3 Implementation

3.1 Research methodology and work plan, work packages and deliverables

The project consists of five work-packages (WP1-WP3: R&D, WP4: Dissemination and WP5: Management). WP1 deals with evolutionary semantic algorithms for data knowledge discovery, WP2 addresses evolutionary biology-AI-inspired models to infer causal knowledge discovery with an implementation for the exploration of the Seas case study, WP3 addresses evolutionary neural biology-inspired for knowledge discovery to provide cooperative forecasting in federated networks. WP3 also provides a empirical case implementation of cooperative forecasting for the exploration of the Seas.

Demonstrators: The project will create three demonstrators of increasing complexity all containing full reproducibility and automation capabilities:

- $\mathcal{RH}$v1.0 Software demonstrator with evolutionary semantic algorithms to decipher ontologies along many data-sources for the exploration of the Seas data knowledge discovery case study (MS1);
- $\mathcal{RH}$v2.0 Software demonstrator with evolutionary biology-AI-inspired modeling for spatiotemporal causal pattern knowledge discovery (MS2);
- $\mathcal{RH}$v3.0 Software demonstrator using evolutionary neural biology-inspired networks for spatiotemporal discovery in federate networks (MS3).

Table 3.1a: **List of work packages**

Work package No.	**Work package title**	**Lead No.**	**Lead Short Name**	**PMs**	**Start Month**	**End Month**
1	Data knowledge discovery	1	CSIC	XX	1	18
2	Causal knowledge discovery	6	TARTU ULIKOOL	XX	7	24
3	Discovery in federated networks	9	UNIGRAZ	XX	13	36
4	Dissemination	10	IEO	XX	1	36
5	Management	6	EAWAG	XX	1	36
			Total PMs	XXX		

The inference of causal mechanisms and the discovery of spatiotemporal patterns in federated networks is a generic problem found in e.g. many agents sharing resources, sustainability, eco-evolutionary networks, biodiversity maintenance, or social networks. Thus, the discovery computation of spatiotemporal patterns represents an ubiquitous computational problem in digital and natural ecosystems, where many evolving and heterogeneous agents and interactions share information to reach sustainability goals. In the demonstrators of $\mathcal{ROBHOOT}$, we will consider at least different scenarios for each of the software implementations such that agents contain many evolving traits and interactions can also evolve along different signs and effects (M1, M2 and M3). This allows, for example, finding trait and interaction changes patterns that improve sustainability scenarios with respect to the observed empirical patterns in the exploration of the Seas case study. In the course of the project, more complex context-dependent trait changes of agents and interactions together with different learning functions will be considered to explore how they affect sustainability properties in federated networks.