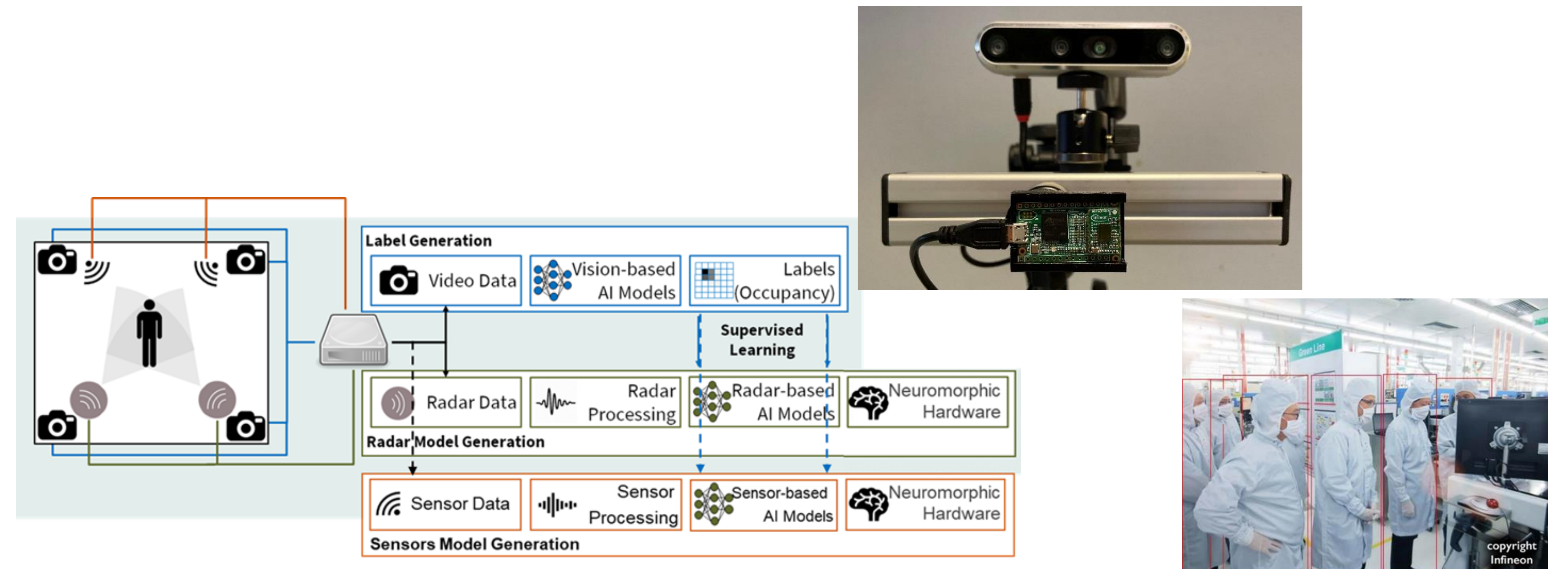
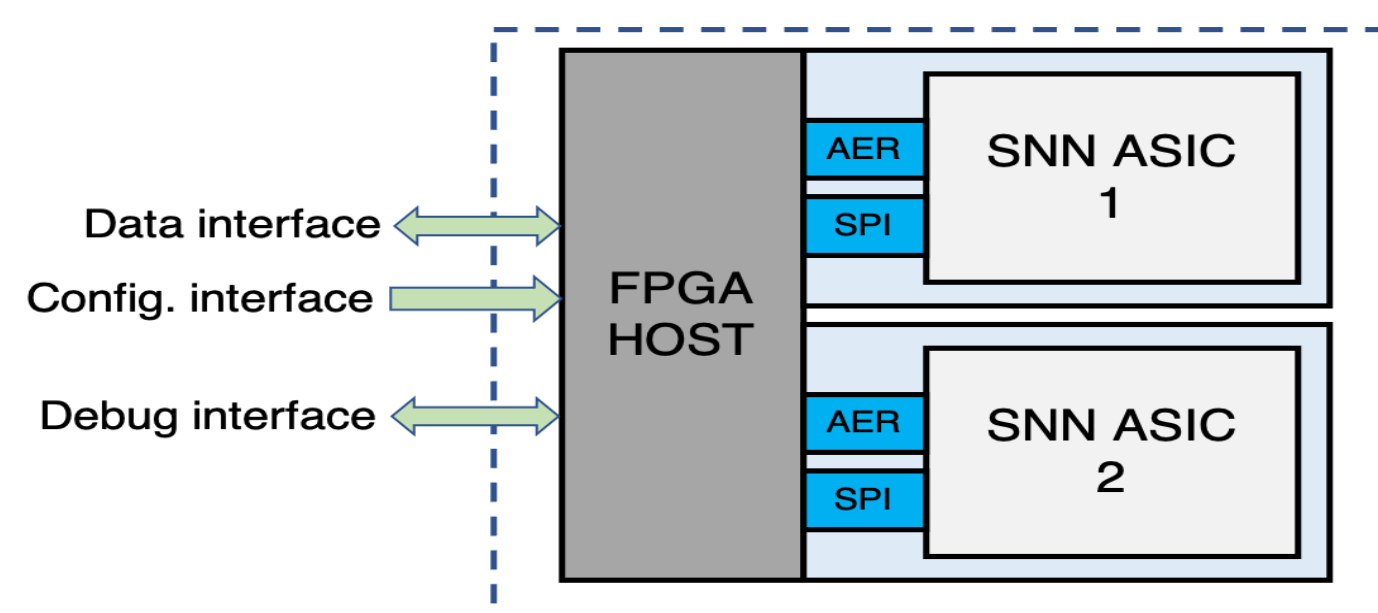


### Overview & Setup

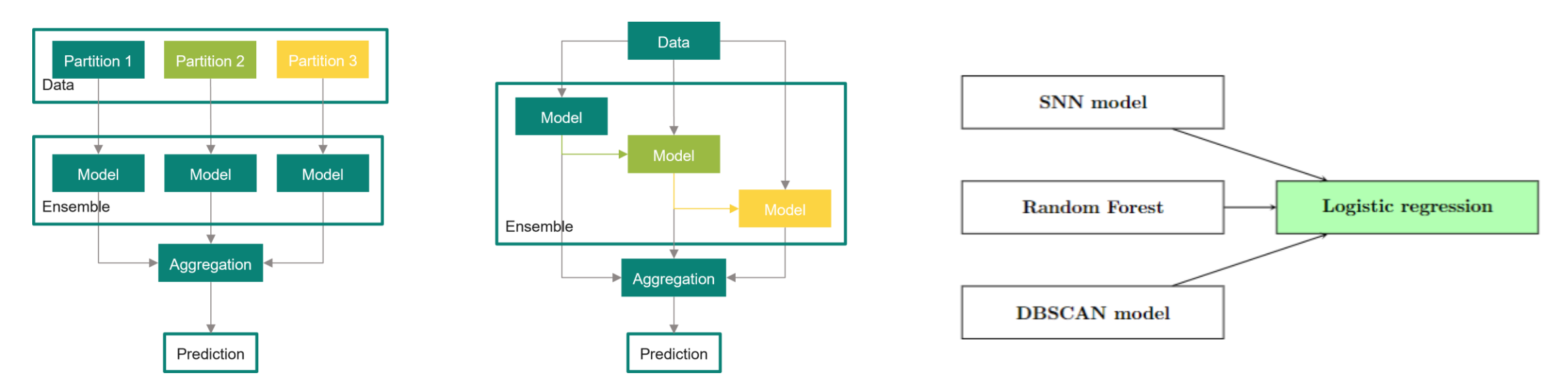
- Position recognition and people counting play a key for industrial indoor applications like laboratory and factory monitoring
- State-of-the-art approaches have issues with privacy, latency, scalability and cost
- IFAG and EESY explore the scaling of the neuromorphic technology, SNNs, to solve these problems
- Demonstrator setup consists of:
  - Platform 4.2 with Multi-SNN-ASIC-Unit
  - 4 sensor nodes with cameras and radars
  - Processing pipeline with single SNN models and ensembles



- Platform 4.2 with Multi-SNN-ASIC-Unit was developed by IFAG for exploration of distributed SNN algorithms
- Unit consists of a FPGA for management of the distributed models and two INNATERA SNN ASICs



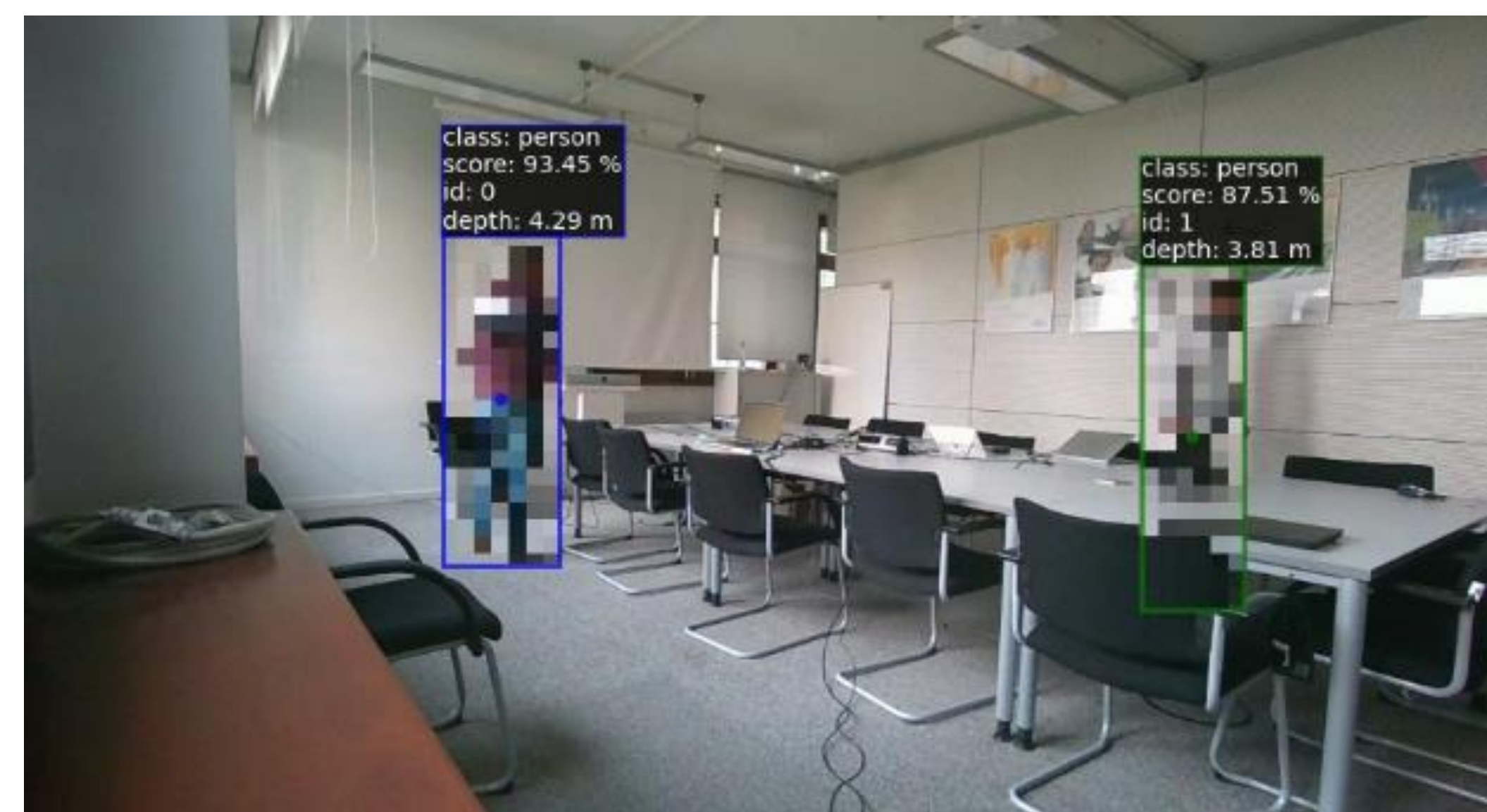
### Technology



- Three different SNN ensemble approaches were developed based on the standard methods bagging, boosting and stacking
- One CNN and single SNN models were implemented and developed as reference

### Results

- Evaluation Data sets gathered with setup containing 0 to 5 persons standing and walking in a room
- Evaluation showed:
  - Ensembles cannot beat single models, but they have comparable performance
  - Stacking approach has the best accuracy on the platform
  - Application may not complex enough to benefit from ensembles
  - CNN is overall slightly better than other approaches



### Impact

- Results define the next research directions:
  - Investigation of SNN for complex applications ( e.g. generative AI)
  - Exploring how distributed approaches compare in regard to other KPIs and evaluation criteria (e.g. robustness)
  - Development of other distributed SNN algorithms (e.g. big-little approach)
- Adapting product planning based on research results
- Leveraging results for further funding project projects e.g. NEUROKIT2E

### Progress beyond SoA

- Exploration and development of high performing SNN ensembles in the context of complex application
- One of the first steps towards leveraging combination of different AI algorithms for complex applications
- Scaling SNNs via ensemble approach
- Development of concepts for multi AI/NN ASIC hardware architectures

### Lessons learned

- Potential determined of:
  - distributed SNN algorithms
  - approaches combining SNNs with other AI approaches
- Chosen KPIs do not provide the full picture
- Software and hardware results have a lot of potential for improvements
- Evaluation method of distributed approaches need to be improved (e.g. consider data transfer in measurements)
- Still looking for a killer application for SNNs

