

Title: Feasibility of a Saliency Map for a 49-channel Retinal Prosthesis

Hiroyuki Kanda¹, Takaomi Kanda², Yukie Nagai², Minoru Asada², Takashi Fujikado¹

1. Department of Applied Visual Science, Graduate School of Medicine, Osaka University, Japan

2. Department of Adaptive Machine Systems, Graduate School of Engineering, Osaka University, Japan

Objective

To evaluate the feasibility of a saliency map (Itti et al. 1998) for a 49-channel retinal prosthesis, we constructed a retinal prosthesis simulator system and measured the accuracy of a localization test in two different image processing algorithms: a saliency map and a conventional model (brightness map).

Methods

The simulator system comprised a head-mounted camera, a laptop computer, and a head-mounted display (HMZ-T3, Sony, Japan). An image was captured using the head-mounted camera and was converted into a 7×7 -pixel image by each of the algorithms using our custom-made software. The 7×7 -pixel image was then projected onto the head-mounted display.

To compare the characteristics of the two algorithms, we recruited five healthy volunteers aged 21 - 38. All subjects wore the simulator system and took the localization test for both algorithms. For the localization test, subjects were instructed to point at the center of the visual target on a touch panel display, placed at 40 cm from the subject. The target position and the color combination of the target/background (black/white, white/black, green/red, and red/green) were randomly changed. In each trial, we recorded the error distances from the center of the target to the position indicated by the subject. The ANOVA was used to compare the baseline characteristics of the error distances for the four the target/background color combinations.

Results

There were significant differences in the characteristics of the error distances between the color combinations ($p < 0.01$, ANOVA) for the brightness map. In contrast, there were no significant differences for the saliency map ($p = 0.91$, ANOVA).

The mean error distances for the saliency map were significantly smaller than those for the brightness map ($p < 0.05$, paired t-test), when the color combination was green/red or red/green.

Conclusions

The results of the present study suggest that the recognition rate of visual objects can be maintained using a saliency map. These findings demonstrate the feasibility of the saliency map for the 49-channel retinal prosthesis.