

# AI for environment at RISE

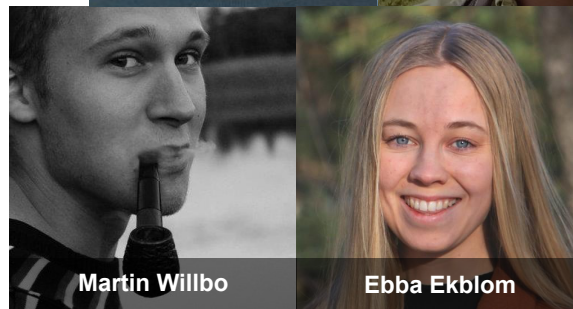
*Olof Mogren, PhD*



**RI  
SE**

# Research group

- Applied modelling:
  - Environment and climate
  - Health and precision medicine
  - Privacy-preserving machine learning
  - Efficient and distributed learning
- Language, vision, sound, sensor data, combinations
- Foundations of machine learning
- Collaborations

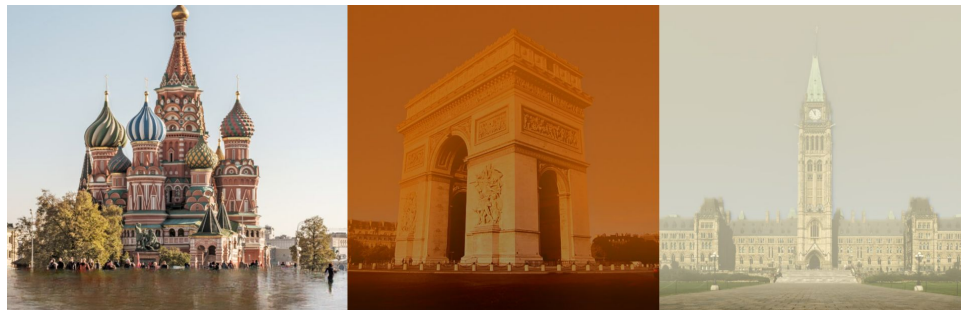
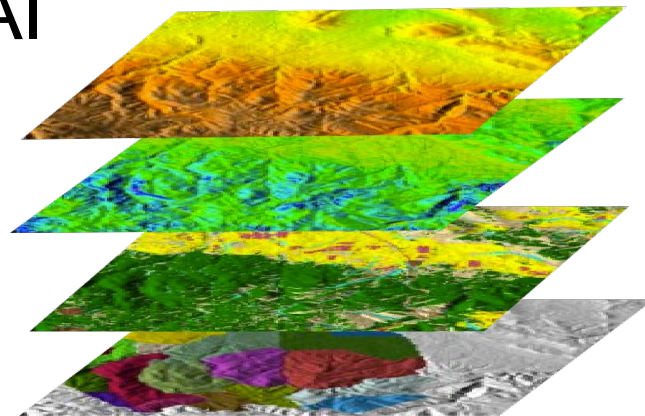




*Altenburg, Germany, July 2021. India Times.*

# Climate change adaptation using AI

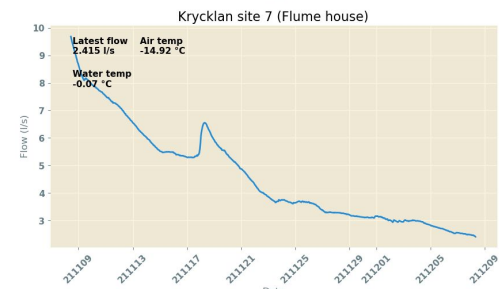
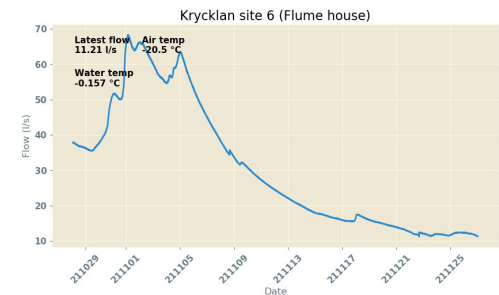
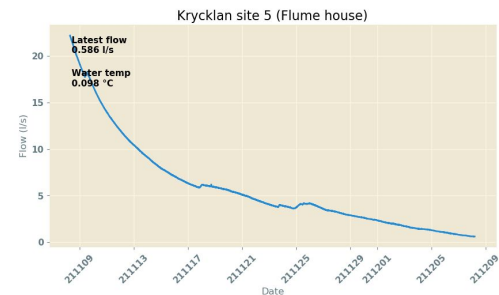
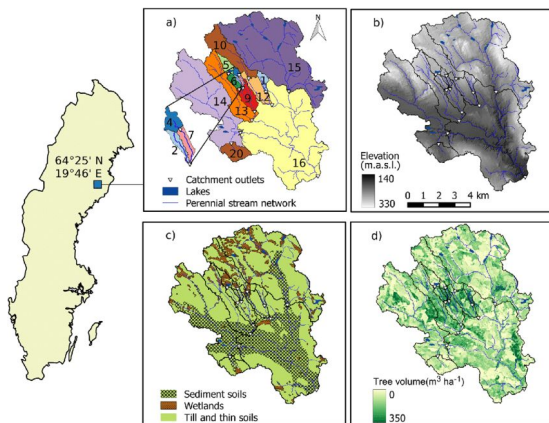
- Geographical analysis
  - Risk prediction: flooding, landslides, etc.
  - Capacity i wetlands and floodplain
  - Visualise and demonstrate scenarios
  - Where to do efforts?
- Biodiversity
  - Risk prediction
  - Track key species
- Disaster management
  - Wild fire tracking and prediction



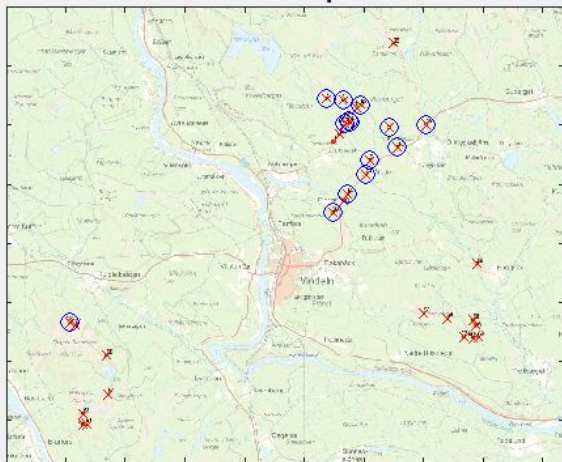
[thisclimatedoesnotexist.com](http://thisclimatedoesnotexist.com)

# Krycklan catchment area

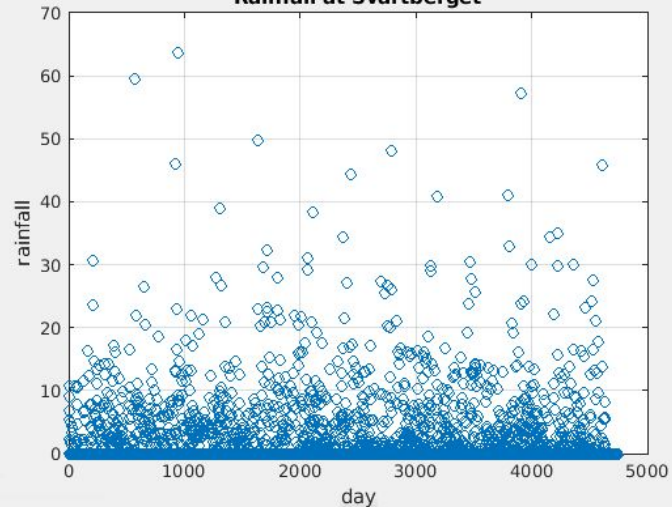
- Vindelälven
- 6780 hectare watershed catchment
- Over 30 years
- hydrology, climate, water, and soil water chemistry



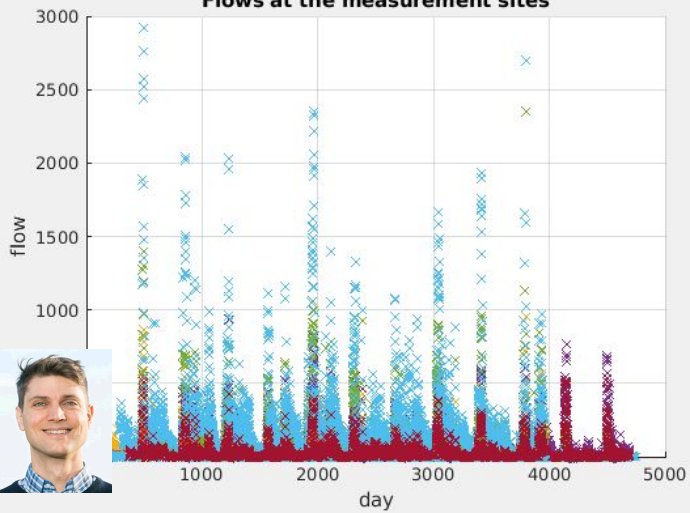
### Measurement map with ids



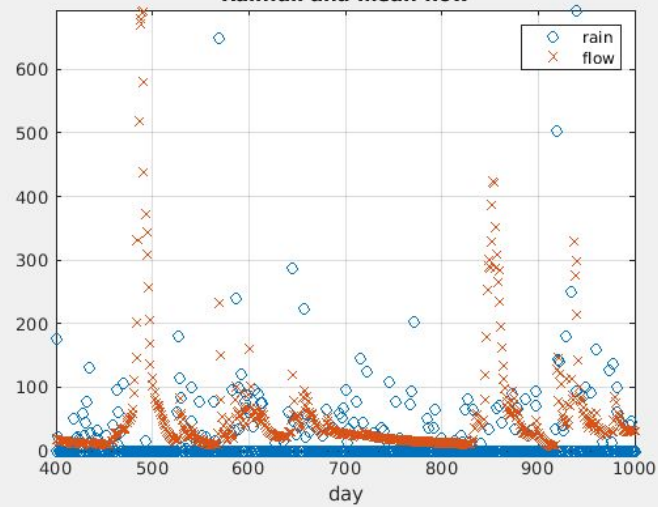
### Rainfall at Svartberget



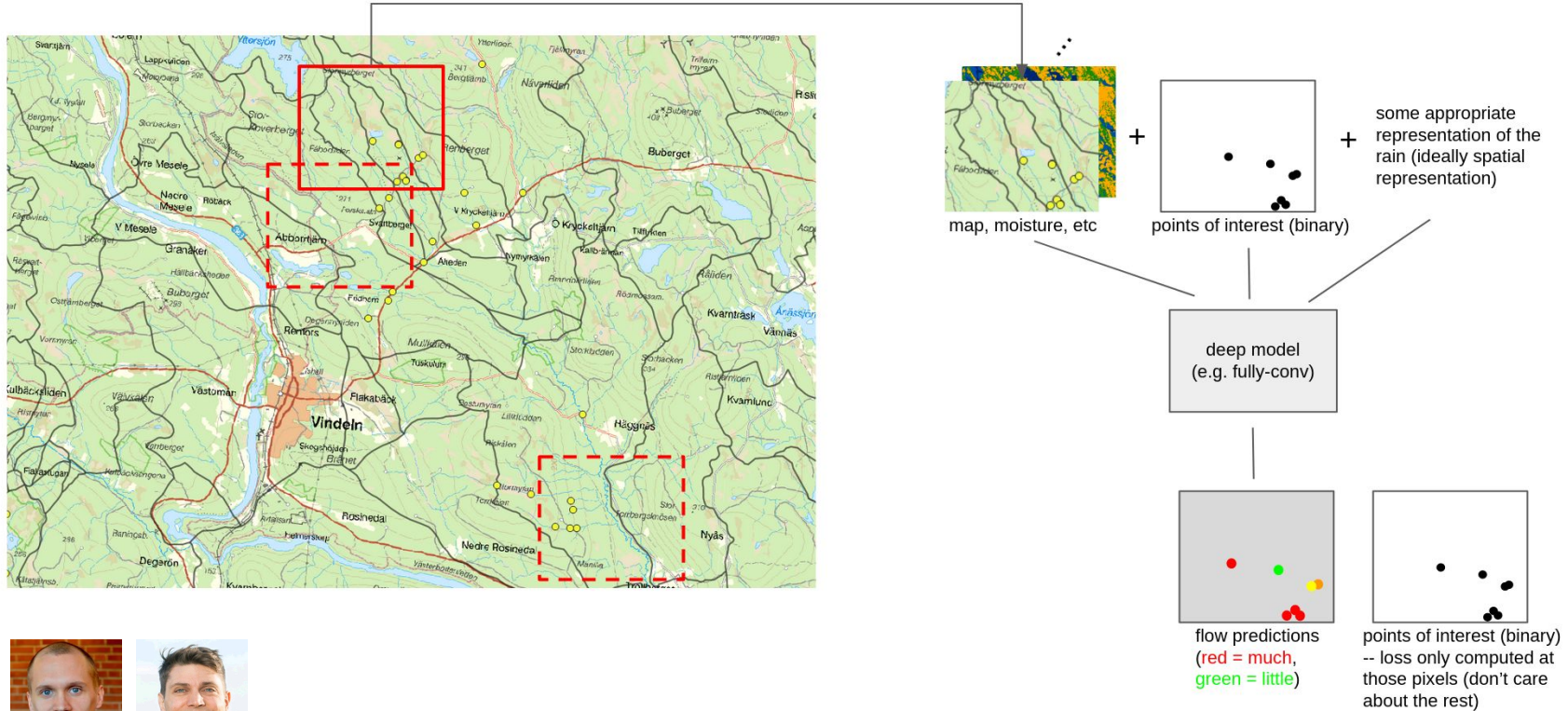
### Flows at the measurement sites



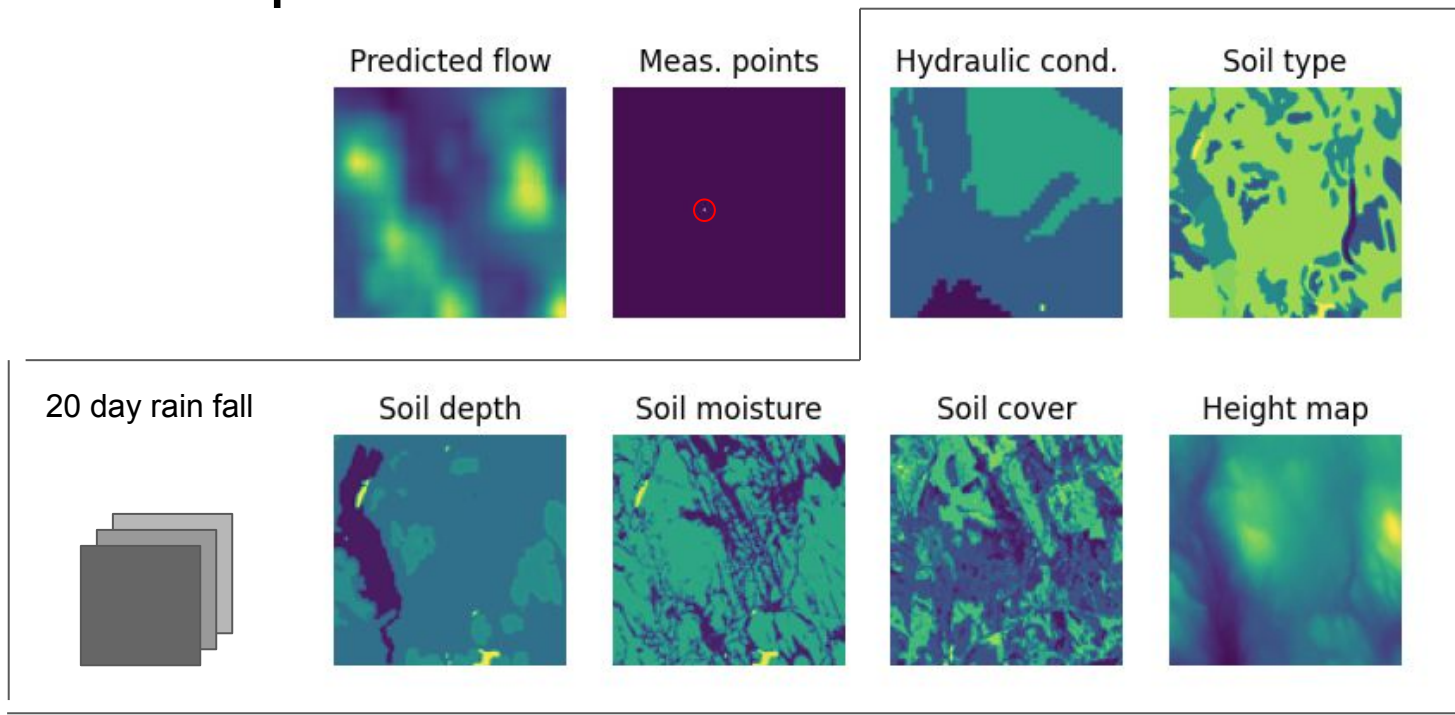
### Rainfall and mean flow



# Krycklan catchment



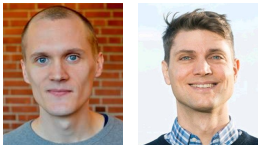
# Feature maps





# Preliminary insights, Krycklan

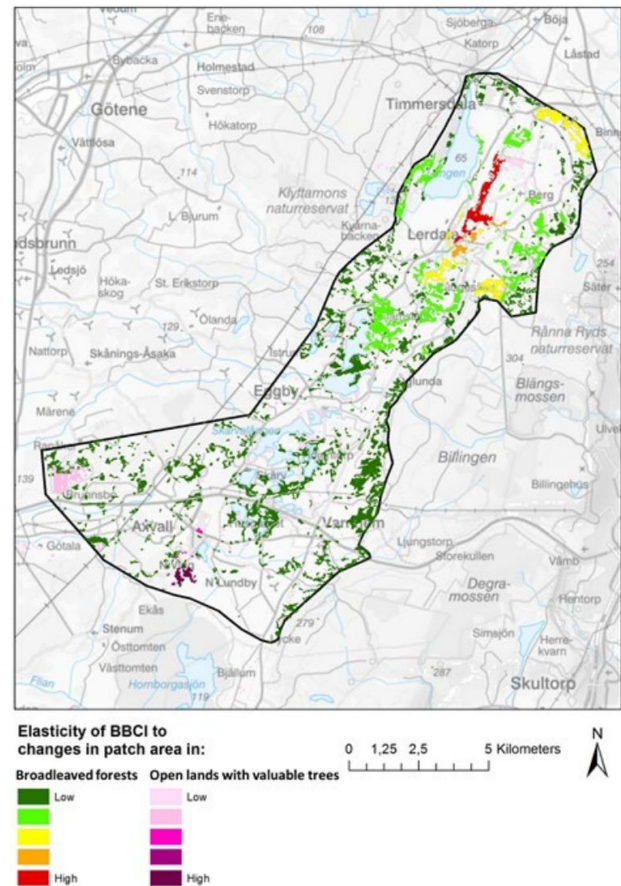
- Flow is predictable
- April/May more challenging
- Feature importance evaluation ongoing



# Biodiversity quantification

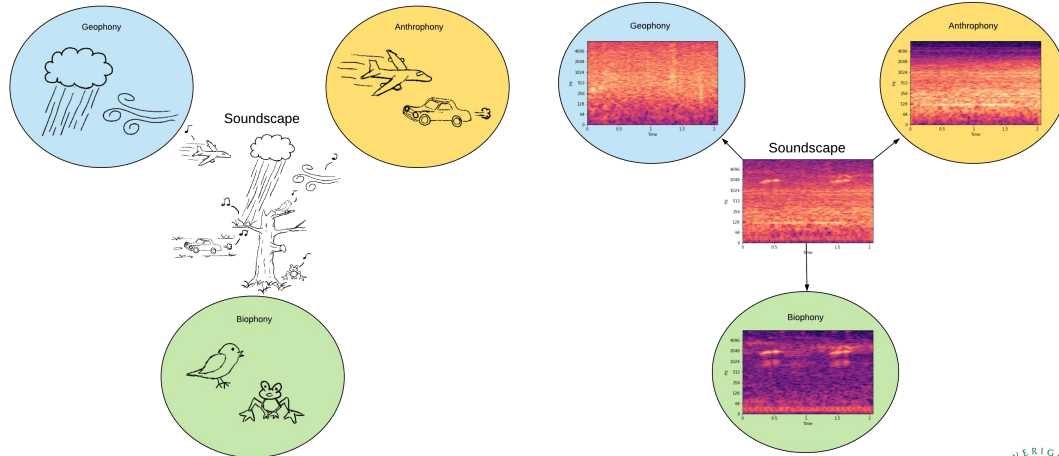
# Habitat diversity for biodiversity

- Multimodal holistic analysis of habitat diversity
- Remote sensing
- Swedish National Land Cover Database (NMD)
  - geographic forest data
  - land-cover data from sources such as the
- National Inventories of Landscapes in Sweden (NILS)
  - substrate information

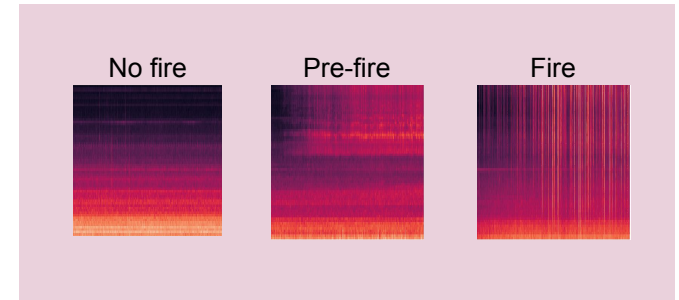


# Soundscape analysis for biodiversity modelling

- PhD project
- Environmental monitoring
  - weather events
  - marker species



Acoustic source separation



Sound event detection

# Data

“Does the recorded data meet expectations?”  
Noise? Missing values?

**Band A: Appropriateness**

Is the data actually useful to solve the task?

**Band B: Faithfulness and representation**

From “Hearsay data” to  
“data is accessible”

**Band C: Accessibility**

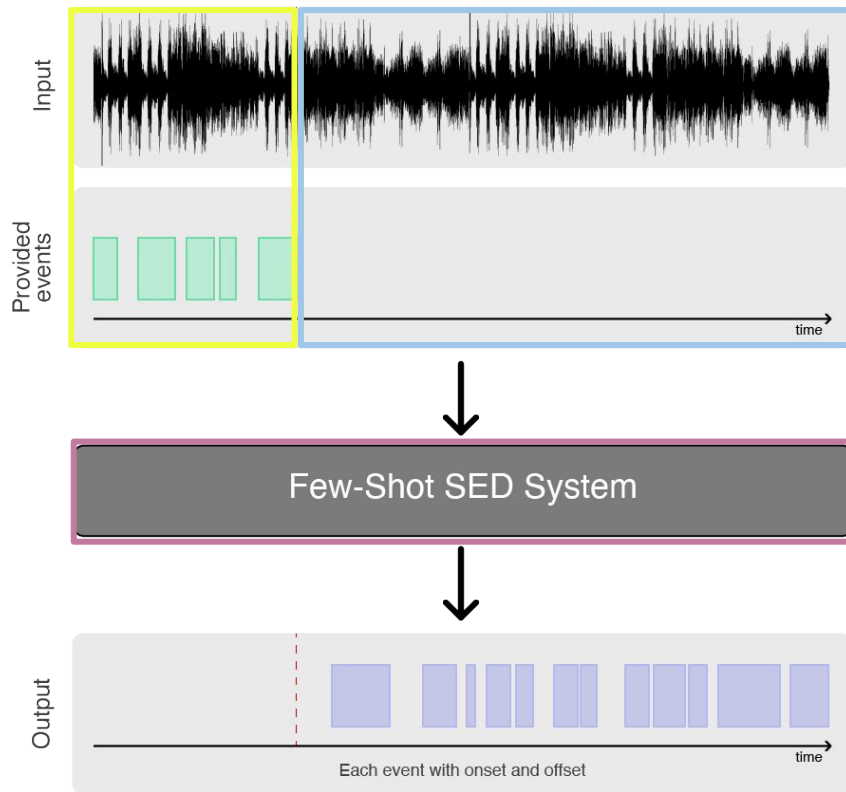
# Sound event detection

- Large amounts of data
- Laborious annotation
- Learn from few examples



# Sound event detection

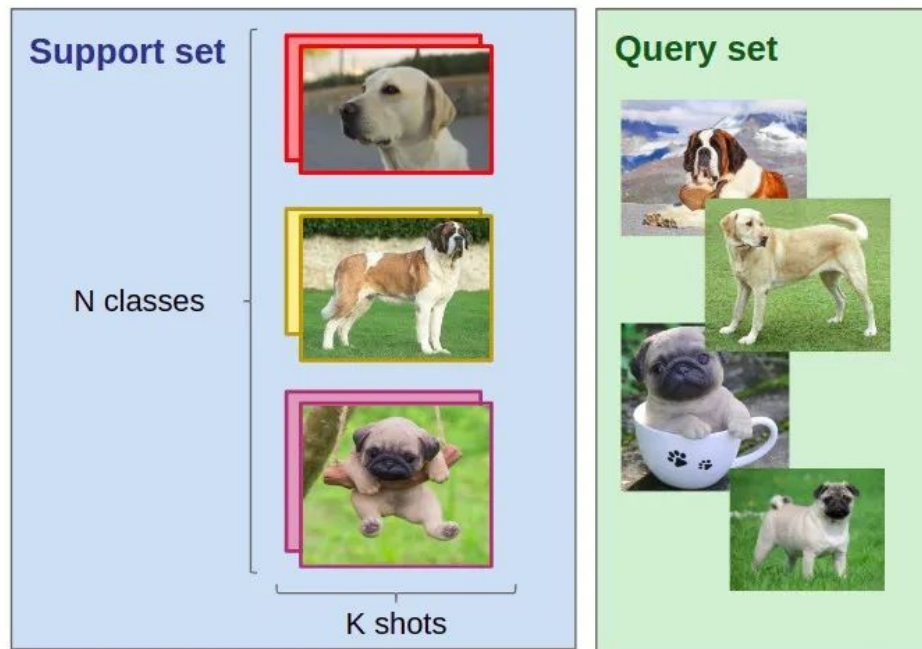
- Support set from provided events
- Query set
- Goal: Predict event onsets and offsets in the audio



# Few-Shot Learning

*Small set of examples of each class*

- K-shot
- N-way
- Support set
- Query set



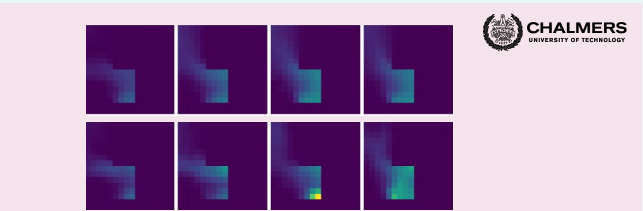
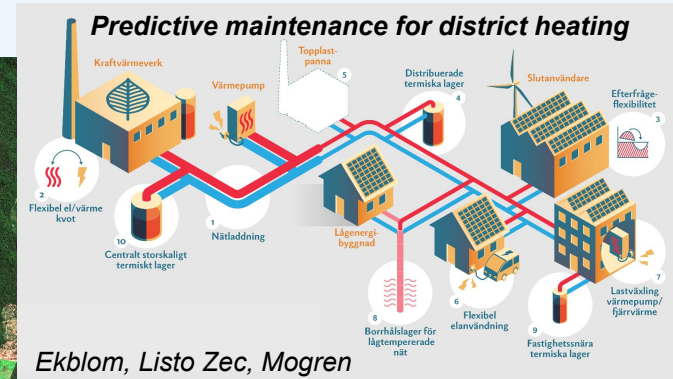
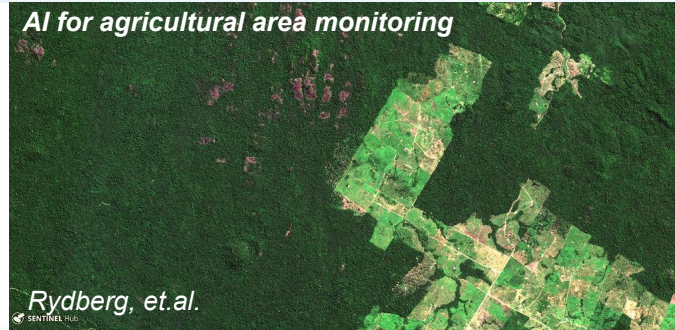


# Self- or semi-supervised few-shot learning for sound event detection

- Leverage large unannotated data sets
- State-of-the-art few-shot learning



# Related activities at RISE



Physics simulations, Edvin Lam & Mogren, MSc proj.

Martinsson, Listo Zec, Gillblad, **Mogren**. Adversarial representation learning for synthetic replacement of private attributes. IEEE Big Data 2021 <https://arxiv.org/abs/2006.08039>, 2020.

Onoszko, Karlsson, **Mogren**, Listo Zec. Decentralized federated learning of deep neural networks on non-iid data 2021 FLUPDC workshop at ICLM, <https://arxiv.org/abs/2107.08517>

Martinsson, J., Schliep, A., Eliasson, B., **Mogren, O.**, Blood glucose prediction with variance estimation using recurrent neural networks. Journal of Healthcare Informatics Research. 2020. <http://mogren.one/publications/2019/blood/>

# Learning Machines Seminars



Thursdays at 15:00

- 2021-12-16: Stéphane d'Ascoli, FAIR Paris and ENS Paris.
  - *Double descent: insights from the random feature model.*
- 2022-01-13: Andrew Jesson, University of Oxford.
  - *Head in the clouds? Why decision making is hard.*
- 2022-01-20: Jon Nordby, Soundsensing.
  - *Monitoring noise, machinery and processes using Machine Learning.*
- 2022-01-27: Aleksis Pirinen, RISE.
  - *AI and Climate Change.*
- 2022-02-03: Josephine Sullivan, KTH.

**Register to  
receive  
invitations!**

**[ri.se/lm-sem](http://ri.se/lm-sem)**

# Thank You!



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*Notable collaborators in this talk: Martin Willbo, John Martinsson, and Alexis Pirinen.*