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# Neuromorphic foveation applied to semantic segmentation

Amélie Gruel<sup>1</sup>

Dalia Hareb<sup>1</sup>

Jean Martinet<sup>1</sup>

Bernabé Linares-Barranco<sup>2</sup>

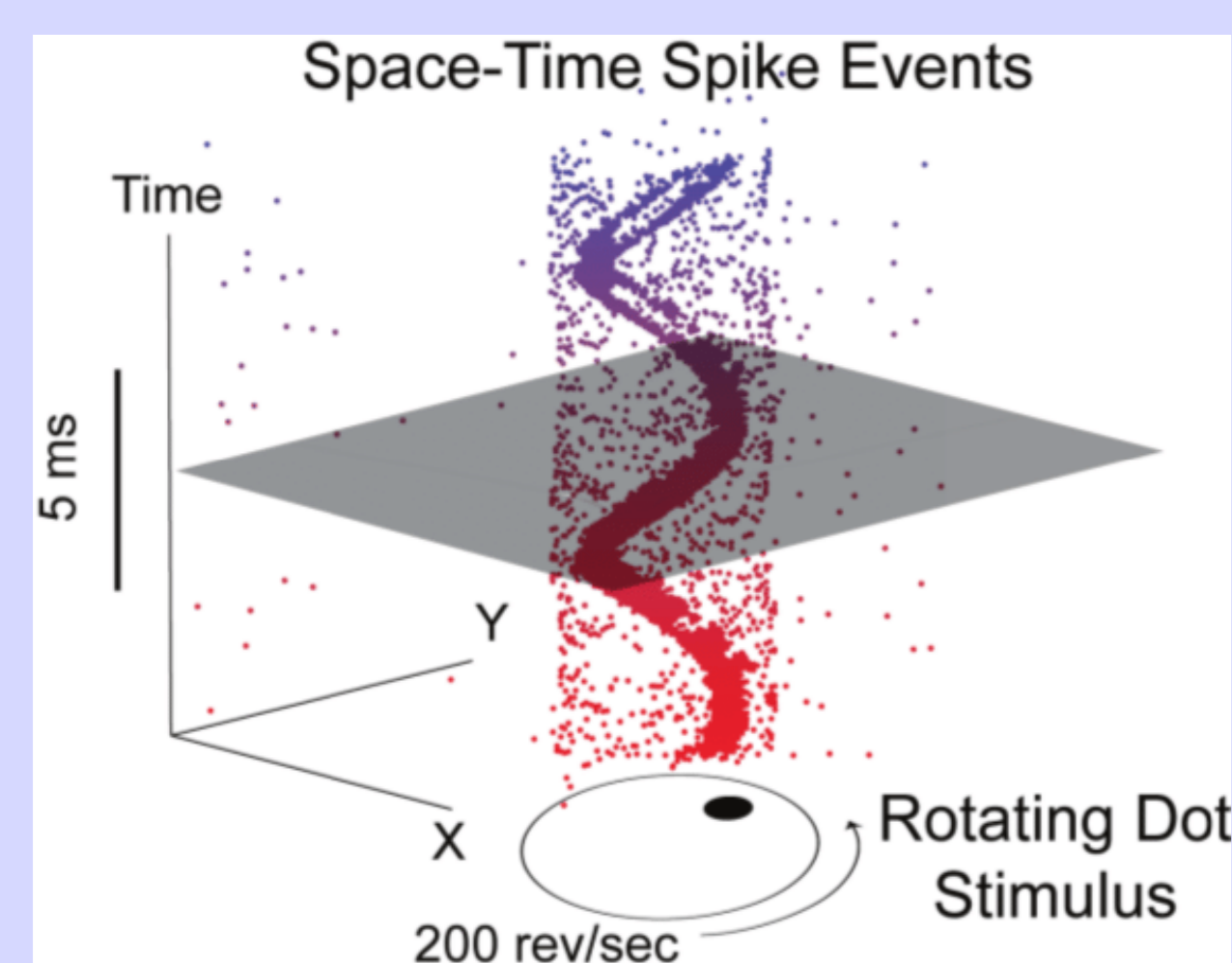
Teresa Serrano-Gotarredona<sup>2</sup>

<sup>1</sup>Université Côte d'Azur, CNRS, i3S - France

<sup>2</sup>Instituto de Microelectronica de Sevilla IMSE-CNM - Spain

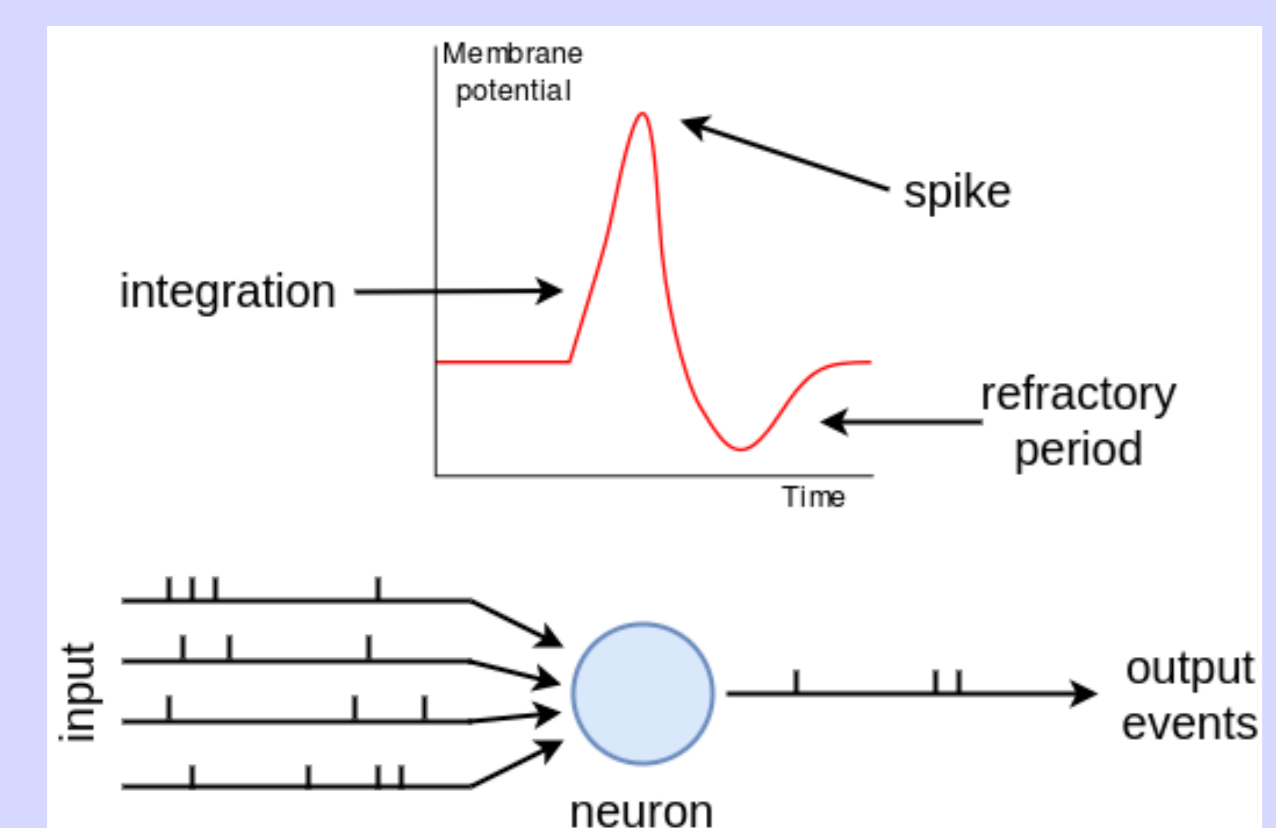
We present in this work the evolution of the performance of semantic segmentation with respect to the amount of event data used, to demonstrate the stakes of foveation. Semantic segmentation model: Ev-SegNet [Alonso, 2019] Dataset: DAVIS Driving Dataset 2017 [Binas, 2018]

## Event camera



[Lichtsteiner, 2008] & [Mueggler, 2015]

## Spiking neural network



[Maass, 1997]

**References**

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[Bear, 2007] M.F. Bear, B.W. Connors and M.A. Paradiso (2007). *Neurosciences, Exploring the brain*. W. K. Health.

[Binas, 2018] J. Binas, D. Neil, S.C. Liu, and T. Delbruck (2017). DDD17 : End-To-End DAVIS Driving Dataset. *arXiv :1711.01458 [cs]*.

[Gruel, 2022] A.Gruel, A.Vitale, J.Martinet and M.Magno (2022). Neuromorphic event-based spatio-temporal attention using adaptive mechanisms. *AICAS*.

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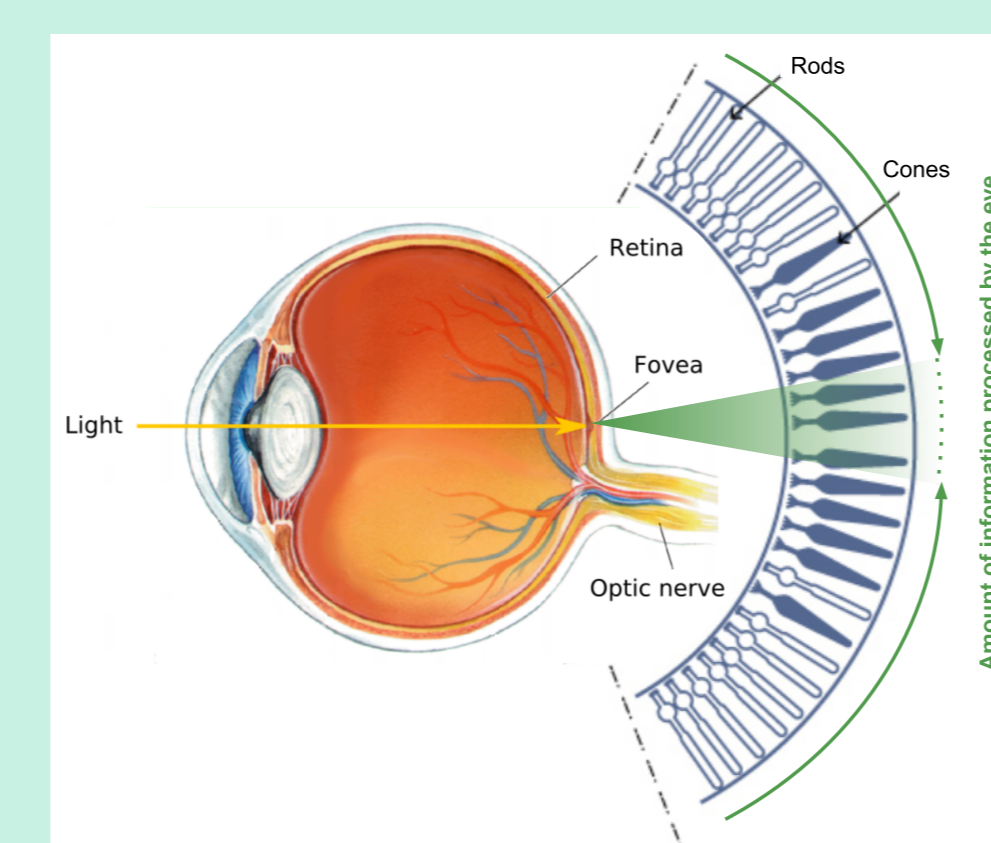
[Maass, 1997] W. Maass (1997). *Networks of Spiking Neurons: The third generation of neural network models*. *Neural Networks*.

[Mueggler, 2015] E. Mueggler, G. Gallego and D. Scaramuzza (2015). Continuous-Time Trajectory Estimation for Event-based Vision Sensors. *RSS*.

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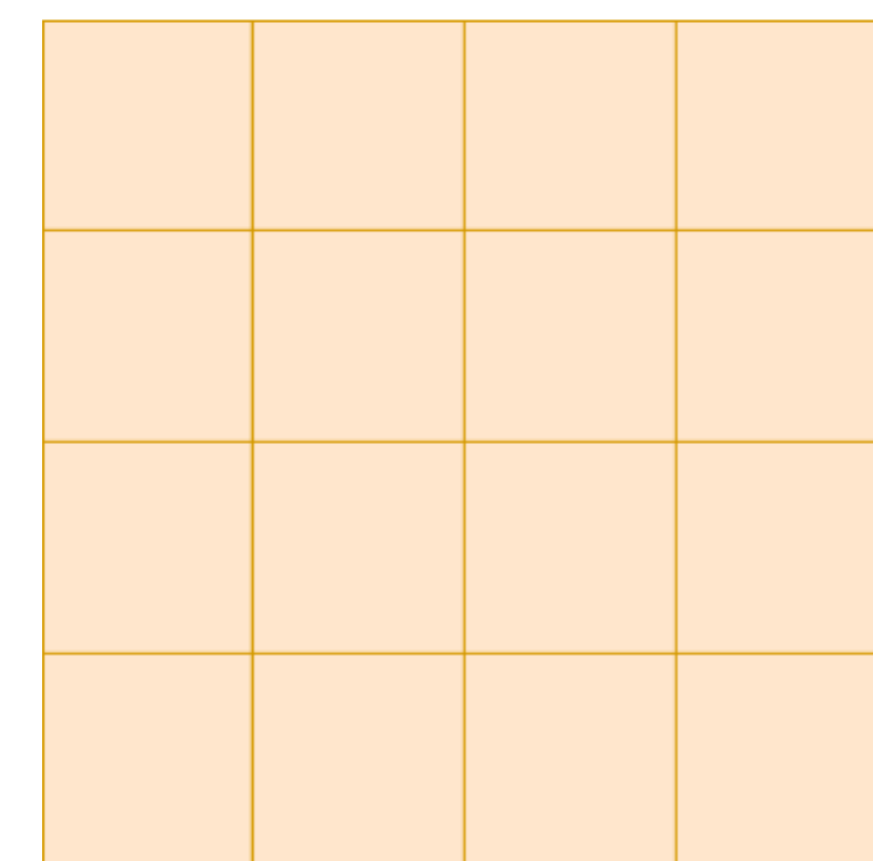
## Foveation methodology

### Biological foveation

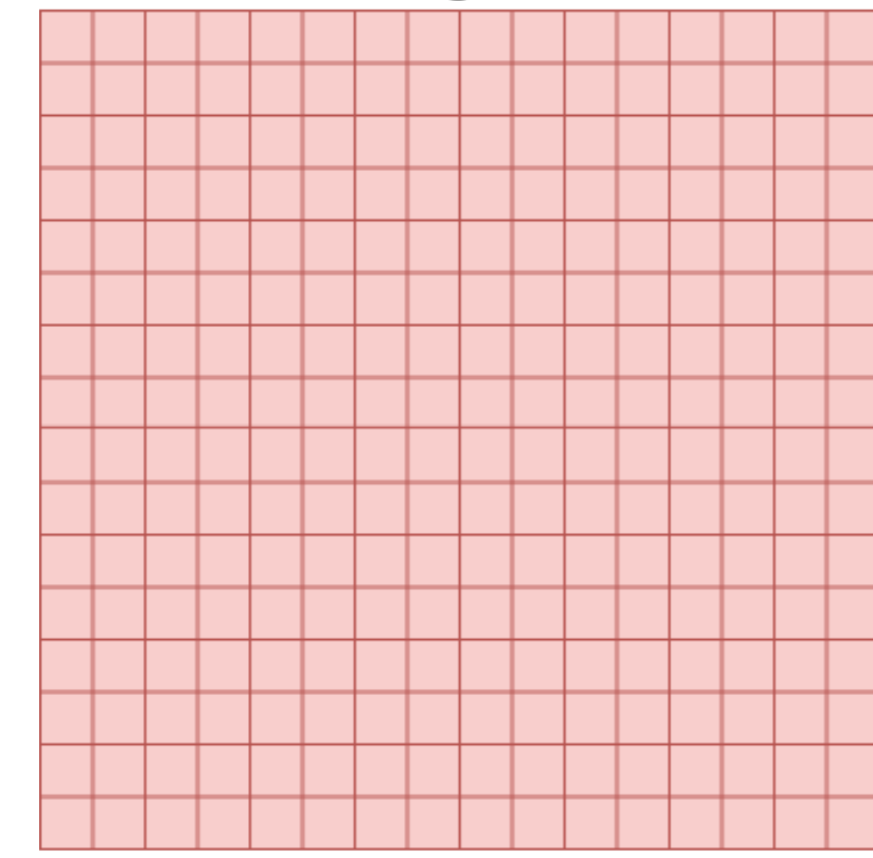


Adapted from [Bear, 2007] & [Tobii Technology, 2020]

Events in low resolution



Events in high resolution

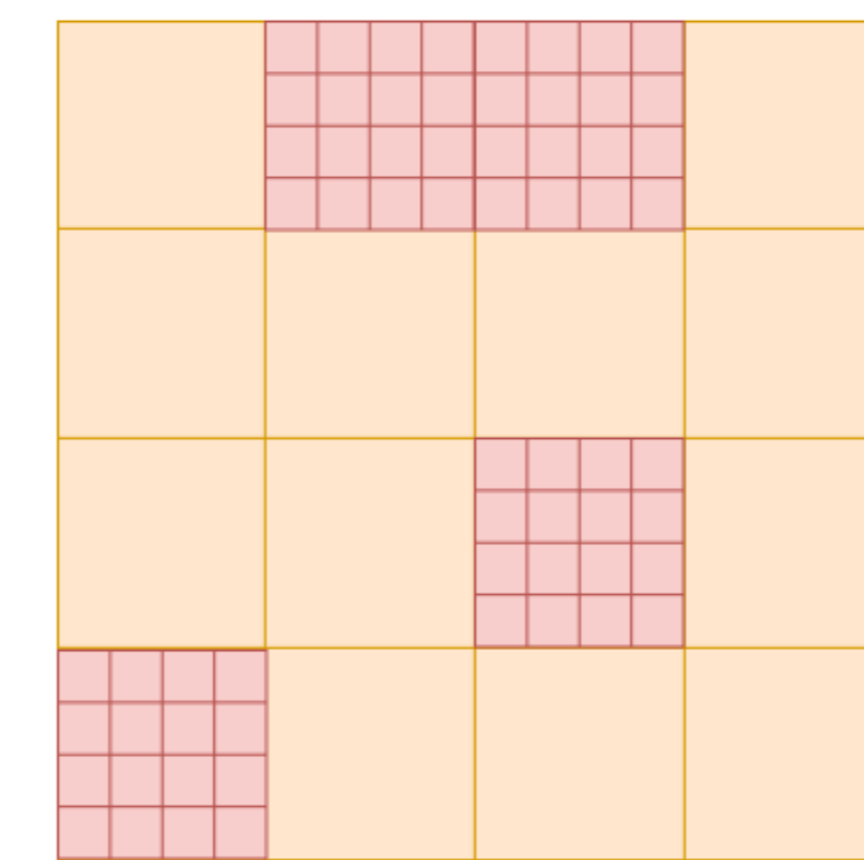


### Neuromorphic foveation

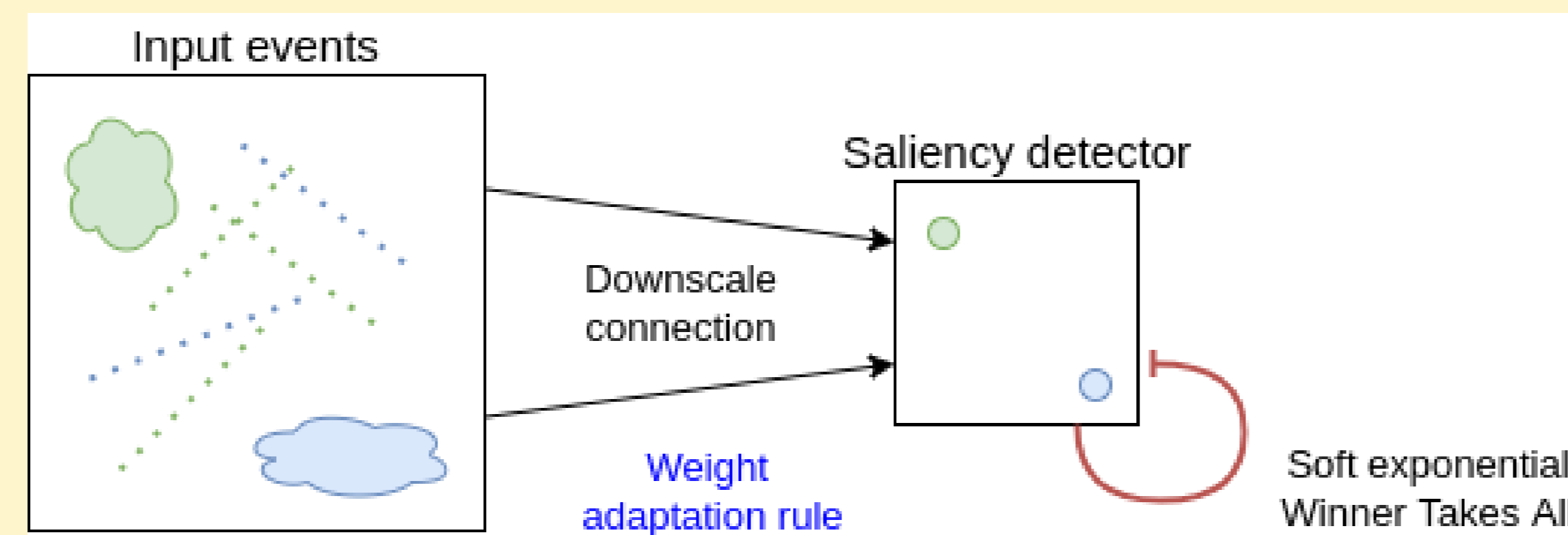
- Reduction of the amount of raw data to handle
- Preservation of relevant information
- Significant energy-efficiency

Regions of Interest

Foveated events



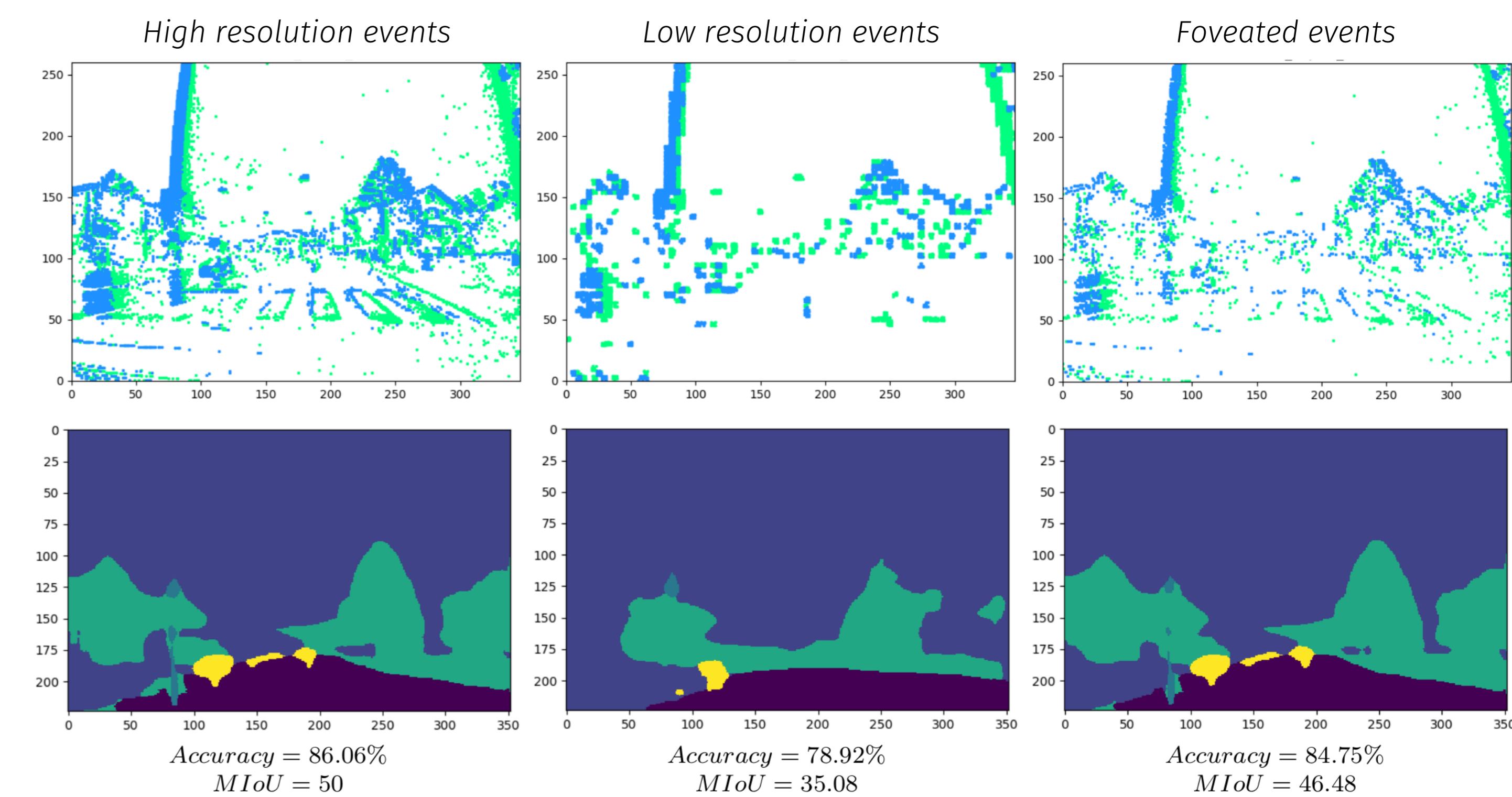
### Saliency detection by event density



Adapted from [Gruel, 2022]

## Experimental results

Visual representations of DDD17 samples: accumulated events (top) and Ev-SegNet segments (bottom).



Semantic segmentation accuracy according to the number of events (top) and its evolution according to the percentage of total events (bottom) in the dataset after processing

