Taxonomy of a Digital Ecosystem for Preventing and Mitigating Marine Debris

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Considering the importance of marine debris as part of the Anthropocene Risk to the ocean, it appears mandatory to make an effort to fully exploit the wealth of the increasing relevant global data resources utilizing leading edge technologies, approaches and concepts. There is a proliferation of data and knowledge platforms that aim at enhanced data integration and improved access to knowledge derived from data. Most of these platforms take a thematic approach or are targeting specific user groups. A fundamentally different alternative approach aims for a global digital ecosystem for the environment (GDE4E), which utilizes the rapid development of new technologies and methodologies to create an ecosystem of active species interacting with each other and users. A "healthy" ecosystem has a broad diversity of active species that interact with each other and evolve over time. Developing the concept of an ecosystem that integrates data, information derived from the data, and knowledge co-created in a collaboration of human agents with data requires identification of the species that live in this ecosystem.

Similar to a biological ecosystem, it is fundamental to recognize the keystone species that are central to the functioning of the ecosystem and that determine the nature of this system. The taxonomy of the GDE4E defined here includes five domains. Each of these domains has classes that consist of a number of families, and each family comprises a number species.

The initial domains considered are:

1) data collection (DCD): digital (software) agents that collect new data and generate a flow to those species that represent data products;
2) data representation (DRD): digital agents that represent data objects and can provide information extracted from these objects, as well as, give access to the data in the objects and receive feedback on data and the uses;
3) tool representation (TRD): digital agents that give access to models and data processing tools;
4) knowledge representatives (KRD): digital agents that represent knowledge created by interaction of human and digital agents;
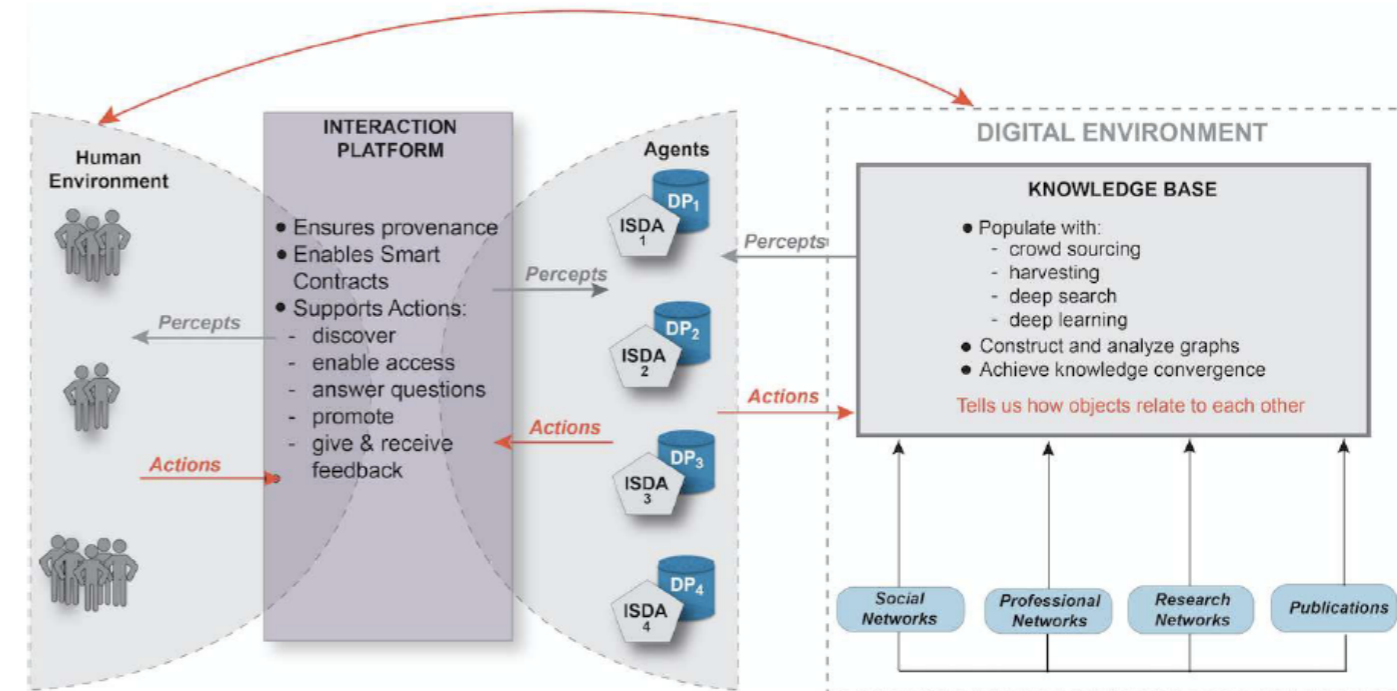5) best practices (BPD): digital agents that represent best practices and can provide training.

Figure 1. The GDE4E enables a transition for data as passive objects (DPO) to data as active subjects (DAS). In the DAS concept, each data product (including knowledge) is represented by an intelligent semantic data agent (ISDA, Plag and Jules-Plag, 2020). The ISDAs utilize the graph data in a knowledge base to discover applications and users that could benefit from their data products. They interact with those users, or user that contact them, to provide knowledge or manage access to data. All interactions that impact the data are recorded to ensure provenance. The knowledge base generates graph data based on information obtained through crowd sourcing or extracted from social and research networks and publications.

While most of the agents in the DCD are reflective agents, the agents in the other domains have to be learning agents that combine model-based, goal-based and utility-based agents. These agents also need semantic capabilities (Fig. 1). A first implementation of the GDE4E can utilize the infrastructure available through the Web. The standardized protocol for the communication between the different agents requires a major development within the framework provided by the Web.

Refrence:
Plag, H.-P., Jules-Plag, S-A., 2019. A Transformative Concept: From Data Being Passive Objects to Data Being Active Subjects. Data, 4(4), DOI: 10.3390/data4040135