

Scichain – Science in a blockchain

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Abstract—A distributed database should be the hearth of the science, allowing immutable publication of scientific information. Here, a platform able to manage peer-reviewed paper submission is proposed. The proposed system is able to handle new concepts and deal with those already in work nowadays. By proposing a system for journals, blockchain a cheaper, faster and more reliable system can emerge, opening a wide range of possibilities for future journals and research reliability.

This has been a long week.

Since the arrival of my brother Vitor in Rio (or my visit to Igor, Vitor speaking now...) we have (as always have been) talked a lot about the huge possibilities science has been offering to us each day, bringing comfort with nice communications at big distances, amazing content in the Internet, cheaper clean energy, but science also gives us even more destructive power to humans (atomic bomb and today's even more deadly weapons) and destructive human activities (massive pollution and global warming). This week was hard both physically (Fig. 1: Vitor's Yoga, Fig. 2: climbing Palm-tree) and mentally (unprecedented crisis in public higher education at Rio state, Fig. 3: guerra na Alerj, tiros de dentro da igreja), but one thing we managed to work on expanding our curiosity was at the Bitcoin network. We have always knew about it, but never took time to understand its foundation: the blockchain. And this is such an amazing invention!

The Bitcoin blockchain is an immutable chain of operations that uses the power of distributed nodes to mine (or compute) certificates to validate money transactions. Well, we immediately thought, but can we store other things than money in such a network? The answer is yes, and science could benefit a lot from it!

Day two.

After digging a bit more on Bitcoin and other cryptocurrencies (also doing our scientific homework on related works), we found about another great invention: the Ethereum. The Ethereum is much more than a simple cryptocurrency, it provides solid and programmable blockchains that could virtually support any app that implements the concept of Smart Contracts. The Smart Contract is basically (...). And this is when science comes on!

Science has had its good days with the advent of the Internet, with greater than ever contributions and new journals, but scientific field is starting to perish from an evil the community helped to create: publish or perish [1]. The publication pressure is strongly decreasing the quality of published work

is the last few years [citation], and many think science could be compared to garbage in few years if bad science goes on at this pace [citation]. Many interesting discussions have taken place and solutions have been proposed, including (...). One thing is common: science of the 21th century must be open. Many journals have already moved to or at least supported Open Access (by author's payment) or with a completely open policy. While the openness degree may vary, it's a common direction. Since printed material has been drastically reduced in past few years, electronic material will keep its rising emission with less costs and more confiability.

But where to store science in a immutable and secure way? Coming back to the Blockchain, it's right there. The Blockchain can help us in many other aspects than just storing the scientific content, it may provide an efficient alternative to the implementation of peer-review systems. In particular, we expect that it will make peers from a specific community can judge the quality of a proposed work and validate its ideas, methodology aspects and results, in a much faster and fluid way. If the work gets enough acceptance from community, it is validated and stored right there, in the Blockchain. As new works come to the network, they help to "glue" older "blocks" together and expand the scientific network. Different communities can organize themselves in different kinds of Blockchain-based systems, composed of different rules, including the implementation of automatic testing protocols to process and validate data even before the review process begins. Shorter papers could be encouraged, also encouraging the inclusion of validation data, review times will drop due to a bigger number of available reviewers, acceptance rates will go up. The quality of the work could be measured taking into account both the quality of the ideas, strength of the evidence provided, and number of qualified peers that signed (reviewed) the work (such as using data from publons.com). In fact, even after "publication", by achieving a minimum review rate, more reviews could be made, also attached to the chain, and replication works could be strongly encouraged and much easily organized.

Day three: and rest of the week

Thinking about these motivations, here is our proposal: Scichain – a blockchain for science.

(...)

A prototype has been developed over the Ethereum network and it is freely available at address xxx, currently supported by a Brazilian non-profit organization for innovation, the IPDT. In fact, this corporation is run by another Coelho brother, Bruno, which is a huge enthusiast for innovation and science.

Finally, we believe that acting this way, we will make

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science GREAT again! xD

Should the authors be told about who are the peer reviewers? <http://www.nature.com/nature/peerreview/debate/nature04991.html>

The rise of the block is also reaching public interesting [2], a field that should be fulfilled with technologies that has the essence of trust. Being distributed, it differs from centralized and decentralized approaches Paul Baran (1964) [3]....Discuss these architectures

The idea of using quantitative measures for verifying the quality of a in peer review [4] can be explored inside the blockchain. Besides classical approaches, which can qualify the unique key signed by the review and its reputability, the confirmations, time spend and others measure can be assigned with the proposed system.

The rise of distributed database, connected with peer-to-peer cash systems [5],

the network unanimously agree with the responses, science would be carved in a stone that could strongly resist against tampering and revision

MONEY HANDLING

SciChain will bring interesting ways of dealing with the necessary "publication" fees.

A. Opt 1

In a first classic way, the authors will access the journal website and submit the paper as usual. The journal will publish an encrypted version of the paper in the blockchain (also paying the gas), and only the allowed referees will have access to the decryption key. Time limit for reviews can be enforced by setting contract variables, and the journal editor can block reviewers from submitting delayed reviews if a decision has been made. The reviews will also send their response via website, so all gas costs will again be paid by the journal. If the paper is accepted (by the editor), then a complete version is published, and author names revealed (also reviewer names, if OpenReview). In this case, journal must have private funds to support the publication process, so authors and reviewers do not pay.

B. Opt 2

More dynamic journals can be created using smart contracts. For example, the author can submit the paper directly to the blockchain and paying gas costs (only the decryption key is sent to the editor). The editor maintains a list of authorized reviewers, that can submit their reviews to any paper, at any time. Obviously, bad reviewers can be banned from the system at any time (by the editor), if not complying with the journal rules. An automatic judging system can decide, based on reviewers reputation and response (in rank), if the paper gets accepted (by comparing to a limit set by the editor). In this case, the moment a paper is accepted it will be already "published" in the ledger. Note that rules based on acceptance-only or ignore-rejection can be created (SEARCH THIS LATER, DOES IT EXIST SOMEWHERE??), according to the journal internal rules. In this system, the authors and reviewers would pay to participate in the process,

however these funds can be get back as interested supporting agencies (universities, companies, government) can easily see which money was invested at each part of the process (since the ledger is fully transparent).

I. SECURITY FOR JOURNAL MANAGEMENT

The journal editor handles some smart contract extra power, but it can be below administration users, for example (the true owners of smart contract wallet). Continue...

Due to the bigger fluidity in research (really faster publication times), negative results and replication tests will be much more encouraged. The inclusion of data and automated testing of hypothesis integrated with automated scientific workflows will also help to pre-judge papers before the review process, and plagiarism will be extinct, as all publications will be available in the blockchain, thus making it quite simple to trace for plagiarism. With bigger reproducibility, replicability, visibility, availability and faster review/publication times, science will certainly evolve in a much more natural way. Finally, WE WILL MAKE SCIENCE GREAT AGAIN! =D

<https://www.oreilly.comideas/blockchain-enabled-open-science-framework>

<http://systematicreviewsjournal.biomedcentral.com/about#peer-review+policy>

<http://www.biomedcentral.com/journals>

<https://figshare.com>

<http://scienceblockchainlab.org>

* Include automated testing for industry standards.

* Dissemination (and creation) of protocols for automatic verification of results

* reduce publish or perish pressure, by increasing the number of publications (with reduced sizes), while not sacrificing quality, by also increasing number of active reviewers and reducing review/publication times

II. ALL AUTOMATIC

Although the current version of SciSchain does not support a fully automation role of the editor (by a smart contract) in a double-blind fashion, that could be possible in the future. Nowadays, the challenge is to keep secretive information in a public blockchain to enforce double-blind (the private keys currently held by the editor outside the blockchain), and there are proposals for Homomorphic Computing only supporting on multiplication and addition (<https://blog.ethereum.org/2014/12/26/secret-sharing-daos-crypto-2-0/>), by means of a very high computational cost. If open submission is allowed though, a smart contract could automatically and randomly choose reviewers to manage a submission, if a proper ranking function is devised for reviewers, to encourage good reviews and punish bad ones. The generation of random numbers in the ledger is also a challenge, however there are already interesting new ways emerging to solve this problem (citar string labs string.technology).

III. SECURITY WITH QUANTUM COMPUTERS

Quantum computing can crack some of the elliptic curve algorithms and the most used current cryptography RSA (<https://bitcoinmagazine.com/articles/bitcoin-is-not-quantum-safe-and-how-we-can-fix-1375242150>) but maybe this can be fixed with Lamport signatures (pensar nisso, ser que j podemos incorporar agora no Scichain de uma vez?).

MUITO BEM HERMANO, est indo mais veloz que eu imaginava Incrvel

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