Data-driven methodologies for large-scale implementation and roll-out

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CITIES workshop / webinar: Data-Driven Technologies for Energy Efficiency and Flexibility. August 12, 2020, 9:00 AM - 12:00 PM CEST
Outline
Detecting house / household characteristics from measurements and weather data

- Briefly about ENFOR
- Single house / household analyses
- Deployment on massive amounts of houses / households
- Harvesting additional information by comparing with background information
- Concluding remarks
Forecasting and optimization software platform

ENFOR solution portfolio

Software platform with a number of specialized solutions:

- **WindFor** - Forecasting of wind power
- **SolarFor** – Forecasting of solar power
- **LoadFor** – Forecasting of power load/demand
- **PMON** – Statistical quality control of the production from wind and solar farms
- **HeatFor** - Forecasting of heat demand
- **HeatTO** - Optimization of district heating networks
- **MetFor**: Locally optimized weather forecasts
- **PriceFor** – Forecasting of electricity prices
- **ChargeME** – Forecasting and charge management of electric vehicles
- **HydroFor** – Forecasting of hydro power production
Concept 1: Estimate building characteristics from data

Simple model capturing main characteristics

Concept 2: Control the heating supplied to the building

Controller includes a model capturing main characteristics

Climate data for every location
- or forecast data

- ERA5-land available from Copernicus (European Union's Earth Observation Programme) Climate Data Store
- Surface data (temperatures of air and soil, wind, solar radiation, precipitation, …)
- The spatial resolution is 9 km
- The temporal resolution is hourly
- Same format as forecast data
Analysis engine

- Receives the energy consumption measurements and climate data
- Calculates / estimates energy characteristics on a per household basis
- Only the characteristics are stored together with an ID allowing the data to be linked with background information.
- Different analysis engines may supply different type of energy characteristics

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How to scale up and harvest the benefit

System overview

Measurements

Controller

Analysis Engine

Synthesis (Machine Learning)

Climate data / weather forecasts

Background data interface (BBR etc.)

Reporting & user interaction

E.g. UA vs. ground floor area

E.g. distribution of UA residuals across houses

Measurements

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Synthesis
Machine learning analysis linking houses / apartments / households to background information

- Find the best possible mapping from background information to energy consumption characteristics
- The part which cannot be explained by the mapping is the interesting houses / apartments / households, because this points towards entities with unusual good or bad energy performance
Data base

- One part of the data base contain the results from the analysis engine (example right)
- An other part of the data base contain the house / apartment / household background information
- Yet an other part of the data base contain the machine learning analysis model errors (model residuals)

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Concluding remarks

System characteristics

• Modular design where individual components can be replaced / updated

• Analysis engine can run the analyses for the individual households in parallel and can therefore easily be scaled

• The machine learning based synthesis works only on KPI’s and background information and can therefore handle millions of households with standard technologies. Big data technologies can be applied if required

• Reporting select houses / households with unusual model residuals

• Via user interaction it will be possible to gather additional information (see aforementioned DYNASTEE paper).
Thank you for your attention!

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