

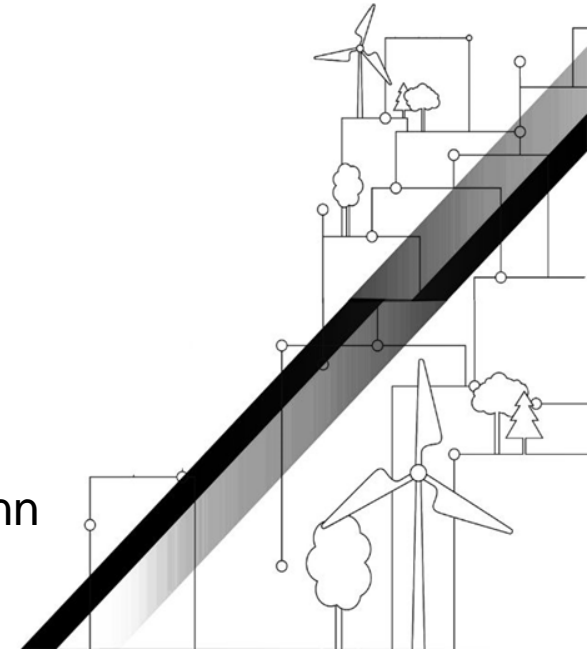
Project Nr 2

2

Local sustainability booster



Team: Dylan Johnson, Oliver Paul, Lucas Tochtermann

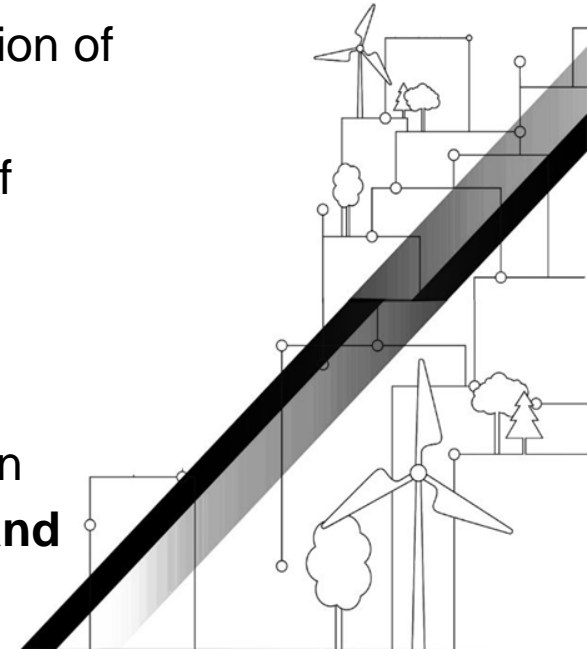


The Challenge

- In order to achieve the goals for the swiss energy strategy we must **increase sustainable energy production and consumption**
- There are metrics for the current status of the expansion of PV, renewable heating and e-mobility
- We want to find out **which are the key influencers** of these sustainable indicators at municipality level

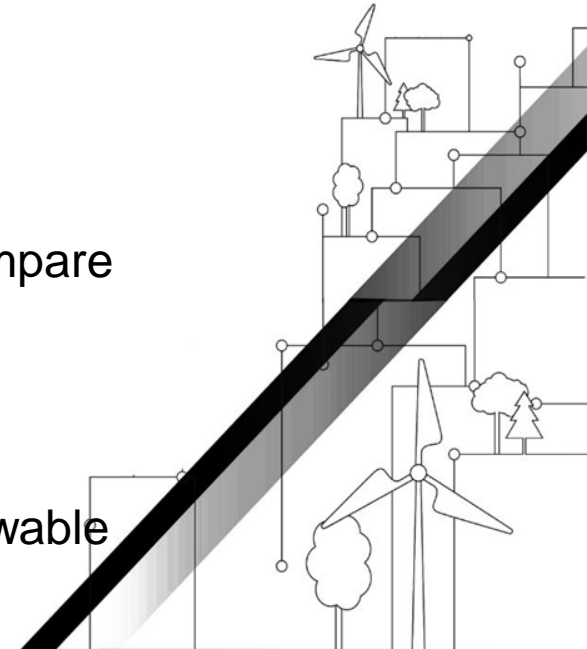
The Idea

- If the group can identify important factors leading to an increase of these sustainable indicators, **resources and funds can be allocated in an efficient way**



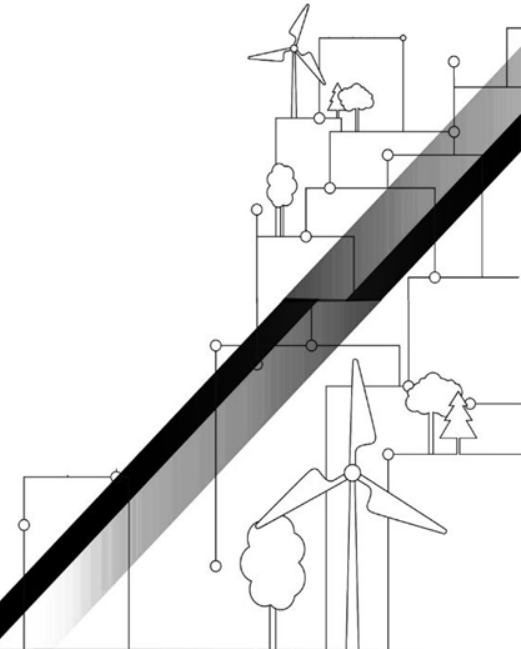
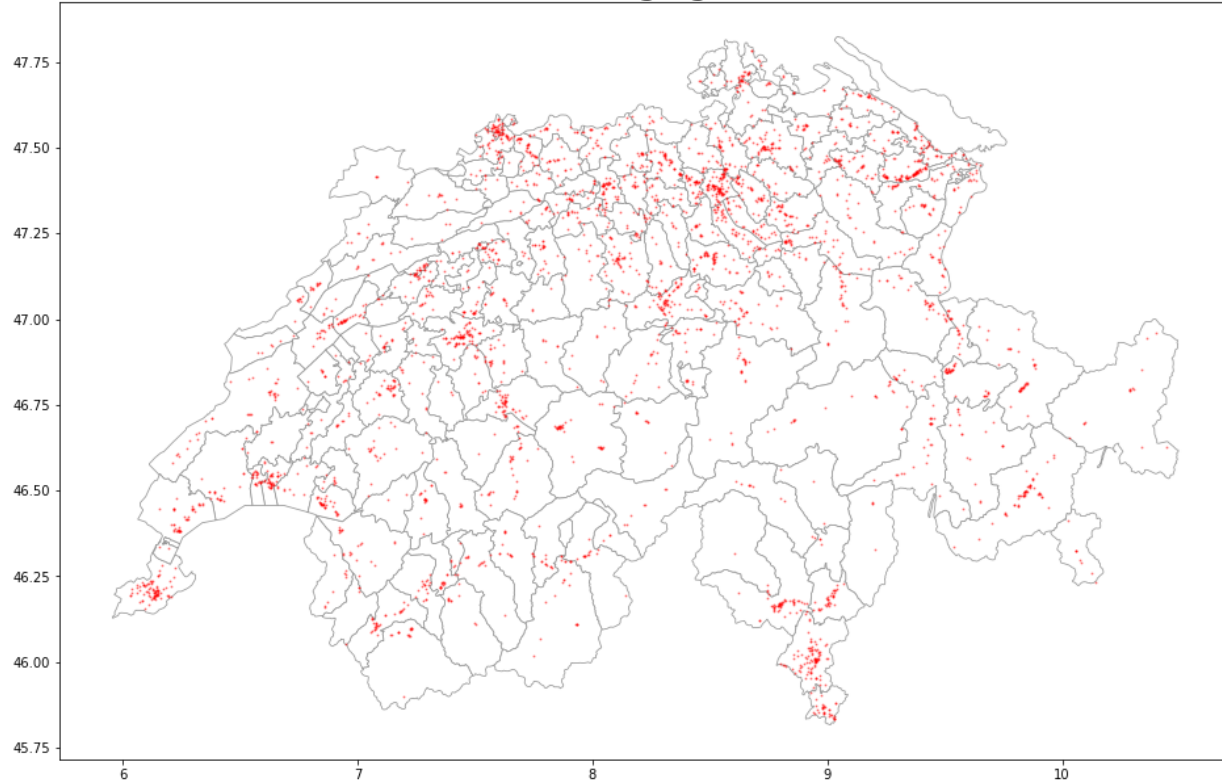
What we did

- Gather data (socio-demographic, weather, topographic, infrastructure, political and electricity-costs)
- Visualize correlations, spatial data and do feature engineering
- Run statistical and Machine Learning models and compare the results
- The idea! Find a function $x \rightarrow y$ which describes the relationship between demographic features and renewable behaviours

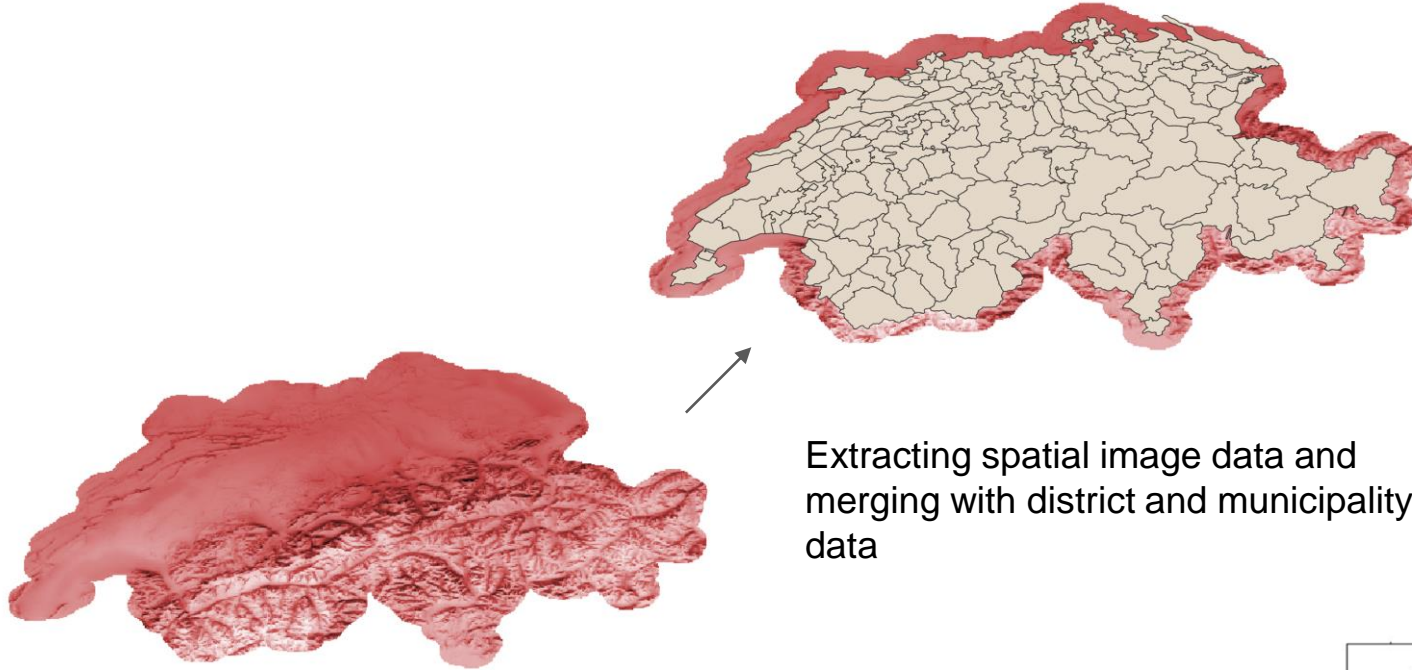


Visualizations

Swiss EV Charging Locations



Visualizations



Significance testing linear models

EV share

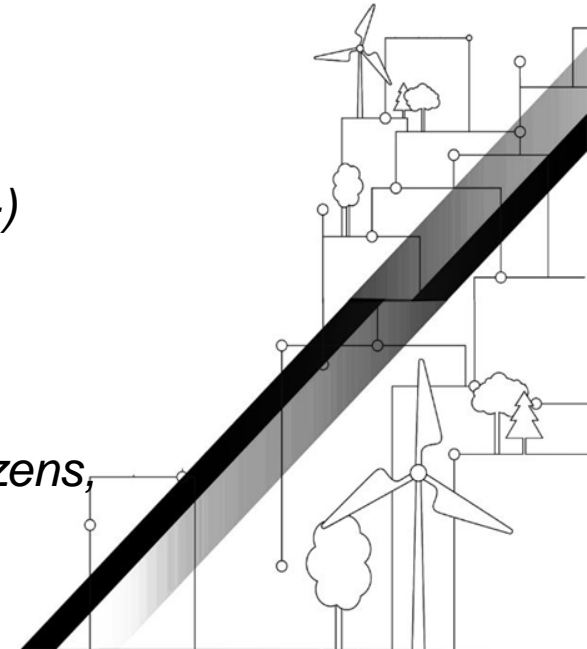
- *Income (+), electricity tariff (-), pop density (+) with older populations (40-64 +), carbon taxes (+)*

PV share

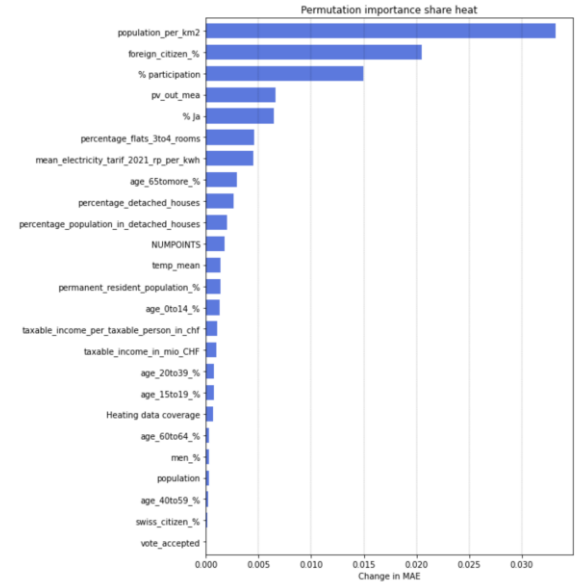
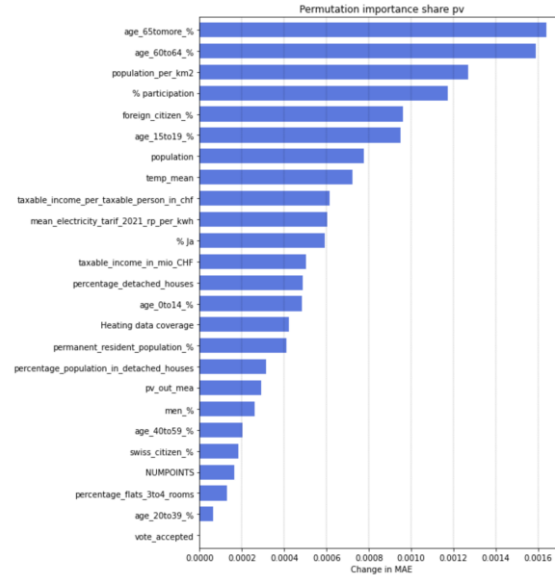
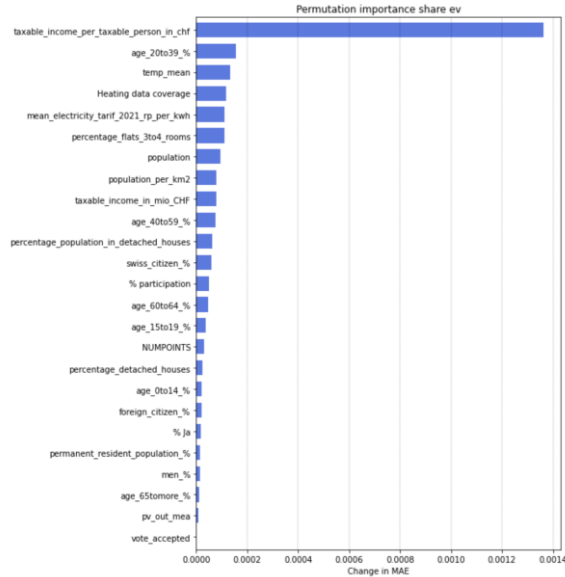
- *Larger homes (+), Swiss citizens (+), young (+), old (-) adult populations, temperature (+), carbon taxes (-)*

Renewable heating

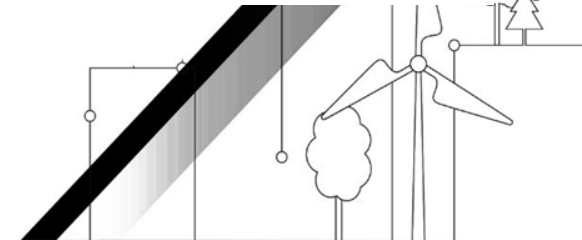
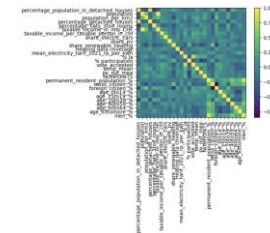
- *Pop density (-), income (-), temperature (-), swiss citizens, (+), young adults (-), child populations (+)*



Feature importance XGboost models



While we cannot extract meaningful weights like in linear modelling, we are able to extract feature importance for a far more powerful model



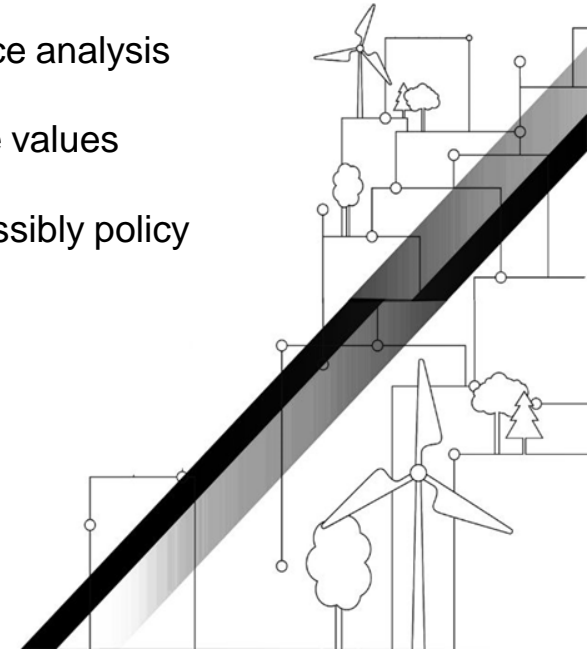
Game theory application using SHAP values **2**

By using a game theory approach we can compute the interactions between features, and their effect on the target variables.

The overall importance of these values aligned with the feature importance analysis

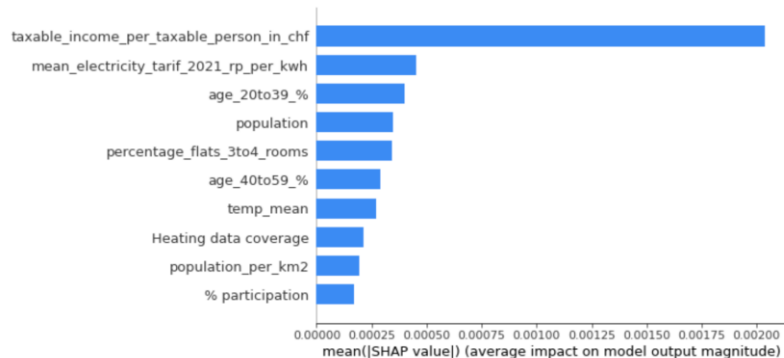
Here we can identify how the model will behave based on varying feature values

This approach allows us to generate artificial data to test scenarios or possibly policy interventions

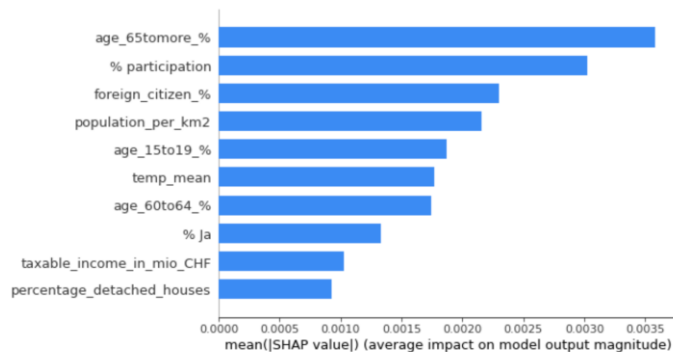


Game theory application using SHAP values 2

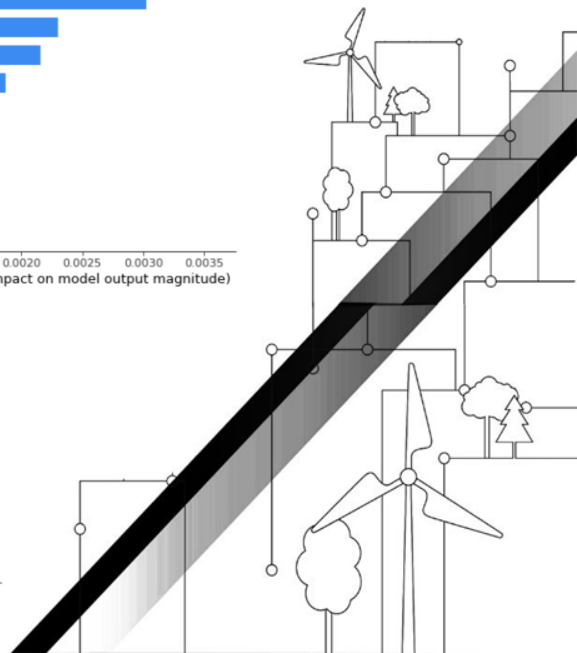
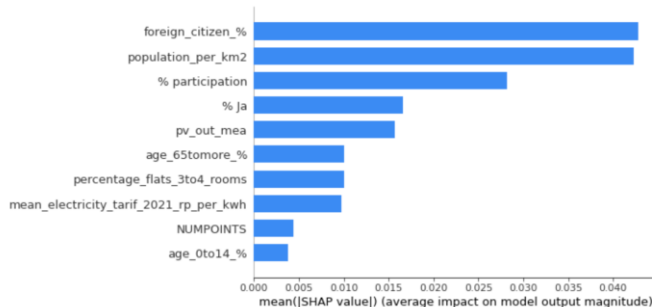
EV penetration



PV penetration

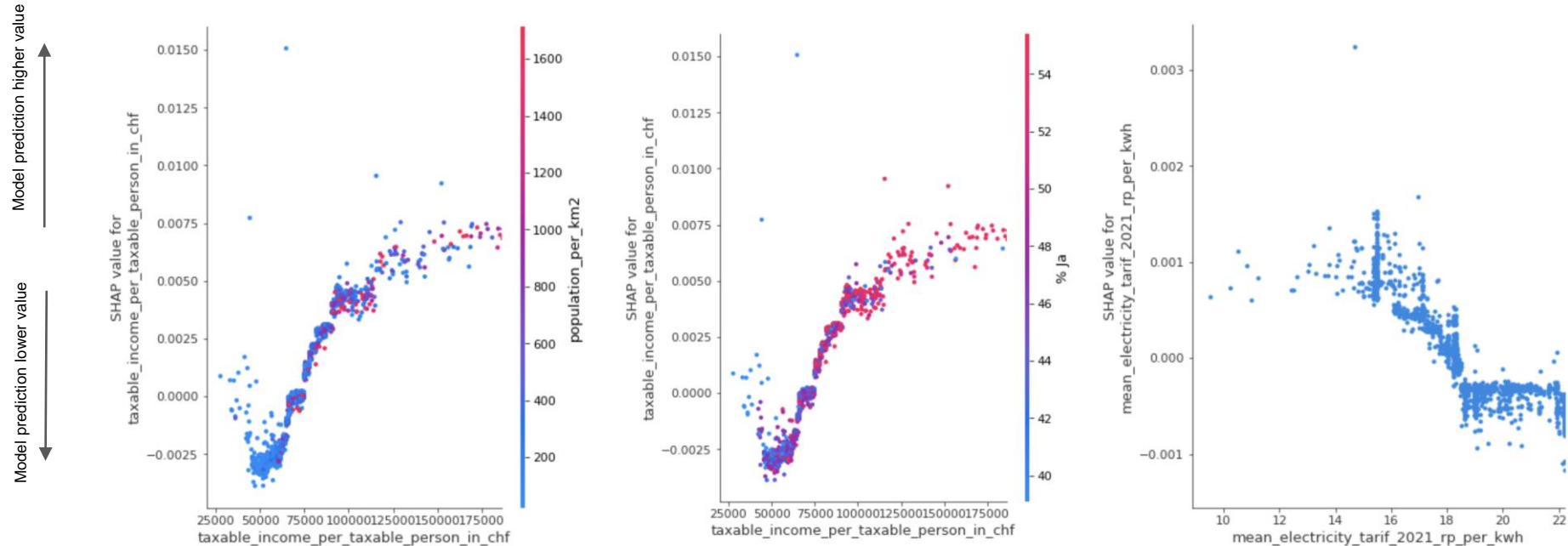


Renewable heating



Game theory application using SHAP values 2

How do changes in feature values impact the models predictions? Could this be used to test new interventions? - For EV penetration



Game theory application using SHAP values 2

What impacts the models distribution at a single municipality level?

Dardagny, Geneva

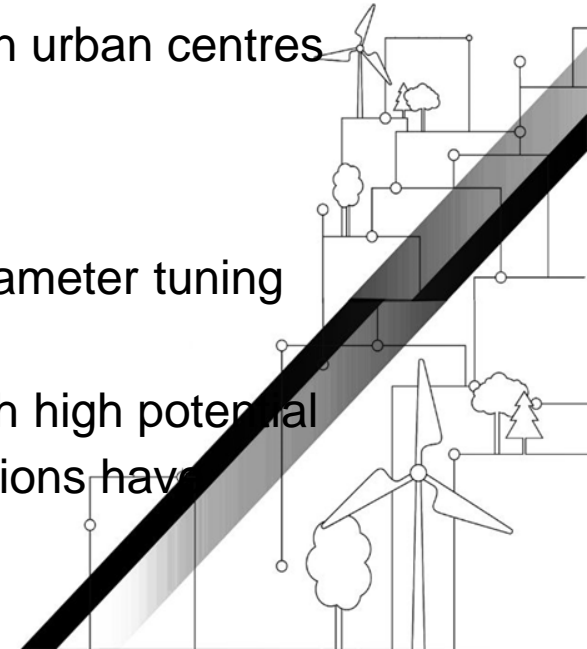


First insights / policy recommendations

- Electric Vehicles: Lower electricity tariffs significantly increased uptake. Targeted charging grants at MP level.
- Solar PV: Target information campaigns on older populations
- Renewable Heating: Make efforts to provide options in urban centres

Next steps

- Improve model with more relevant data and hyperparameter tuning
- Build a pipeline using future updated data
- Identify and communicate results to municipalities with high potential
- Add temporal data to understand how policy interventions have impacted behaviour in the past



Questions ?

Team

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