NEUROMORPHIC VISION: EVENT-BASED PROCESSING

Assignment

Since event cameras are fundamentally different from standard cameras, the processing of the generated data should also differ from the conventional image analysis. The stream of events (both positive and negative) is generated at a pixel-level with microsecond precision, in response to the intensity changes e.g. due to motion or structured light. The data is sparse and in general can be processed by:

- Continuous frame reconstruction and extension of computer vision methods to an image of integrated events.
- Finding geometric transformation for each incoming event (kHz frequency) and developing tracking algorithm.
- Motion compensation to maximize the alignment of corresponding events, to be solved as variational problem.
- Spiking Neural Networks, where neurons communicate via discrete spikes. Applicable on data coming directly from event camera and can be used for e.g. object recognition.
- Contour tracking and surface of active events, accounting for the polarity of events.

Depending on the affinity and the interest of a student, the problem will be formulated to extend our knowledge on (e)motion recognition, tracking, structural vibrations and magnification of otherwise invisible signals et cetera.

Internship overview

- Bachelor / Master Student
- Internship / Graduation
- Mathematics/Physics/Engineering
- Location: Eindhoven

Technologies

- Computer vision,
- Spatiotemporal analysis.
- Machine Learning
- Statistical physics

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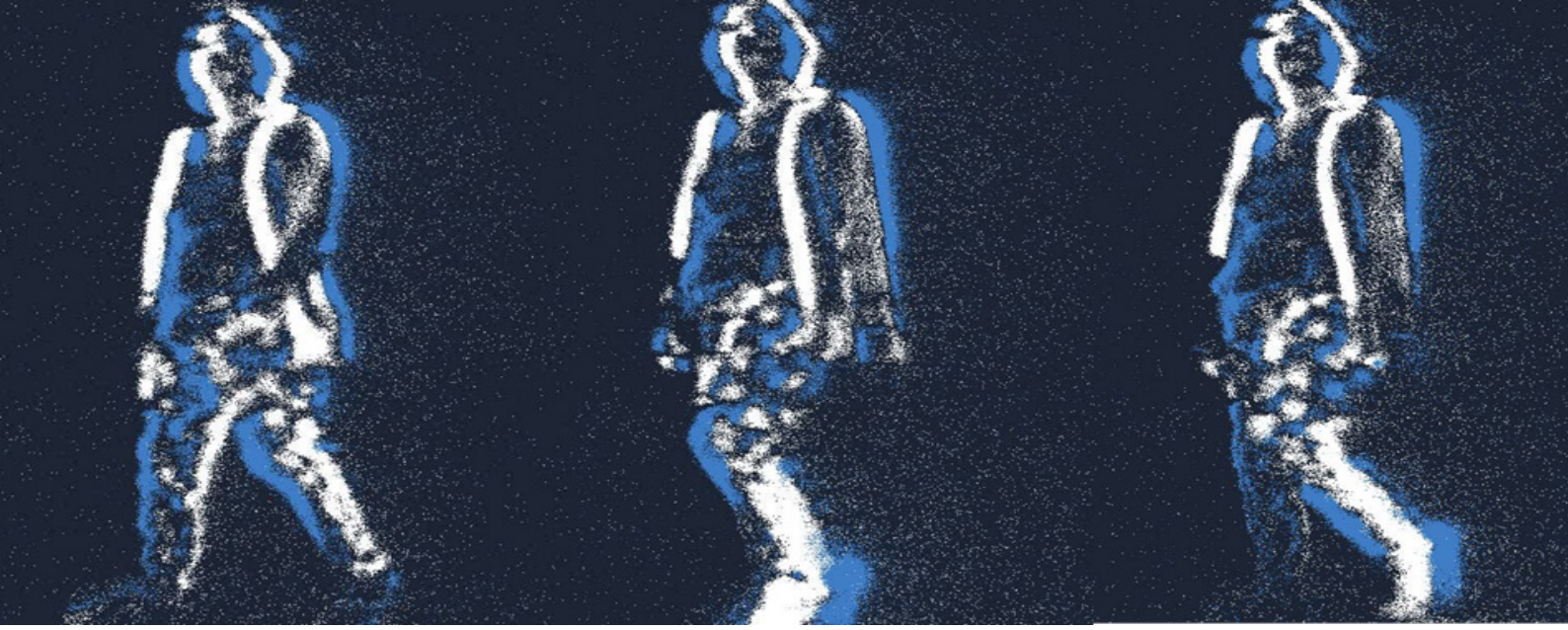
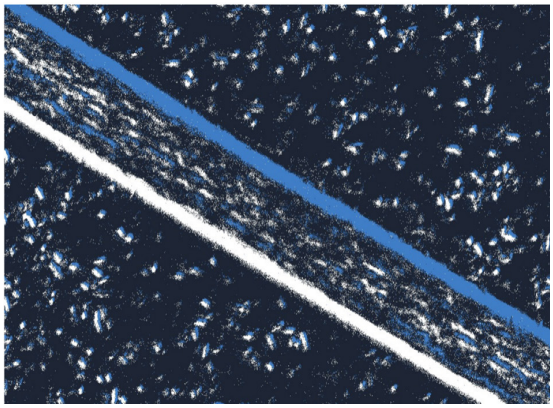


Activities

A student will make use of event camera (EVK 4 from Prophesee) as well as Metavision SDK within Python environment. Depending on the type of video and problem at hand the advanced methods like event-based visual flow, image reconstruction, motion segmentation/compentsation etc., will be used to process/integrate events over space-time and extract useful degrees of freedom to be analysed with statistical methods.



Context

Inspired by a human retina, event camera is a novel sensor, which records only the changes of intensity as asynchronous stream of events. Contrary to the conventional frame-based cameras, which output integrated pixel intensity at the framerate of tens of milliseconds, the pixels in event camera act independently and respond to the environment changes/motion much faster than human eye perceives, with one microsecond precision. Moreover, very high-dynamic range and low power consumption allows to operate at extremely poor(bright) light conditions, and to reconstruct the details of a scene in real time. Despite the numerous advantages and variety of interesting technological applications, mathematical methods of processing event-based data are lagging behind. Building on top of computer vision and machine learning approaches, we will advance the knowledge for event data processing and physics-based modelling.

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Would you like to know more about this student assignment?

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