# User Report

## Oncological imaging - AI is indispensable for tumor classification

Evangelisches Klinikum Niederrhein uses SEARCH Lung CT for distribution and volumetric quantifications of disease patterns

Has artificial intelligence (AI) come to stay? The answer is clearly yes, because from laboratory medicine to radiology, it is helping medical professionals obtain plausible, quantifiable and reproducible results in significantly less time. And as a result, it is easing the burden on medical departments suffering from large workloads. AI will actually take over many activities in the future in areas where it is readily applicable. "Repetitive work in our specialties, such as determining and matching values, is an excellent domain for the use of machines," says Prof. Dr. Jörg Michael Neuerburg, Chief Physician of the Central Department of Diagnostic and Interventional Radiology at the Evangelisches Klinikum Niederrhein (EvKIN) Ev. Hospital BETHESDA.

The network is an academic teaching hospital, part of the University of Düsseldorf, and has five locations in the Ruhr region, including Ev. Klinikum Duisburg-Nord, Johanniter Krankenhaus Oberhausen, Herzzentrum Duisburg-Meiderich, Ev. Klinikum Dinslaken and Ev. Krankenhaus BETHESDA zu Duisburg. As a maximum care provider, the hospital operates a thorax center with two pulmonology departments as well as a heart center. The radiology department employs 16 radiologists and 9 neuroradiologists, serving half a million people from the Lower Rhine to the Ruhr region.

### Artificial intelligence must be embedded

For AI to be accepted, reproducibility of results is an important factor; according to Prof. Neuerburg; however, complete integration into the usual radiological workflow is an absolute must. The problem with AI systems, as well as their predecessors - CAD systems, has always been implementation into the workflow: "If a separate program has to be opened and the images also have to be sent to another computer, the workflow is delayed. Radiology, like all other departments, is measured by throughput. If AI means additional work, acceptance is low. This problem has been solved very well by contextflow in collaboration with VISUS; SEARCH Lung CT is perfectly integrated into our workflow," says Prof. Neuerburg.

# User Report

**The introduction of AI as a joint task**
The radiologists at EvKIN work with the JiveX PACS from VISUS (Compugroup) and the ORBIS hospital information system from Dedalus HealthCare, both of which are already closely integrated. This provided good conditions for installing SEARCH Lung CT from contextflow in coordination with the pulmonologists. After the initial problems on the part of the legal department regarding data transfer were solved (it had to be ensured that no data protection guidelines would be affected during data transfer to other servers), the integration of the new program succeeded very quickly and without affecting ongoing operations thanks to the cooperation of the in-house IT, VISUS and contextflow.

**The pitfalls of oncological imaging**
In radiology, oncological imaging is a never-ending challenge: the targeted search for the tumor, its standardized classification, in the case of treatment, the assessment of its progress (or not). "Let's take a patient with a large brain hemorrhage as an example. To answer the question of whether tumors were already present, the current examination must be compared with the previous examination. Of course, artificial intelligence can absolutely answer that much faster and more efficiently than we can," says Prof. Neuerburg, describing a current case for the use of AI.

The chief radiologist already has broad experience with AI systems and uses three programs in his department: BoneXpert, an AI-based bone age determination system used in pediatrics to identify growth retardation or acceleration, and in forensics to determine the age of delinquent juveniles. Further AI support is provided by Transpara - a mammography screening tool that uses a graduation from zero to ten to indicate the probability of developing breast cancer.

For lung diagnostics, radiologists at EvKIN have been relying on SEARCH Lung CT for the past year to improve the overall quality and quantity of lung diagnostics, and in particular, to assist in assessing the distribution pattern of emphysema. "These distribution patterns are important to pulmonologists because they serve as the basis for setting valves to adequately ventilate the lungs. Therefore, we have adapted our findings to provide quantitative results on the extent to which, for example, the upper lobe is ventilated differently than the middle lobe after valve placement," the radiologist explains.

# User Report

In addition, SEARCH Lung CT is used for lung nodule detection staging during follow-ups. Previous examinations are compared with the current results to identify increasing structural densities. In addition, the system detects new nodules and measures the volumes of the existing ones; thus, it enables an assessment of a treatment's progress. Thus, the radiologists at EvKIN mainly rely on quantitatively measurable changes. "SEARCH Lung CT is currently still in the development phase, so we use the tool as an add-on and report the volume information as a supplement to our findings without these values being standardized in the workflow," explains Prof. Neuerburg.

On the expert's wishlist is the expansion of the software to include the pleural region, for example, to detect occupational diseases such as mesothelioma, which occurs after exposure to asbestos. At the moment, the tool analyzes the lungs, but not all structures. Therefore, the radiologist's additional visual findings are still necessary at this stage, especially since in the case of bronchial carcinomas, a look at the adrenal glands or the liver is also advisable to see whether metastases of the primary tumor have formed in the abdomen.

**Standardization and classification pave the way for AI**
After a long lead-up, radiology is now moving swiftly toward standardized findings. What began years ago with the BI-RADS classifications in breast cancer screening has now become established via the PI-RADS classification in prostate imaging and the LI-RADS and ACR classifications in lung screening: a stringent and institution-independent staging system. This refers to the classification of tumors into specific disease stages, which subsequently require different treatment. For example, metastasized diseases are not only removed surgically; whereas early stages related to the organ can certainly be treated surgically, depending on the histology. "This is the direction in which AI will develop and have a significant impact on the lives of radiologists in the future. Because this is where the volumetry of lesions and volumetric comparison come into play, which is now mandatory for tumor center certification as part of oncology standardized staging.

"On the way to standardized reporting in radiology, the software from contextflow will therefore provide us with important support," concludes Prof. Neuerburg, hinting at the latest paths in medical imaging.

# User Report