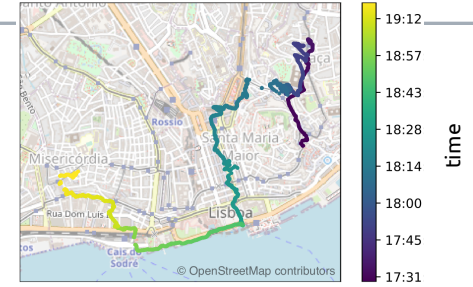




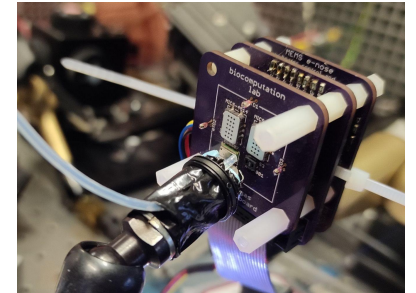
Shutterstock



DJI drones



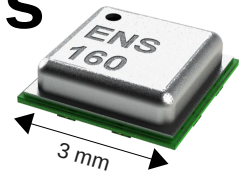
Rapid Inference of Geographical Location with an Event-based Electronic Nose



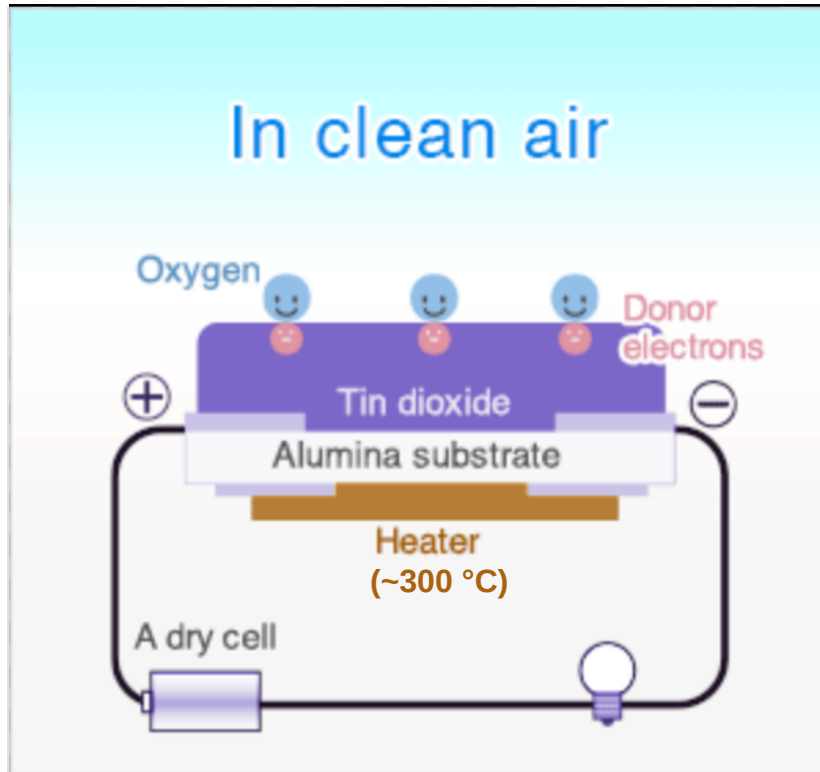
Nik Dennler, Damien Drix, Shavika Rastogi,
André van Schaik, Michael Schmuker

Artificial Olfaction using Metal-Oxide Gas Sensors

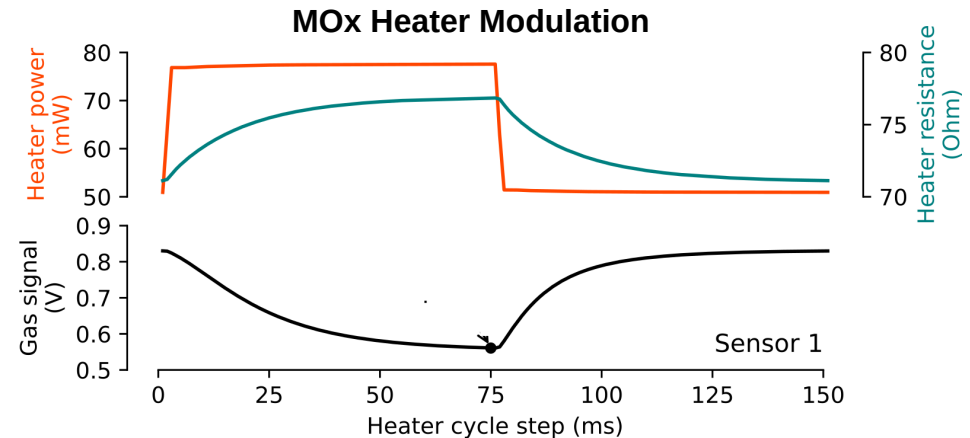
Sciosense B.V.1



- Sensor resistance drop when reducing gases react with TiO_2
- Sensitive, but not very specific
- Conventionally, heated to constant $\sim 300^\circ\text{C}$
- Heater modulation increases specificity and decreases integration time

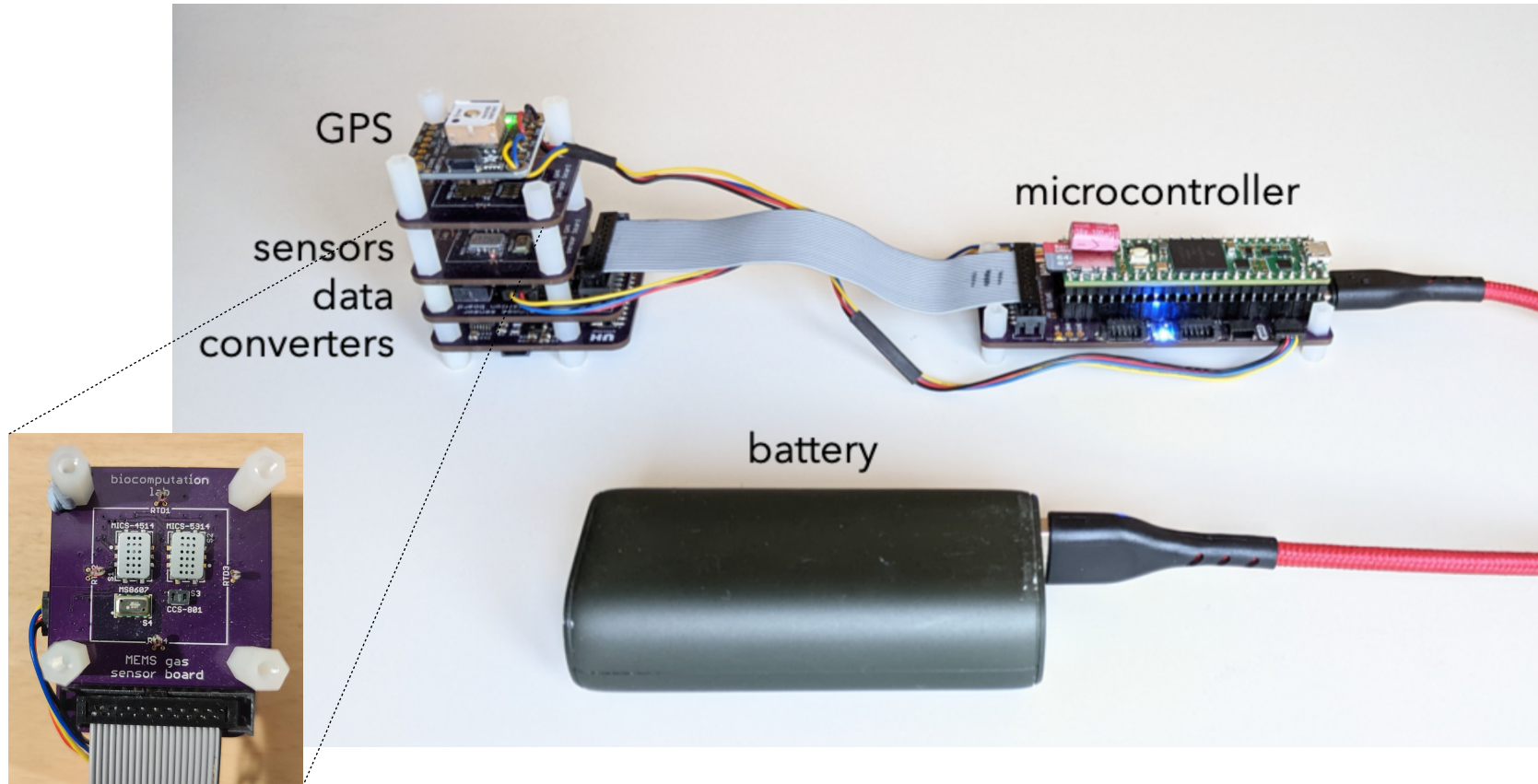


Figaro Inc.

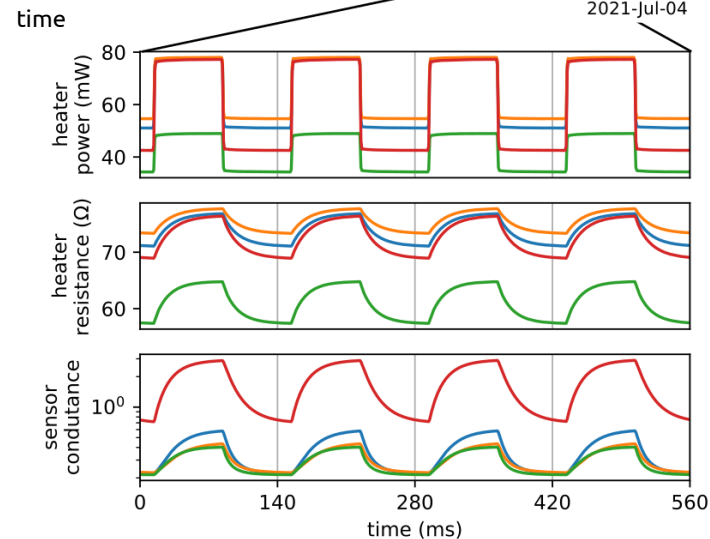
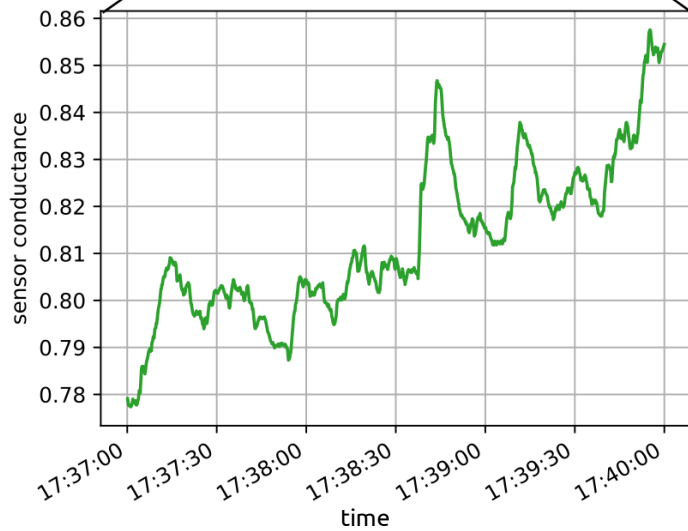
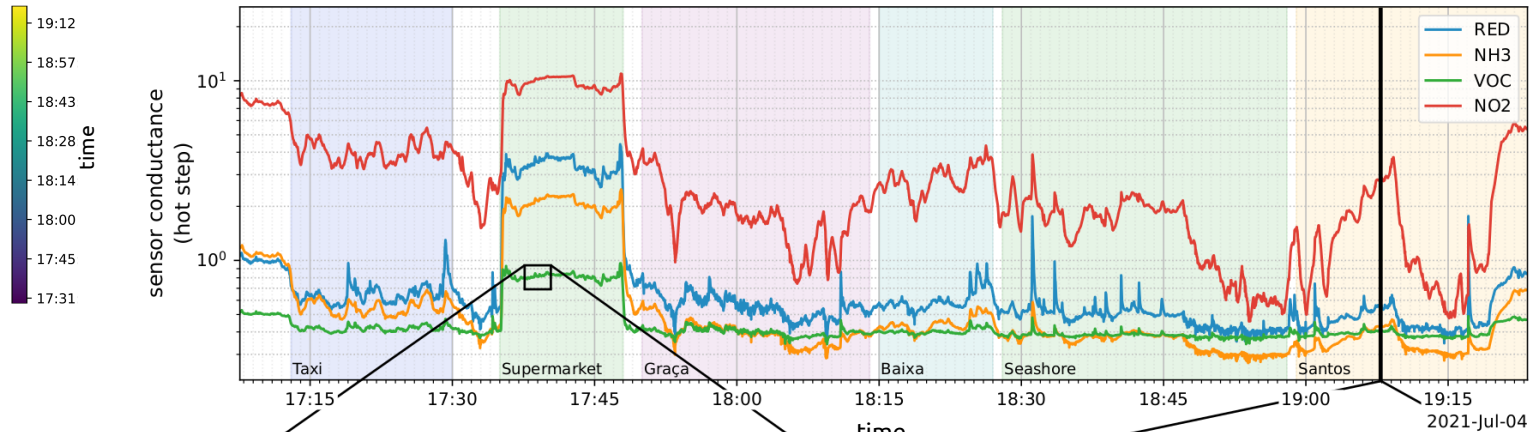


Drix and Dennler et al., 2022, in press

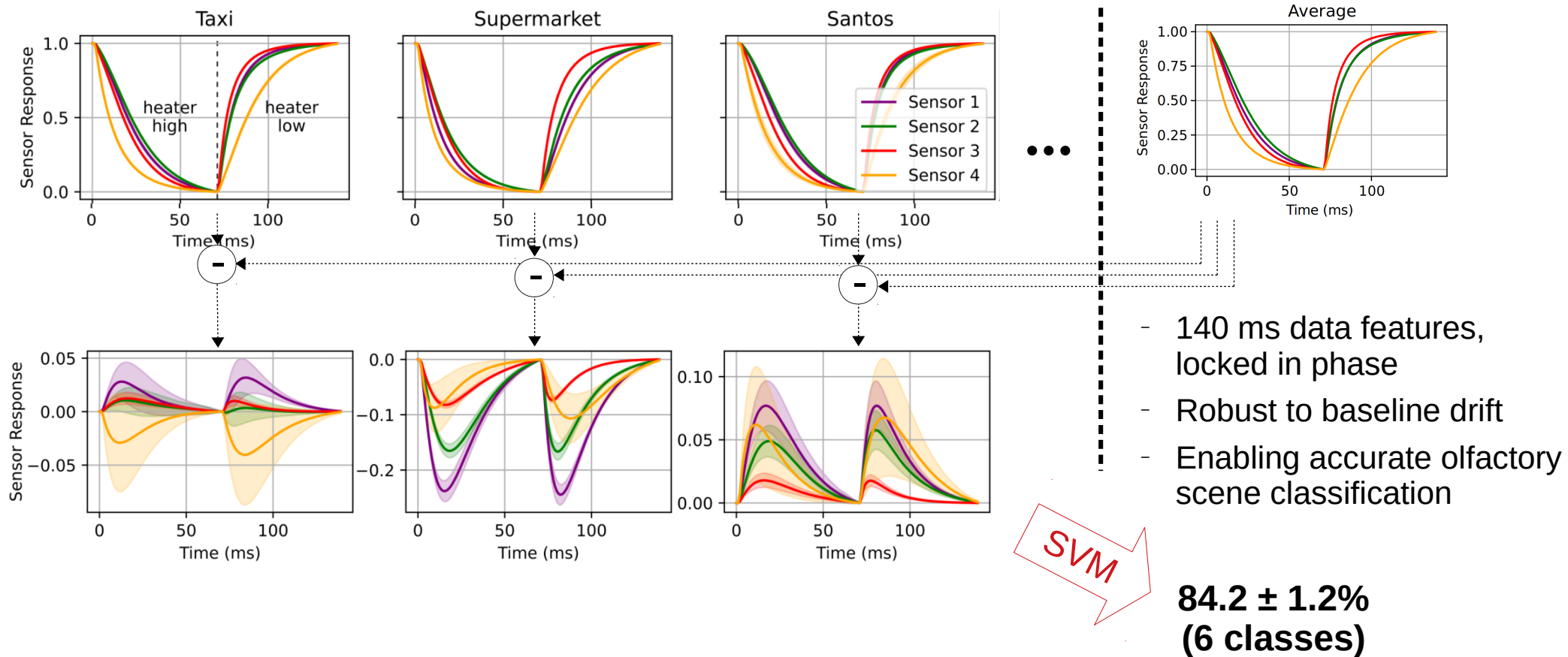
4-Chn Heater Modulated (H-M) Electronic Nose



4-Chn H-M Electronic Nose: Field Recordings

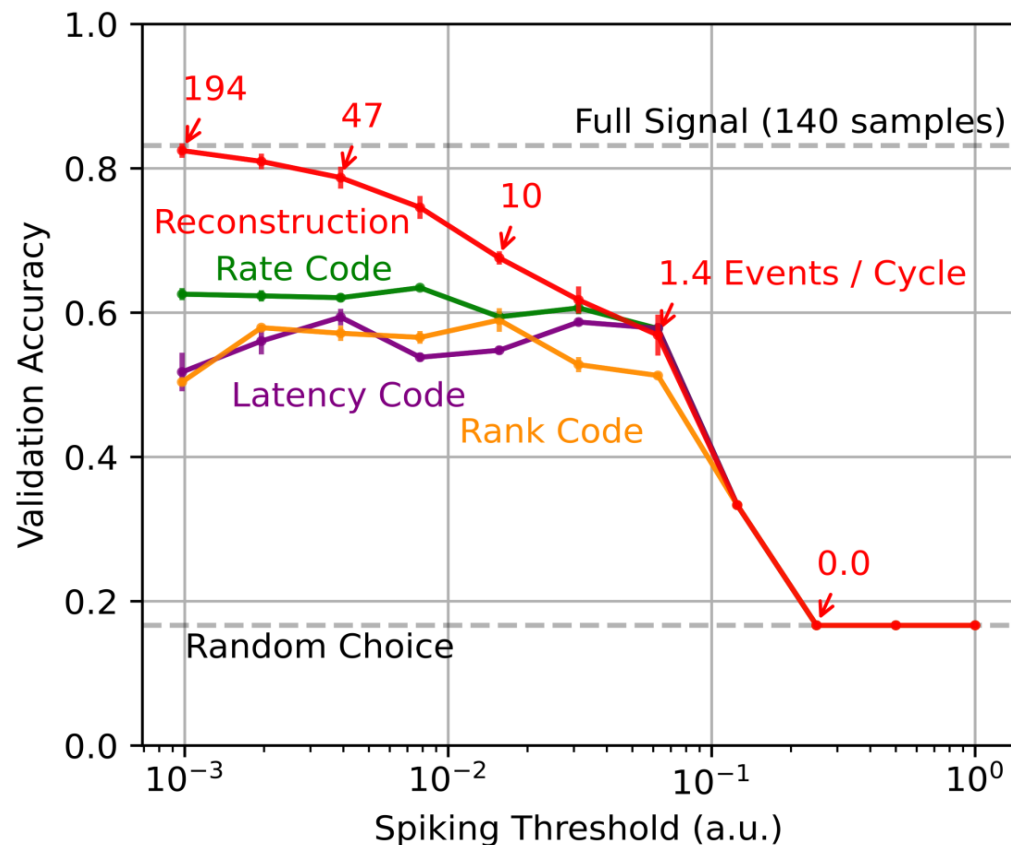
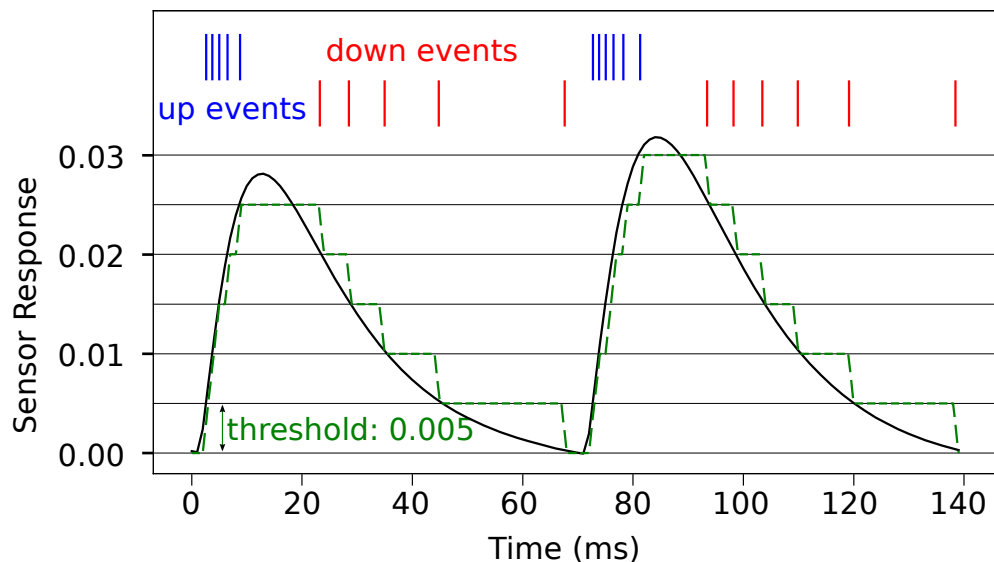


4-Chn H-M Electronic Nose: Features



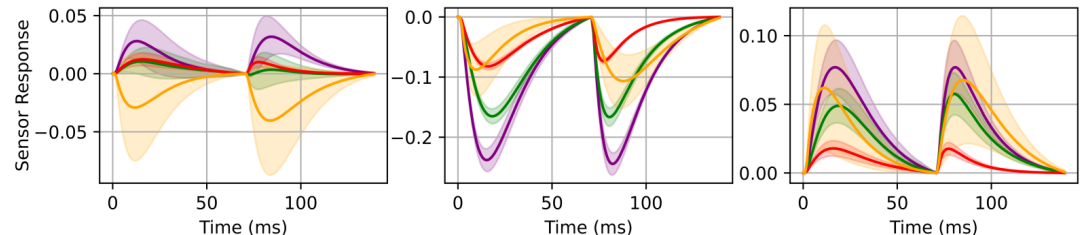
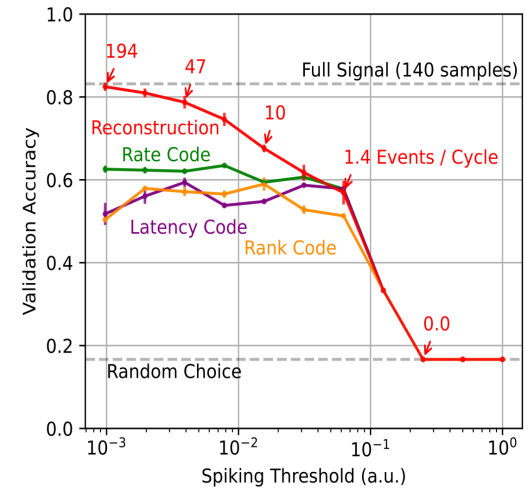
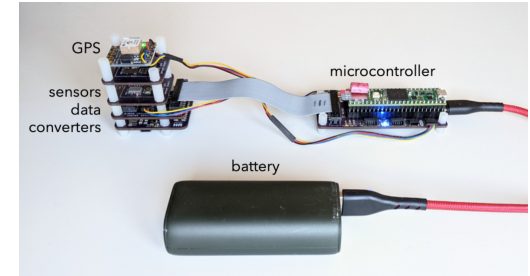
4-Chn H-M Electronic Nose: Events

- Change-event generation via send-on-delta sampling
- Comparing classification performance for different event encoding schemes (reconstruction, rate code, latency code, rank code)



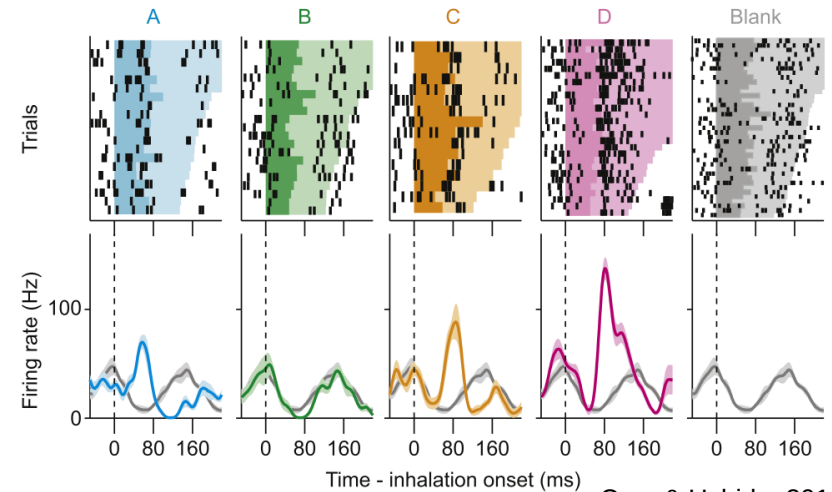
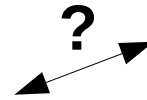
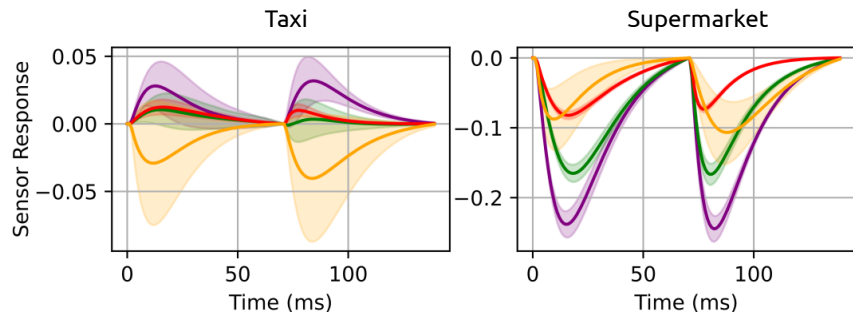
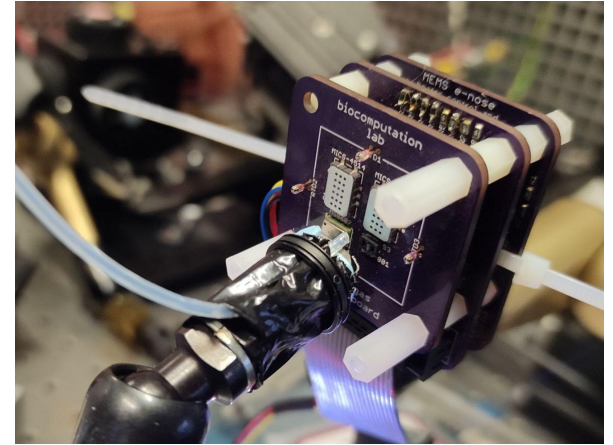
Key Takeaways

- Novel electronic nose design using heater modulated MOx gas sensors
- Heater cycles lend themselves for fast and robust odour classification features
- When considering events, the full temporal dynamics of event trains yield much better results than rate code, latency code and rank code



Work in Progress and Next Steps

- Verify results in controlled environment
- Explore analogies to biological olfactory system (oscillations in activity of tufted & mitral cells)
- Implement spike-based processing (SNNs)
- Consider full hardware implementation of neuromorphic olfactory sensor front-end



Cury & Uchida, 2010

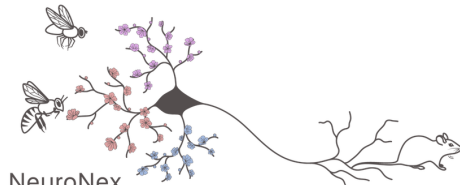
Acknowledgements

Damien Drix

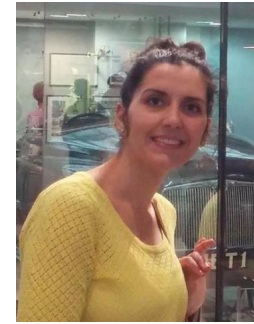
Shavika Rastogi

Prof. André van Schaik

Prof. Michael Schmuker



NeuroNex
ODOR2ACTION



Maria Psarrou

Samuel Sutton

Tom Warner

Prof. Andreas Schaefer