University of Münster

Department of Information Systems

Title

Seminar Thesis

in the context of the seminar

More than meets the A-eye: Reflecting Human Vision in Artificial Intelligence

submitted by

Annika Terhörst, Dominik Eitner, Simon Luttmann

Principal Supervisor	Prof. Dr. Christian Grimme
Supervisor	Lucas Stampe, M.Sc. Chair for Data Science: Computational Social Science & Systems Analysis
Student Candidate	Annika Terhörst, Dominik Eitner, Simon Luttmann
Matriculation Number	527050, 503468, ..
Field of Study	Information Systems
Contact Details	annika.terhoerst@uni-muenster.de, deitner@uni-muenster.de, sluttman@uni-muenster.de
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2.1 Image Segmentation

Image segmentation is the process of dividing an image into different regions by grouping pixels and assigning each pixel a label. This step is an important part of many computer vision applications, such as detecting tumors in medical images or identifying pedestrians in autonomous driving. According to human visual perception, the identified regions are non-overlapping and meaningful - however, defining what exactly counts as a "meaningful" region can be difficult, as human perception is subjective and object boundaries are not always clear (Yu et al., 2023).

There are three common types of segmentation:

Semantic segmentation assigns every pixel in an image a semantic label, such as "car" or "sky". *Instance segmentation* separates individual objects within the same class, for example distinguishing several people in one image. *Panoptic segmentation* combines both approaches by providing pixel-wise class labels and also identifying individual object instances.

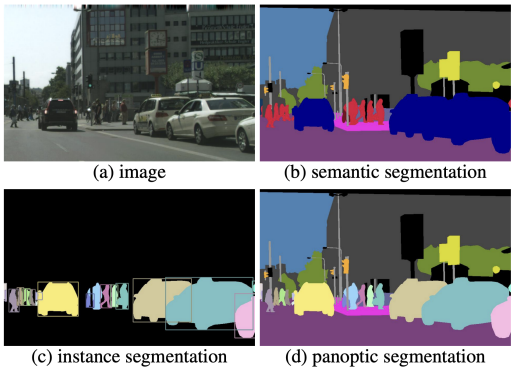


Figure 1 Types of image segmentation by Kirillov et al., 2019

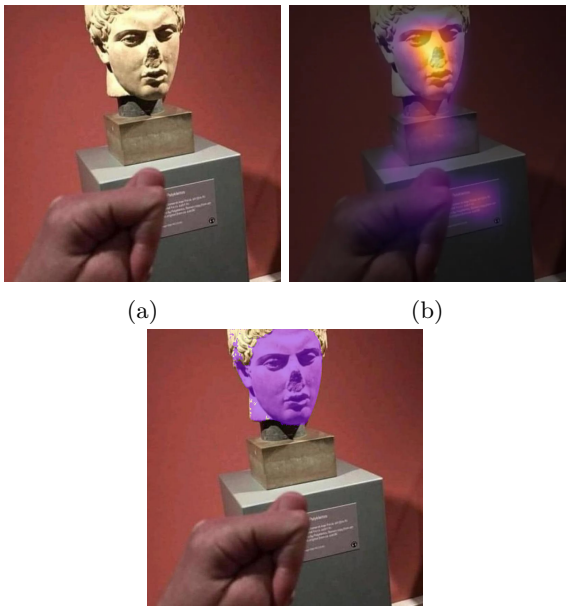
Earlier approaches to image segmentation include algorithms such as k-means-clustering (Dhanachandra et al., 2015). Yet in recent years, deep learning models have significantly improved the segmentation effect and performance, therefore becoming the dominant method for solving segmentation tasks in complex environments (Minaee et al., 2022).

2.2 Salient Object Detection

The human visual system pays more attention to certain parts in an image, a property known as saliency. Inspired by this mechanism, *saliency detection* models aim to predict which regions in an image are most likely to attract human visual attention. These models typically provide saliency maps in form of heat maps, in which higher intensity values indicate regions detected to be more important (Ahmadi et al., 2018).

Salient Object Detection (SOD) – also referred to as salient object segmentation (Borji et al., 2019) or saliency segmentation (Kakanopas & Worarat-panya, 2021) – goes one step further by segmenting the most salient object(s) of an image. SOD can be interpreted as a two-stage process: 1) Detection of the most salient object and 2) Accurate segmentation of the region of that object. In contrast to general image segmentation, SOD focuses on segmenting only those objects that are (or that are predicted to be) most salient (Borji et al., 2019; Liu et al., 2011). Figure 2 illustrates the difference between saliency detection and salient object detection.

2.3 Models



(a) (b)

(c)

Figure 2 (a) the original image, (b) saliency map (Alexander Kroner, 2025) (c) salient object detection mask generated using SAM3 guided by the eye-tracking data

3 Methodology

3.1 Experimental Design

3.2 Planned Practical Steps

4 Results

4.1 Model Selection

4.2 Expected Results

A Appendix

TODO: Add result pictures and/or our code here

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