Accountable Medical Data Exchange using Blockchain

Highlights

- To investigate blockchain models for trusted data sharing in healthcare
- To investigate a system that can offer accountable and auditable sharing of data that is available in hospitals and elsewhere
- To investigate new smart contracts and consensus protocols that can automate the data sharing process and digitally track its use

Overview

There are petabytes of data available with NHS and other health organizations. This will lead to revolutionary advancements in digital health if this data is widely made available for research and development. Medical community such as NHS hospitals and clinics do not share medical data for research and development activities due to ethical and legal concerns. The fundamental problem in data sharing is the lack of trust and accountability on how it will be used and whether it is being used for the intended purpose. Current distributed data management systems and tools do not offer mechanisms where the data providers can keep track of who is accessing the data and if its use is subject to the institutional ethical and legal practices. Due to this reason, very few research groups and organizations have access to medical data and this is becoming a bottleneck for ambitious research projects that require access to data to make breakthroughs in digital health such as personalized health, digital pathology, diabetic retinopathy and medical image analysis such as X-rays analytics for cancer detection.

To enable trusted data sharing across mutually distrusting parties and making the data exchange process auditable and accountable, we propose to use a blockchain enabled data management and sharing system. Blockchain is a great technology for secure data storage, however, it struggles when large amounts of data are being stored and accessed. Blockchain has severe performance limitations and its use for sharing large scale medical data has not been investigated. In addition, currently there is limited understanding available on how the shared data will be reliably tracked and audited for compliance protocols and how to report any violations in data use. This project will investigate auditability and shareability of blockchains for large scale medical data management and exchange.

Level: PhD
First Supervisor: Prof. Ashiq Anjum
Second Supervisor: Prof. Lu Liu
Application Closing Date: 27th February 2020
Subject Areas: Information and communication technologies (ICT), Healthcare technologies, Digital Economy

This image taken from learningsinsights.com highlights that healthcare providers, funding agencies and pharma companies are teaming up for joint R&D projects in blockchain.
Methodology

To address the trusted data exchange problem, a graph structure will be proposed that can store the blockchain data in a structured and scalable fashion. Once the blockchain data transactions are represented as a graph model, this will become easier to distribute the graph on distributed resources. This will lead to better scalability and performance on how large-scale data is stored and securely accessed on distributed resources in a blockchain system.

We will build an experimental environment comprising Hyperledger framework and will start replacing the data management layer with the proposed graph layer. We will then extend the consensus protocols to make use of the graph model for high performance and scalable consensus development among distributed parties in the healthcare space.

Medical data sharing rules will be represented as smart contracts to demonstrate that the proposed blockchain system offers automated data sharing with built-in accountability and auditability.

We will actively work with the healthcare partners to ingest medical data to the proposed data system and demonstrate its effectiveness for accountable, compliant and scalable data sharing.

Further Reading


5. Blockchain for AI: Review and Open Research Challenges, Khaled Salah ; M. Habib Ur Rehman ; Nishara Nizamuddin ; Ala Al-Fuqaha, Page(s): 10127 –10149, 2019, DOI: 10.1109/ACCESS.2018.2890507

Funding

This research project is fully funded.

Home/EU Applicants

This project is eligible for a fully funded EPSRC studentship which includes:

- A full UK/EU fee waiver for 3.5 years
- An annual tax free stipend of £15,285 (2020/21)
- Research Training Support Grant (RTSG)
Application Instructions

The online application and supporting documents are due by Thursday 27th February 2020.

Applicants are advised to apply well in advance of the deadline, so that we can let you know if anything is missing from your application.

Required Materials

1. Online application form
2. Two academic references
3. Transcripts
4. Degree certificate/s (if awarded)
5. Curriculum Vitae
6. EPSRC Studentship Form
7. English language qualification (If English is not your first language)

All applications must be submitted online, along with the supporting documents as per the instructions on the website.

Please ensure that all email addresses, for yourself and your referees, are correct on the application form.

Online application form

Deadline : 27th February 2020

Please refer to the application advice and link to the Apply Button on the EPSRC Studentships webpage.

Research Proposal/Proposal Statement

Please list the supervisor, code and title of the project you are applying to. You will also be required to upload the EPSRC Studentship form when prompted for the Personal Statement upload.

If you are applying for more than one project, please email your additional EPSRC Studentship form to Csepgr@leicester.ac.uk

Funding

Select 'Studentship' and then 'EPSRC' from the dropdown menu.

Application Timeline

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>27th February 2020</td>
<td>Deadline for online application and supporting documents</td>
</tr>
<tr>
<td>13th March 2020</td>
<td>Interview invitations to be sent out</td>
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<tr>
<td>25th - 27th March 2020</td>
<td>Interview days</td>
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<tr>
<td>31st March 2020</td>
<td>Informal offers to be made</td>
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<tr>
<td>15th April 2020</td>
<td>Deadline for acceptance of informal offers</td>
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Application Tips and Advice/Application Status

Applying Early
Although the deadline is 27th February, we advise you to apply early so we can advise you of any delay with your application such as missing documents etc.

Online Application Advice
- Check all the email addresses you have entered are correct before submitting.
- Check you have uploaded the CSE Studentship Form in place of your personal statement.

Once You Apply
Once you have submitted your online application form, and uploaded your supporting documents, a copy will be sent to the school for review.