Case Study

Industry
Solution Focus Area

AI and image visualisation technologies used to fight COVID-19 and future diseases

The AIX-COVNET team is researching applying automated AI technologies to predict disease outcomes from imaging and clinical data.

UNIVERSITY OF CAMBRIDGE

NHS
Cambridge University Hospitals
NHS Foundation Trust

At a glance

- Researching AI technologies, imaging and clinical data to predict outcomes in COVID-19 patients
- A team of experts are exploring healthcare data and algorithms with the aim for clinicians to make informed decisions
- Using Intel's Pandemic Response Technology Initiative funding and technology support
- The results are being used to help prepare for future healthcare emergencies

Challenge: How could AI work alongside clinicians in hospitals to deliver better diagnostic solutions in the future?

During the beginnings of the COVID-19 pandemic, Dr Mike Roberts (Senior Research Associate of Applied Mathematics) and Professor Carola-Bibiane Schönlieb (Professor of Applied Mathematics) of the University of Cambridge wondered how AI technologies could help clinicians predict and potentially manage disease outcomes.

The challenge was to find a way of using existing clinical data to develop AI tools for COVID-19 diagnosis and prognosis for hospital patient management. So that their research could begin, Dr Roberts and Professor Schönlieb not only needed funding, but also the help from professionals outside their specific fields.

Solution: How the AIX-COVNET algorithms could help patients in the future

Thanks to a newly launched initiative from Intel called the Pandemic Response Technology Initiative (PRTI), the two managed to secure the funding they needed. They were now free to reach out through their vast network of professional contacts, and create a global team made up of people from various disciplines. All of them working together to develop an AI toolkit that might one day help manage and treat COVID-19 patients. The AIX-COVNET team was born, and their initial research work could begin.

"It was beautiful to see a multidisciplinary team come together, made up of clinicians, medical researchers, mathematicians, computer scientists and engineers."

Professor Carola-Bibiane Schönlieb (Professor of Applied Mathematics)

As mentioned, the team's work, and the software involved, are currently in their research phases. However, it's hoped that it may be ready for real-life patient diagnosis by late 2023. But we do know enough to take a deeper dive into how the AIX-COVNET program might work.

A server, set up in the hospital, is connected to the imaging system. When a patient with suspected COVID-19 comes into hospital, they would receive a CT scan of their chest. 3D images are formulated, which will be sent to the algorithm devised by AIX-COVNET.

Figure 1. A radiologist reviews a patient's CT scan before sending it to the AI algorithm.

The images are overlaid by the AI-predicted disease region. The algorithm is trained using a database of 20,000 chest images, taken from numerous hospitals across England and Wales. Based on initial measurements taken from the patient, and by pinpointing the different patterns when compared to the database, the clinician would receive quantification of the disease, helping them to predict how it might develop.

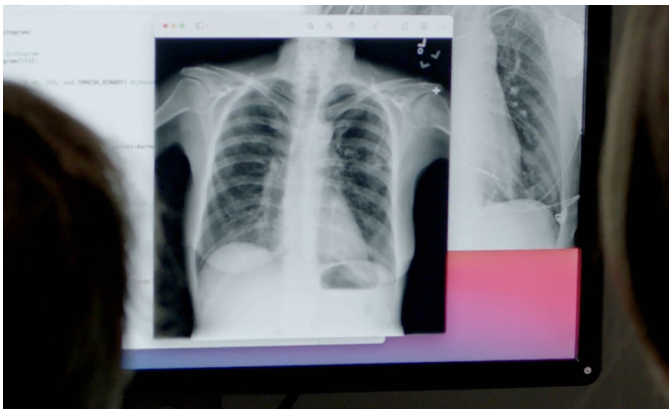

Figure 2. 20,000 chest images were used in the development of the AIX-COVNET algorithm.

From here, choices can be made on the best care pathway for the patient. Whether they should go to the ICU or the ward, for example.

Figure 3. A patient with suspected COVID-19 comes into the hospital to receive a CT scan.

Using the Intel® Movidius™ Neural Compute Stick has helped the research team run the necessary algorithms without the need for a costly GPU (a highly specialised Graphic Processing Unit). Intel also provided the 3rd Gen Intel® Xeon® Processor-based server that was invaluable in the early testing of the algorithm.

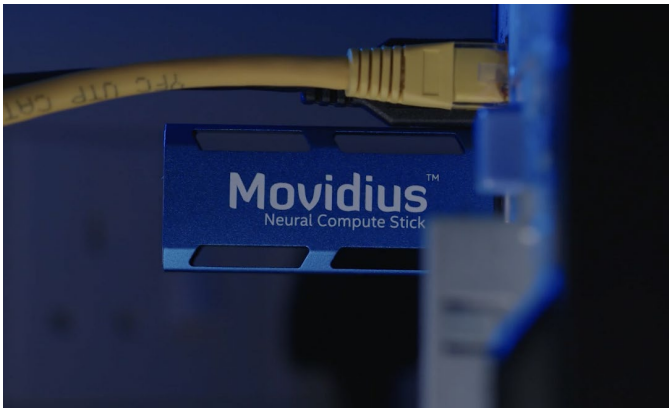

Figure 4. Intel® Movidius™ Neural VPUs enable demanding computer vision and AI workloads with efficiency.

As part of their research work the team are also looking into whether COVID-19 can be detected from a routine and inexpensive blood test. The aim is to use comprehensive data from blood tests, the most common clinical test in the world, to predict outcomes for patients.

Results: The need for more accessible data, and the importance of dialogue across disciplines

At the moment, the earliest prototype algorithms designed to identify, segment and quantify diseases are in the clinic, awaiting regulatory approval. Yet the work has already highlighted the need for better data access. AI is fuelled by high quality training data, allowing it to find patterns and generally determine the quality of the algorithm. The better the data, the better the outcomes.

The work has also flagged the importance of creating a new robust software framework to accommodate the reproducibility and reusability of the algorithms. This way they can be developed further to become a scalable, robust and useful tool for NHS clinicians to use in a real environment.

Perhaps most importantly, the work has underlined the importance for researchers, clinicians and mathematicians to engage in multi-disciplined dialogue. The act of learning from other experts will be essential as the trend of AI in healthcare continues to grow.

Conclusion: Preparing for future healthcare emergencies

It is hoped that the ongoing research carried out by the AIX-COVNET team will create a tried-and-tested blueprint for any future health emergencies, including new potential global pandemics. It's a blueprint the team believe can also be scaled across the whole of the NHS in the UK. And because the common patterns of COVID-19 look similar to other existing respiratory epidemics, it's hoped the segmentation tools can be used to tackle, say, influenza. It will also establish improvements in best practice for development and communication, along with informing other AI tools on how to function in a real-life environment.

"It's exciting to see how this can be rolled out, making AI significantly more accessible and gaining outcomes and answers faster and easier. That's when you get to a point where you change the world with technology."

Phillippa Chick, Global Account Director, Health & Life Sciences at Intel

Learn more

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Intel AI

Intel Healthcare Technology Solutions