New radiomics model uses immunohistochemistry to predict thyroid nodules

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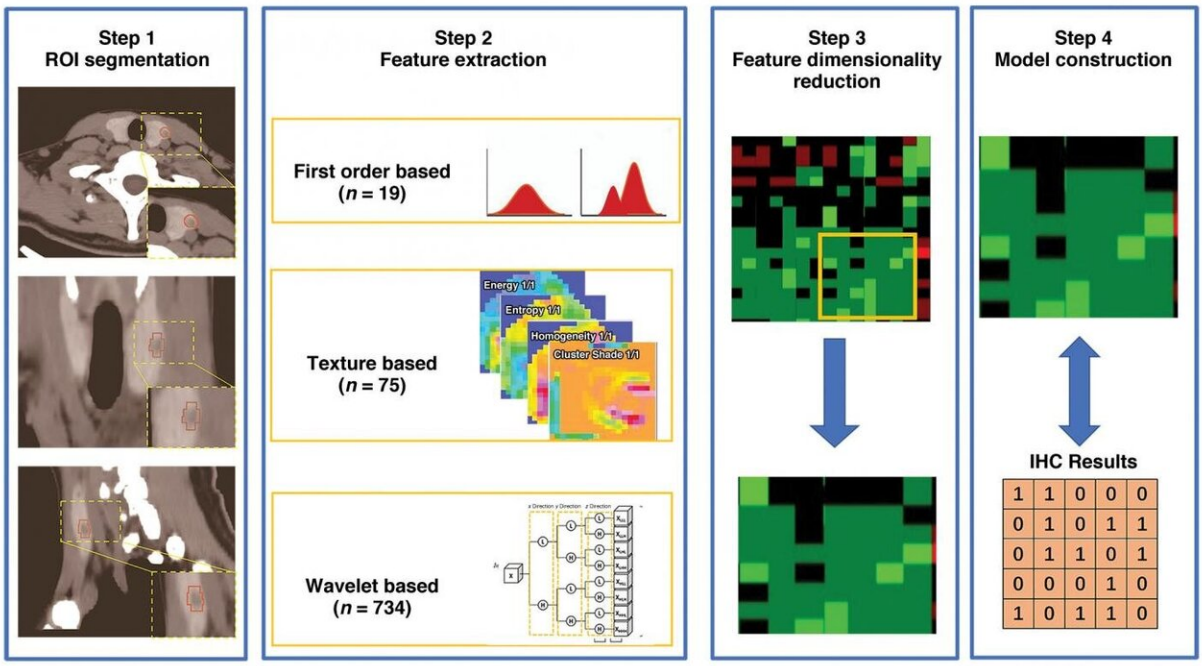

Yellow lines denote area of analysis; red lines denote ROI for radiomic features extraction. X = original image, L = low-pass filter, H = high-pass filter. Credit: *American Journal of Roentgenology* (AJR)

According to an ahead-of-print article published in the December issue of the *American Journal of Roentgenology* (*AJR*), researchers have validated a first-of-its-kind machine learning-based model to evaluate

immunohistochemical (IHC) characteristics in patients with suspected thyroid nodules, achieving "excellent performance" for individualized noninvasive prediction of the presence of cytokeratin 19, galectin 3, and thyroperoxidase based upon CT images.

"When IHC information is hidden on CT images," principal investigator Jiabing Gu explained, "it may be possible to discern the relation between this information and radiomics by use of texture analysis."

To assess whether texture analysis could be utilized to predict IHC characteristics of suspected thyroid nodules, Gu and colleagues from China's University of Jinan enrolled 103 patients (training cohort-to-validation cohort ratio) with suspected thyroid nodules who had undergone thyroidectomy and IHC analysis from January 2013 to January 2016. All 103 patients—28 men, 75 women; median age, 58 years; range, 33-70 years—underwent CT before surgery, and 3-D Slicer v 4.8.1 was used to analyze images of the surgical specimen.

To facilitate test-retest methods, 20 patients were imaged in two sets of CT series within 10-15 minutes, using the same scanner (LightSpeed 16, Philips Healthcare) and protocols, without contrast administration. These images were used only to select reproducible and nonredundant features, not to establish or verify the radiomic model.

The Kruskal-Wallis test (SPSS v 19, IBM) was employed to improve classification performance between texture feature and IHC characteristic. Gu et al. considered characteristics with p

The best performance of the cytokeratin 19 radiomic model yielded accuracy of 84.4% in the training cohort and 80.0% in the validation cohort. Meanwhile, the thyroperoxidase and galectin 3 predictive models evidenced accuracies of 81.4% and 82.5% in the training cohort and 84.2% and 85.0% in the validation cohort, respectively.

Noting that cytokeratin 19 and galectin 3 levels are high in papillary carcinoma, Gu maintained that these models can help radiologists and oncologists to identify papillary thyroid cancers, "which is beneficial for diagnosing papillary thyroid cancers earlier and choosing treatment options in a timely manner."

Ultimately, asserted Gu, "this model may be used to identify benign and malignant thyroid nodules."

More information: Jiabing Gu et al, Prediction of Immunohistochemistry of Suspected Thyroid Nodules by Use of Machine Learning–Based Radiomics, *American Journal of Roentgenology* (2019). DOI: 10.2214/AJR.19.21626

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