Categorization of Meteorological Data by Contrastive Clustering

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Tackling Climate Change with Machine Learning
ICLR 2024

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Wetter und Klima aus einer Hand
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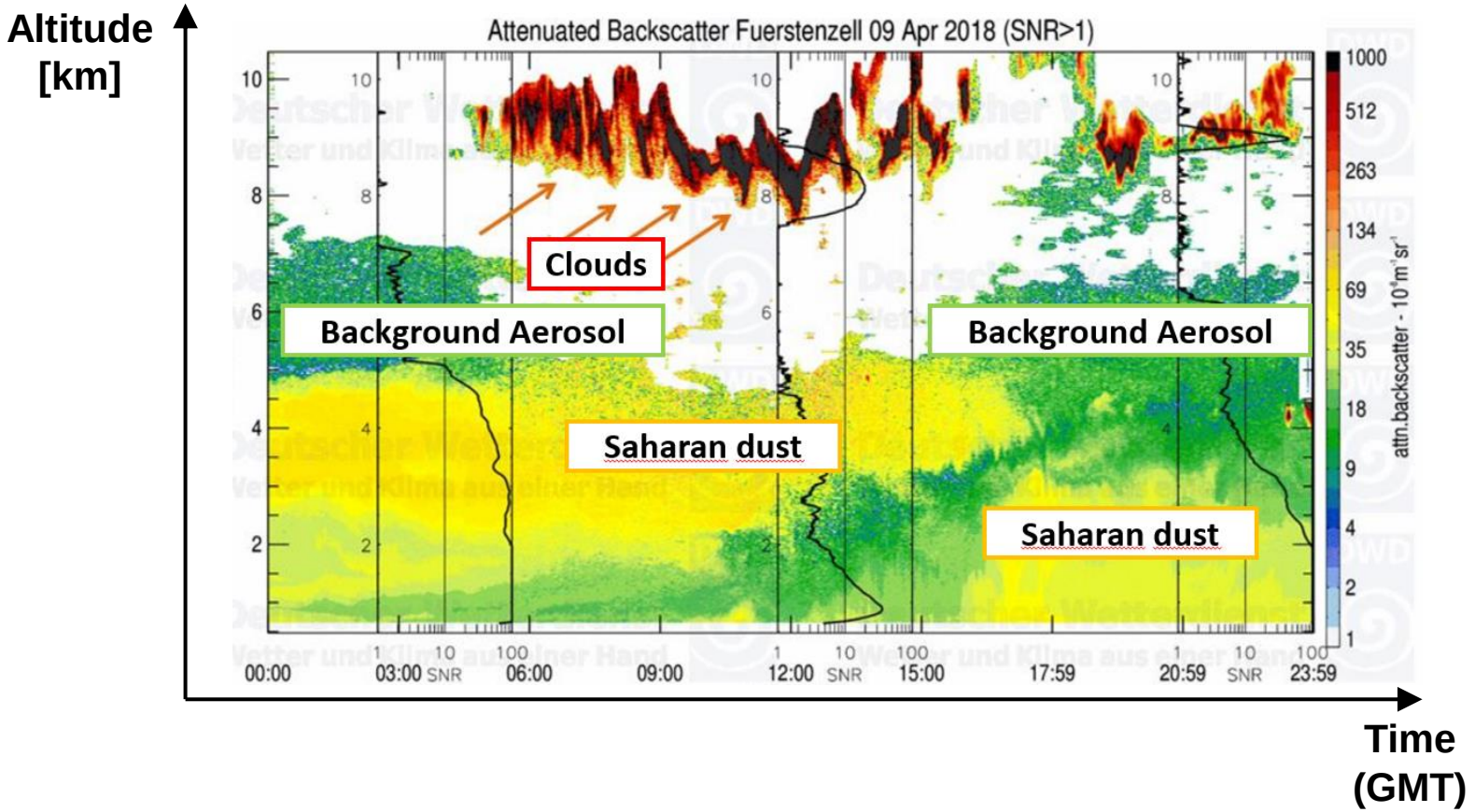
Ceilometers

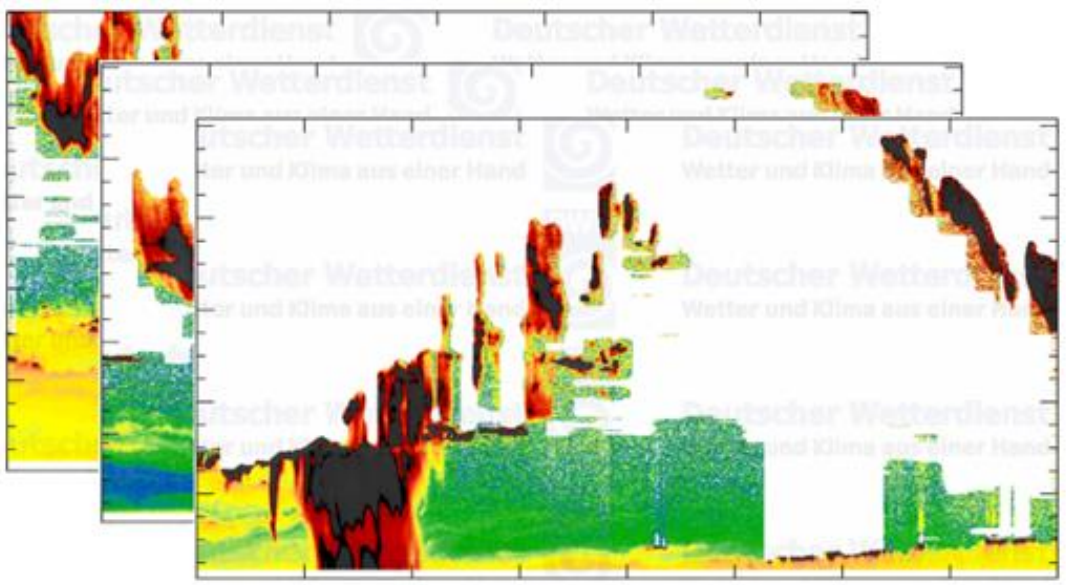
Example measurement - “Quick Look”



Simple LIDAR system
Vertical laser beam
Continuously measuring backscattered light

https://www.dwd.de/DE/service/lexikon/Functions/glossar.html?lv2=100510&lv3=100538
https://www.dwd.de/DWD/forschung/projekte/ceilomap/files/Saharan_dust_example_en.pdf

The Problem



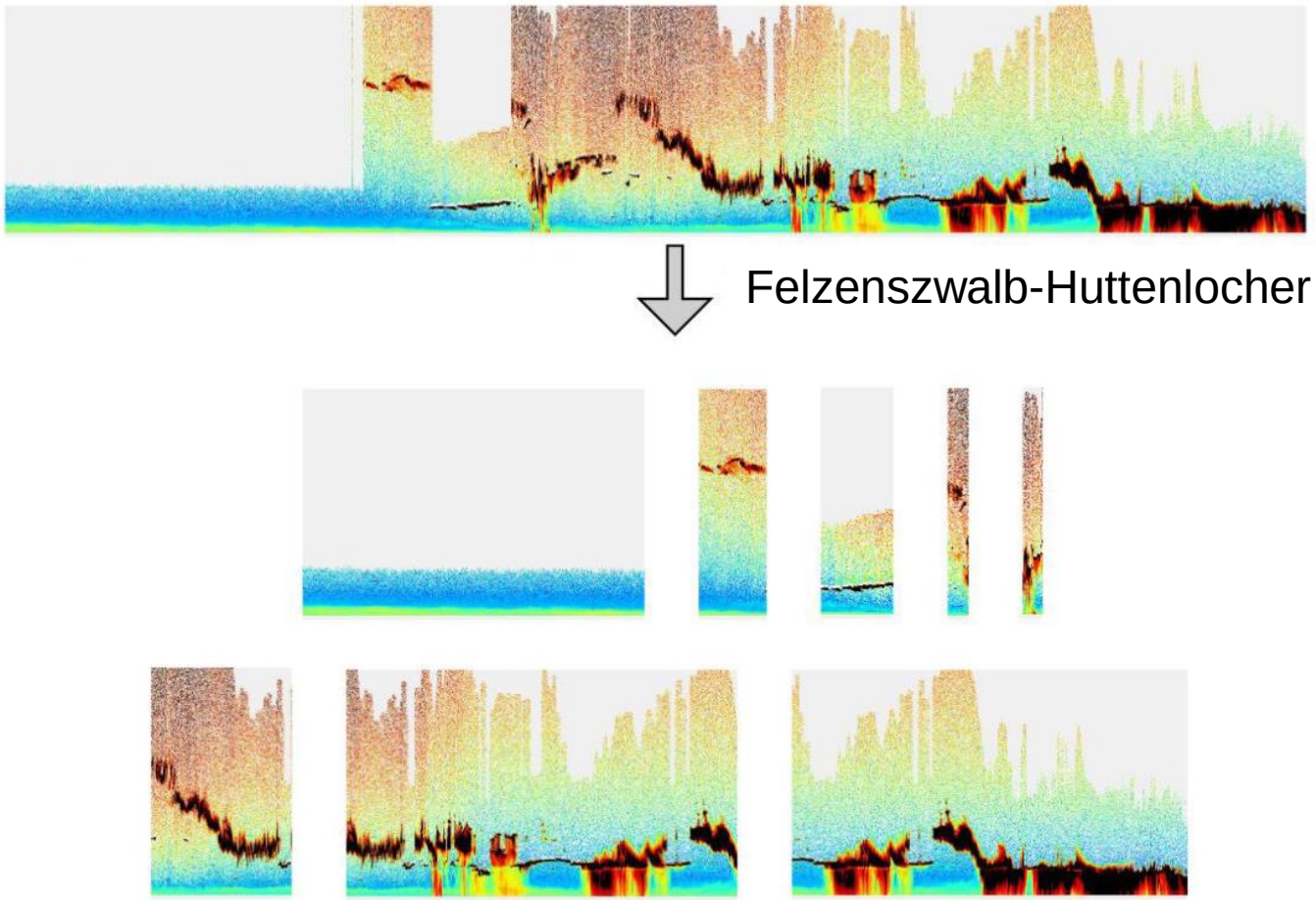
Data is unlabeled

At the moment:
analyzed manually by meteorology experts

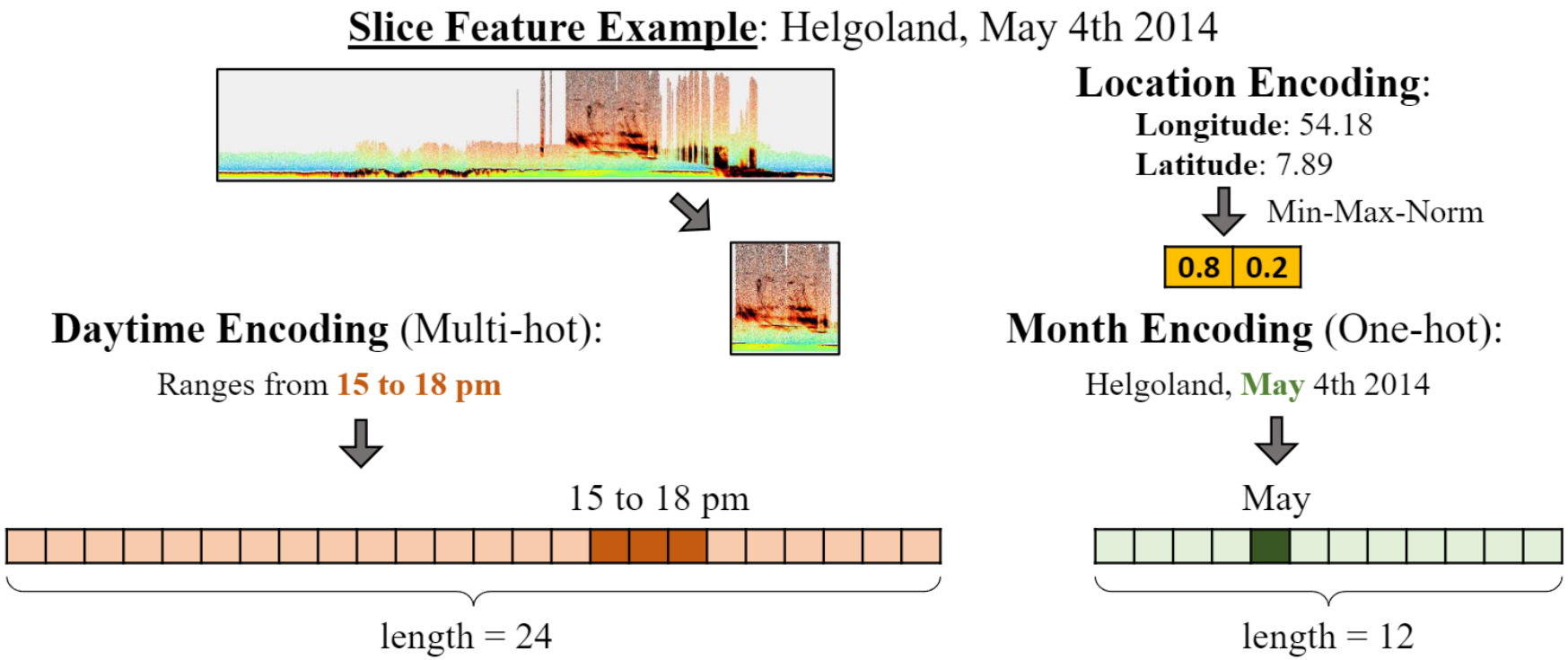
→ Unsupervised Machine Learning

- **Climate science insights**, like frequent, but not necessarily obvious, phenomena
- Automatic detection of situations with specific meteorological conditions for more detailed case studies, e.g., on **aerosol-cloud interactions**

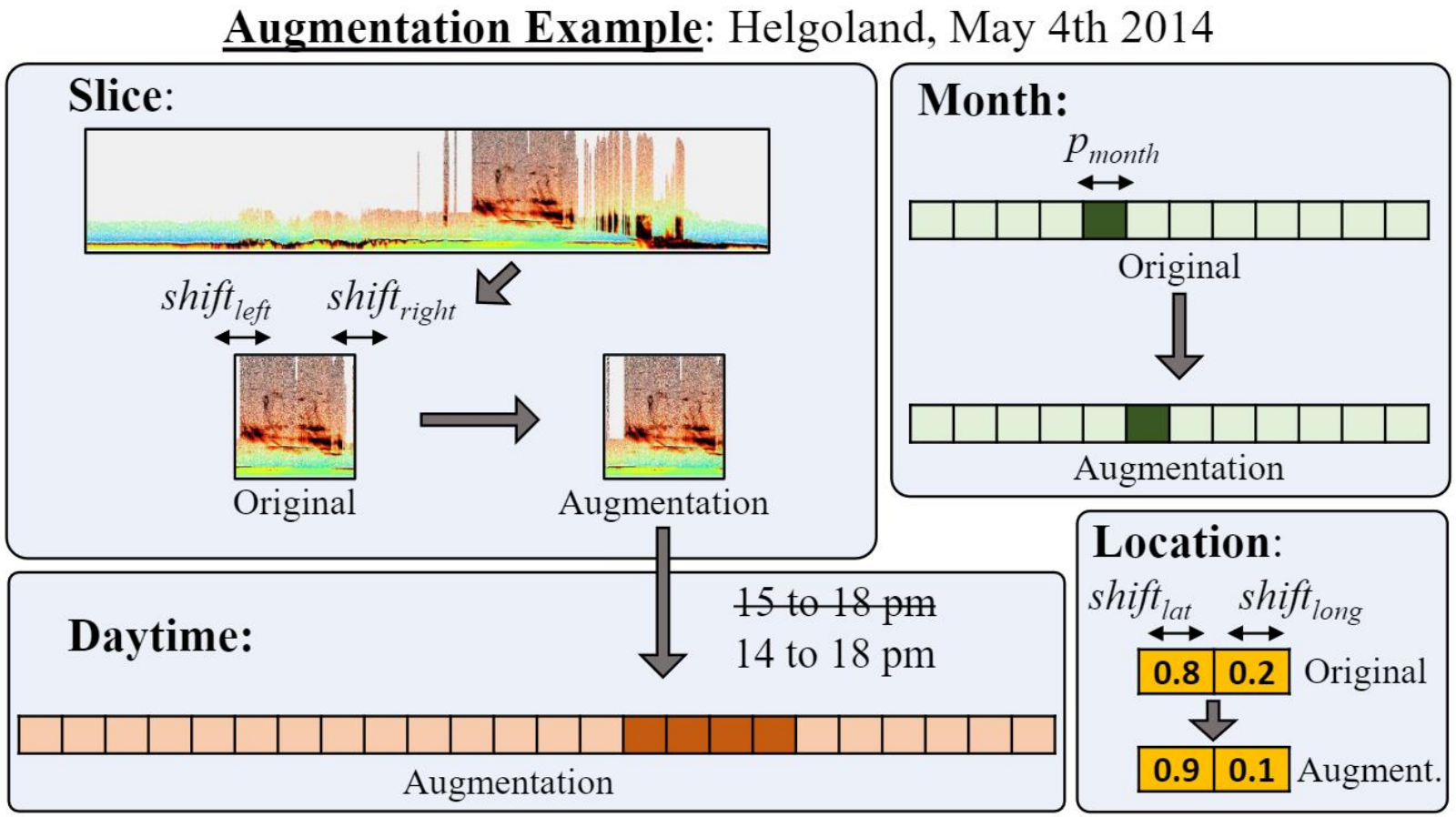
The Approach: Slicing



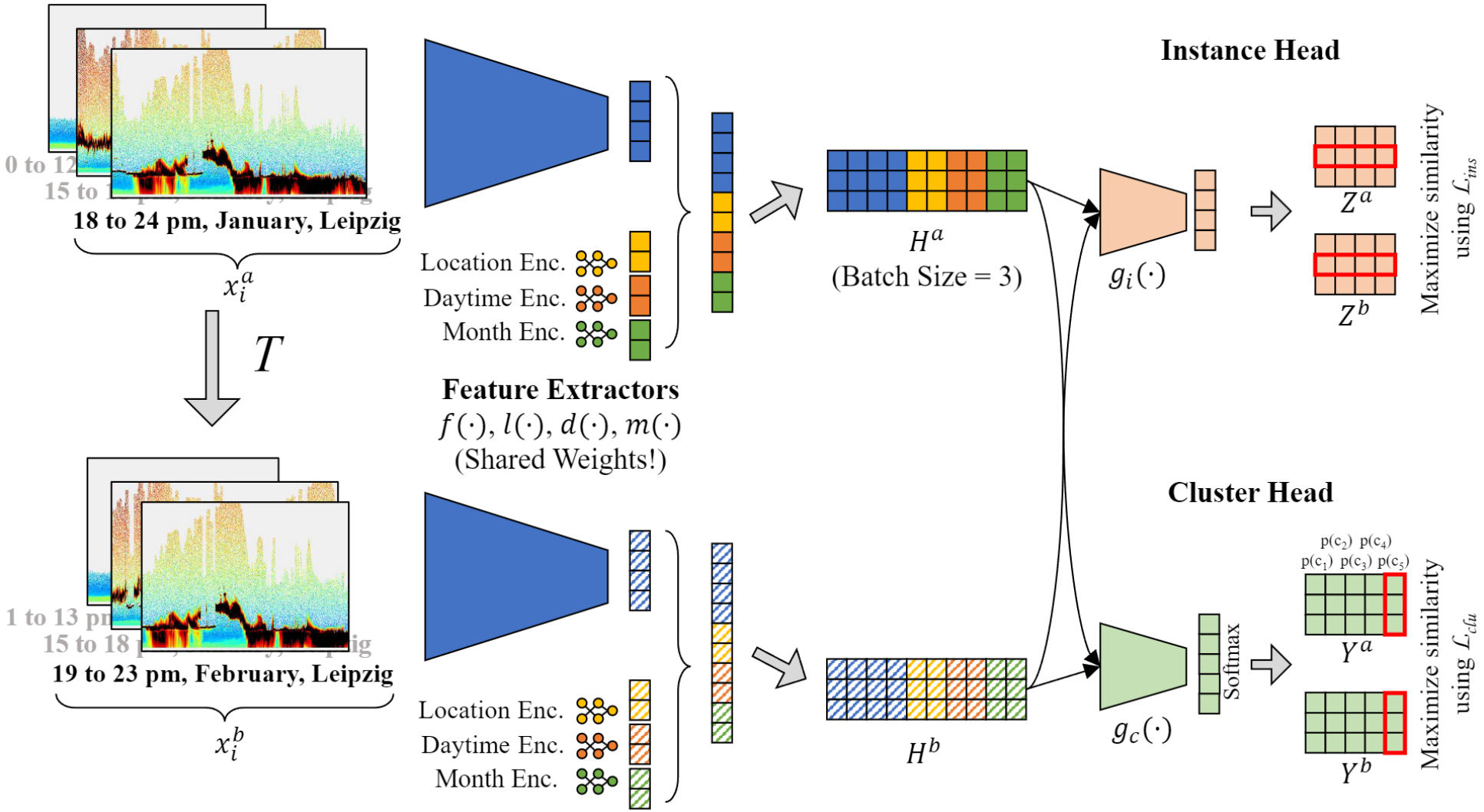
The Approach: Slice Feature Engineering



The Approach: Augmentation Regime

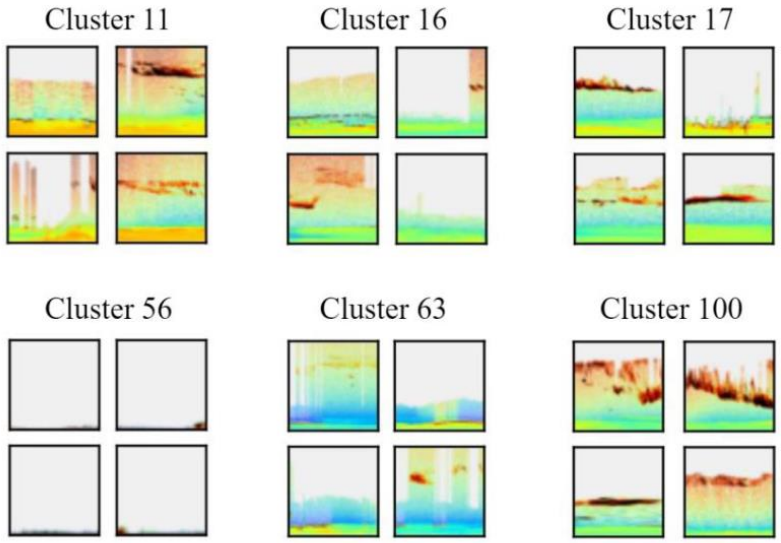


The Approach: Contrastive Clustering

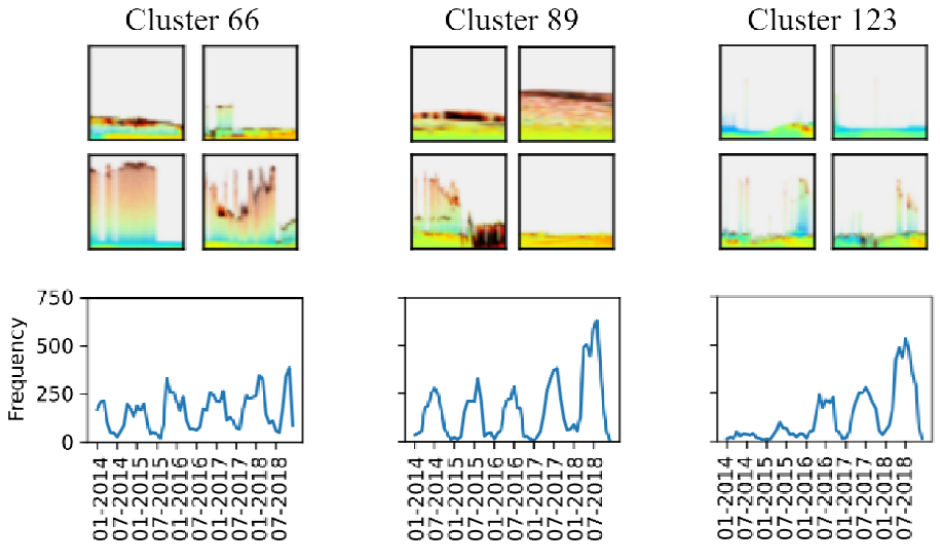


See also: Li et al.: Contrastive Clustering, AAAI 2021.

Results



(a)



(b)

Specialized Clusters
E.g., 56: fog, 63: clear sky,
100: certain kind of clouds

Trend detection
E.g., higher frequency of dry periods (cluster 123)

Outlook

Utilize cluster assignment for annotation process
Use annotations for supervised training

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