The value of AI is in its integration

3 Pioneers from LUMC share their experiences using contextflow integrated into the Sectra PACS

Sectra interviewed three thought leaders from Leiden University Medical Center (LUMC) in the Netherlands about their experiences and insights on integrating AI directly into the radiology workflow. This use case shows the importance of that integration, how it's used in clinical practice, and how they went about choosing the right types of algorithms for the hospital.

LUMC uses contextflow's clinical decision support system for improved analysis of lung CTs to enhance its radiology workflow with artificial intelligence. The software, SEARCH Lung CT, has been seamlessly integrated into the Sectra PACS, enabling radiologists to quantify lung abnormalities, such as lung nodules, emphysema, effusion, consolidation, pneumothorax, and many more.

This integration is a Sectra solution, developed to increase the value and adoption of existing AI, based on standards. SEARCH Lung CT serves to assist radiologists with both quantitative and qualitative information when evaluating patients with suspected interstitial lung diseases (ILD), chronic obstructive pulmonary disease (COPD), and lung cancer. Using this AI assistance, it may also contribute to the wellbeing of radiologists at work, thus going beyond work efficiency and quality enhancement of radiological reporting.

Introducing

- *Prof. Dr. H. Lamb*, Professor of Radiology, Head of the Cardio Vascular Imaging Group (CVIG), Department of Radiology
- *Dr. W. Grootjans*, Technical Physician, Head of the Imaging Services Group, Department of Radiology
- *S. Romeijn*, Technical Physician, clinical implementation of AI, Department of Radiology

Trends in radiology: more data, higher workloads, better PACS integrations

In recent years, data volumes in radiology have increased dramatically. “We have an ever growing number of clinical imaging requests. Exams have more slices and require a higher resolution, so there is much more imaging data to review and analyze quantitatively,” says professor H. Lamb. Dr. W. Grootjans adds: “Image quantification has become a standard task in radiology, and its importance will only continue to increase. It provides referring physicians with the necessary information to personalize patient care, improve sensitivity to detect changes over time, which ultimately aims to improve patient outcomes.”

In addition, general awareness of the potential of AI is increasing. Lamb: “Since the radiological workload continues to increase and the number of radiologists will not increase, we have a challenge. AI will help to maintain high quality of image reading with sustainable well-being of radiologists, allowing them to focus more on their role as consultant and communicator. Radiology with AI support is shifting the radiologist’s role towards a navigator of healthcare. We need to keep radiologists satisfied in their jobs and likewise offer our patients good turnaround times.”

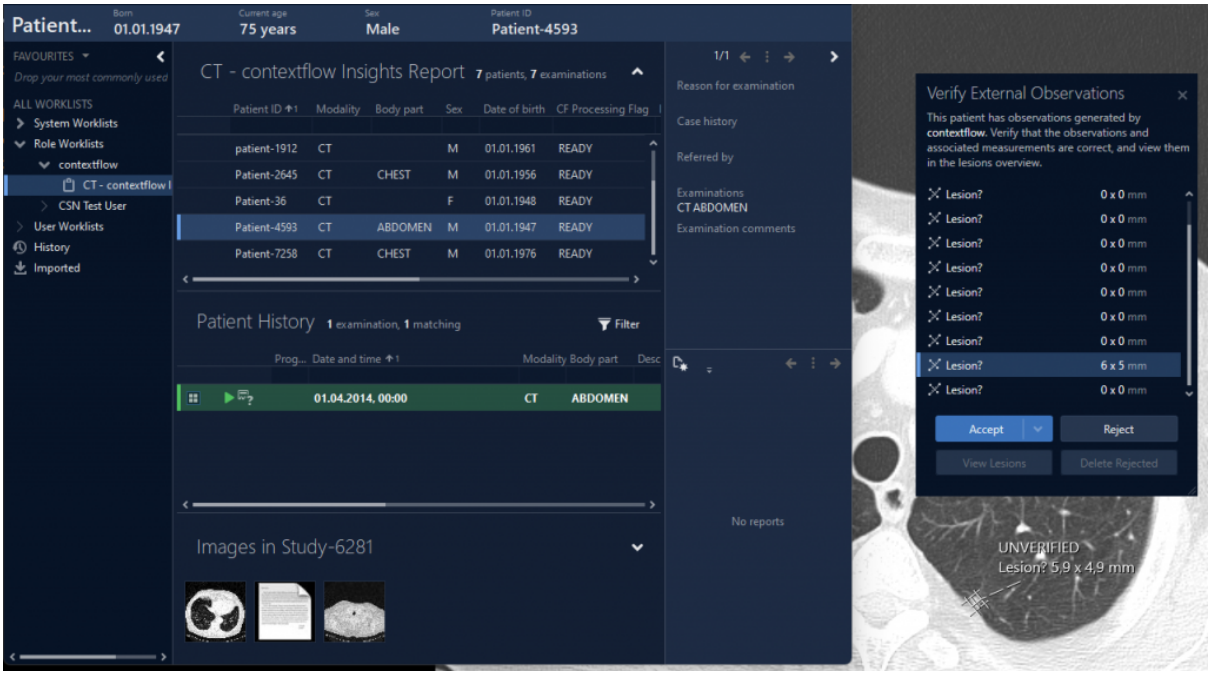
Numerous AI algorithms have been developed in the past few years. This brings plenty of choice, but working with AI goes beyond choosing to work with a specific tool. S. Romeijn explains: “Algorithms often perform very well, but that is only the first step. The second step is integration because you can’t do anything without this. Most of the added value of AI is in its optimal software integration, in this case the PACS, which helps us get something out of it in practice. For radiologists, the right data must be in the right place at the right time. This also stimulates radiologists’ enthusiasm.”

Collaboration: the essential factor

Dozens of companies worldwide are developing algorithms to detect lung abnormalities. LUMC chose contextflow SEARCH Lung CT, which is now one of the first tools that LUMC has integrated into its Sectra PACS. One deciding factor was this developer’s openness to improvement. “To us, the [nature of our] collaboration is an essential factor, and with this, their openness to change. You don’t just want to buy a license. You want them to customize their product and

work on projects together. We are not simply their client, but we will also have to get along well with each other," according to Lamb.

The functionality of contextflow stood out, as it takes a general approach to image analysis. Romeijn: "Ultimately, their software is more widely applicable than other algorithms focusing on specific lung abnormalities. It's a tool for the lungs and, therefore, a lot more interesting than having eight different tools that say something about a thorax CT, with all kinds of different outputs that are difficult to combine. So the vision of contextflow is very appealing to us."



PACS integration and its improvements

The LUMC team met contextflow in 2018. "In those four years, we had a lot of meetings that set direction for the future. Ultimately, it's about being able to implement your vision into the software," says Grootjans. The integration into the Sectra PACS started in 2020.

"At the time, we were still exploring what AI was all about. Since it was one of the first AI algorithms to be implemented, we spent approximately one year on discussing IT security and filling in the paperwork. Then COVID-19 came. [At that point,] we were in touch with both Sectra and contextflow. An important thing to note is that this degree of AI integration into the PACS was unheard of before Sectra made it possible. Sectra is also currently the only PACS that is

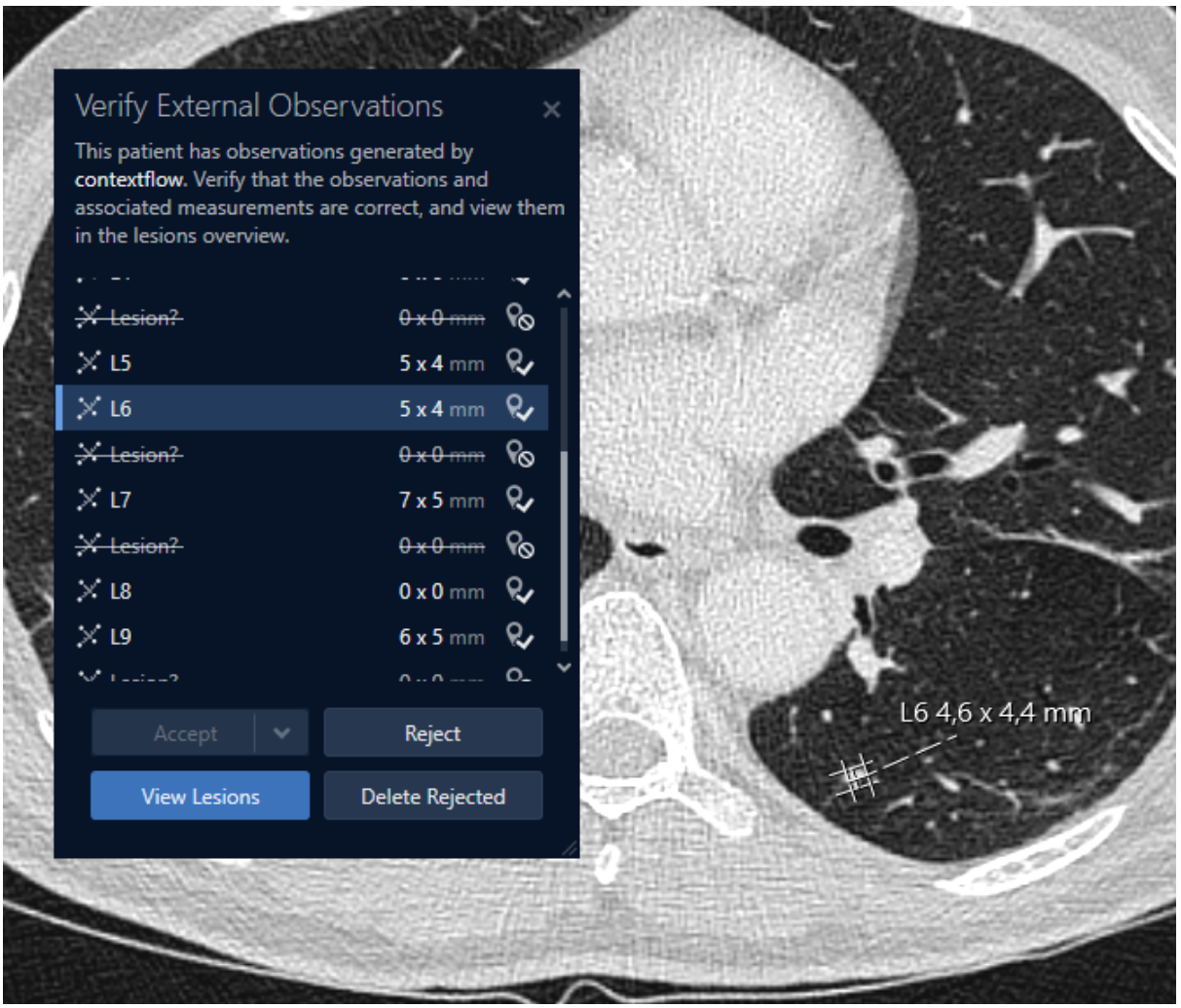
technically capable of integrating that deeply. On top of that, contextflow is one of the very few AI vendors capable of such a deep integration."

Because it was a pioneering collaboration, all parties had to gain more insight, which then had to guide the workflow setup in the best possible way. Romeijn: "We catch up with contextflow every month. During the integration, this was daily or weekly via email to discuss the necessary tweaks and adjustments. They respond very quickly and take home our feedback."

Formally established collaboration contracts define what the LUMC team provides and what the AI vendor will offer in return. "You could call these co-creation contracts," Lamb explains. "We help them annotate lung abnormalities, and they create tailored solutions. You can't do this from the start. First, you have to get to know and trust each other. Nowadays, we are at that stage where we can basically [try anything]."

LUMC's image annotations help validate the algorithms. In addition, the LUMC team can share their practical experience, from which contextflow learns what works well and what does not. This input will further determine the workflow and how the radiologist can interact with it.

At LUMC, the arrival of COVID-19 accelerated their pioneering with AI. Lamb: "Everyone had to work from home. Suddenly, we could start doing things we wanted to do for years. There was also a huge need for the quantification of lung patterns. What percentage of the lung was affected by COVID-19?" Many IT problems were solved during this period, including legislation-related ones.



The integration of contextflow SEARCH Lung CT was a step-by-step process. Romeijn: “At first, we had to open a link in our PACS, directing us to a separate contextflow viewer. That was a nice integration by itself.” But the wish of the end users remained to have as much integration with the Sectra PACS as possible.

Another improvement in the contextflow – Sectra integration is how its output can be transferred to reports. Lamb: “I [previously] couldn’t transfer the results from the analysis directly into my report. No software had this possibility. So we all asked for that.” Now it’s more a matter of checking and accepting the output before it is added to a report. This also prevents errors.

The application itself is also constantly improving. “We know that they thought carefully about longitudinal analyses. This feature has not yet been implemented, but it’s coming after this summer,” Romeijn explains. From then on, contextflow can also be used to properly visualize and quantify the

development of lung abnormalities over time. Lamb: “This is what we told them from the beginning. We need to follow lung nodules over time, visualize them using graphs, doubling times, and more. They have developed this feature exactly as we want it in daily use. This development is truly a win-win. Collaboration offers you the best solutions.” According to Romeijn, it can be a challenge to test what works best in clinical practice. For example; how to choose which previous scans and series should be compared with the latest scan.

The impact of working with AI

What impact does working with AI have on radiologists? Lamb says this is difficult to say, “because how do you measure this impact?” In the Radiology AI Lab, he and his team are developing a method to quantify how focused radiologists stay in their tasks. “As radiologists, we take very few breaks. We sometimes start at 8 AM and go home at 8 PM, which shouldn’t be possible. We want to discover the parameters that are most informative about your reliability, efficiency, but above all, your job satisfaction.” This shows that working with tools like contextflow goes far beyond saving time and improving quality of care, but also about job satisfaction and preventing burnout.

Patient communication remains essential when working with AI. “They have access to their EHR (Electronic Health Record) data, but the wording is often very technical and medical. People can start panicking. We want to take that into account by having a simple patient explanation in the future,” Lamb says. Romeijn adds that if there is a difference between the AI output and what the radiologist sees, the radiologist should let the patient know why the difference exists and what findings prevail.

At LUMC, referring clinicians have rapidly become used to the radiological output with the help of AI. Lamb explains that they see the luxury of it. “Even though it has taken some time to set up, it is a very efficient, quantitative way of communicating.” According to Grootjans, it is “vital to further involve the referring clinicians so that you keep looking at the workflow holistically. What information are you providing, and what is necessary?” Of course, the human factor will always be needed. Lamb: “I am not worried about that at all. I hope

that everything will be automated at some point and that radiologists will translate this into clinical practice. They will become [more like] imaging consultants and can guide patients toward their next steps.”