



Time Series Aggregation Module (TSAM)

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Outline

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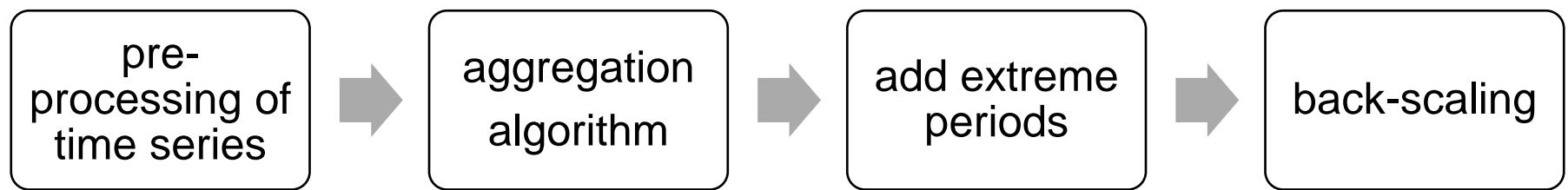
Why do we use TSAM?



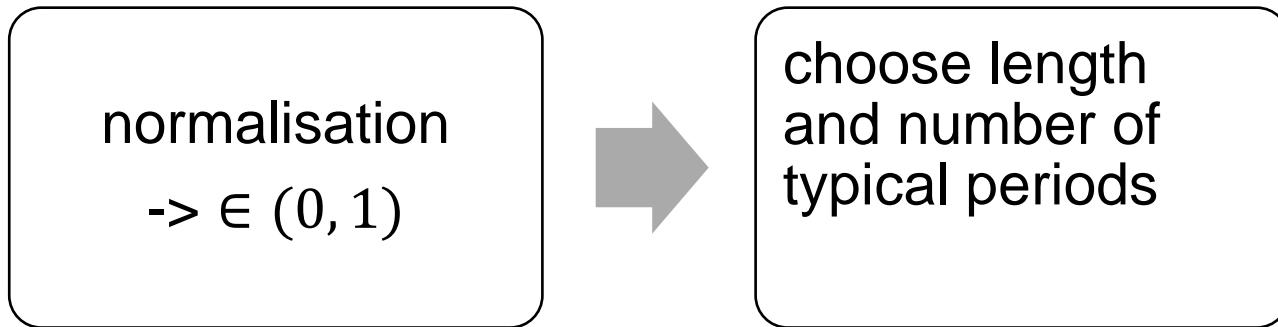
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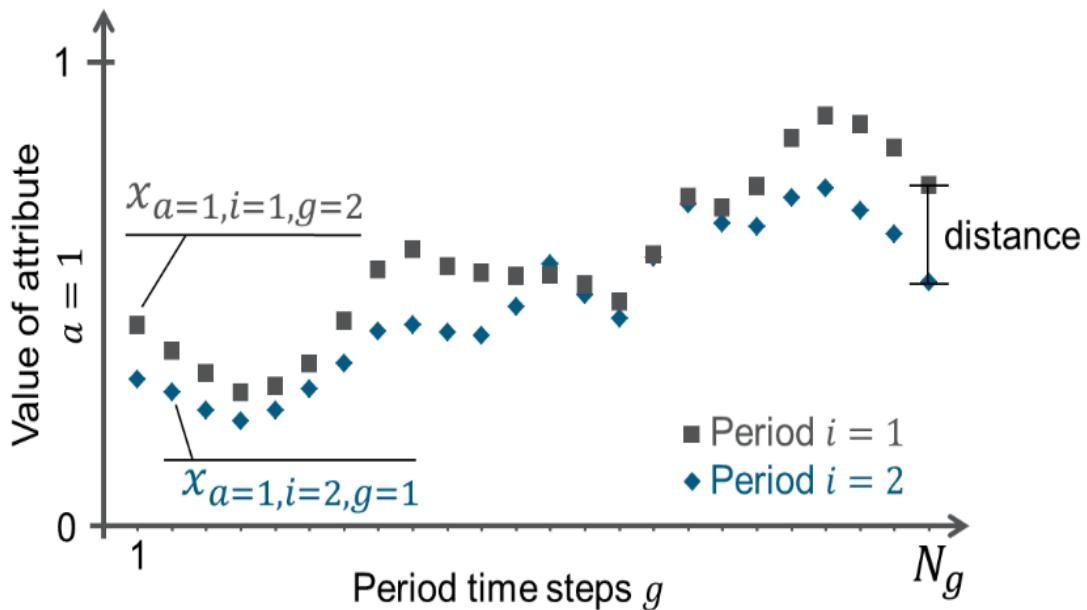
Sequence of time series reduction



1. Pre-processing of time series

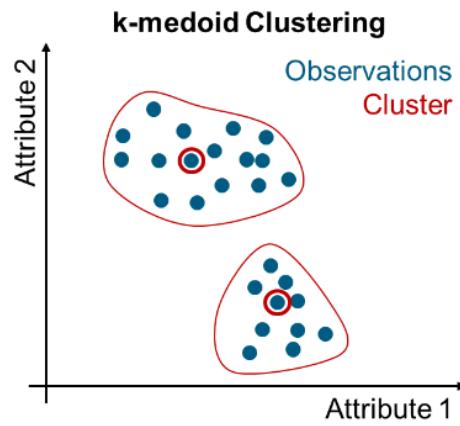
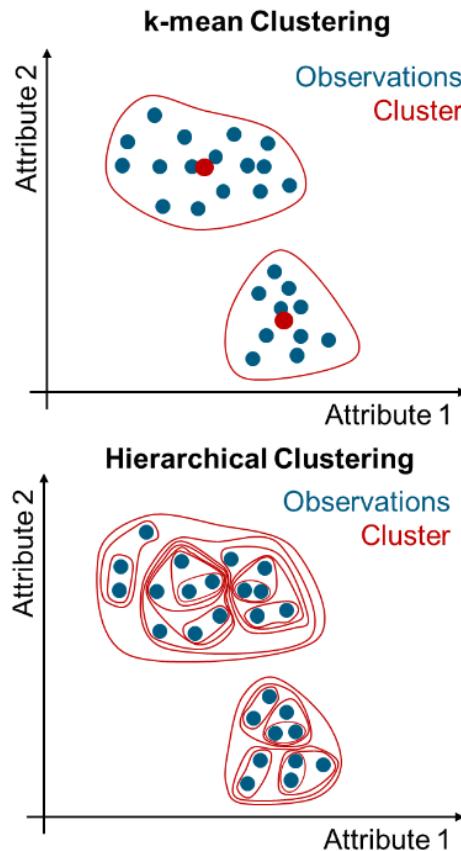


Example pre-processing: typical day for one application



- one application -> $a = 1$
- one year with 365 days
 -> $i = 365$ candidates for typDays
- one day with 24 hours
 -> $g = 24$

2. Clustering days of two applications



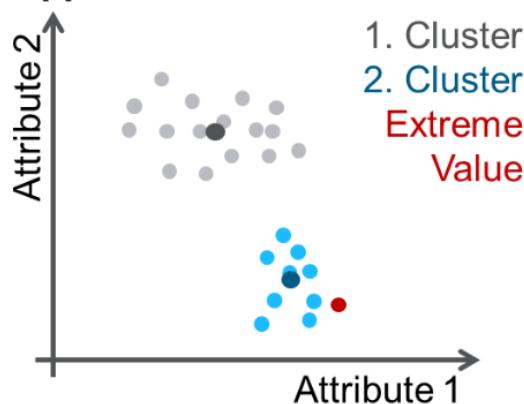
- # cluster a priori
- clustering similar days
- -> k typDays

3. There are 4 methods for extreme periods

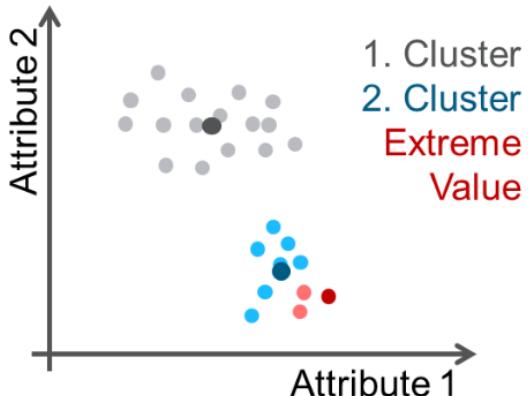
1. None



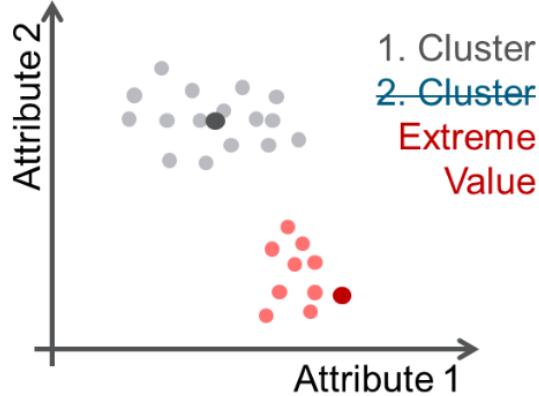
2. Append



3. Additional representative period



4. Replace representative period



4. Back scaling of aggregated time series

- goal: no systematic errors



average aggregated time series = average
full time series

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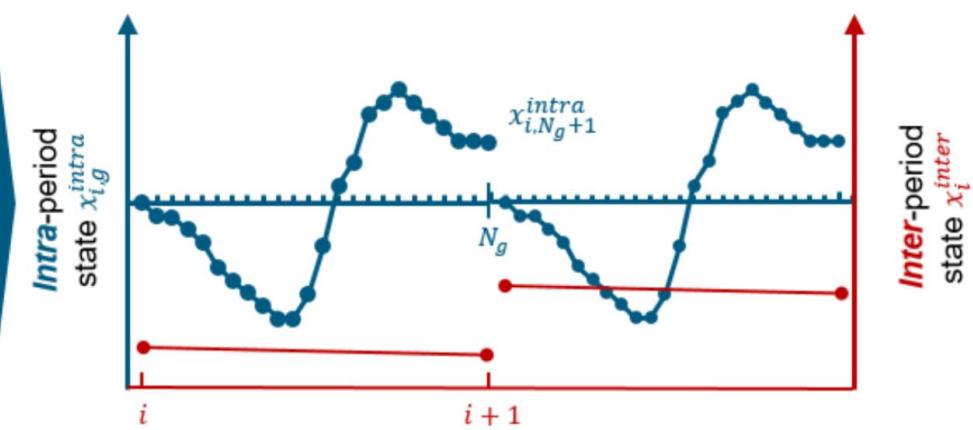
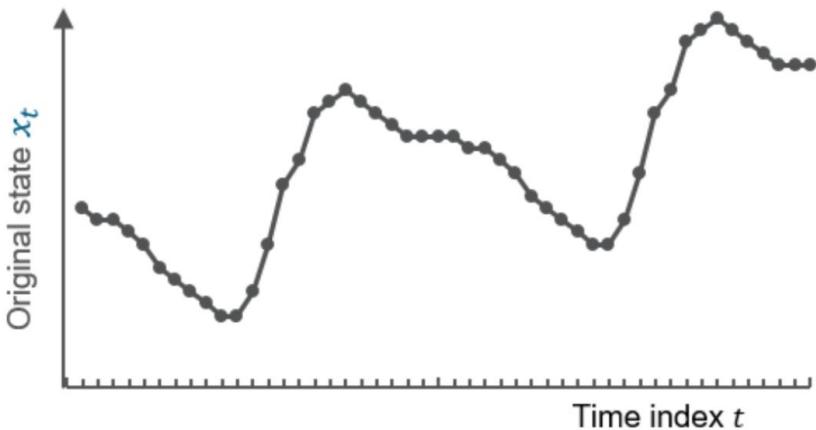
There are two time layers:
intra and inter-periods

1. intra-periods
 - As before
2. inter-perioden
 - Storage level between periods
3. Superposition
 - sum of sub storage levels equals storage level

Storage level is deconstructed

superposition:

$$x_{intra} + x_{inter} = state \ x$$



- i : days
- g : hours
- blue: intra
- red: inter

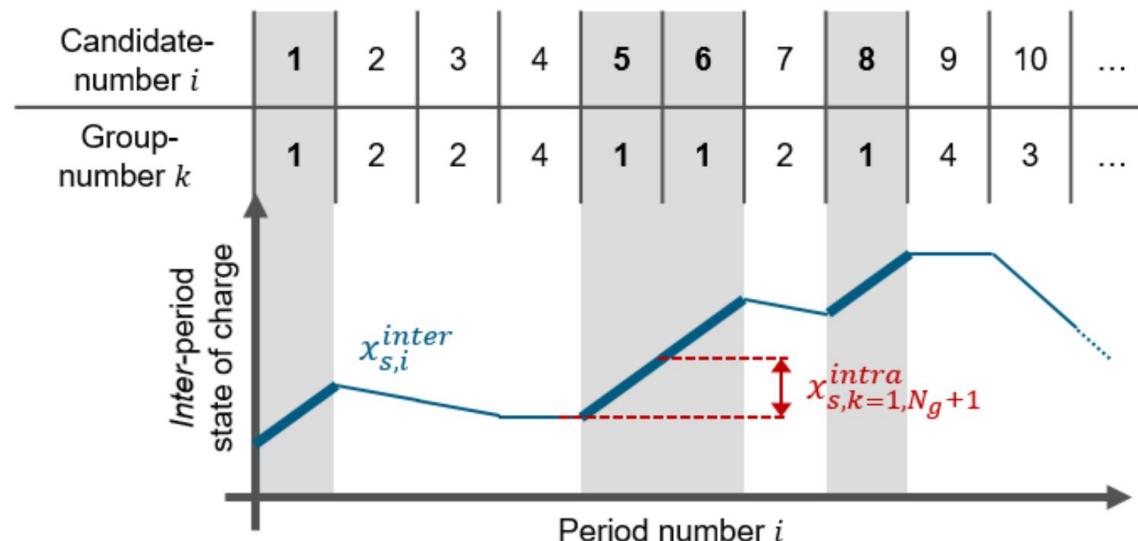
Quelle: Kotzur et al. (2018).

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Calculation of a storage level delta for each typical period

Superposition:

$$x_{intra} + x_{inter} = state \ x$$



- i : days
- g : hours
- red: intra
- blue: inter
- k : typical Day

Quelle: Kotzur et al. (2018).

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Application in a dummy dispatch model

1. Easy application

- great documentation
- many examples

2. Special features

- Pre aggregation with chosen data
- Disaggregation
- RMSE, RMSE duration, MAE

3. Chances

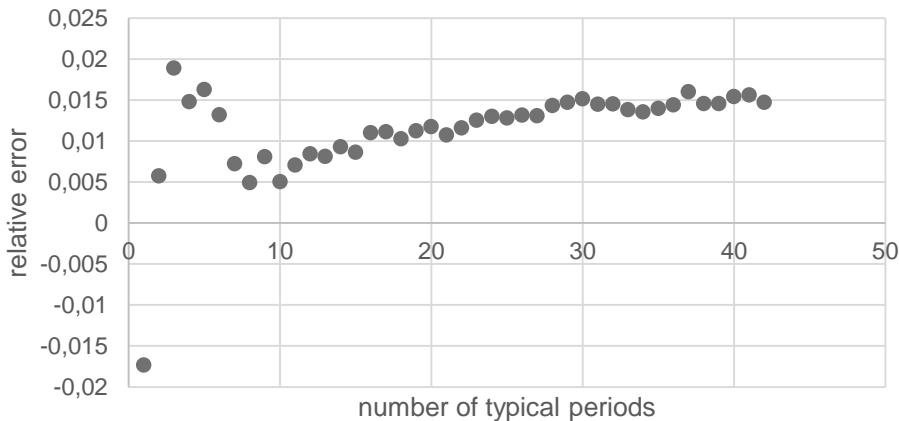
- Cluster Indices only for hierarchical clustering
- Idea and calculation of storage level deltas

Results with dummy model

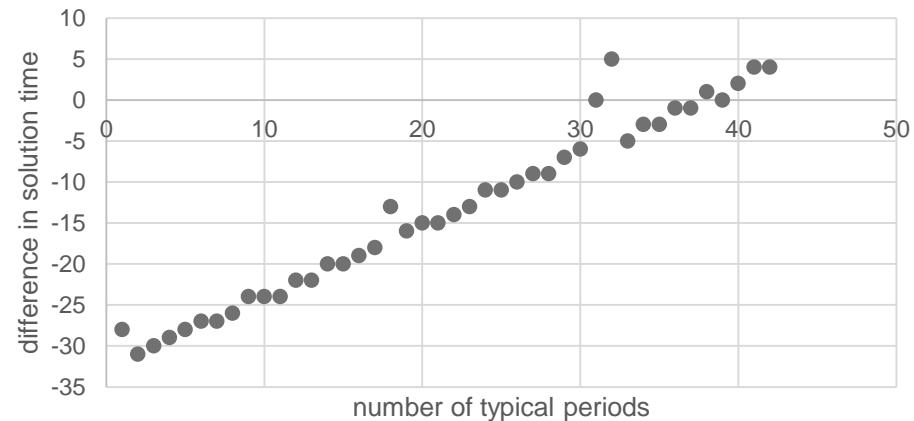
Variation of

- number typical periods
- length of typical periods (not shown)
- 1 year horizon

Relative error of objective
to no TSA



Absolute difference of solution time
to no TSA



Thank you
very much
for your
attention

Literaturverzeichnis

Kotzur, L., Markewitz, P., Robinius, M., Stolten, D. 2017: *Impact of different time series aggregation methods on optimal energy system design*. In: Renewable Energy Vol. 117, S. 474 – 487.

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