Medical Xpress

Imaging tools help radiologists diagnose lung cancer, save lives

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Medical-imaging software under development at Rochester Institute of Technology could someday give radiologists a tool for measuring the growth of nodules in patients at risk of lung cancer, the leading cause of cancer deaths in the United States, according to the Center for Disease Control and Prevention.

Nathan Cahill, an associate professor in RIT's School of Mathematical Sciences, is creating algorithms to quantify the growth of lung nodules imaged on Computed Tomography (CT) scans. The two-year, longitudinal study, funded by the National Institutes of Health, compares existing scans of individual patients. The algorithms will analyze medical images, measuring changes in nodules to identify small cancers or, if stable, obviate unnecessary, often risky biopsies.

Simple factors can complicate the comparison of CT scans, creating extraneous information in medical images, introducing artifacts and possible errors in diagnosis.

"It's not an apples-to-apples problem with reliable correspondence between two images," Cahill said.

Discrepancies between scans of a single patient can result from differences in position and inhalation during imaging. A 10-pound weight gain between CT scans can also affect how surrounding organs push against the lungs and stretch or compress the nodules.

"Having even 1 or 2 millimeters of difference could throw off the estimates of the volumes of the nodules because the size of the nodules might be 5 millimeters or so," Cahill said. "The goal of this project is to develop an algorithm that tries to compensate for all those potential background factors."

Dr. David Fetzer, a radiologist at the University of Pittsburgh Medical Center and a member of the collaboration, suggested the clinical problem. Fetzer, an alumnus from the RIT Chester F. Carlson Center for Imaging Science, had worked as an undergraduate with Maria Helguera, professor in the center, and a member of Cahill's team.

"Modern CT imaging devices produce hundreds and sometimes thousands of images," Fetzer said. "If a patient is being followed for an abnormality, such as a lung nodule, a radiologist must compare these images visually, mentally compensating for differences such as patient position. Slight changes in technique between two CT scans may simulate tumor growth, for instance."

Radiologists compute the doubling time of a nodule, or the range of time it takes for the size of the nodule to increase twofold. A mass that doubles in less than 30 days is growing fast and could be an infection, Cahill said. "If it takes more than one and a half years to double, it's growing slowly and is probably benign. If it's anywhere between that—one month and 1.5 years—then, it could be malignant and you have to do further testing and do biopsy."

Cahill and Kfir Ben Zikri, a Ph.D. student in the Center for Imaging Science, are registering, or aligning, backgrounds to create a common frame of reference between sets of images. The process geometrically transforms one three-dimensional image into another and compensates for background information that blurs edges of nodules, even when underlying diseases like emphysema or fibrosis make intensities in the background brighter.

"Then we can estimate the volumes, which will allow us to more accurately estimate the doubling time and have a better chance to determine if it's a malignant growth or benign," Cahill said.

The technology will be part of the free software libraries offered by Kitware, a North Carolina-based, open-source software company that specializes in medical image analyses. Cahill and Ben Zikri work closely with scientists at Kitware and professor Marc Niethammer at the University of North Carolina at Chapel Hill.

Fetzer is selecting 30 CT scans of patients treated for lung cancer at the University of Pittsburgh Medical Center. The images are scrubbed of patient-identifying information and sent to Cahill and Ben Zikri. Fetzer will clinically verify the algorithmic results.

"With today's technology we have the ability to create three-dimensional datasets, volumes of image data that can be manipulated and analyzed in non-visual ways," Fetzer said. "With techniques such as this we may be able to compensate for background changes and, hopefully, more accurately show growth, assess aggressiveness or prove stability of a nodule. This accurate assessment could dramatically affect patient care, decrease cost and the number unnecessary procedures, and improve outcomes through earlier cancer detection."

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