Robhoot 1.0
The Deep Knowledge Network

December 9, 2019

1 Summary

The Robhoot project aims to connect scientist 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 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

Peer-to-peer interactions composed by trusting and untrusting peers abound in social, economical, natural and technological ecosystems. The science ecosystem, the connections among all the peers, requires multiple steps of information transfer among trusted/untrusted peers to build solid evidence-based science. In this ecosystem, immutable and secure peer-to-peer architecture storing end-to-end open-source research is key to have neutral access and fully reproducible 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). Yet, despite many rapid advances are 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. Therefore, 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.

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. 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.

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*

(smoother transition: describe more clearly predictive power without the need of understanding or knowledge about the predicted system: then introduce knowledge power and how the synergy between both can increase our understanding of any given system) Data driven multilayer process-based methods can increase the pool of deep learning models in data science to understand more broadly the connection between predictive power (i.e., pattern detection), and understanding power (i.e., process-based inference). While conceptual frameworks unifying different layers in many research fields is well established, there is currently a lack of deep process-based learning models accounting for many layers in biological, social, technological and economical systems. Here is where data science can benefit to further developing approaches unifying data

[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

driven patterns and process based theory. The interaction between prediction and understanding power can also advance synthesis in data-science by gaining broader insights from deep pattern- and process- based learning models that can be applied to other many fields.

3 Robhoot Design Goals

In this project we aim to build an automated knowledge ledger network technology to connect open-science and 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.

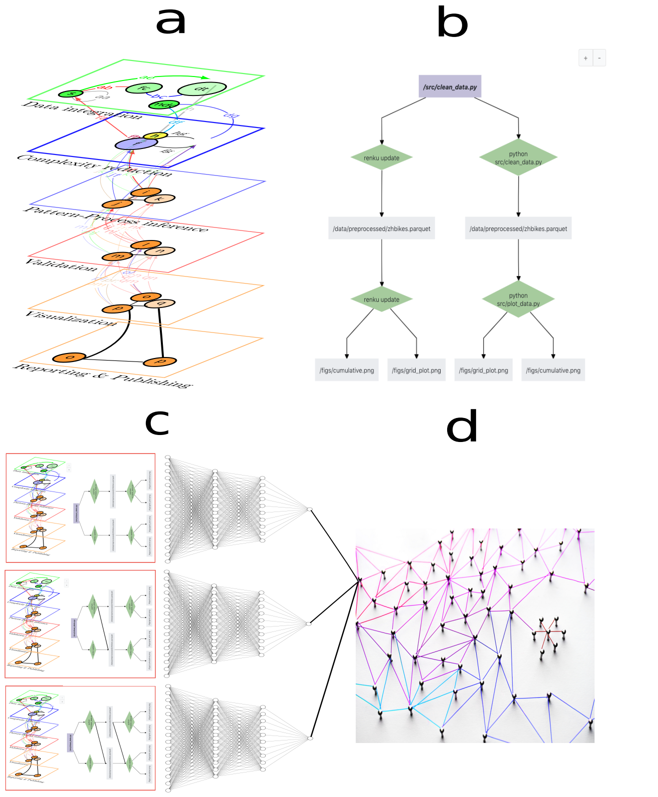

Figure 1: **Deep knowledge-based ledger network technology**. a) End-to-end research cycle from data integration (top) to reporting (bottom). b) The knowledge graph (KG) tracking one research path of a (i.e., Renku open-source code). c) Deep knowledge-based network automatically exploring a population 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 with the outlines of the specific goals of each one 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 three layers).
- Intralayer automation of visualization and reporting generation (Figure 1a bottom three layers).
- Deep inter-layer automation exploring novel neural biological networks algorithms with a 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 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 scenarios to minimize scalability-security-decentralization trade-offs when storing the KGs in the science ecosystem

3.3 DeepKlen 1.0

- Deployment of DeepKlen, a deep knowledge ledger network, to explore the interaction between consensus protocols with the security-scalability-decentralization trade-offs.
- Deployment of DeepKlen to test the robustness of the generated KGs in the automated science ecosystem.
- 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 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 (Figure 1a top layer and Figure X)

3.5 Multilayer nature of Robhoot

3.5.1 Data aintegration

3.5.2 Complexity reduction

3.5.3 Inference

3.5.4 Validation

3.5.5 Visualization

3.5.6 Reporting

3.6 Robhoot in Digital Ecosystems

3.6.1 Computing Power

3.6.2 Decentralization

3.6.3 Neural Networks

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Table 2: *Example table*

Name		
First Name	Last Name	Grade
John	Doe	7.5
Richard	Miles	5

Figure 1: *A majestic grizzly bear*

4 Conclusion

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