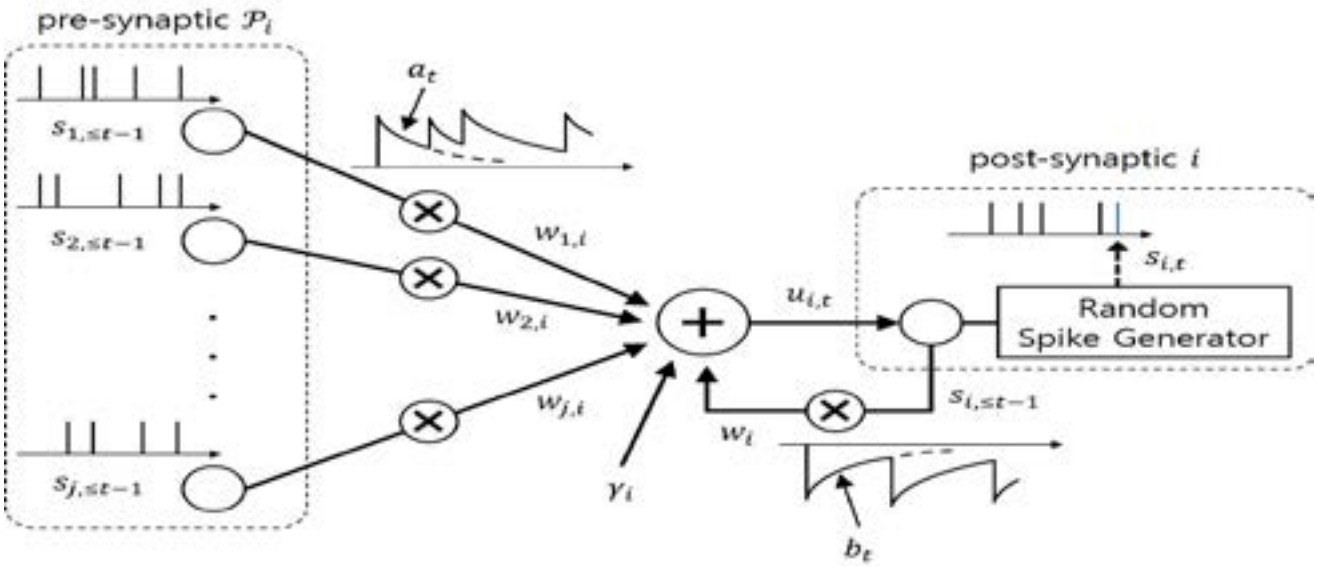

SPIKING NEURAL NETWORKS FOR FAST-MOVING OBJECT DETECTION

Assignment

A ball travelling at speed of 10 m/s and captured by a conventional frame-based camera at 30 frames/s, which in turn are being processed with standard artificial neural network (ANN), will result in prediction with at least 0.5 m uncertainty, due to the latencies introduced. To address this unacceptable latency and to improve the accuracy of the ball trajectory, we will develop a framework, naturally combining an event camera with spiking neural network (SNN). The event camera generates continuous spikes at microsecond time resolution, with the number sensitive to the ball speed. SNN is described as a collection of neurons, which are activated if and only if the sum of spikes reaches a certain (membrane) potential, similar to actual neural dynamics.

How to go from a collection of events and active neurons with local (summation only!) rules to extracting the information and global properties of the system, like moving contours, velocity, object shape, location etc., is the goal of this internship.

Internship overview

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

Technologies

- Computer Vision
- Event processing
- Neuron dynamics
- SNNTorch
- Brian simulator

Activities

Inspired by biological neurons, design SNN architecture(s), suitable to detect, track and predict in time the position and velocity of a ball, captured by event camera. Compare the performance with existing event cluster tracker(s). Together with a team of enthusiastic colleagues work on a strategy to win RoboCup competition.

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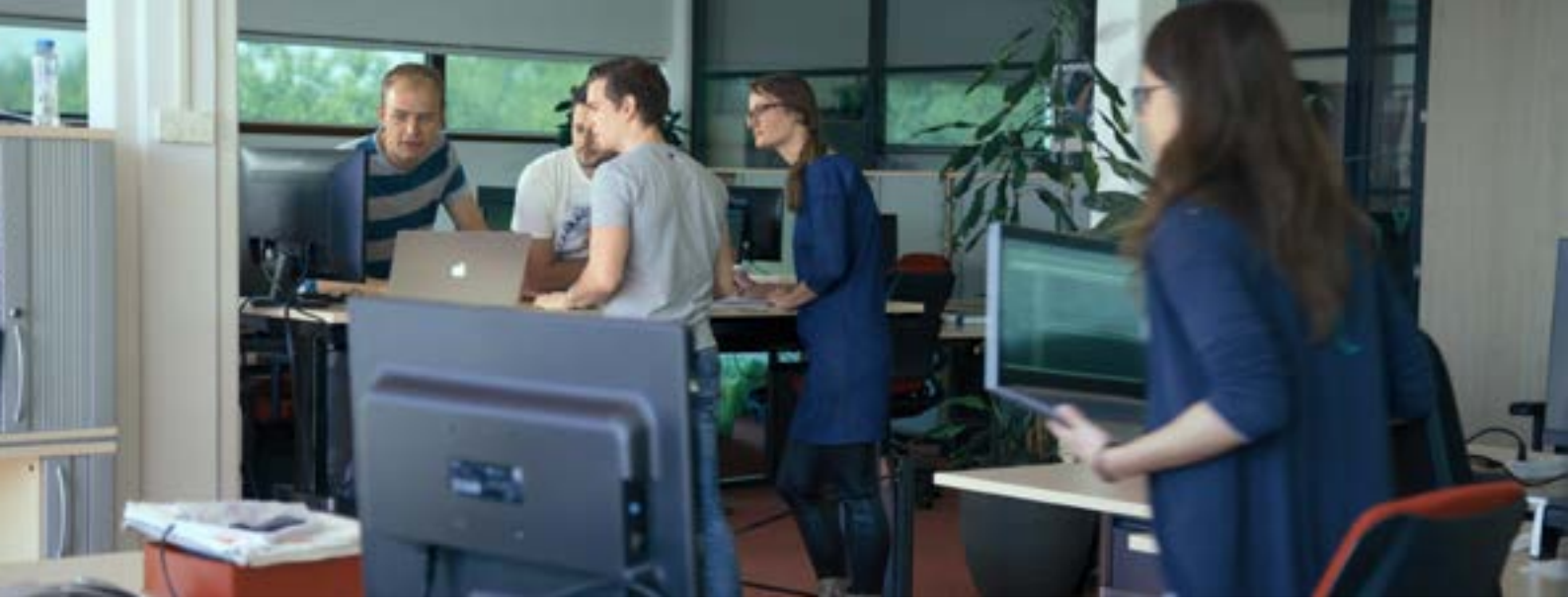


Context

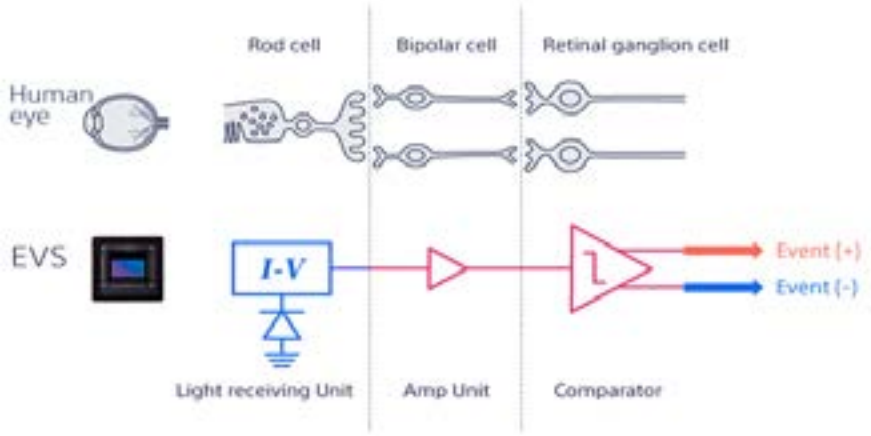
SNNs, which model directly the spiking behaviour of biological neurons, are envisaged as a next generation of neural network models. These networks are particularly suitable for spatio-temporal, sparse, and asynchronous data processing and promise to be faster and more energy efficient, compared to their ANN counterparts. Moreover, SNNs are particularly suitable for processing of events from neuromorphic camera, also known as silicon retina, which detects only changes of the logarithm of intensity.

Since we do not completely understand how our retina and brain work, there are still challenges related to the design and the use of these biologically inspired technologies. With this assignment we plan:

- to advance our understanding on SNN network architectures and direct training, while introducing relevant time-encoding of event data with positive and negative polarities.
- to contribute to the RoboCup competition by creating the solution for robotic goalie with shortest possible reaction time (on CPU or edge devices, see Refs. below).

"Robotic goalie with 3 ms reaction time at 4% CPU load using event-based dynamic vision sensor" by T. Delbruck and M. Lang
https://doi.org/10.3389/fnins.2013.00223

Sioux goes for the win in RoboCup | Sioux Technologies



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- Working on innovative technology
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- Great career opportunities
- Contributing to a safe, healthy and sustainable society

Get in touch!

Would you like to know more about this student assignment?

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