Title: Modelling and efficient processing of complex sensor data for knowledge discovery and real-time change detection of fruit respiration rate during long-term cold storage

Team: ATB: Pramod Mahajan
UOS: Martin Atzmüller, Mario Porrmann

Abstract:
The main goal of this project is to optimize fresh produce storage conditions to reduce food waste and improve quality. A modular sensor has been developed at ATB and proven to be a valuable tool for real-time monitoring of respiration rates in fresh produce. Still, future advancements are necessary to improve its efficiency and effectiveness, both from a data science perspective and from a hardware integration point of view. To achieve this, the sensor shall be installed in a commercial apple storage facility for data collection, followed by embedded processing of raw data to provide real-time data visualization. The next step would be to integrate machine learning algorithms to perform statistical analysis in a data streaming scenario and to make decisions in real-time. The approach includes change detection, anomaly detection, and knowledge discovery in streaming data. Finally, the system shall be further improved by adding new embedded hardware, including dedicated accelerators for machine learning, and improving sensors, leading to higher efficiency. A wide area of topics will be addressed in this project, including data-driven decision-making, real-time monitoring and analysis, embedded processing of sensor data, machine learning in the agri-food chain, resource-efficient embedded machine learning, big data analysis and knowledge discovery in complex agricultural data, finally leading to food waste reduction through improved quality.

Desired skills of the applicant:

- Good programming skills (required)
- Experience in data science (valuable)
- Experience in embedded system development (valuable)
- Knowledge of hardware acceleration for machine learning (valuable)

References:

1. Keshri N, Truppel I, Herppich WB, Geyer M, Weltzien C, Mahajan PV (2019) Development of sensor system for real-time measurement of respiration rate of fresh produce. Computers and Electronics in Agriculture, 157: 322-328
2. Bessemans N, Verboven P, Verlinden B, Nicolaï B (2016) A novel type of dynamic controlled atmosphere storage based on the respiratory quotient (RQ-DCA). Postharvest Biology and Technology, 115, 91-102.