**MSc Research Project: Projecting Crop Rotation Futures in Germany**

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**Aim**: To project crop rotation patterns in Germany under climate and socio-economic change to 2100

**Main challenges**:

1. To evaluate how much can we predict farmers’ decision on crop type rotation
2. To answer which conditions are key for farmers’ decision
3. To project future crop shares under climate change
4. To deal with big data (technical challenge)

**Milestones:**

1. To process the big agricultural data (crop type, soil, climate, and socio-economic conditions)
2. To build a statistical model that predicts crop type using the dataset using machine learning (ML)   
   (output: a vector, the probability of each crop type)
3. To apply interpretable ML approaches for evaluating the relative importance
4. To project the future changes in crop rotation patterns to 2100, using projection data of climate and socio-economic conditions   
   (run with the projection data, with the probabilistic approach)

**Collaboration with/supported by**: Prof. Dr. Claas Nendel (project leader), Diana-Maria Seserman (postdoc at zalf), Clemens Jänicke (HU Berlin)

**Currently avaiable data prepared by Clemens and Diana**:

* Crop sequence (20 possible types) at 10 m resolution over 2005-2020 (x-y coordinates, ID)

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| --- | --- | --- | --- |
| **State\_english** | **State\_germand** | **Abbreviation** | **Data availability** |
| Brandenburg | Brandenburg | BB | 2005-2020 |
| Bavaria | Bayern | BV | 2005-2020 |
| Lower-Saxony | Niedersachsen | LS | 2009-2019 |
| Mecklenburg-Western Pomerania | Mecklenburg-Vorpommern | MV | 2016-2019 |
| Rhineland-Palatine | Rheinland-Pfalz | RP | 2005-2019 |
| Saarland | Saarland | SL | 2012-2018 |
| Thuringia | Thüringen | TH | 2013-2014 |

* Weather variables (radiation, temperature, precipitation)
* Soil/geographic variables (type, elevation, slope)
* Crop price information (depending on crop and year: USD/year)
* Regional crop share(?)

**Questions**:

1. Can we technically make use of the entire dataset? Or only sub-sampled data due to computational limitation?
2. What if a model is built for each state? How relative variable importance and predictability differs among states? Any reasons?
3. How imporant to know soil, climate conditions? Economic condition?
4. How much farmers actually follow the textbook knowledge? (some sequences are not recommended)
5. How many crop types each farmer manage? (diversity)
6. How regional-level (or state-level) crop type diversity and share changes over time and space?
7. (Is it related to biodiversity or landscape diversity?)