

ON-ROUTE SEGMENTATION OF COMPLEX INDOOR ENVIRONMENT FROM DRIVE-THROUGH IMAGE SEQUENCES

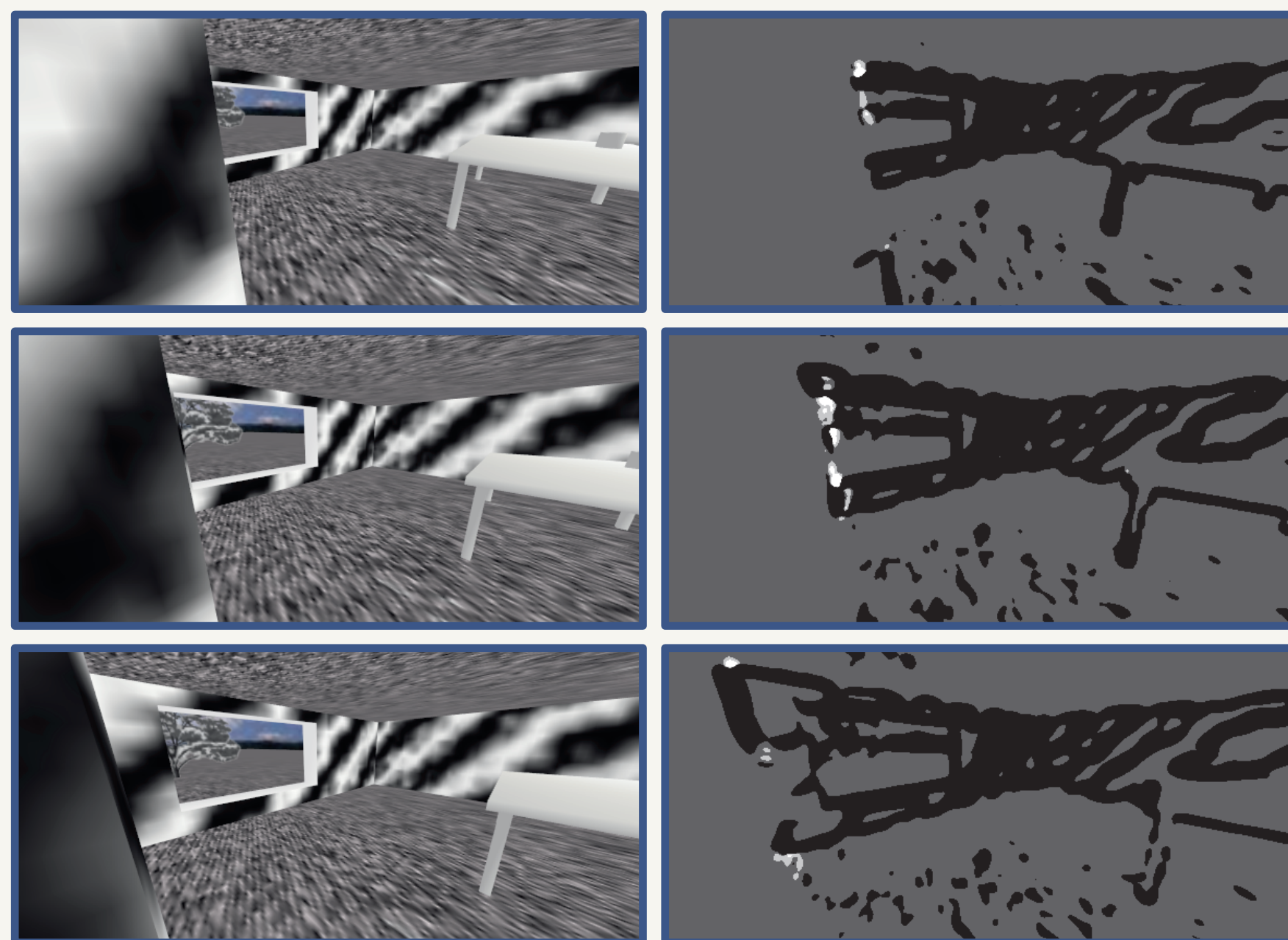
Ecke G. A. & Mallot H. A.

SPACE-TIME CORNERS FOR NAVIGATION

Visual navigation can be based on discrete, recognizable anchor-points extracted from continuous motion sequences. We use the Laptev space-time interest point detector to define points where the agent passes an aperture or occluding object. Results indicate that points of passage provide a suitable skeleton for the representation of indoor spaces.

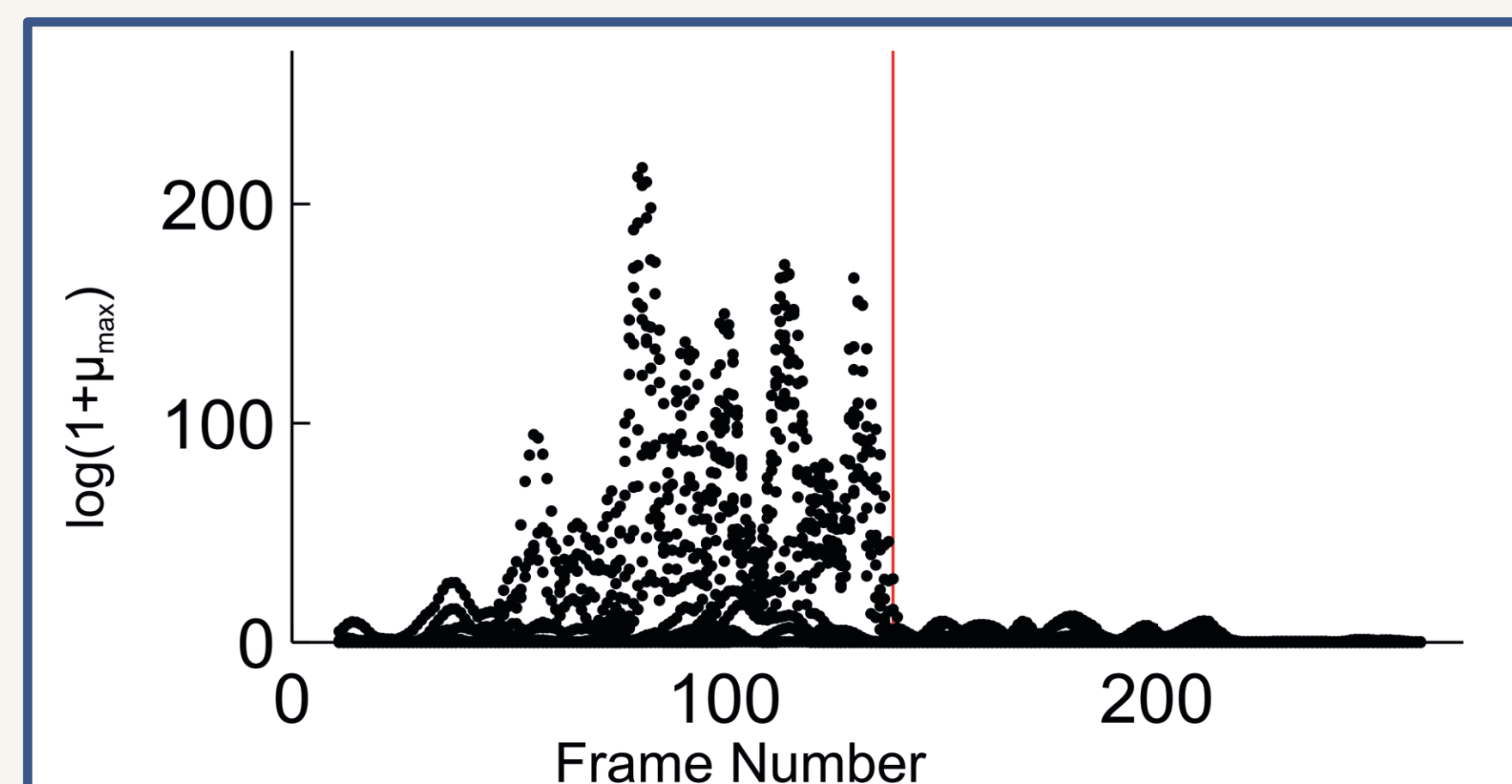
DRIVING THROUGH CONSTRICTED OPENINGS

a. Translational Movement past an Obstacle



In a static environment, Laptev power signifies the occlusion and disocclusion of features, i.e., relative shift of near and distant objects.

b. On-Route Detector Footage



Passage points (crossing of line of sight) can be detected by rise and sudden fall of Laptev power. The red line indicates the disappearance of the wall on the left image margin.

ON SPACE TIME INTEREST POINTS [1]

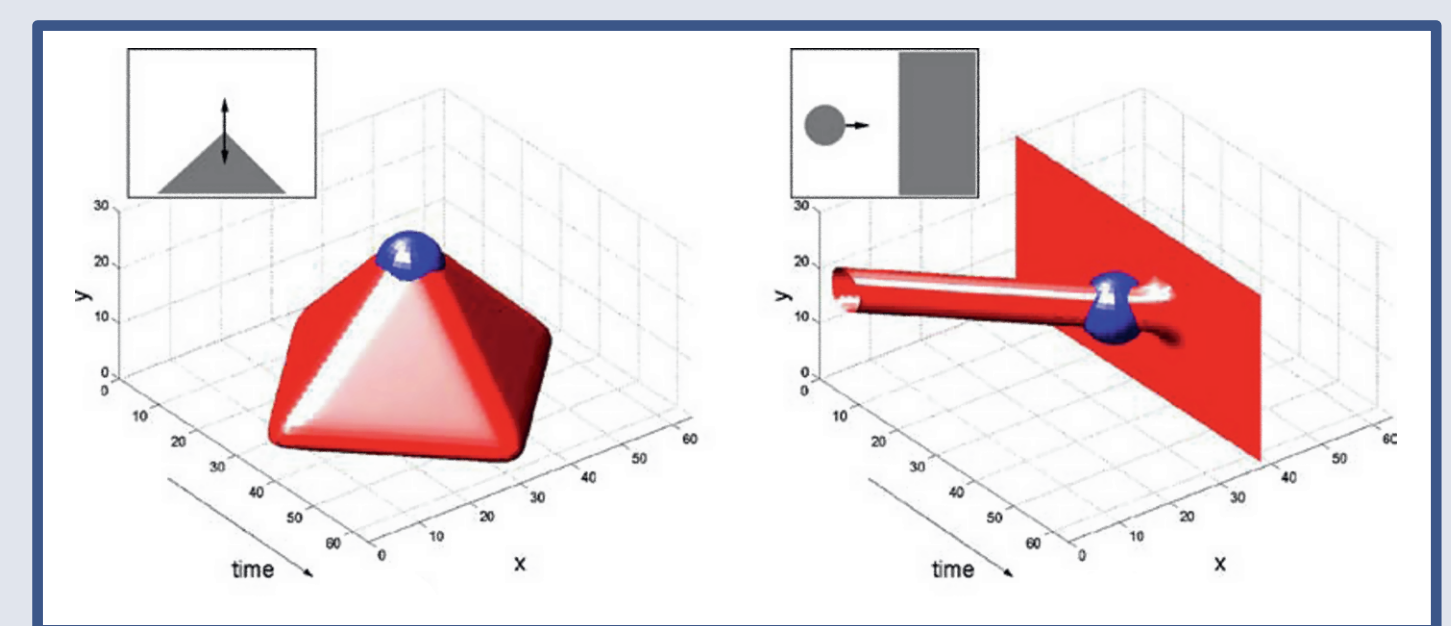
An extension of the Harris combined corner and edge detector^[2] to spatio-temporal image sequences.

$$\mu = g(\cdot; \sigma_x^2 \tau_x^2) * \begin{pmatrix} L_x^2 & L_x L_y & L_x L_t \\ L_x L_y & L_y^2 & L_y L_t \\ L_x L_t & L_y L_t & L_t^2 \end{pmatrix}$$

Derivatives with respect to the two image dimensions and the image stack as temporal component are used to calculate the corner function.

$$H = \det(\mu) - k \text{trace}^3(\mu)$$

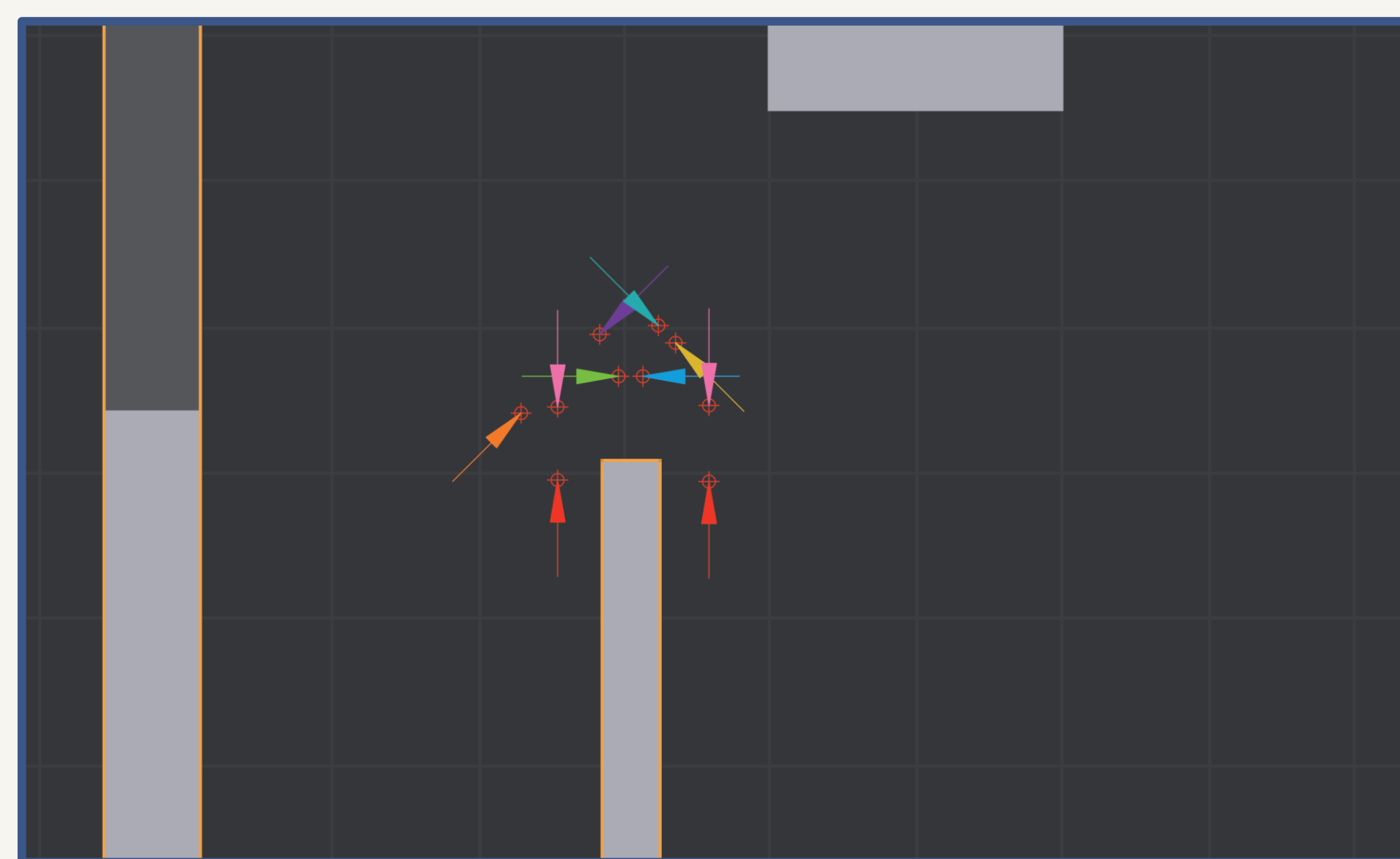
k controls the relative weight of corners and edges.



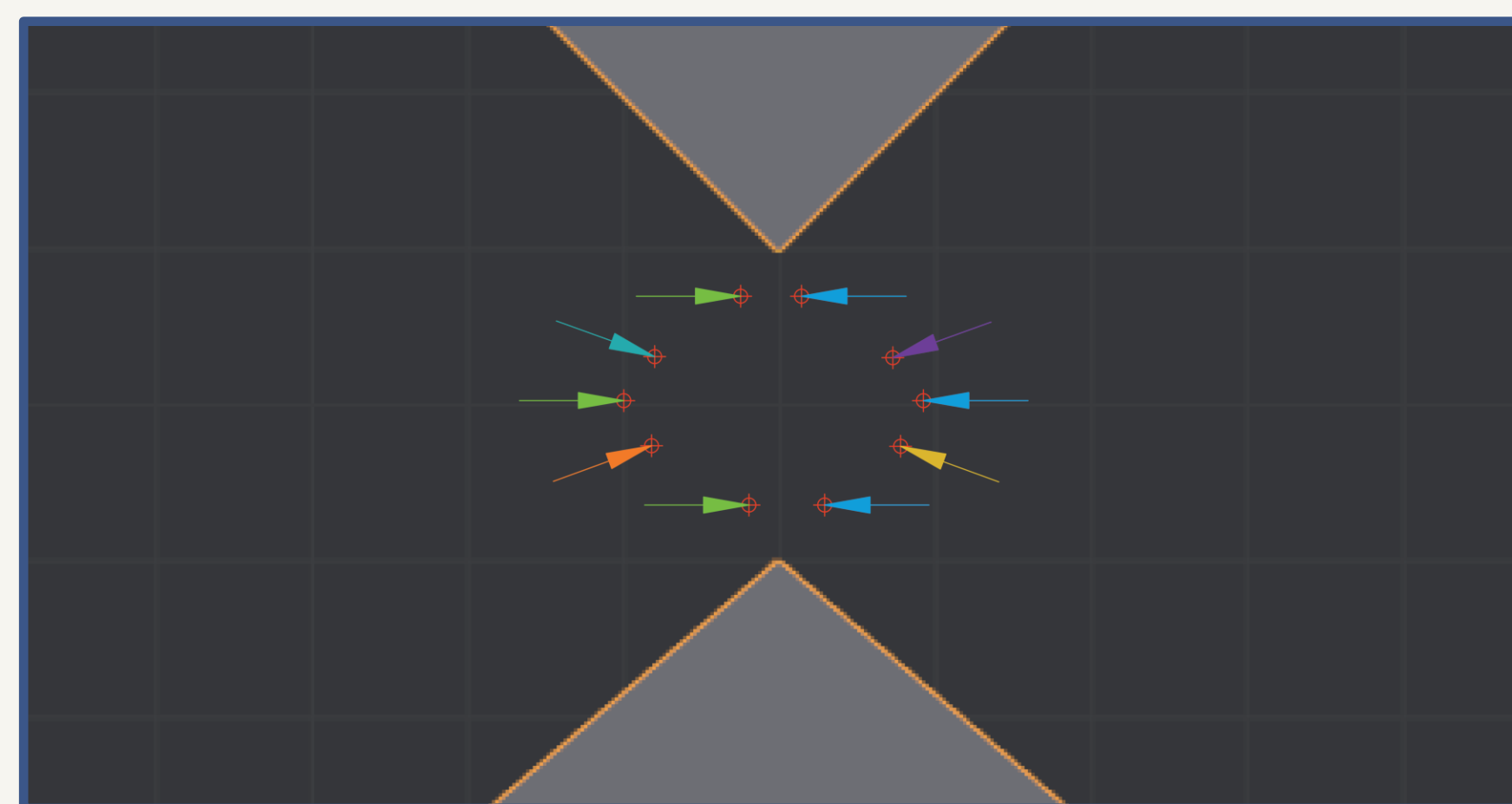
example [1]:
reversal of movement

example [1]:
disappearance behind
occluder

c. Extracting Passage Points



Automatically detected passage points for different movement directions.



Passing two sided openings generates a unique passage point, irrespective of the approach direction.

References

- [1] Laptev, I. (2005). On Space-Time Interest Points, International Journal of Computer Vision 64(2/3): 107-123
- [2] Harris, C., Stephens, M. (1988). A combined corner and edge detector, Alvey Vision Conference: 147-152

Contact

gerrit.ecke@uni-tuebingen.de
Cognitive Neuroscience Unit
Prof. Dr. Hanspeter A. Mallot
Department of Biology
University of Tübingen
Auf der Morgenstelle 28
D - 72076 Tübingen
Germany



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