Robhoot 1.0
The Deep Knowledge Network

December 12, 2019

1 Summary

The Robhoot project aims to connect research and the public in a decentralized network to help taking informed decisions when solving complex social, environmental and technological problems. Current technologies for scientific inquiry and decision-making are highly fragmented and thus only increase robustness, reproducibility, open-access and the interactions with the public marginally. The goal of Robhoot is to propose a hybrid-technology to lay out the foundation for a open-science research ecosystem aiming to strengthen the robustness and reproducibility of science and the interactions with the public. Robhoot is not set out to deliver a finished deep knowledge network in the science ecosystem, but to provide a science-enabled technology in establishing a prototype proof-of-principle to connect decentralized and neutral-knowledge generation with knowledge-inspired societies.

2 The Science Ecosystem

The process of science requires multiple steps of information transfer among trusted/untrusted peers to build solid evidence-based knowledge in social, economical, natural and technological ecosystems. Solid evidence-based knowledge should be immutable and have a secure peer-to-peer architecture storing the open-source knowledge graphs derived from the research output. These steps are key to have fully reproducible open-access reports when taking informed decisions in complex societal, environmental and technological problems. However, public funded science is highly centralized (Günther, 2018; Inhaber, 1977), prone to errors ((Fang Casadevall, 2011)), difficult to reproduce (Hardwicke. et al., 2019)), and contains many biases (Ioannidis, 2005). These elements make the connection between the scientific process and open-access reporting for decision-making highly improbable. Despite many projects are aiming at making the science ecosystem less centralized and biased while increasing openness and reproducibility (refs) a science-enabled technological paradigm connecting open-science to knowledge-inspired societies is not currently in place.

Many studies in decentralized systems are producing an immense gain in detailed knowledge about scalability, security and decentralization trade-offs (refs; TON network; Fabric ledger OS network). Automation and AI technologies is the other angle from which many advances are rapidly occurring (refs). Yet, while the existing technological paradigm is rapidly shifting towards science-based decentralization and automation technologies, end-to-end open-source research accounting for decentralized, neutral and automated knowledge-inspired technologies are missing. Rapid advances of automated research platforms facilitating data integration accounting for sections of the research cycle are currently under development[1] but open-source decentralized automated platforms accounting for the research cycle are still at a very incipient stage of development. While conceptual frameworks conceptualizing the required layers in many research fields are well established (Figure 1a), there is currently a lack of tools automating the knowledge graphs (Figure 1b) into deep process-based learning networks exploring its robustness (Figure 1c) and decentralization power (Figure 1d).

Features	Science Ecosystem	Robhoot 1.0
Decentralization	No	Yes
Open-access	Mostly No	Yes
Immutability	No	Yes
Robustness	Mostly No	Yes
Reproducibility	Mostly No	Yes
Owner-Controlled assets	No	Yes

Table 1: *Robhoot 1.0 aims to be designed to resolve desirable properties of science: Robustness, Reproducibility, Decentralization, Open and Direct access to reporting by peers and not-peers*

3 Robhoot Design Goals

Robhoot aims to build an automated knowledge network technology to connect knowledge-graphs to knowledge-inspired societies (Figure 1). Our final aim is to provide real-time open-access neutral data-rule-knowledge to gain informed decisions when solving complex social, environmental and technological problems.

[1] This is by no means an exhaustive list but it gives an indication of the many projects currently in place: NakamotoT,BigQuery,Automated statistician,Modulos,Google AI,Iris,easeml

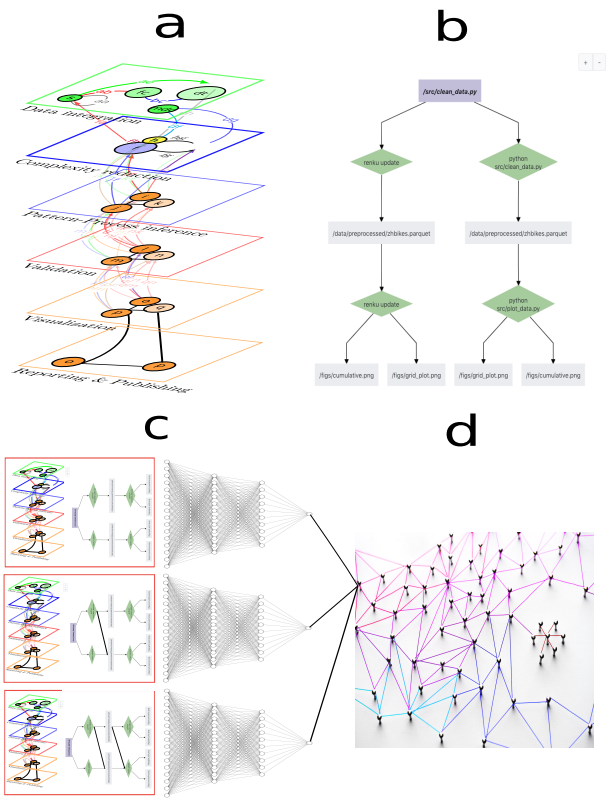

Figure 1: Deep knowledge-based ledger network technology. a) End-to-end research cycle from data integration (top) to reporting (bottom). b) The knowledge graph (KG) tracking one research path of a (i.e., Renku open-source code). c) Deep knowledge-based network automatically exploring a population of KGs to gain process-based understanding of the data. d) The ledger accounts for all the KGs in a distributed network of mutually trusting/untrusting peers with every peer maintaining the population of the KGs (i.e., decentralized P2P git network like Gitchain.) The overall objectives for the project are the following:

3.1 Deep learning networks

- Deploy an automated knowledge-based network technology accounting for end-to-end research in a lineage client-tracker to produce a population of Knowledge Graphs (KGs) (Figures 1a-b).
- Intralayer automation of data integration, inference, and validation (Figure 1a: top four layers).
- Intralayer automation of visualization and reporting generation (Figure 1a: bottom two layers).
- Deep inter-layer automation exploring novel neural biological networks algorithms with lineage client-tracker paths in the multilayer network (Figures 1a-c.)

3.2 Distributed ledger network

- Deploy an end-to-end permissioned-permissionless distributed ledger technology to guarantee decentralization, open-access and security of the KGs populations in the science ecosystem (Figures 1c and 1d.)
- Distributed ledger implementation accounting for consensus algorithms and smart contracts among trusted-untrusted peer-to-peer interactions.
- Exploring consensus algorithms to minimize scalability-security-decentralization trade-offs when storing the KGs in the knowledge network.

3.3 DeepKlen 1.0

- Testnet for the interaction between consensus protocols and the scalability-security-decentralization trade-offs when committing the KGs to the distributed ledger.
- Mainnet to cryptographically link each population of KGs to previous KGs-ledger to create an historical KGs-ledger chain that goes back to the genesis ledger. The mainnet aims to connect database real-time open-access citizen data science to knowledge-inspired societies.

3.4 Robhoot 1.0

- Robhoot Open Network in Biodiversity Research to connect citizen open science to real-time open-access data-rule-knowledge to gain informed decisions when solving local and global environmental problems.
- Citizen open science for biodiversity datasets integration.

4 The multilayer nature of Robhoot

4.1 Data integration

4.2 Complexity reduction

4.3 Inference

4.4 Validation

4.5 Visualization

4.6 Reporting

5 Robhoot in Digital Ecosystems

5.1 Computing Power

5.2 Decentralization

5.3 Neural Networks

6 How to contribute to Robhoot

7 The Robhoot roadmap

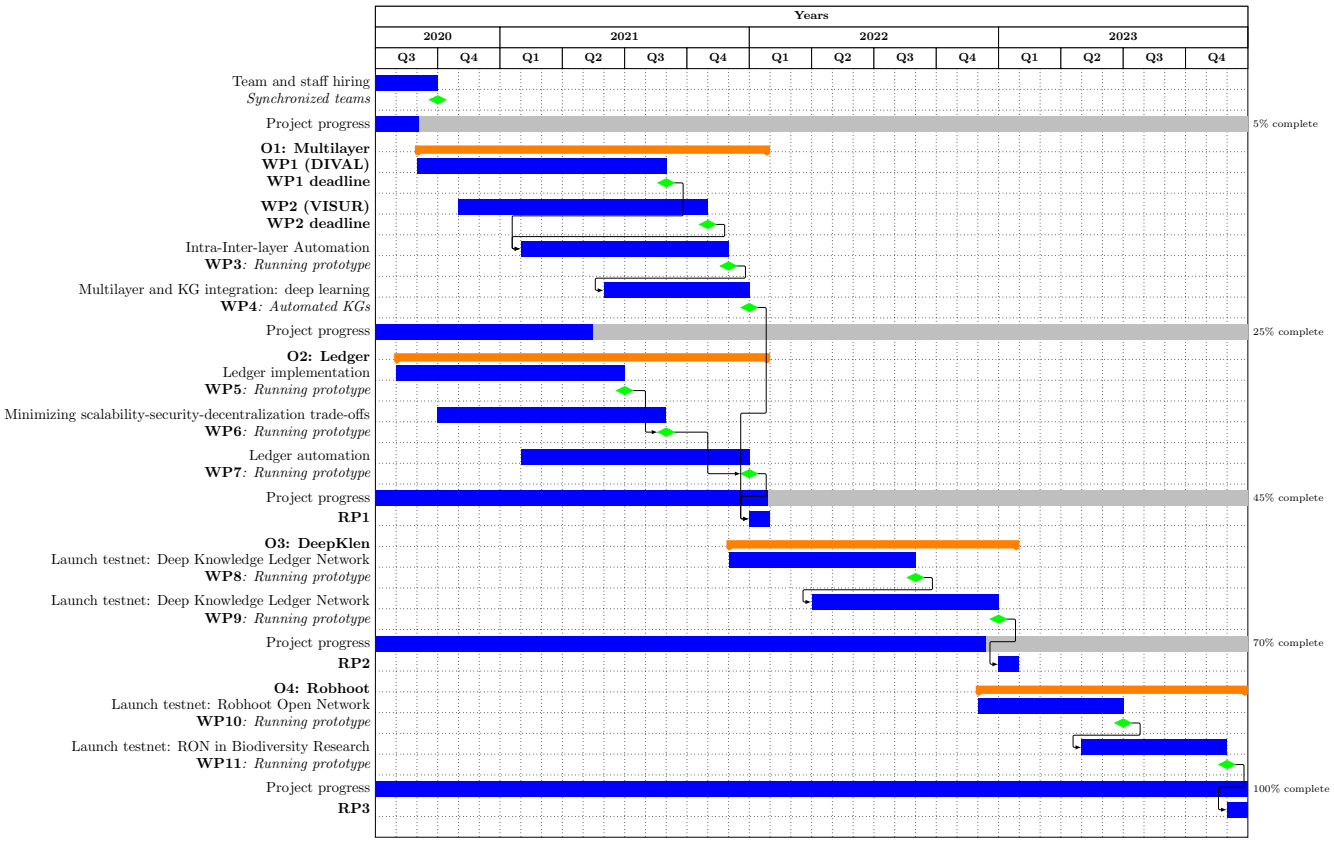

Figure 2: The Robhoot roadmap

8 Conclusion

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