In The Name Of God

HW08

Advanced Neuroscience

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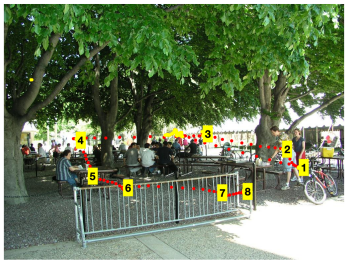
97102099

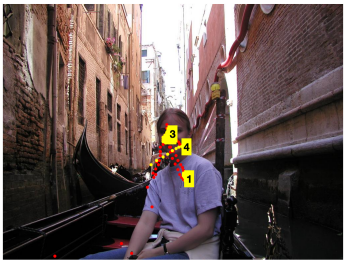
■ Part1 - Eye tracking database

□ Single Person

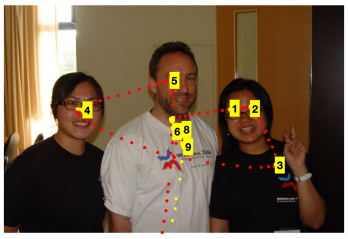
(a) Sample 1



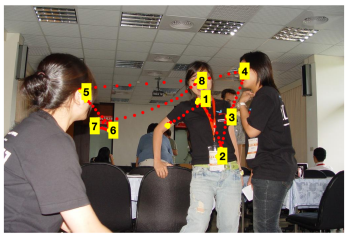
(b) Sample 2



(c) Sample 3



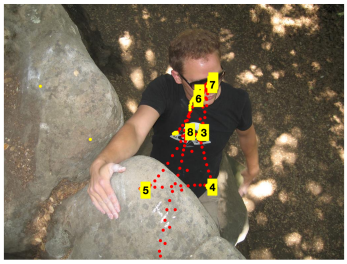
(d) Sample 4



(e) Sample 5

(f) Sample 6

(g) Sample 7

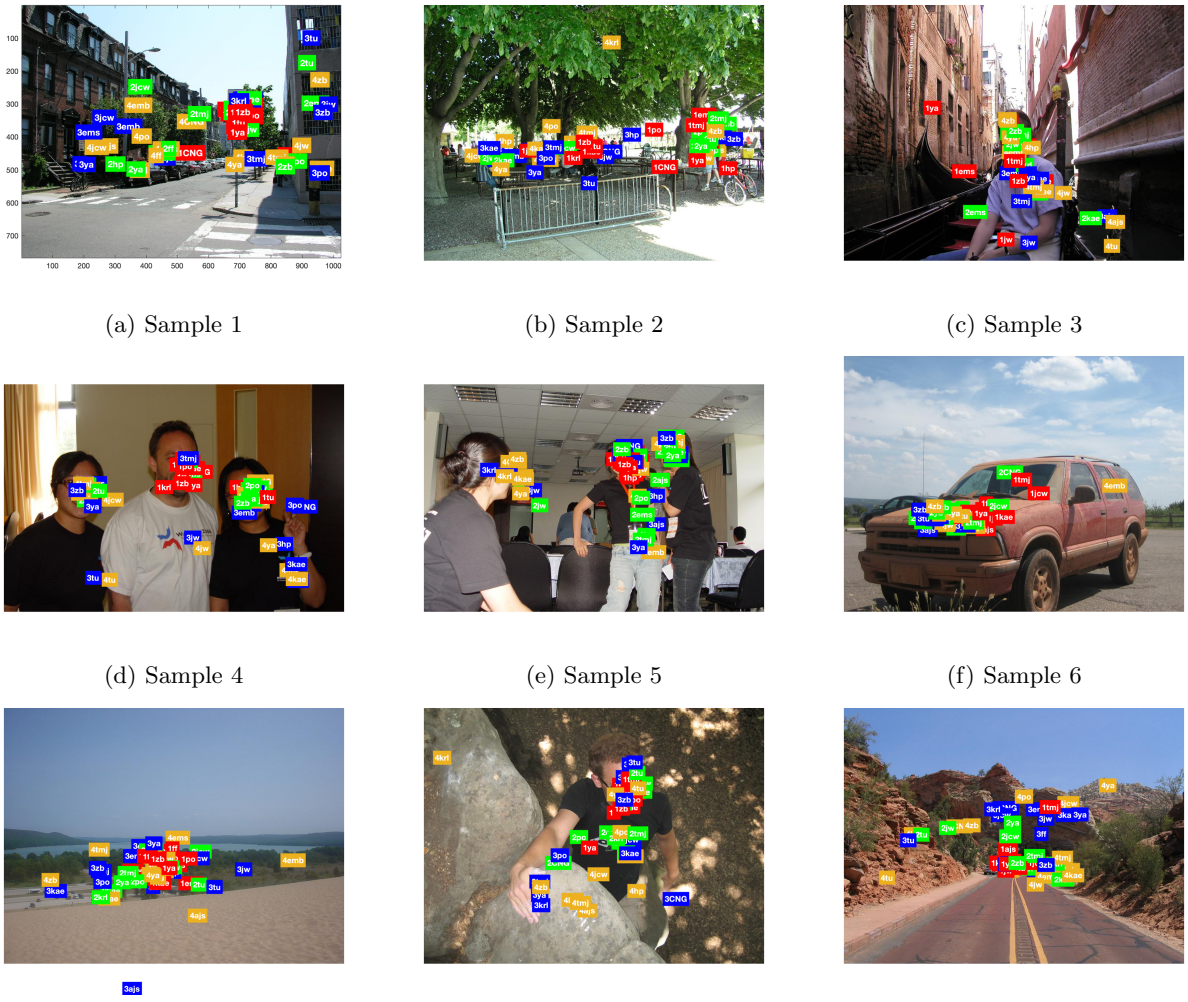


(h) Sample 8

(i) Sample 9

Figure 1: Sample images with eye path plotted as red points (Subject hp)

□ Multiple Persons



(a) Sample 1 (b) Sample 2 (c) Sample 3

(d) Sample 4 (e) Sample 5 (f) Sample 6

(g) Sample 7 (h) Sample 8 (i) Sample 9

Figure 2: Sample images with saccade positions (Subjects ya, po, kae, jcw, tmj, krl, CNG, tu) - Same colors indicate same saccade time for different subjects

Figure 2 shows the eye positions of different subjects on some sample images.

■ Part2 - Saliency Model

The saliency map is synthesized using three different feature groups: low-level, mid-level, and high-level features. The used function on the simulation extracts each set of these features and added them together in order to make the saliency map.

Each feature is explained shortly:

- *Low-Level*

  - **Subband**: Subband features represent frequency features like the mean of the image, edges, and frequent patterns.

  - **Itti**: Itti features consist of orientation, color, and intensity of the image.

  - **Color**: Color features consist of red, green, and blue color probabilities in the image.

  - **Torralba**: Torralba saliency map is also calculated from the subband pyramids of the image. So, it should be similar to the subband.

  - **Distance from Center**: When humans take pictures, they naturally frame an object of interest near the center of the image. For this reason, distance from the center is included as a feature.

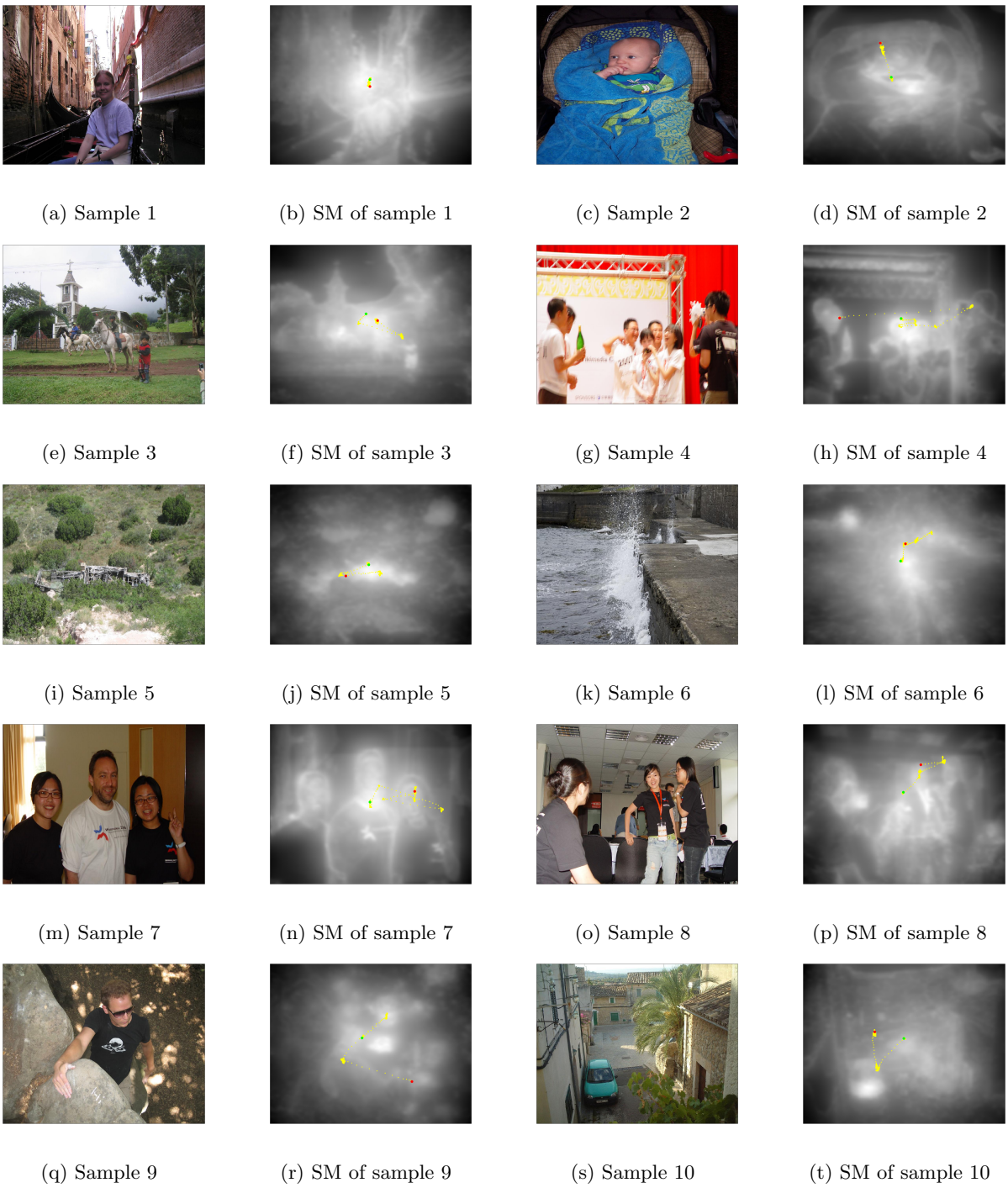
- *Mid-Level*

  - **Horizon**: It finds the possible horizon in the image and puts a gaussian area around the horizon.

- *High-Level*

  - **Object**: Puts A white rectangle in the places of the faces, cars, and people

□ Eye Positions on Saliency Maps



(a) Sample 1 (b) SM of sample 1 (c) Sample 2 (d) SM of sample 2

(e) Sample 3 (f) SM of sample 3 (g) Sample 4 (h) SM of sample 4

(i) Sample 5 (j) SM of sample 5 (k) Sample 6 (l) SM of sample 6

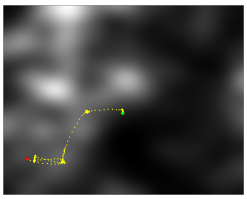
(m) Sample 7 (n) SM of sample 7 (o) Sample 8 (p) SM of sample 8

(q) Sample 9 (r) SM of sample 9 (s) Sample 10 (t) SM of sample 10

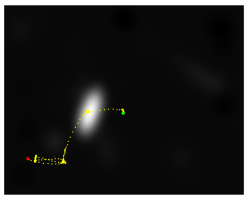
Figure 3: Sample images and their saliency maps with eye path plotted as yellow points (subject hp). The green dot is the initial eye location and the red dot is the last eye location.

□ Different Saliency Maps

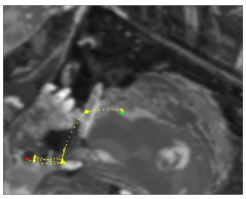
(a) Sample Image



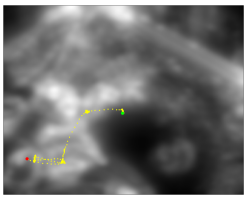
(b) Subband



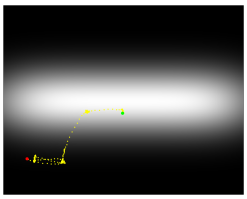
(c) Itti



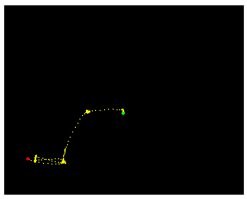
(d) Color



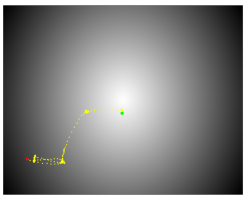
(e) Torralba



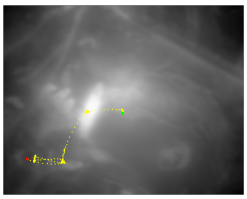
(f) Horizon



(g) Object



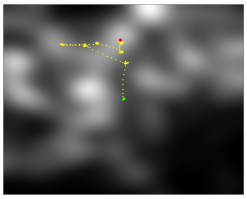
(h) Center



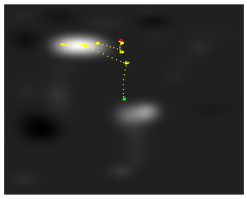
(i) All of the features

Figure 4: Sample Image 1 with saliency map. The saliency map for different features is made by equalizing all of the other weights instead of its weight in the model to zero. The green dot is the initial eye location and the red dot is the last eye location.

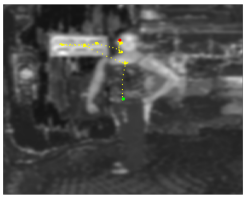
(a) Sample Image



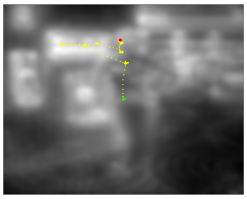
(b) Subband



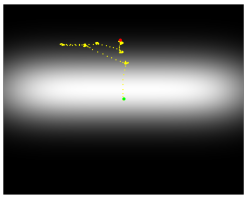
(c) Itti



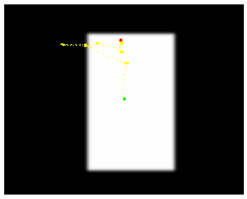
(d) Color



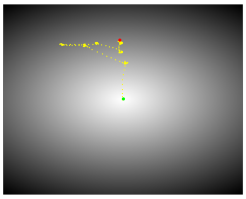
(e) Torralba



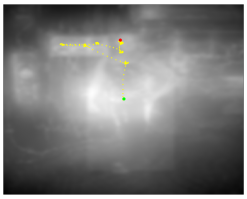
(f) Horizon



(g) Object



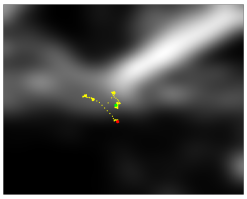
(h) Center



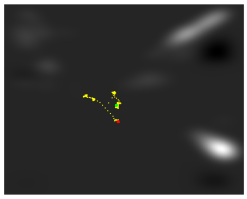
(i) All of the features

Figure 5: Sample Image 2 with saliency map. The saliency map for different features is made by equalizing all of the other weights instead of its weight in the model to zero. The green dot is the initial eye location and the red dot is the last eye location.

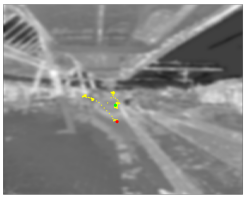
(a) Sample Image



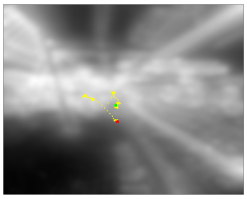
(b) Subband



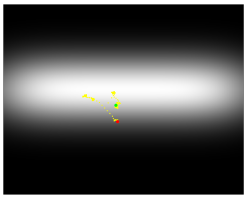
(c) Itti



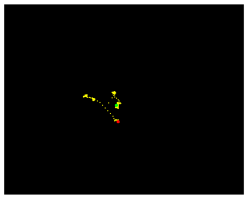
(d) Color



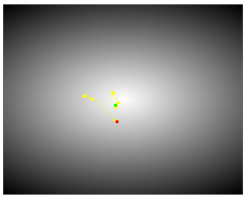
(e) Torralba



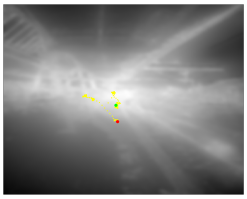
(f) Horizon



(g) Object



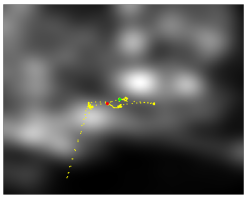
(h) Center



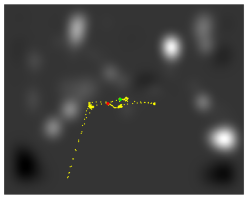
(i) All of the features

Figure 6: Sample Image 3 with saliency map. The saliency map for different features is made by equalizing all of the other weights instead of its weight in the model to zero. The green dot is the initial eye location and the red dot is the last eye location.

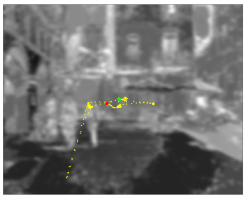
(a) Sample Image



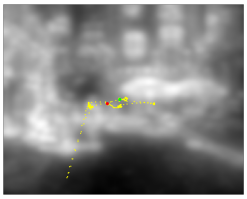
(b) Subband



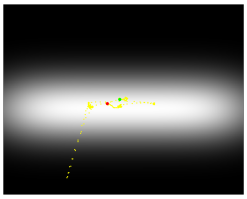
(c) Itti



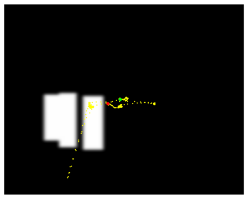
(d) Color



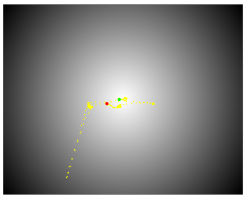
(e) Torralba



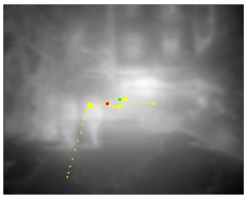
(f) Horizon



(g) Object



(h) Center



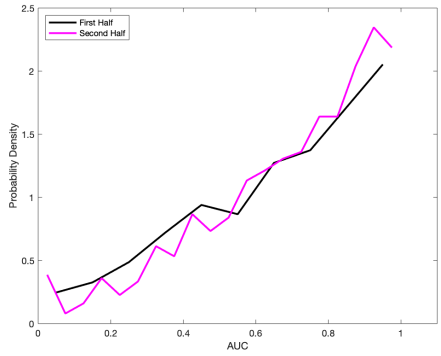
(i) All of the features

Figure 7: Sample Image 4 with saliency map. The saliency map for different features is made by equalizing all of the other weights instead of its weight in the model to zero. The green dot is the initial eye location and the red dot is the last eye location.

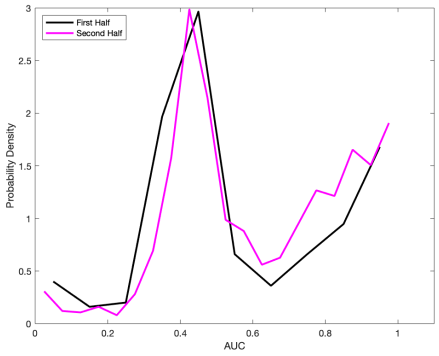
As can be seen in Figures 4, 5, 6, and 7 because the fixation point is at the center eye position always starts from the center of the image. Then, if there are faces in the image, the subjects will mostly first look at the faces and then go for other details. So, it is noteworthy to mention that the subjects will first inspect the high-level features (faces, objects, and ...) and then inspect the details and low-level features.

■ Part3 - Comparing Saliency Maps to Fixations

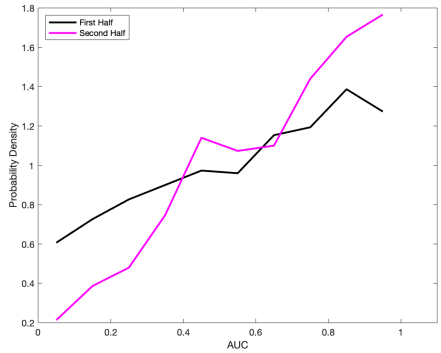
□ Presence of only one feature



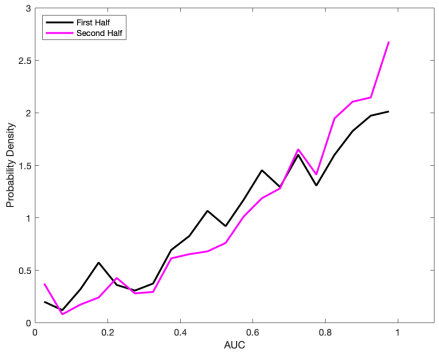
(a) Subband



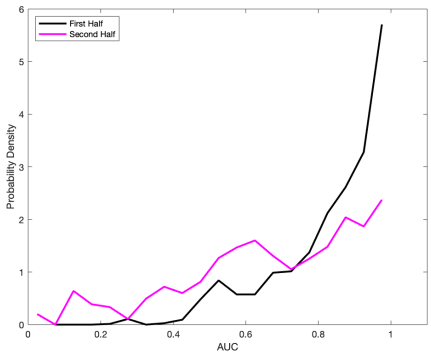
(b) Itti



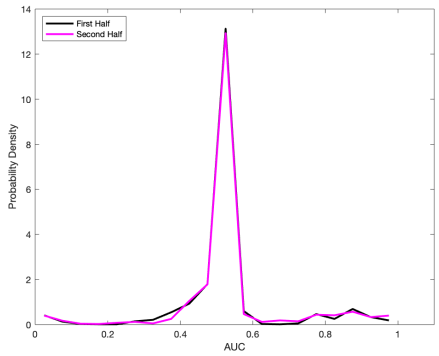
(c) Color



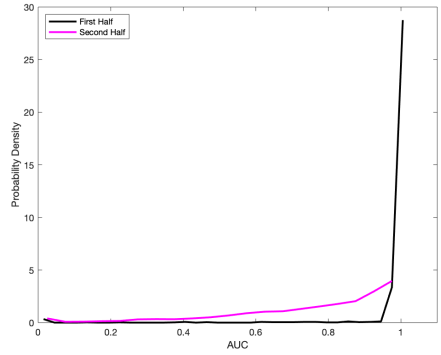
(d) Torralba



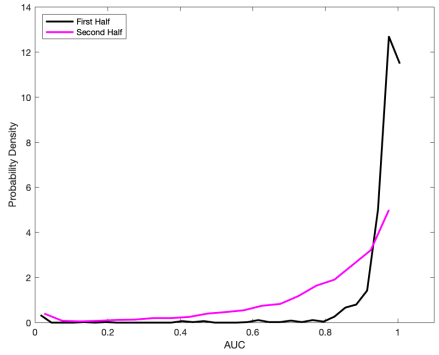
(e) Horizon



(f) Object



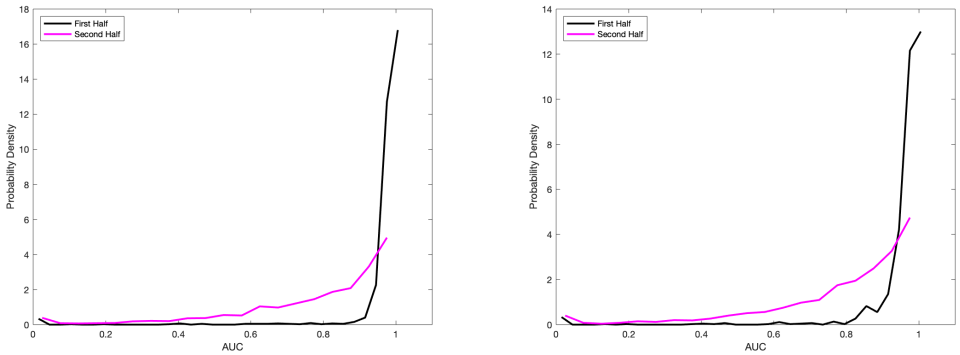
(g) Center



(h) All of the features

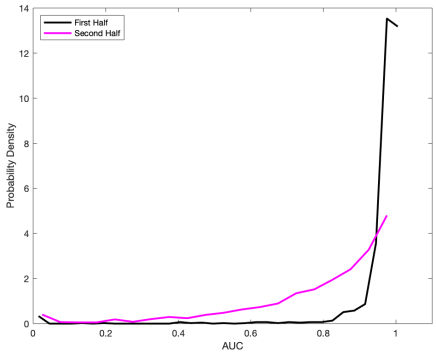
Figure 8: PDF of AUC scores for different features between saliency maps and first 0.2 seconds of the eye path

□ Absence of only one feature

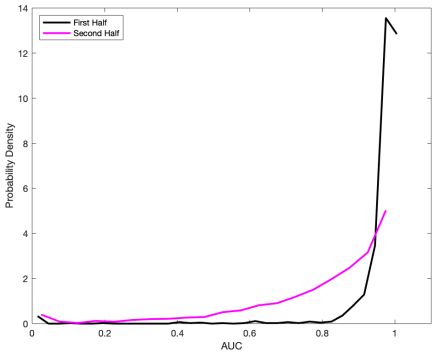


(a) Subband

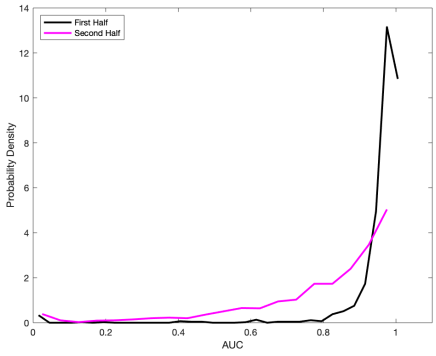
(b) Itti



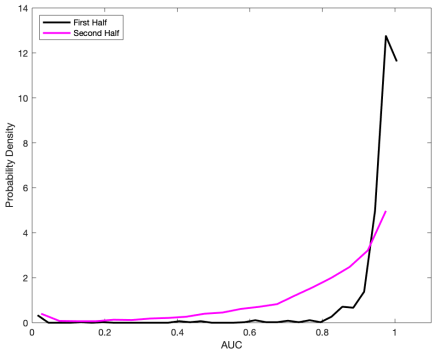
(c) Color



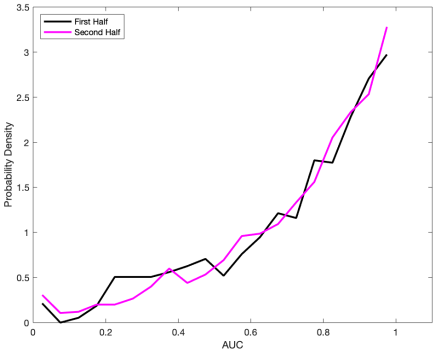
(d) Torralba



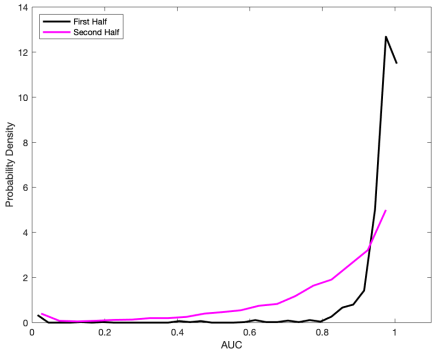
(e) Horizon



(f) Object



(g) Center



(h) All of the features

Figure 9: PDF of AUC scores for different features between saliency maps and first 0.2 seconds of the eye path

PDFs in Figures 8 and 9 are made using data os all 15 subjects and 100 randomly chosen images from all 1000 images. Also, the first 0.2 seconds of eye locations are used to calculate the AUCs.
As I expect, the distance from the center can encode the eye positions very well, because the subjects will mostly look at the center of the images. Also, as it is obvious in the Figures, most of the features only can encode eye positions in the first 0.2 of the task because after 1.5 seconds, the subject will look at different options and the calculated features can't model it.