Real time diagnosis to tackle aortic disease

Aortic disease is a leading killer worldwide, and despite perceived progress in diagnostic and therapeutic techniques the burden from aortic disease is growing. The overall global death rate from aortic increased from 2.49 per 100,000 in 1990 to 2.78 per 100,000 in 2010. The climbing death rate is even more pronounced in developing countries with an increase in median death rates (per 100,000) of 0.71, three times higher than in the developed world where it is 0.22.The diagnosis of aortic dissection is time sensitive and depends on cross-sectional imaging, in particular CT angiogram. Up to 50% of aortic dissection patients are initially misdiagnosed as having other conditions, such as acute coronary syndromes, non-dissecting aneurysms, pulmonary embolism, or aortic stenosis and machine learning techniques have been used to successfully increase accuracy and reduce the time taken to diagnose the condition. In those requiring endovascular intervention for complicated aortic aneurysm, the speed and accuracy of measurement becomes all the more pertinent.

The aim of the project is to model the blood flow in the aorta which has been conventionally done using the finite element models. However, these methods can be computationally exhaustive and time consuming and may not be able to produce predictions in real time essential for diagnostic purposes. It is therefore required to introduce methods that will significantly reduce the complexity and time. Thanks to the OCRE cloud vouchers, this type of real time diagnosis is now within reach and research avenues become significantly broader than previously.

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FIELD OF STUDY
Medical & Health Sciences

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OCRE RESOURCES USED
Cloud Services

> The ability to allow for real time predictions on such complex data models has previously been out of reach to us. This project challenges that notion by utilising the computational benefits of cloud services and represents an exciting example as to how it is possible to utilise these benefits for significant medical advances in the area of aortic disease diagnostics.
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> – Andy Donald, Research Fellow, University of Galway, Data Science Institute

CHALLENGE

Computational Modelling & Complex Data

There are two main challenges to achieving the aims of the project: the computationally exhaustive nature associated with producing a blood flow model within the aorta, and the efficient storage of complex, large, CT scan 3D images and the efficient interaction with this data.

Previously, similar projects would have had to have relied on locally deployed computing resources. In our experience, this has previously limited the amount of resources that can be made available for research purposes and has significantly reduced the scope of those research outputs due to cost and technical issues.

SOLUTION

Scalable Cloud Services

By utilising cloud solutions, we can solve both problems by leveraging services that are designed specifically to produce solutions in these areas.

The scalable nature of the services means that it is much easier to scale up availability of computational resources when specifically needed during the aortic blood flow modelling process. Similarly, the size and scale of the patient data benefits from the many different storage solutions present. The nature of these services means that we are not only accessing this data more efficiently, but we are also ensuring that this sensitive data is stored securely as it is being interacted with.

IMPACT

Broadened research horizons

With the availability of these cloud service solutions, the research team has now been able to focus solely on the research outputs without having to worry necessarily about issues associated with space, stability and management of services. It also gives researchers the ability to plan more effectively due to the scalable nature of the cloud resources.

The services also open new avenues of research which might have been closed off previously when using a traditional locally based resource.