

The Lung Image Database Consortium (LIDC): Radiologist Agreement in the Identification of Lung Nodules in CT Scans

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Purpose: The Lung Image Database Consortium (LIDC) is developing a public database of thoracic computed tomography (CT) scans as a medical imaging research resource. A key aspect of this database is the annotations assigned by LIDC radiologists to indicate lung nodules in the scans. In this study, we evaluated the consistency of nodule identification.

Methods and Materials: 130 CT scans were reviewed by one radiologist at each of 4 LIDC sites through a two-phase process. During the initial "blinded read," radiologists independently annotated lesions they identified as "nodule $\geq 3\text{mm}$ (diameter)," "nodule $< 3\text{mm}$," or "non-nodule $\geq 3\text{mm}$." During the subsequent "unblinded read," the blinded read results of all radiologists were revealed to each of the 4 radiologists, who then independently reviewed their annotations along with those of their colleagues; a radiologist's own annotations then could be deleted, added, or left unchanged. This approach was developed to identify, as completely as possible, all nodules in a scan without requiring forced consensus. Lesions designated as "nodule $\geq 3\text{mm}$ " are the primary focus of the LIDC effort.

Results: After the initial blinded reads of the first 30 cases, 71 lesions received "nodule $\geq 3\text{mm}$ " annotations from at least one radiologist; however, all 4 radiologists assigned such annotations to only 24 (34%) of these lesions. Following the unblinded reads, a total of 59 lesions were so annotated by at least one radiologist, with 27 (46%) of these lesions receiving such annotations from all 4 radiologists. Considering the complete read of all 130 cases, 285 lesions received "nodule $\geq 3\text{mm}$ " annotations from at least one radiologist, of which 55 (19%) were identified as such by all 4 radiologists and 82 (29%) were identified by only one radiologist.

Conclusion: The two-phase reading approach improves radiologist agreement for nodules $\geq 3\text{mm}$. Even with this approach, however, substantial variability remains across radiologists in the task of lung nodule identification: only 19% of lesions identified by at least one radiologist as "nodule $\geq 3\text{mm}$ " were identified as such by all 4 radiologists.

Clinical Relevance/Application: Substantial variability exists in the manual identification of lung nodules in CT scans.