Real-Time Heart Monitoring of Thousands of Patients

Organizations

Innovation Dooel has developed and sells the ViewECG software certified as a medical device for remote real-time ECG monitoring.

Universität Klagenfurt provides expertise in developing efficient, scalable HPC workflows.

Ss Cyril and Methodius University in Skopje support the deployment of the developed HPDA solution.

End User

HPC Expert

National HPC Competence Centre

Partner Ss Cyril and Methodius University in Skopje is part of the North Macedonian NCC.

The Challenge

The primary purpose of ECG monitoring as a widely used diagnostic tool is to detect arrhythmias and alert for a potentially life-threatening heart condition. This is essential to ensure timely and effective treatment and prevent serious heart damage. However, usually patients need to stay in the hospital for monitoring. Innovation Dooel's ViewECG is a unique medical software based on real-time ECG data from wearable sensors, using Signal Processing and Machine Learning (ML) techniques for detecting heart arrhythmias, that permits patients to follow their everyday routine, while giving them peace of mind knowing that their heart condition is continually monitored. This gives ViewECG a clear business advantage.

So far, ViewECG has been successful in monitoring dozens of users concurrently processing a large amount of ECG data. However, two main challenges arise with the exploitation and wider deployment. Firstly, there is a need to improve the existing ML arrhythmia classification model, which would require training on an extensive benchmark dataset with hundreds of gigabytes of input data and taking hundreds of days on Innovation Dooel's infrastructure. Secondly, for scaling up to many more users, the solution deployment needs a large-scale computing capacity to efficiently process an enormous number of concurrent ECG data streams in less than 3 seconds for each request. This has not yet been achieved in the market.
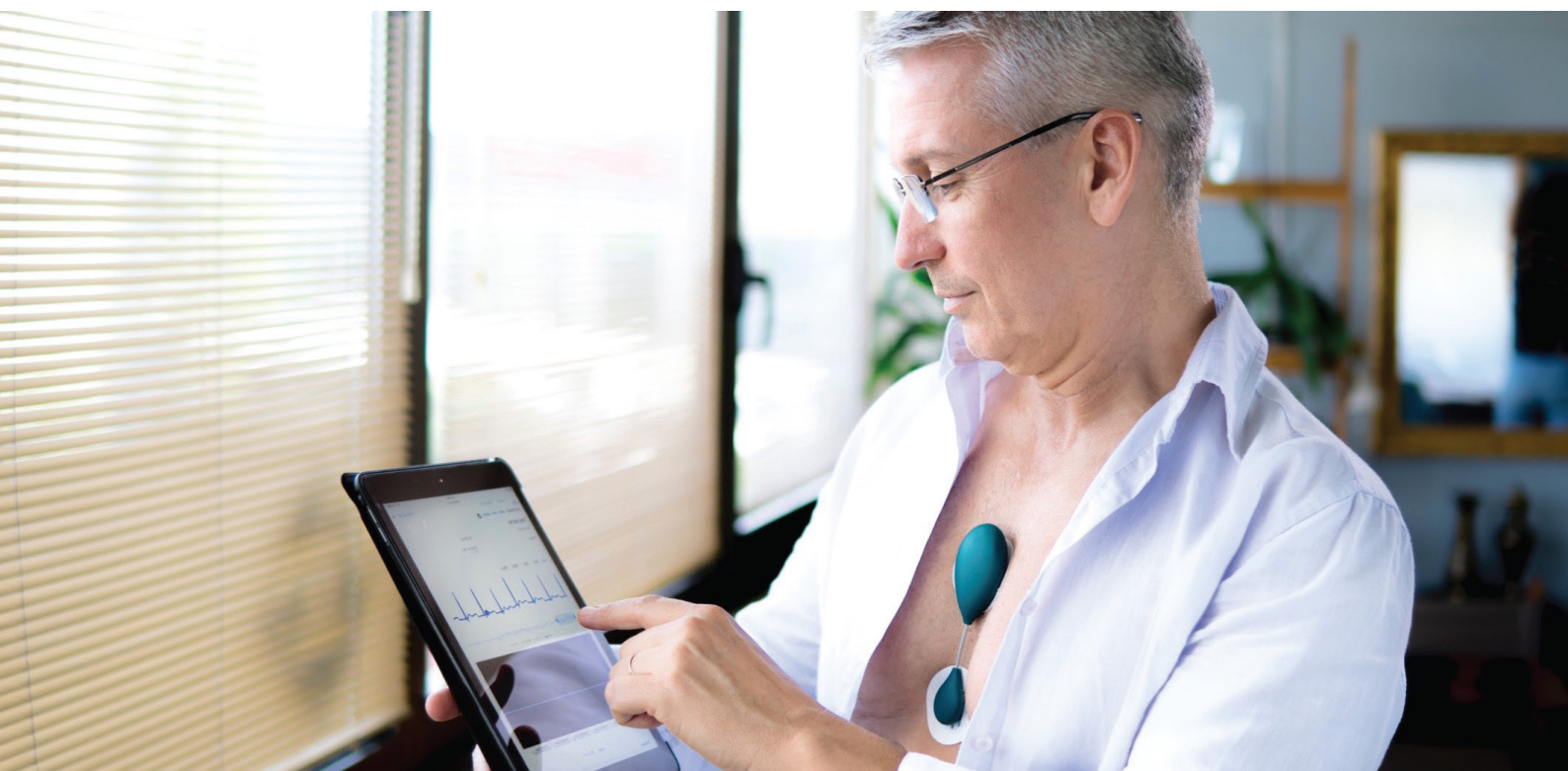
The Solution

HPC was used to solve both business challenges. GPU-based HPC (using in sum about 11,000 core hours and 5,200 GPU hours) was used to train a new ML model to detect specific heart arrhythmias, improving its accuracy and reducing the error rate by 50%.

To efficiently process thousands of incoming ECG streams with high velocity and data volumes, containers and functions as a service were employed avoiding redevelopment and replicated administration tasks.

The NCC North Macedonia has provided expertise in deploying this HPC-enhanced Data Analytics solution, and the University of Klagenfurt has assisted in realizing a scalable solution through various serverless HPC systems and a workflow manager.

The Impact

The experiment realized a solution that ensures operational resilience with a robust solution for easy business scale-up. The new service reduces the costs for system administration, software upgrades, and maintenance, resulting in a more efficient and profitable business.

Thanks to the achieved scalability boost to tens of thousands of users, in particular the ability to handle the associated ECG analysis requests concurrently, Innovation Dooel expects to double their revenue through additional sales. The improved arrythmia detection, reducing errors by 50% and achieving an accuracy of 90%, will significantly increase the competitiveness of Innovation Dooel's service.

Through this new service, medical doctors can simultaneously monitor the health status of multiple outpatients without requiring their physical presence in a hospital, thereby reducing costs to the health system significantly. In particular, the service will contribute to early detection of dangerous arrhythmias to prevent severe heart damage, improving overall healthcare and increasing life expectancy.

Benefits

- Innovation Dooel expects to double its revenue by selling the new service, which now scales to tens of thousands of users.

- 50% error reduction and 90% accuracy lead to a more competitive product with significant improvement in arrhythmia detection.

- 25% increase in efficiency and profit due to reduced costs for processing an incremented workload with reduced software administration.