Generating a Saliency Map with Focus on Different Aspects of Human Visual Attention

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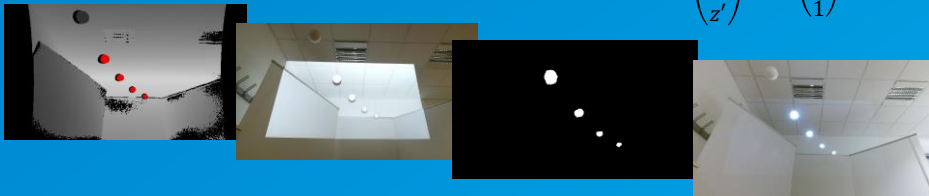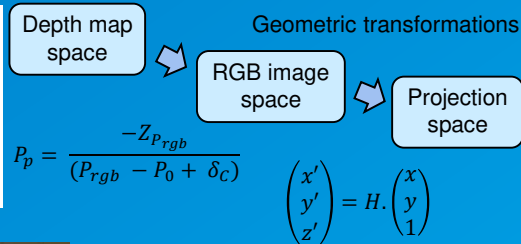FACULTY OF INFORMATICS AND INFORMATION TECHNOLOGIES

Abstract

We introduce a **novel method for conducting user studies** focused on research of the human visual attention **in a real-world environments**. We ignore the specifics of visual attention modelling from the camera perspective and introduce a novel perspective (**the egocentric perspective**) for further research of the human visual attention. The ultimate goal of our novel research approach is to implement our findings from the egocentric perspective in the existing saliency models which are based on the previous research of visual attention from the perspective of a camera.
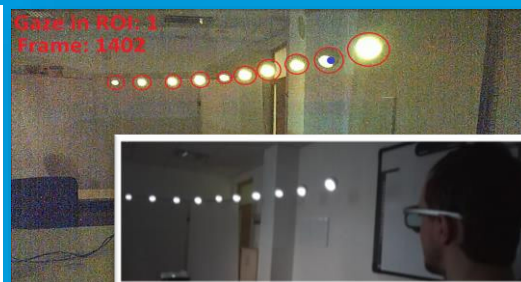
Novel dataset

- **37 participants**
- **Egocentric** perspective
- Projection of changes on the scene:
    - **Concurrency** (2 ROI)
    - Complete **combinations**

Evaluation

- **First fixations** after change
- **Comparison** of ROI with each other
- **ROI depth score** (50% = chance):

$$score' = norm(percentage); \ score' \in \ <0;1>$$
$$score = score' + 0,5$$

Method proposal

- Provide an observer **a real scene**
    - **Project content on ROI**
    - Kinect 2.0, LCD projectors
    - Computer vision

Depth map space → RGB image space → Projection space

Geometric transformations

$$P_p = \frac{-Z_{P_{rgb}}}{(P_{rgb} - P_0 + \delta_C)}$$

$$\begin{pmatrix} x' \\ y' \\ z' \end{pmatrix} = H. \begin{pmatrix} x \\ y \\ 1 \end{pmatrix}$$

Request handling — Data acquisition — Data processing

- Monitor the **visual attention**
    - Mobile **glass eye-tracker** (SMI)
    - SMI **SDK**

- **Evaluate** the dataset
- ROI segmentation & tracking
    - **Highest contrast** regions
    - **Dense** optical **flow** (Farnebäck)
    - **ROI shift** algorithm

$$C(x,y)' = C(x,y) + \vec{v}_{shift}$$

Gaze in ROI: 1
Frame: 1402

Results and evaluation

- **The most salient depth**
- Saliency **decreasing with the distance** from the most salient depth
- **Depth saliency coefficient** – depth-weighting saliency function
- **Outperformed state-of-the-art** models
- Novel and **perspective approach**

Projected content
default | changed

$$y_{t1} = 0.70e^{0.13x} \qquad y_{t2} = 1.82e^{-0.09x}$$

Values: 0.93, 1.03, 1.03, 1.24, 1.15, 1.07, 1.05, 0.91, 0.82, 0.76

Distance from the observer (depth) [m]
Depth saliency coefficient

ROC curve – egocentric dataset
ROC curve – NUS3D dataset
True positive rate
False positive rate
— Our model
– – State-of-the-art model
······· Baseline