

Company: IMEC

Title: ANN based pedestrian detection using a heterogeneous sensor network

Level of topic

- MSc

Master's programs

- Computer Science and Engineering
- Electrical Engineering
- Embedded Systems
- Systems and Control

Duration:

- 9 months

Skills

- Experience in implementing algorithms with embedded systems
- Knowledge of estimation theory/detection theory/machine learning/data modelling
- Proven experience with MATLAB/Python/C/C++
- Previous experience with wireless sensor networks and/or pedestrian detection is an added plus.
- Motivated student eager to work independently and expand knowledge in the field
- Good written and verbal English skills

Project description

Detecting and tracking of people is a key research area, with applications spanning content-based indexing, entertainment, security surveillance and also medical care for the elderly and disabled. Conventionally, person detection is posed as a machine vision problem, where optical/infrared images captured by cameras are used to learn and even track person mobility using pattern recognition algorithms. However, large-scale installation of such bulky systems are not always feasible and are too expensive for simpler applications. Such applications include, for example, intrusion detectors for home, monitoring pedestrian traffic in mega-cities and in general counting the number of visitors entering/leaving in a venue. In all these scenarios, it suffices to detect a person and keep track of the number of visits.

An elegant and cheap way to achieve this goal is to place Passive Infra-Red (PIR) sensor(s) around the region of interest and count the number of visitors. Furthermore, additional information can be obtained from strategically placed gas-sensors such as CO₂, NO₂, temperature, humidity, which could indicate human presence. In summary, the data collected from such a heterogeneous network of sensor nodes could not only detect human presence but also provide

insight into congestion in a small area. Such tasks are realizable using a wireless sensor network, such as the in-house IMEC-IoT network. The IMEC wireless air quality network platform consists of multiple sensor nodes, each equipped with a diverse portfolio of gas (and environment monitoring) sensors such as CO₂, temperature and humidity. The data collected the nodes are transmitted to a central node via 802.15.4 radio standard. The centralized node sends the collected data to cloud storage, which is then accessible by desired clients. The task in hand is to propose and implement algorithms to detect human presence and monitor human congestion in a small area, such as a meeting room, using the heterogeneous network of sensor nodes. One possible solution could be to train an Artificial Neural Network (ANN) on the IMEC-IoT sensor network, using the PIR presence/passing detector.

Tasks

- Literature survey on traditional pedestrian detection
- (Optional) Designing and build an electronic hardware with a PIR detector
- Developing algorithm(s) for detecting human-congestion in a small area
- Simulations to validate the algorithm
- Implementing the solution(s) on the IMEC IoT sensor network
- Testing and analyzing the performance of the implemented algorithm
- Thesis writing and documentation at IMEC-Holst Centre
- (Optional) submit the work to a top-ranking publication