

OPEN BACHELOR/MASTER TOPICS



Institute of Signal Processing



BACHELOR THESIS

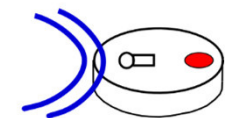
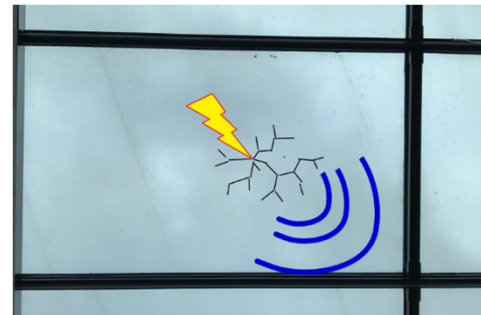
ACOUSTIC EVENT DETECTION

Acoustic monitoring of the environment

- Detection of pre-specified events
- Increase safety and security in homes or industrial plants

Applications

- Burglar alarm systems
- Industrial condition monitoring
- Rodent invasion



Tasks

- Research on techniques and algorithms
- Simulation and performance analysis
- System requirement analysis / Prototype uC implementation

SILICON AUSTRIA LABS

Austria's new Research Center for Electronic Based Systems (EBS)

<https://silicon-austria-labs.com/>

- ≡ Three Locations , **Linz, Graz, Villach**
- ≡ Growing to 360 researchers in 2023
- ≡ Focus in Linz is on **Embedded System** (Signal processing, Machine learning, wireless communication) and **RF Systems**
- ≡ **Joint research labs with the JKU**



eSPML Lab

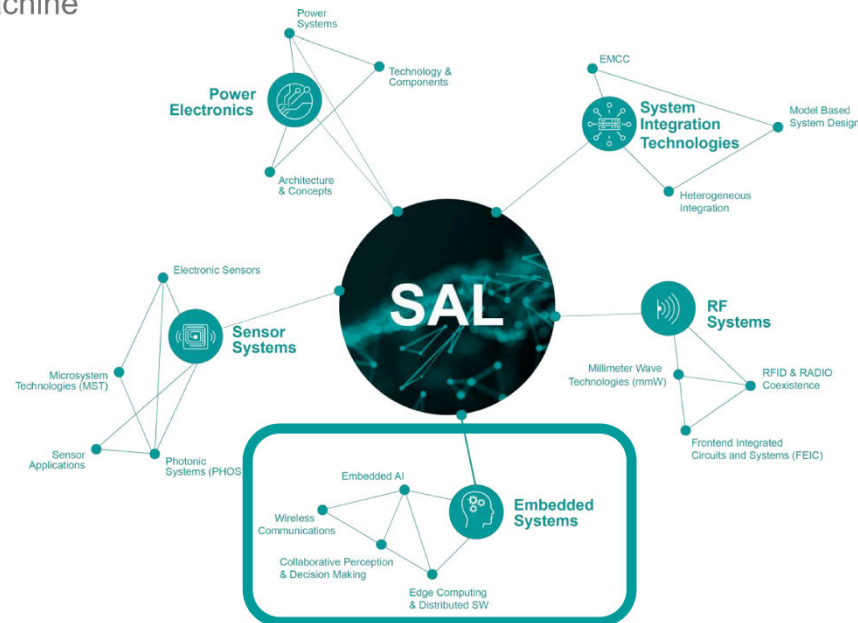
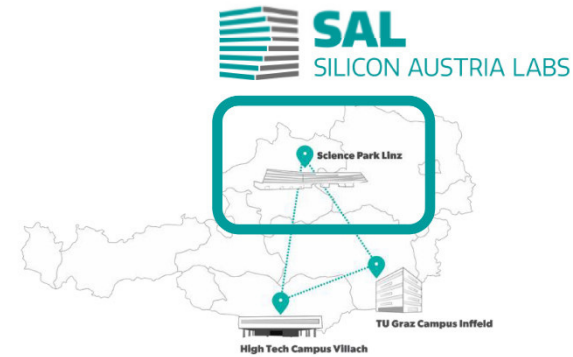
Embedded Signal Processing & Machine Learning



mmW Lab

Millimeter Wave RF Technologies

- ≡ **Many interesting projects with industrial partners**
- ≡ Radar tomography, non-destructive testing, Artificial intelligence on Satellites
- ≡ Master thesis offered in the group of **Embedded AI**
- ≡ located in the OIC (Science Park 4 from 2021)



A TOUCHLESS SCREEN USER INTERFACE

Towards Battery Powered On-device Training



Master thesis topic and objective

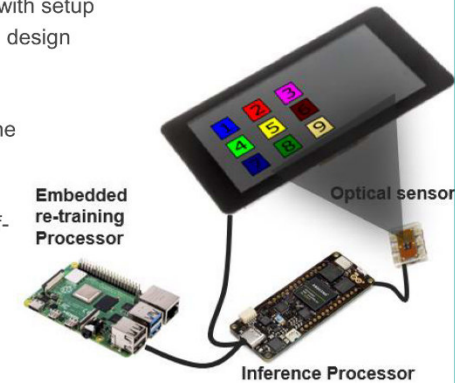
- ≡ **Mission:** develop a **standalone embedded platform** for sensor system self-calibration and on-device machine learning
- ≡ **Application:** realize a touchless screen user interface demonstrator consisting of
 - ≡ (Touch) screen
 - ≡ Optical sensor, baseline: color sensor¹, backup alternative: low resolution camera²
 - ≡ Inference Processor (ultra low power microcontroller): Arduino Portenta H7³
 - ≡ Re-training processor: baseline: Raspberry pi, backup alternative: Nvidia Jetson

Mode of operation:

- ≡ Employing temporal and pattern encoding of different locations on the screen, the approaching finger above the screen will be observed by the optical sensor to infer touchless screen input.
- ≡ The system first operates in touchscreen mode to generate self-labelled optical sensor data.
- ≡ Following re-training on the more powerful embedded processor (to account for different lighting environments, user behavior) the trained ML system performs inference⁴ of touchless input on the ultra low power microprocessor.

The student's work during the thesis encompasses

- ≡ assembly of the demonstrator setup (hardware interfacing, UI design, data collection scripts)
- ≡ collection of user data with setup
- ≡ data analysis and ANN design
- ≡ implementation of the ANN for inference on the microcontroller⁴
- ≡ scripting to automate steps 2-4 to enable self-improvement using the retraining processor
- ≡ working with SAL colleagues towards publications



References

- ¹ <https://ams.com/tcs34725>
- ² <https://www.arduino.cc/pro/hardware/product/portenta-vision-shield>
- ³ <https://www.arduino.cc/pro/hardware/product/portenta-h7>
- ⁴ <https://www.tensorflow.org/lite/microcontrollers>

We are looking for

- ≡ Motivated, flexible and team-oriented students with skills in
 - ≡ microcontroller (i.e. C) and python programming
 - ≡ machine learning
- ≡ **Project start: any time**

We offer

- ≡ Stimulating and supportive international work environment focusing on innovative research
- ≡ Experience-dependent salary for planned duration of 6 month
- ≡ Attractive job opportunities for graduates

Please contact: lothar.ratschbacher@silicon-austria.com

ISP Contact: Michael.Lunglmayr@jku.at

JKU

**JOHANNES KEPLER
UNIVERSITY LINZ**