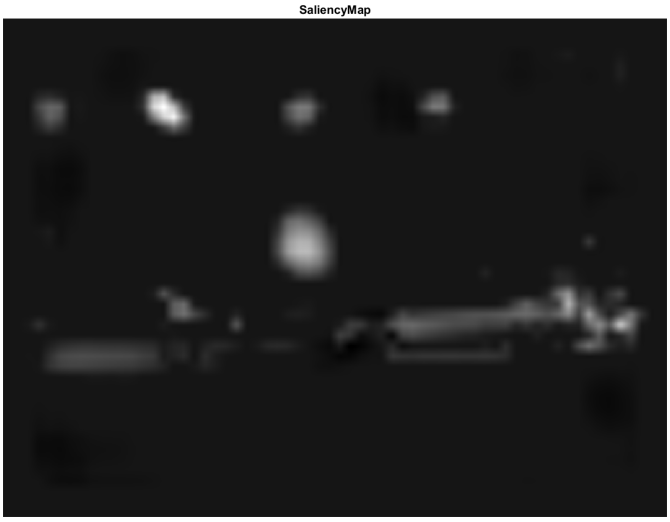


For the following image:

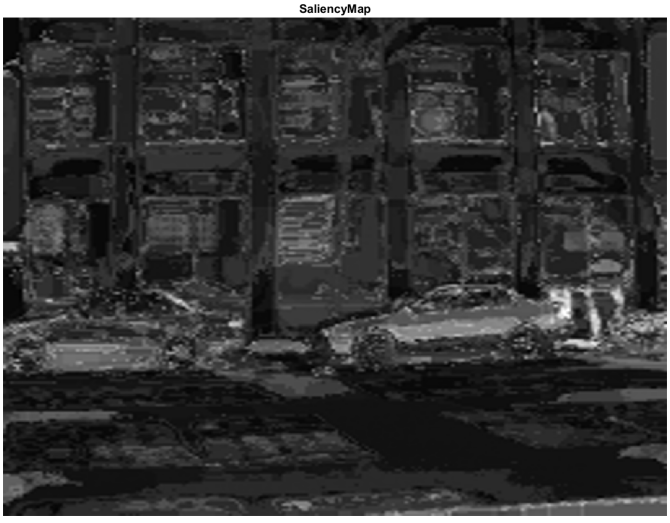
The results are as below:
feature 1:



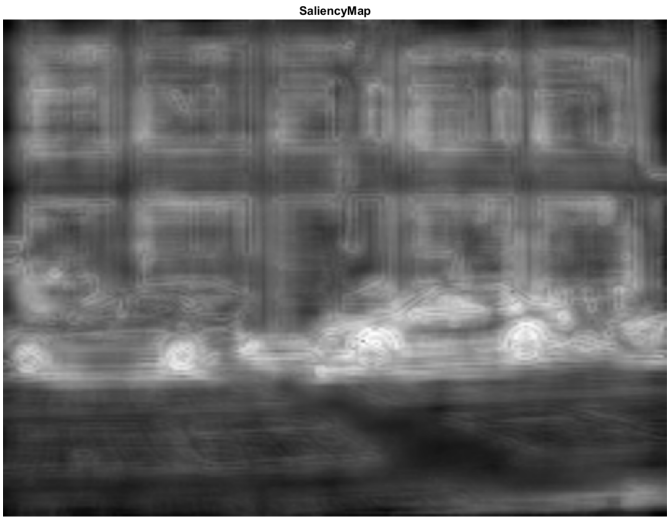
feature 2:



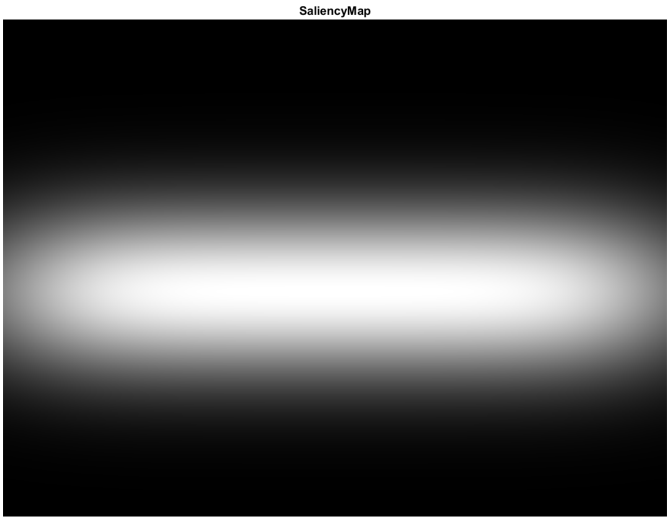
feature 3:



feature 4:

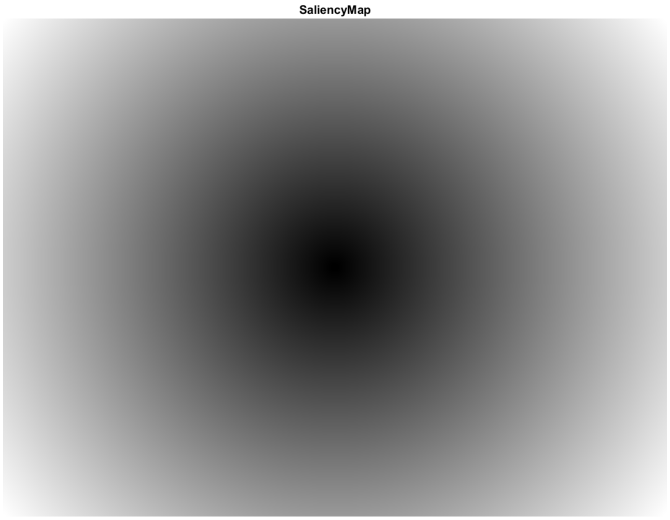


feature 5:

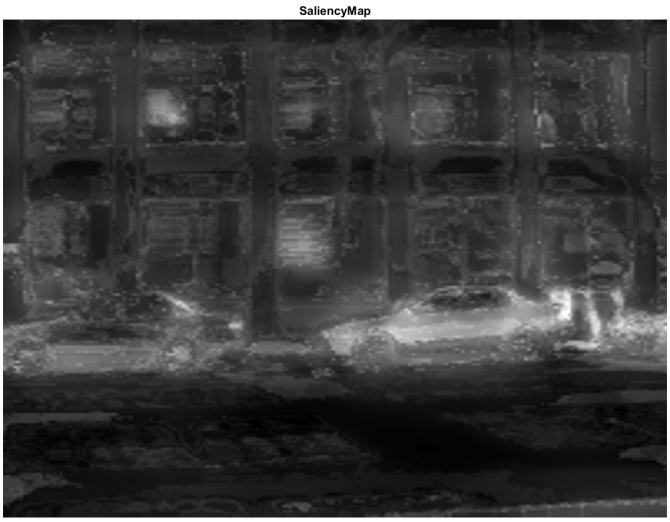


feature 6:

feature 7:



All features :



Feature 1 is about subbands of the steerable pyramids.

Feature 2 is the feature which finds Itti & Koch channels. In the Itti and Koch model, the computation of saliency is based on the responses of three layers of neurons, which are often referred to as "channels":

1. Color channels: These neurons respond to color information in the image, and are sensitive to both the hue and saturation of image regions.

2. Intensity channels: These neurons respond to differences in luminance or brightness between adjacent image regions.

3. Orientation channels: These neurons respond to edges and contours in the image, and are selective for different orientations.

The output of the three channels is combined to form a saliency map, which represents the probability that each pixel in the image is the object of attention. The map highlights the most salient regions of the image, which can be used to guide further processing, such as object recognition or tracking.

Feature 3 is about finding probabilities of colors at blur level.

Feature 4 is about finding Torralba saliency. The Torralba saliency model builds on the theory that the visual system evolved to facilitate efficient processing of complex natural scenes, where objects of interest are often embedded in complex backgrounds. The model follows a two-stage architecture where there is an early feature extraction stage followed by a contextual processing stage.

In the feature extraction stage, image features are extracted at multiple spatial scales and orientations, similar to the Itti and Koch model. However, unlike the Itti and Koch model, the Torralba saliency model explicitly considers the relationship between the target object and its context in the image. In the contextual processing stage, the model uses a statistical measure derived from the image statistics to evaluate the saliency of the target object relative to the context of the image. This measure reflects the probability that the target object is part of a meaningful pattern in the image, and therefore should be attended to.

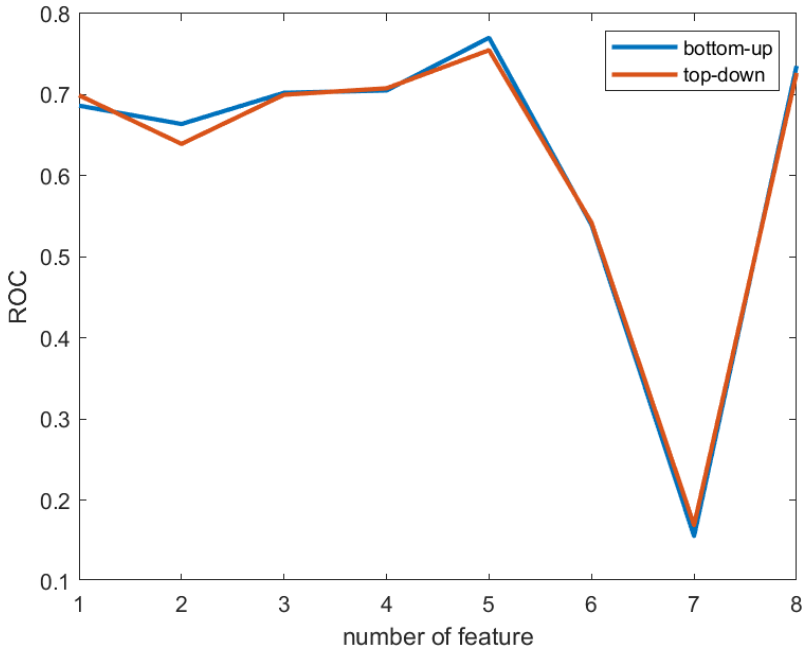
Feature 5 is about finding horizon patterns.

Feature 6 is about finding pattern of cars and people in the image.

Feature 7 is about finding the distance to the center of image.

1 part 3:

We calculate mean of ROC across all users and all images for bottom-up and top-down:



For each feature if ROC is greater for bottom-up, the feature is the effect of bottom-up and vice versa. I have ran the code for four hours and I think the result is not OK.