# Beyond Geoscience frontiers

Machine and Deep learning for Research applications

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Our very first Motivation: LATICE project*

- <u>Where</u>: Department of Geosciences

- <u>What</u>: Land-ATmosphere Interactions in Cold Environments
  - Sensor design
  - Snow – Ice
  - Vegetation-soil

- <u>Technological problems identified</u>:
  - Not much knowledge in the department of Geoscience concerning sensor design and machine/deep learning techniques
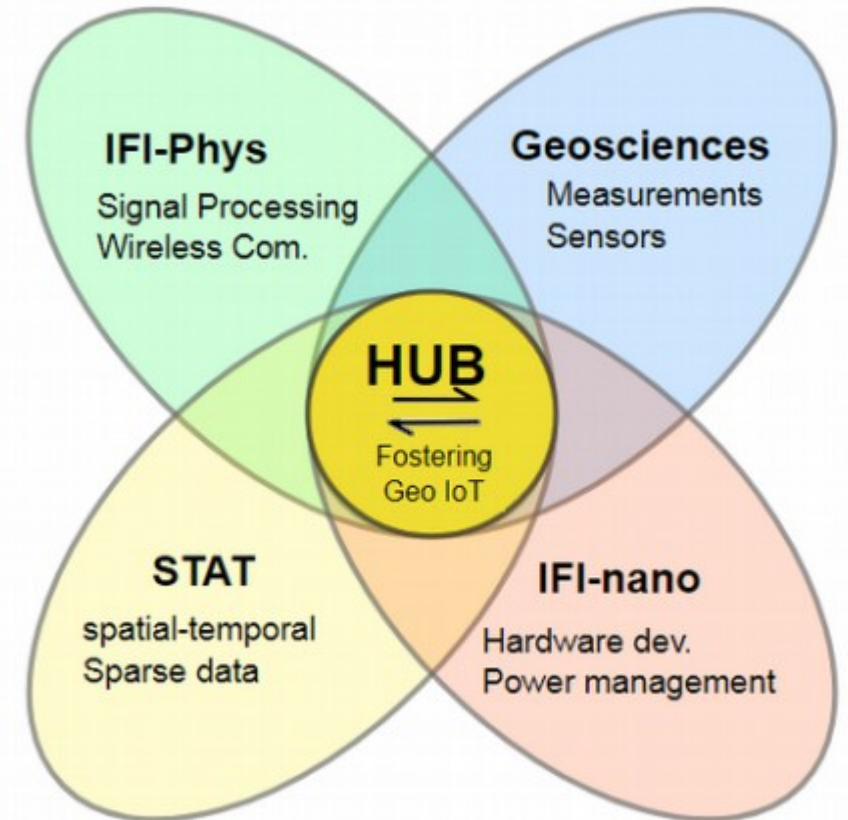 - Researchers wasted a lot of time

*Land-ATmosphere Interactions in Cold Environments (https://www.mn.uio.no/geo/english/research/groups/latice/)
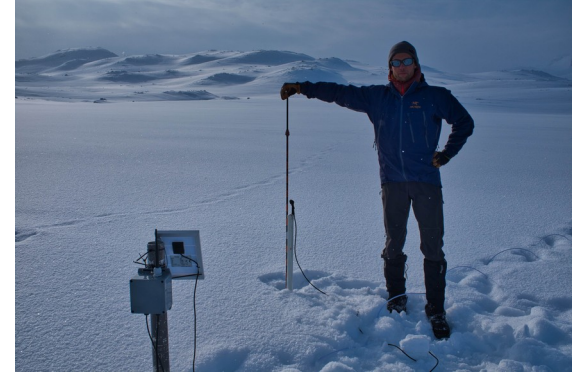
UiOHive

- Share experiences and knowledge across research groups/departments
- Develop in-house technology and software adapted to researcher's needs
- Develop competences (workshops, studyGroups)

Hub of individuals and groups at University of Oslo (Norway) interested by Internet of Things (IoT), microcontroller/Hardware development, Machine&Deep Learning and Artificial Intelligence (AI)

# Training: Establish trust and understand needs

- Feb 3, 2017: Big Data with pyspark
  https://uio-carpentry.github.io/2017-02-03-pyspark/
- Sept 29, 2017: Spatio-temporal data in python
  https://uio-carpentry.github.io/2017-09-29-geopython/
- February 8, 2018: Reproducible Research with Jupyter Dashboard
  https://uio-carpentry.github.io/2018-02-08-dashboards/
- Sept 18, 2018: UiOHive hands-on workshop to learn about microcontroller and sensors
  https://uiohive.github.io/Hive/#portfolio using Åpensonen for
  experimental informatics (http://sonen.ifi.uio.no) facilities
- Oct 19, 2018: StudyGroup@UiO: work along session on deep learning
  https://uio-carpentry.github.io/studyGroup/#portfolio
- Oct 26, 2018: StudyGroup@UiO: co-working session on IoT with Arduino
  https://uio-carpentry.github.io/studyGroup/#portfolio

Research field/question/problem related to AI

- Upscale observed vegetation, soil properties, and fluxes from local scale to continent or even global scale

- Detect the potential relationships between environmental factors and vegetation variables

- Perform downscaling and bias-correction of the climate model output for climate impact study

- Use machine learning for data assimilation to better integrate observations into vegetation model parameterizations

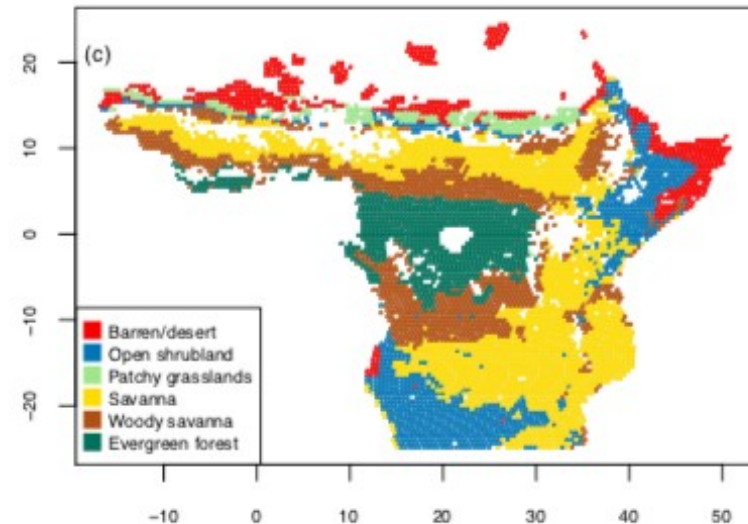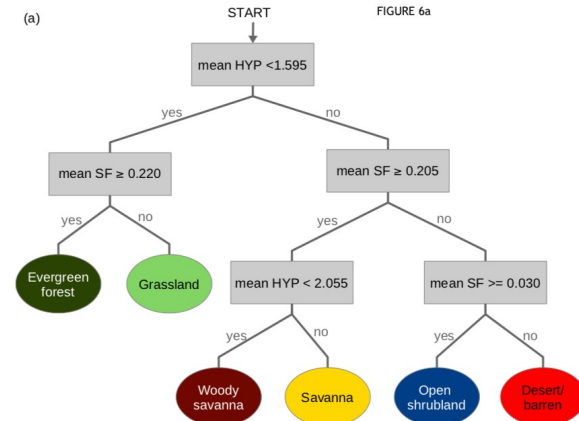# Example studies:

Redescription model

decision-tree model
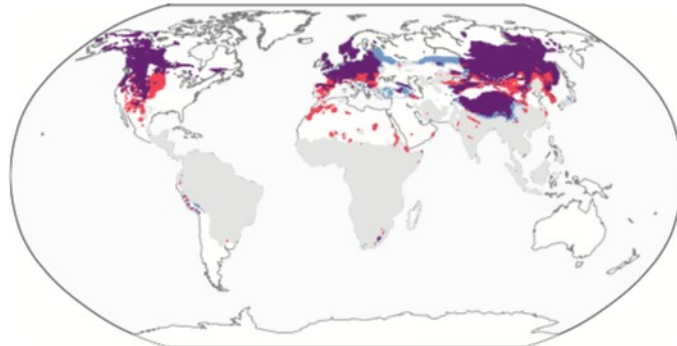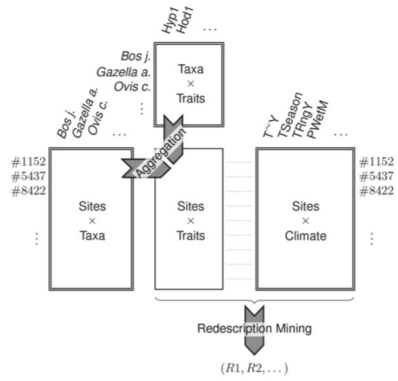
1) Map of redescription R1
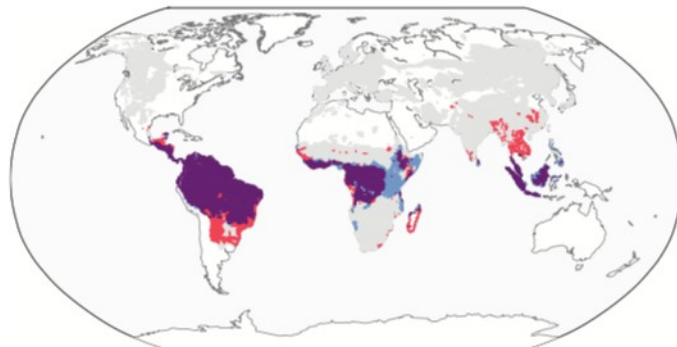
3) Map of redescription R2

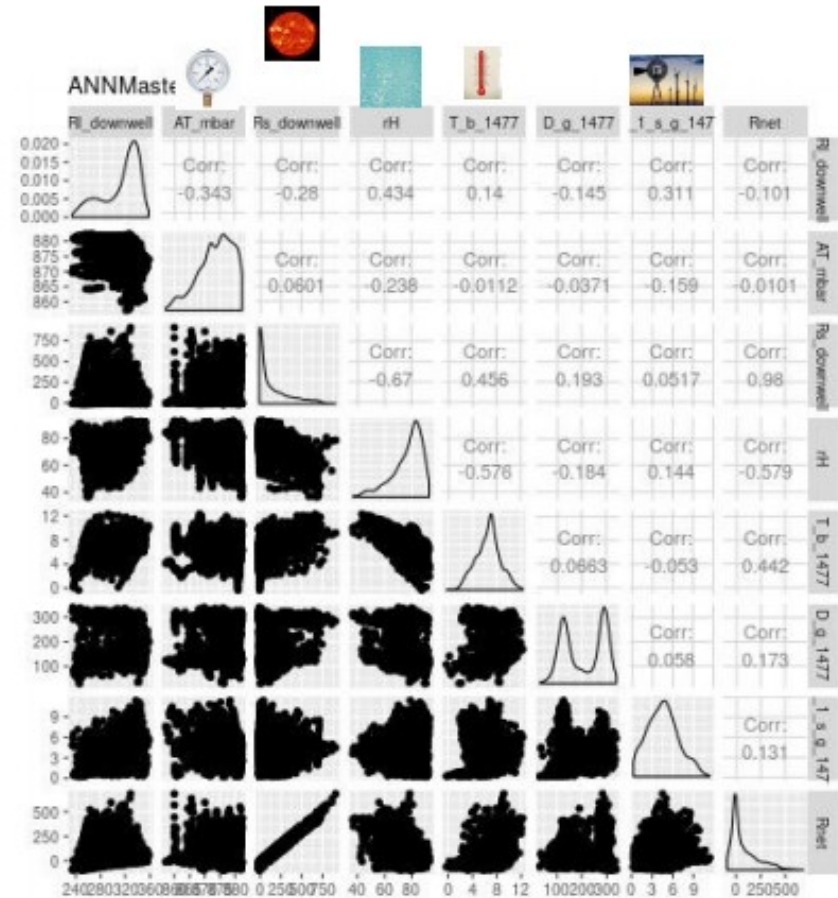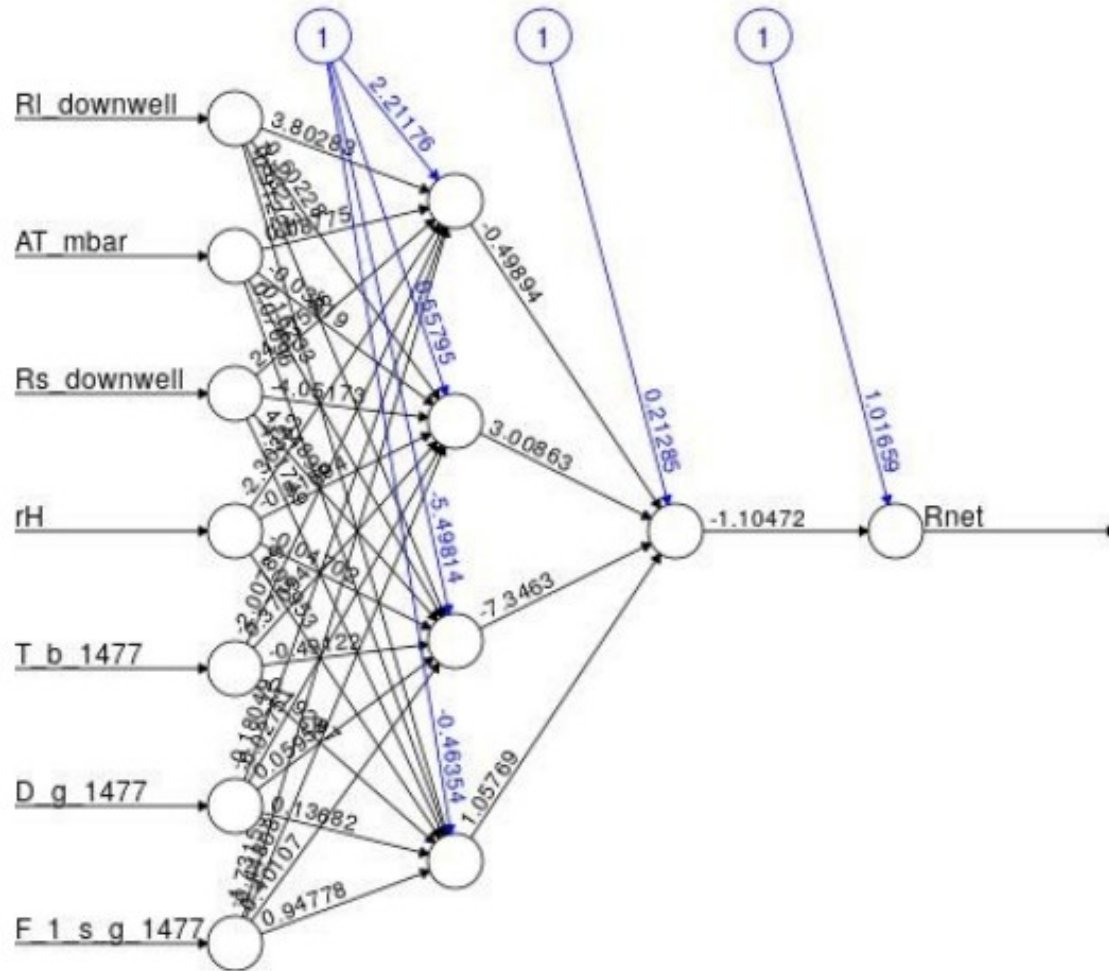*Galbrun et al. 2018*

Zliobaite et al. 2018

Provide support

Error: 0.020769   Steps: 9946

Needs goes beyond Geosciences
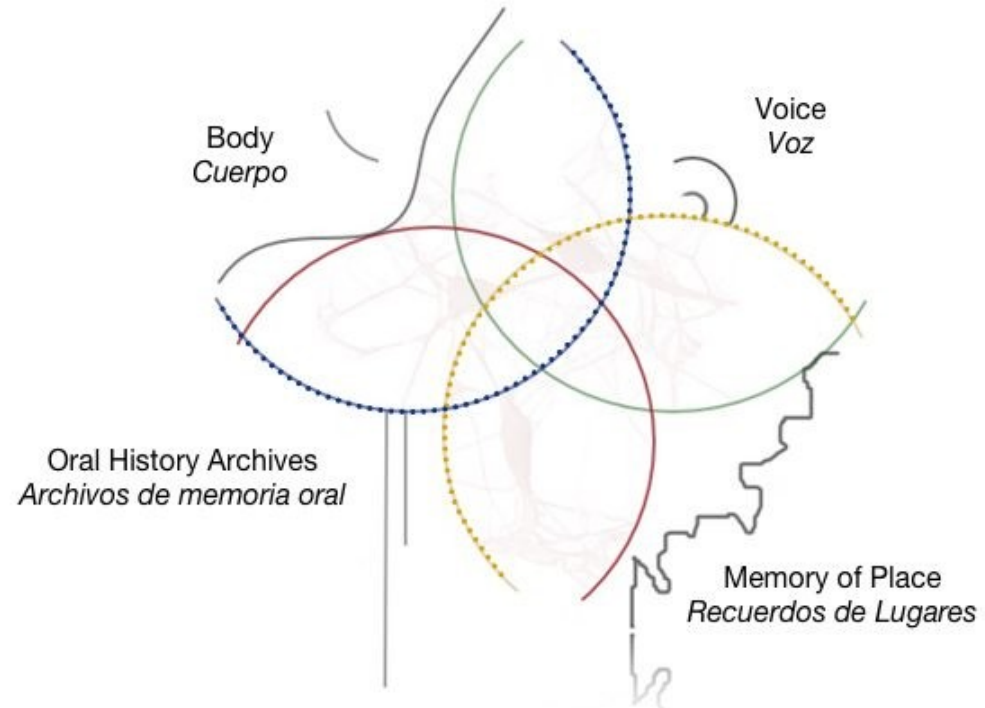# Department of Musicology

https://intimal.net/

Intimal: Interface for relational listening

Ximena A. Diaz

A physical-virtual 'embodied system' for relational listening integrating: **body, memory, migration** and **telematics.**

Conclusion

- Several on-going projects with relatively low needs (both in terms of infrastructure and techniques)

- Researchers gain more knowledge and understanding on how AI can be applied within their fields of research

- We reach much more disciplines than expected in the initial UiOHive project because services to answer to these needs are currently inexistant or unknown at UiO…

✉ We expect a substantial increase in resources needs both in terms of capacity and services

What is needed...

- Most users do not care (and do not know...) whether it is via servers with GPUs, HPC facilities, public or private cloud services BUT
  - They will need to access large amount of data and computing resources
    - Storage (NIRD)
    - Compute (Notur, IaaS, etc.)

- They need performance but more importantly easy to use Services such as those offered by private cloud providers (see for instance AWS Amazon SageMaker, Amazon Storage, Amazon Compute) to gain a better understanding on their needs
- Strong collaboration with USIT and Sigma-2 is required