

A Sharper Focus In Radiation Therapy Planning



Internal movement caused by a patient's breathing presents a major challenge in tumor imaging. Motion artifacts in clinical images can cause difficulties when planning radiotherapy. René Werner from the University Medical Center Hamburg-Eppendorf (UKE) has long been concerned with precisely this problem. Together with Christian Hofmann, physicist at Siemens Healthineers, they have developed an innovative solution for handling respiratory motion in radiotherapy planning – always with the focus on achieving better outcomes for cancer patients.

Two in three cancer patients will receive radiation therapy (RT) at some point during their treatment. RT uses ionizing radiation to kill malignant cells and it is therefore very important to deliver the maximum dose to the tumor while at the same time minimizing the dose to the surrounding healthy tissue. The aim is to kill cancer cells but spare neighboring organs-at-risk. To plan optimal RT delivery, a computed tomography (CT) image of the patient is acquired in the treatment position. Physicians or clinicians use this image to contour the target of the treatment, the tumor, and delineate it from the surrounding organs-at-risk to be spared.

Motion during imaging, however, can introduce image artifacts and therefore make the planning process more problematic. Internal breathing induced movements, especially affect lung or liver lesions. To account for motion when deciding on and during treatment, a high-quality 4D CT of the patient is required. In the past, over 75% of 4D CT showed artifacts due to the irregular breathing patterns of patients. This is why René Werner, Head of Image Processing and Medical Informatics at the UKE in Hamburg and Christian Hofmann, physicist and CT expert for radiation oncology at Siemens Healthineers, wanted to find a better solution for the benefit of patients.

The result of their collaboration was a new intelligent 4D CT algorithm known as Direct i4D1 that makes it possible to reduce these artifacts substantially. Available on the new CT Simulator, SOMATOM go.Open Pro, Direct i4D adapts to the patient's breathing in real time by setting the scan parameters according to the breathing curve of the patient. By intelligently selecting acquisition and reconstruction parameters, it is possible to improve the 4D CT image outcome.

"Direct i4D really is a paradigm shift: Previously, the patient had to adjust to the scanner as the scanner always had fixed parameters for breathing that were correlated with 4D CT. Now we have taken the exact opposite approach: the scanner is controlled by the patient's breathing. This allows us to avoid missing imaging data due to irregular breathing which causes artifacts in the images," explains Werner. Watch the video to learn more about the development and benefits of Direct i4D for radiotherapy planning.

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