AUTUMN: Architecture and Design

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Introduction

The Autumn framework is designed to develop cost and potential distribution dataset for carbon dioxide from captured sources based on available data. The output is both intended to be used as it is for visualization and as input for further models and analyses. The architecture is intended to be mainly procedural but not strictly,as the user interactive API is intended to be Object Oriented for ease and familiarity. Given the data based approach used, the project is developed to be highly customizable, basic configurations can be addressed in the config file, more detailed approaches for the different steps can be integrated in the modules.

Quality Values

Priority	Value	Description
1	Transparency	The user should be able to understand the process behind each of the steps that happen to produce the final dataset
2	Adaptability	The user should be able to integrate new information through modifying the configuration files or integrating a completly new dataset in the hogenization module.
3	Readability	The data flow should be easy to understand, any new operation should be included in the corresponding module
4	Extensible	There should be ease towards integration of new data and features.
5	Performance	Any operation in this software should not surpass the order of minutes for data of the magnitude of MBs.

Requirements

Technical

Requirement	Context
Windows	The software is developed on Windows, Linux and MacOS systems are not directly supported.
Python	The Python version used is 3.7.3, the required package versions are listed in the repository.

Organizational

Roles	Context
SET(Software Engineering Team)	Eugenio Arellano, Niklas Wulff, Benjamin Fuchs
Stakeholders	Hans Christian Gils, Department of energy system analysis at Institute of Networked Energy Systems, DLR
Timeline	Alpha release in December 2020, Beta release in Q1 2021
Open source ready	Features, dependencies and components which are contraindicative or at odds with an open source publication should not be used
Development tools	Source code and its complements are located in the DLR GITLAB repository for AUTUMNincluding the software documentation. For development, the conda package manager, the PyCharm community edition IDE and gitbash are used. Documentation is built in LaTeX

Code Style

Conventions

The development follows the PEP8 guideline and DLR department of energy system analysis conventions.

Modularity

Operations are separated from functions by using separate module files; functions in the function modules should not use Pandas DataFrames as inputs or outputs. Any DataFrame operation should be implemented in the operation modules. Operations that take as input a dataset and output another dataset should be an individual module themselves. Each folder contains secondary tools that should work independently from each other. However the configuration of all the sub-tools should be managed from a single config file in the root directory of the repository.

Procedural Approach

The backbone of the tool is procedural, classes should be used mainly for Data (Data-Classes). It is recommended to have benchmarking outputs for dataset operations, That way the pipeline can be monitored easily and new operations can be implemented when desired.

Data and Figures

As part of the output of the master thesis associated to this work, a recollection of published literature data and index values was done for the harmonization of power plant costs of CCUS utilization. This recollection is made available in this repository in the input section. Other inputs can be fetched from their original producers with the functions implemented in their respective sections, not all the data used on the original work is available, to make for it, a collection of fictitious data is created to assert functionality. Image file figures should be exported in their respective data folder, for other figures like .html it is reccomended to build another folder.

API

The api.py file contains basic operations for the user to produce, fetch and plot the data.

Contribution

AUTUMNis open for feedback in the alpha release, with little to none contribution allowance. During th beta release there will be opportunity for restricted community based contribution. It will be not until the first release where the user contribution will be completely open.