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Use Cases in five domains

(Digital Industry, Digital Farming, Transport and Smart Mobility, Healthcare and Digital Life) were selected involving 14 use cases in total.

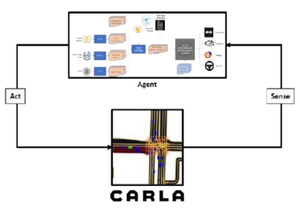
Objectives

Integrate (HW/SW), Develop application, validate and evaluate the applicability of the neuromorphic technologies for various application`domains, which are essential for the future of European competitiveness.
A short overview of the use cases addressed by Transport and Smart Mobility, Healthcare and Digital Life domains is given here.

Transport and Smart Mobility

Use Case 3.5
Path Planning for Autonomous steering

Partners:
GML, Valeo



Description: Continuously calculate trajectories, based on deltas in world map, avoid intersects, while optimally steering the vehicle, e.g. by solving many diff equations

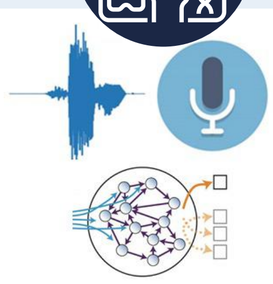
Challenges:
- 100Hz world map update rates and <10ms latency huge comp. loads
- Small form-factor (<200x200mm) and power consumption (<2W)

Positioning vs State of the Art:
- Reduce power by 100x over SotA
- Reduce latency by 10x over SotA

Development Status:
- Datasets identified and prepared (Lyft+, CARLA Simulator)
- Initial network training done (Resnet50)
- Initial steering algorithm done and validated
- Preparing integration of GML hardware into demonstrator

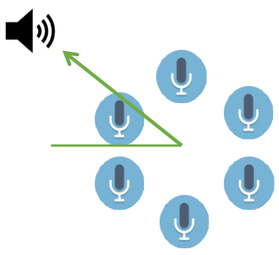
Digital Life

Use Case 5.1
Path Planning for Autonomous steering



Overall Challenges:
- Continuous real time computation
- Low-latency, low-power requirements

5.1a: Continuous audio scene classification. The audio environment is monitored continually, to assist in selecting a noise reduction scheme appropriate for the environment.
Status: Development completed benchmarking in progress

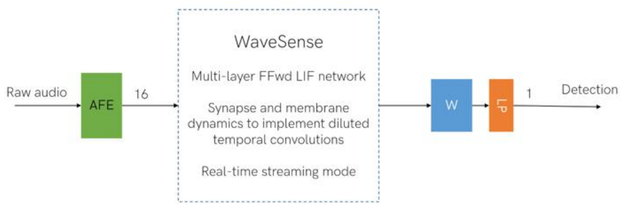


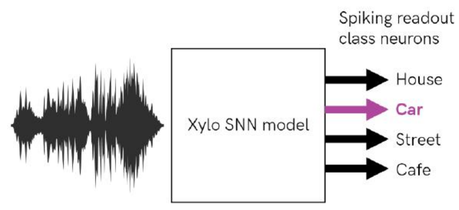
5.1b: Audio event detection: Continuous monitoring of audio signals for pre-defined trigger events, such as glass break (for security purposes) or distress call (for health monitoring purposes).
Status: Development in progress based on 5.1a results

5.1c: Multi-microphone auditory processing: A low-power sensory processing task designed for multiple simultaneous input channels (i.e. a microphone array), to assist in noise reduction in smart home devices.
Status: Development in progress based on 5.1a and 5.1b results

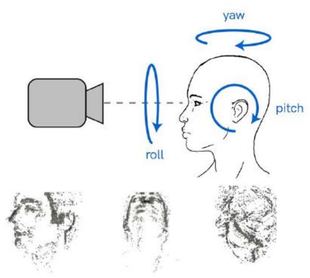
Partners:
Synsense, UZH, FHG, STGNB

5.1d: Voice Activity Detection: Monitoring of audio scene for detection of voiced speech which acts as a wake up signal for smart devices.
Status: Basic development in progress and preparing hardware integration





Use Case 5.2
Vision -based human computer interaction application



Description: Glance detection for mobile hand-held devices, to be used as a smart wake-up trigger

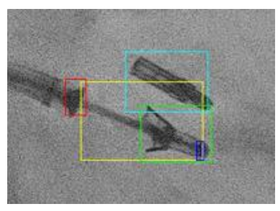
Challenges:
- Low-latency and low-energy requirements
- Low false-reject rate requirements

Development Status:
- Reference demo implemented
- Initial demo trained and deployed to Specks vision SOC

Partners:
Synsense, UZH, CSEM, STGNB

Healthcare

Partners:
PMS, imec-NL



Use Case 4.1
Multi-modal image processing and device tracking in medical X-ray & ultrasound images

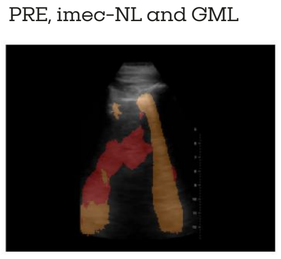
Description:
Navigating a medical device like a Mitral Clip to the right location in the heart is challenging and requires accurate and intuitive image guidance.

Challenges:
- Detection accuracy → placement of device
- System latency → eye-hand coordination

Positioning vs State of the Art: Benchmark the SNN version of the detection algorithm against an implementation in state-of-the-art GPU HW

Development Status:
- Data acquired and annotated
- Network trained, CNN version of device tracking available
- Started preparation for SNN implementation

Partners:
PRE, imec-NL and GML



Use Case 4.2
Ultrasound acquisition or processing

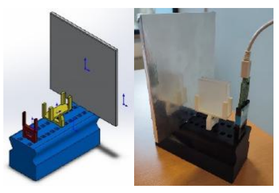
Description: Lung ultrasound can detect healthy/unhealthy (Covid-19, Pneumonia) patients. We create a neural network to automatically detect healthy/unhealthy lungs

Challenges:
- Make NN fit on the two platforms

Positioning vs State of the Art:
- Automatic detection
- Need low power consumption for mobile ultrasound

Development Status:
- Data privacy process completed
- Explored SNN network design
- Completed data processing and started annotation
- Started algorithm development

Partners:
EESY, IFAG



Use Case 4.3
Glucose Monitoring

Description: Apply SNN algorithms to high-frequency sensor data to classify different glucose level in water dilutions.

Challenges:
- To distinguish standard human body glucose concentrations

Positioning vs State of the Art:
- Leverage the faster computation of the SNN to reach accurate results of the glucose level using less time and energy resources

Development Status:
- Glucose measurement setup was created and data gathered
- Explored backup data
- Started algorithm development

ANDANTE

AI for New Devices And Technologies at the Edge

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