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Appendix: Content Summaries of Best Papers Selected for the 2020 Edition of the IMIA Yearbook, Section Cancer Informatics

Ardila D, Kiraly AP, Bharadwaj S, Choi B, Reicher JJ, Peng L, Tse D, Etemadi M, Ye W, Corrado G, Naidich DP, Shetty S

End-to-end lung cancer screening with three-dimensional deep learning on low-dose chest computed tomography

Nat Med 2019 May 20;25:954-61

A deep learning algorithm that uses a patient's current and prior computed tomography volumes was developed to predict the risk of lung cancer. The model achieves 94.4% area under the curve (AUC) on 6,716 National Lung Cancer Screening Trial cases and performs similarly on an independent clinical validation set of 1,139 cases. Furthermore, the algorithm outperformed six expert radiologists with absolute reductions of 11% in false positives and 5% in false negatives. Lung cancer is the number one cancer killer and is felt to be much more curable if detected early, making this a major public health issue. Despite this, rates of CT lung cancer screening are low. This study suggests one way in which the barrier to these low rates can be breached.

Campanella G, Hanna MG, Geneslaw L, Miraflor A, Werneck Krauss Silva V, Busam KJ, Brogi E, Reuter VE, Klimstra DS, Fuchs TJ

Clinical-grade computational pathology using weakly supervised deep learning on whole slide images

Nat Med 2019 Jul 15;25:1301-9

The authors developed a multiple instance learning-based deep learning system that uses only the reported pathologic diagnoses as labels for training. They evaluated the system on a very large single-institutional dataset comprising 44,732 whole slide images from 15,187 patients. Performance was evaluated on a limited number of cancer types: prostate cancer, basal cell carcinoma, and breast cancer metastatic to axillary lymph nodes. For these cancer types and circumstances, AUC was above 0.98, setting a clear new bar for performance of systems of this type. According to the authors, implementation of such a system in the clinical setting would allow pathologists to exclude 65-75% of slides while retaining 100% sensitivity. This type of automated performance could usher in a new era of pathology automation.