論 文 の 内 容 の 要 旨

論文題目 Gaze Analysis and Visual Saliency Prediction Across Different Age Groups
(年齢の異なるグループに渡る視線の解析と視覚的顕著性の予測)

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Visual attention studies in computer vision research discuss models that have been developed to simulate elements of the scene that are likely to attract human attention. In other words, given an image the model computes a saliency map that encode for conspicuity at every location. These models have wide applicability towards target detection in natural images, advertisement designing, image re-targeting and editing.

The computational models developed so far have considered only adult observers and do not generalize well to the observers of different age groups, i.e. the age-related differences in scene viewing behavior has not been considered while computing saliency.

This dissertation proposes a framework to quantitatively analyze the age-related differences in gaze landings during scene viewing and use the recommendations from this analysis to adopt existing models to the observer's age.

To make the contribution easily comprehensible, the dissertation is divided in three parts:

Analysis: As a part of this section we proposed framework to analyze age-impact on two different attributes of fixation; fixation location and duration.

1. **Fixation location based analysis:** We developed the measures to quantify four aspects of scene viewing behavior: exploratiVeness, agreement in explored locations within and between age groups, depth bias, and center bias. Each of these contributes to the detailed understanding of how gaze distribution for scene viewing changes with age.
2. **Fixation duration based analysis:** We check if all the fixations have same role in free viewing? To answer this question the proposed study classified the fixations in ambient and focal for all the age groups based on the fixation duration and saccade amplitude. This is then followed by developing metrics for investigating age-related changes in ambient and focal visual processing mode.

Age-adapted Saliency Model: The results of the analysis section are leveraged to develop age-adapted saliency model that can predict salient locations for observers of different age groups. The differences in viewing behavior of the observers in terms of their tendencies to exploit different level of image details, and apparently different foreground-background tendencies are carefully incorporated into the age-adapted saliency model. The proposed age-adapted saliency models are seen to outperform the existing state-of-the-art saliency models in predicting observer's fixations.

Application: The prior knowledge about age-related differences in scene viewing is used for a novel application of signboard saliency detection in street videos during free viewing and task viewing. Our proposed signboard saliency detection model can predict relative saliencies of the signboard more accurately than the existing models during free viewing and task viewing scenario. Further we also analyze signboard saliency patterns for two age groups: adults and elderly.

The proposed analysis framework and age-adapted saliency model in this dissertation contribute in understanding the age-impact in scene viewing behavior in context of developing an age-adapted saliency models. Our work is strategically beneficial, as most conventional models of visual attention can be easily tuned to age-related changes in scene viewing by following the recommendations of our analysis result.