Advance Neuroscience HW 8

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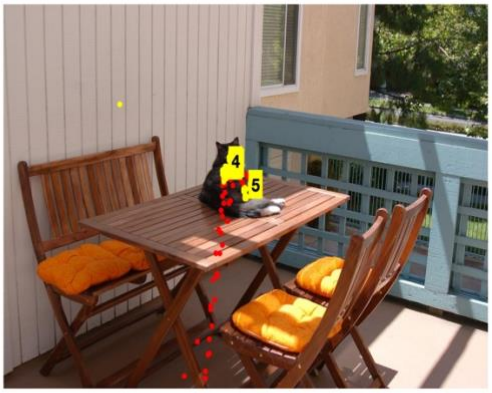
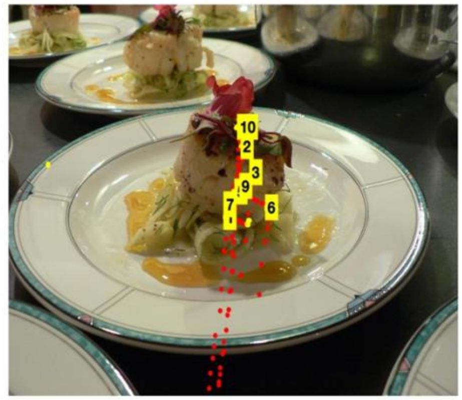
1. Eye Tracking Database

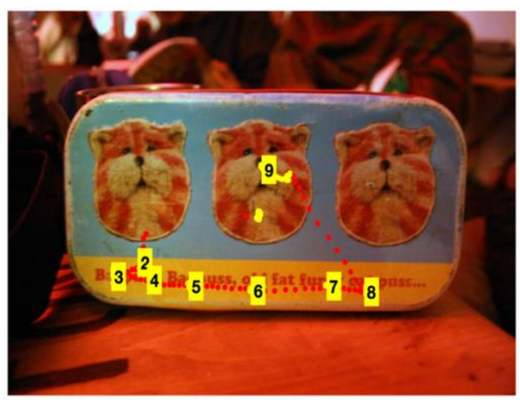
In plot one, we can see the fixation point and in plot two we can see the fixation point for some users:

Plot one(fixation point):

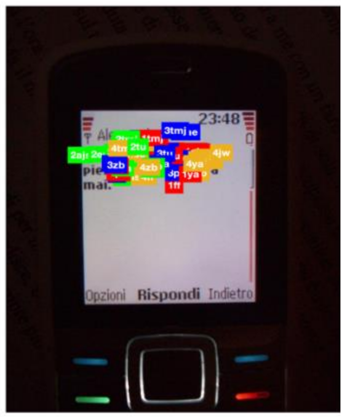


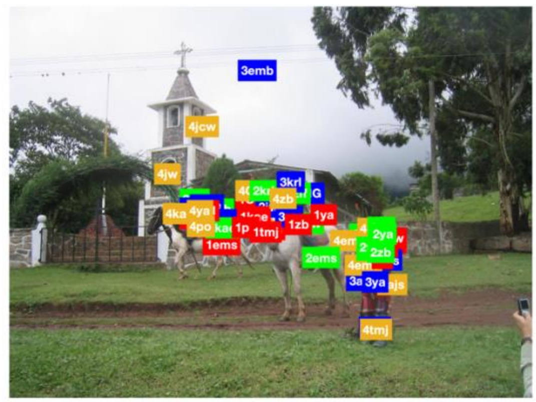


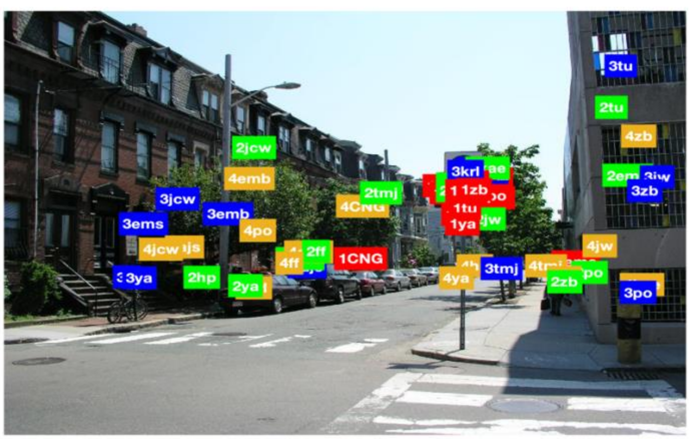

23:48
Alessandro Randi
Opzioni
Rispondi
Indietro

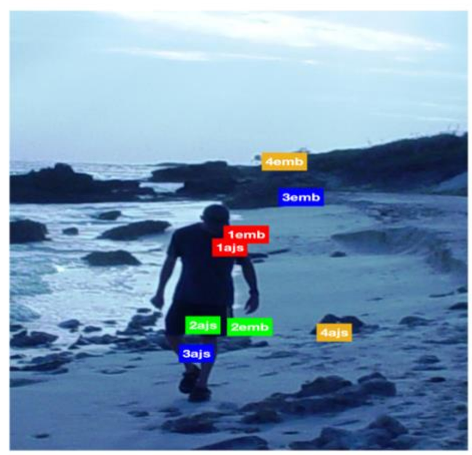


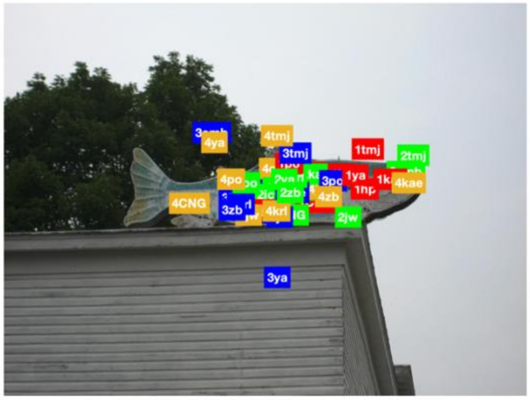
Plot two(fixation for users):

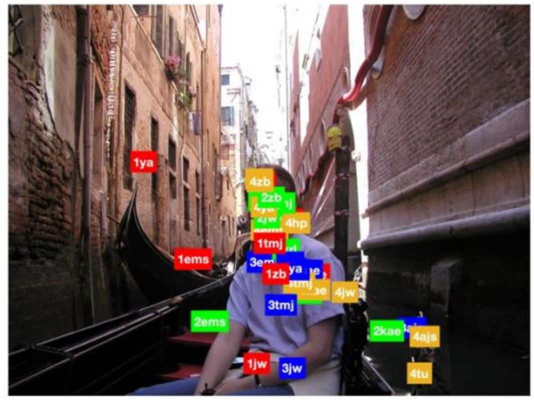












2. Saliency Model

1. **Subband Features**: These are features obtained from wavelet transforms of the image. A wavelet transform breaks down an image into different frequency components, and studies each component with a resolution that matches its scale. The pyramid subbands at four orientations and three scales refer to different levels of resolution and orientation in the image. This can help recognize edges and other low-level features in the image.

2. **Itti Features**: Named after Laurent Itti, who proposed a computational model of visual attention, these features are used to calculate "bottom-up" saliency, or the degree to which particular areas of an image stand out relative to their surroundings. Itti Features include intensity (how bright the area is), orientation (the angle of the lines in the area), and color contrast (how different the area's color is from its surroundings).

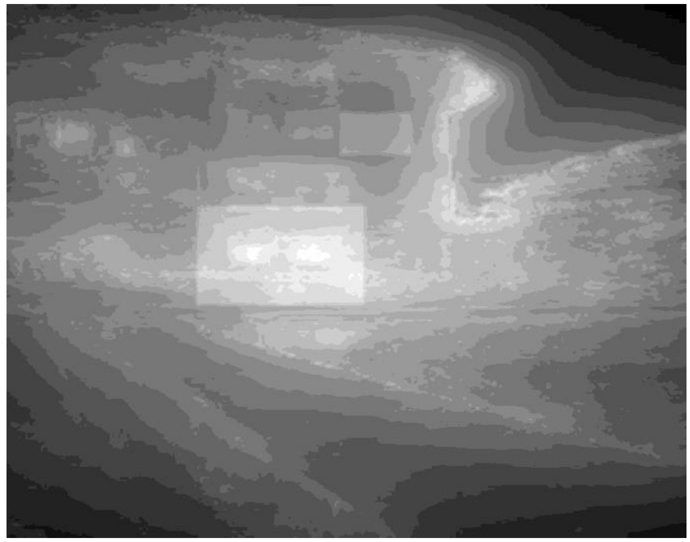
3. **Color Features**: These are relatively straightforward and consist of the values of Red, Green, and Blue (RGB) channels in the image, as well as the probabilities of these channels. These features help to understand the color properties of the image.

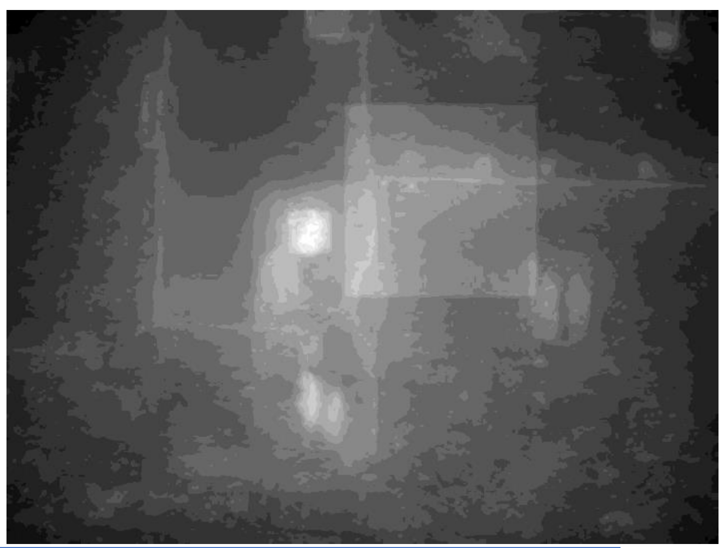
4. **Torralba Saliency**: Named after Antonio Torralba, this is a type of saliency model which also uses wavelet transform features. Torralba's model is based on the concept of center-surround differences at multiple scales and orientations in the wavelet transformed space.

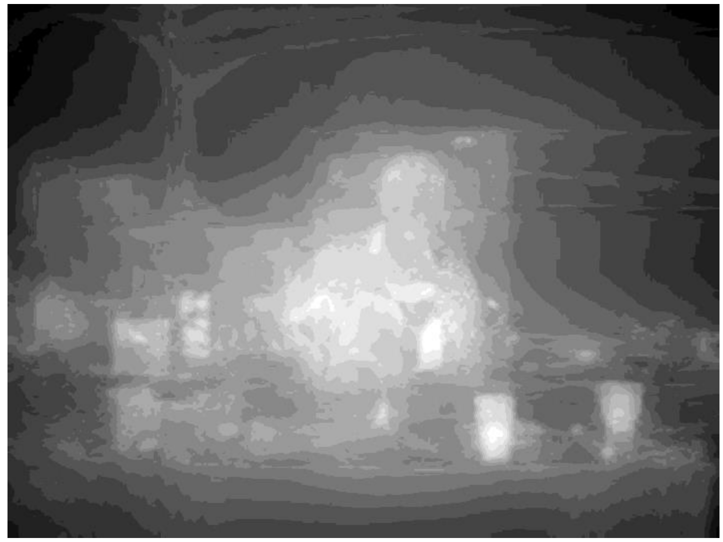
5. **Horizon Features**: These are mid-level features that capture the "horizon" or the division between ground and sky in an image. Because most objects of interest tend to rest on the ground, understanding the horizon line can be helpful for tasks like object recognition and scene understanding.
6. **Object Features**: These are high-level features that involve specific objects of interest within an image, such as cars, faces, and persons. These features often require more sophisticated recognition algorithms, possibly even deep learning.
7. **Center Prior**: This refers to the concept in visual attention that humans are more likely to pay attention to the center of an image. The distance of each pixel to the center of the image is a high-level feature that can be used to predict where a human viewer is likely to focus their attention.

Each of these types of features can be important for different image processing tasks, and they can often be combined to create more robust and versatile systems. For example, low-level features like subband and color features can be used to quickly filter out uninteresting parts of an image, while high-level features like object features and the center prior can be used to zero in on the most important parts.

Some images with low-level features like Subband Features:







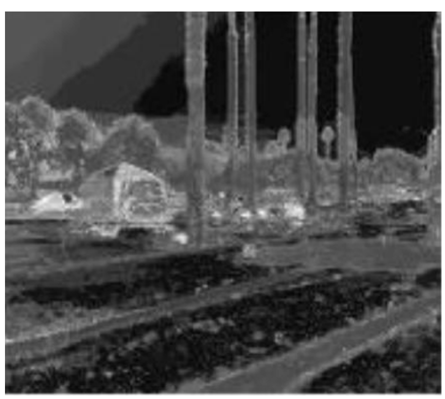
Some high-level feature:

Some image with all features:

Feature 1:

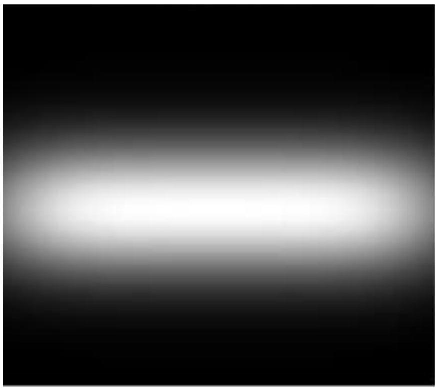
Feature 2:

Feature 3:



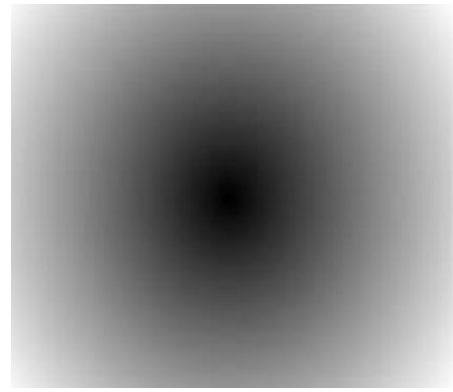
Feature 4:

Feature 5:



Feature 6:

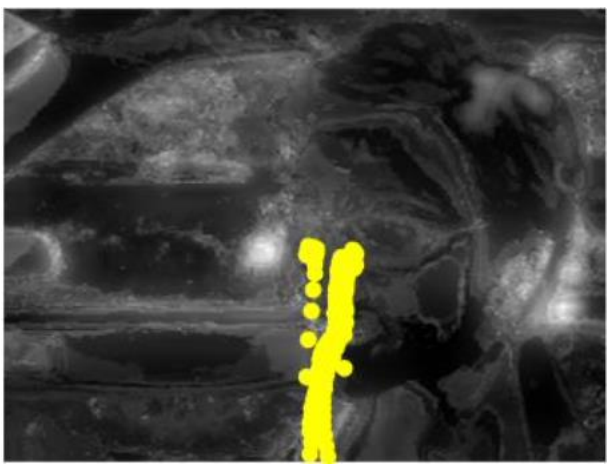
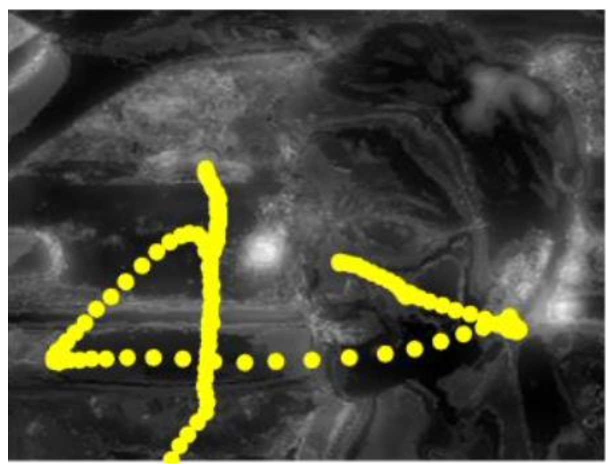
Feature 7:



3. Compare Saliency Maps to Fixations

Eye location during the first and second half of looking:

First second

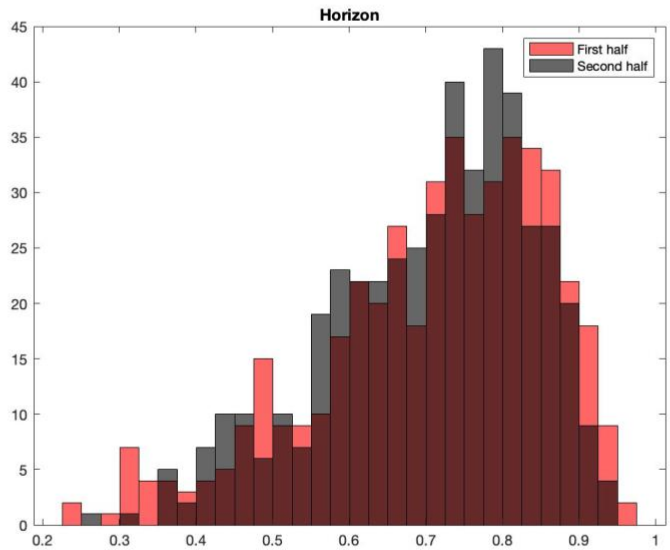



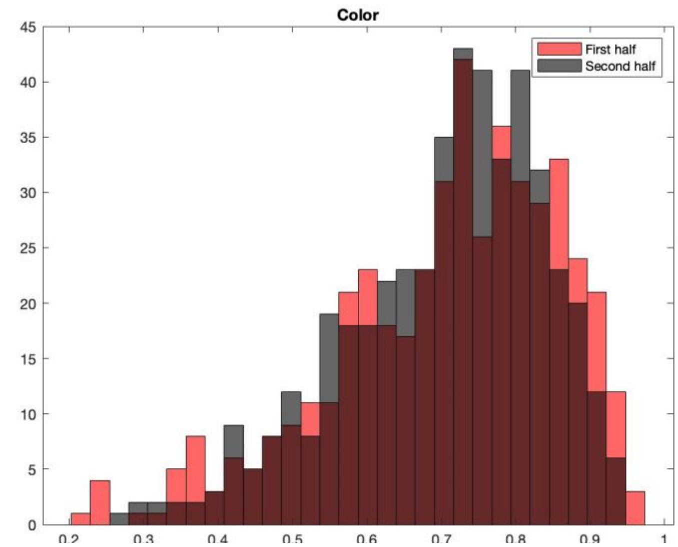
I didn’t plot the eye’s location for other features, because it wasn’t obvious.

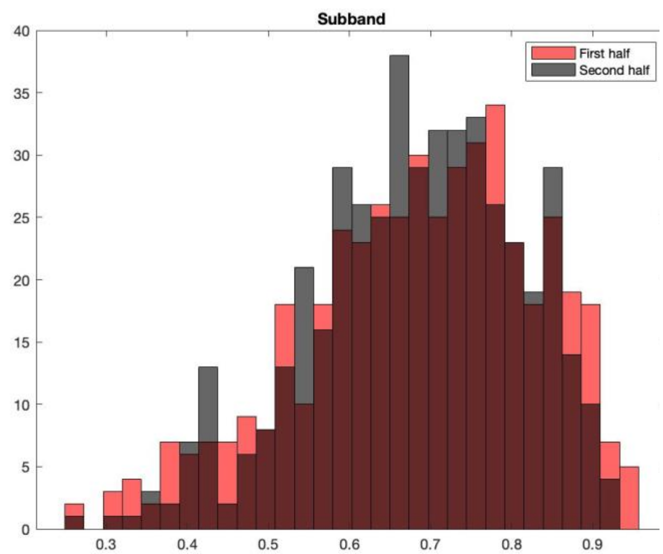
The ultimate goal was to evaluate the effectiveness of different types of features in predicting where people look in an image. Here's an explanation of the process:

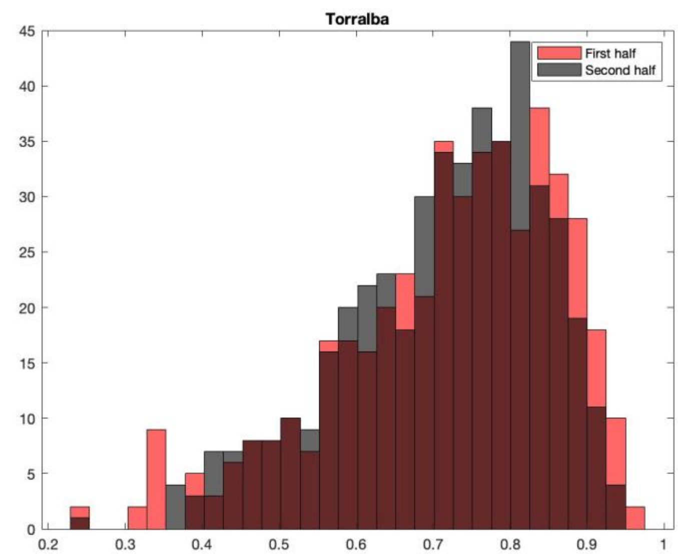
1. This means that for each image, eye movement data were collected from different individuals. This data typically includes information about where and when the person looked at different parts of the image.
2. **Calculated the ROC for Each Saliency Map Derived from Images**: A saliency map is a representation of an image that highlights the areas likely to attract human attention or "salient" areas. In this case, saliency maps were derived from 1003 different images, and the Receiver Operating Characteristic (ROC) was calculated for each. The ROC is a measure of how well a binary classifier can distinguish between true and false positives, so in this case, it would be used to assess how well the saliency map predicts where people actually look in the image.
3. **Seven Saliency Maps By Excluding Just One Feature for Each Image**: To understand the impact of each feature on the saliency map, seven different versions of the saliency map were created for each image, each time excluding one of the seven features. This allows the researchers to see how important each feature is for the overall prediction of where people look in the image.
4. **Two Trials for Each Image Used Separately to Indicate the Bottom-Up and Top-Down Effect of Each Feature**: Here, each image was likely shown to the subjects twice for a duration of half seconds each time. This was done to evaluate both the "bottom-up" and "top-down" effects of each feature. Bottom-up effects are driven by the stimulus itself, while top-down effects are driven by the viewer's knowledge and expectations.

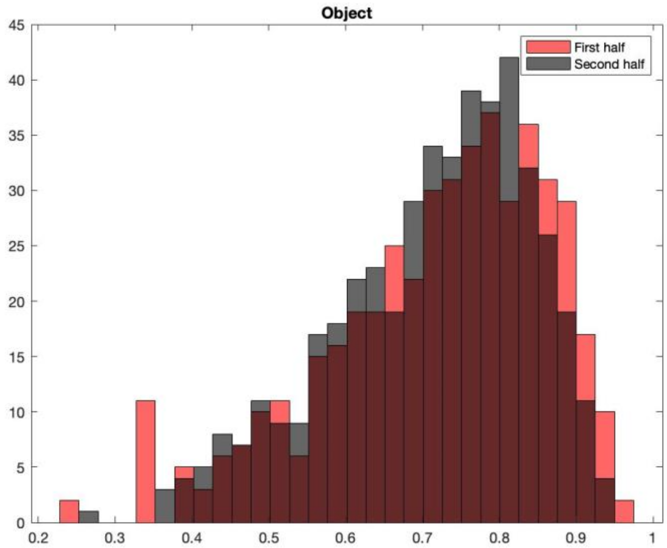
This is the result:

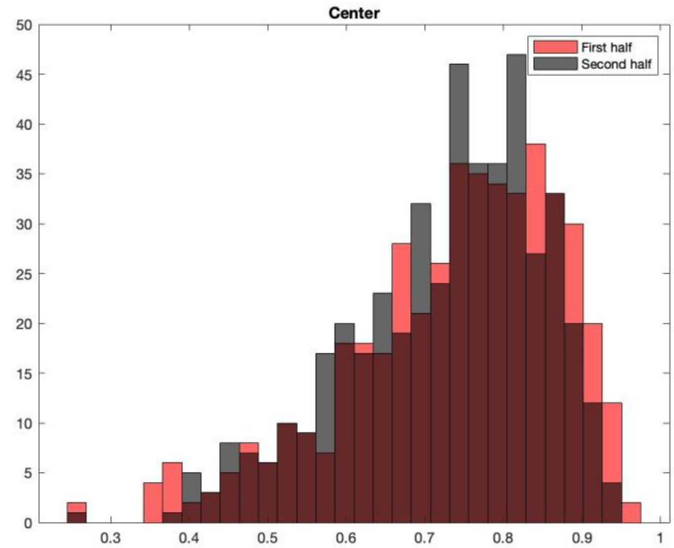


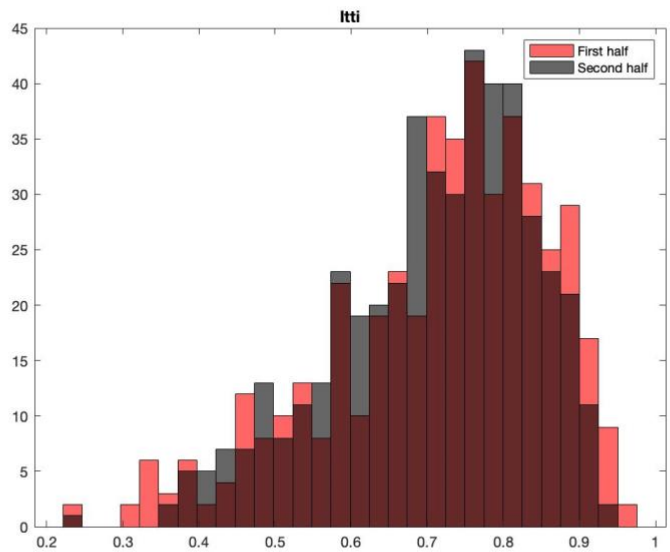












The list of features (SubbandFeatures, ColorFeatures, etc.) is ranked according to their importance or contribution to the model's performance. The most important feature (SubbandFeatures in this case) contributes the most to the model's performance, and removing it causes the most significant decrease in the ROC.