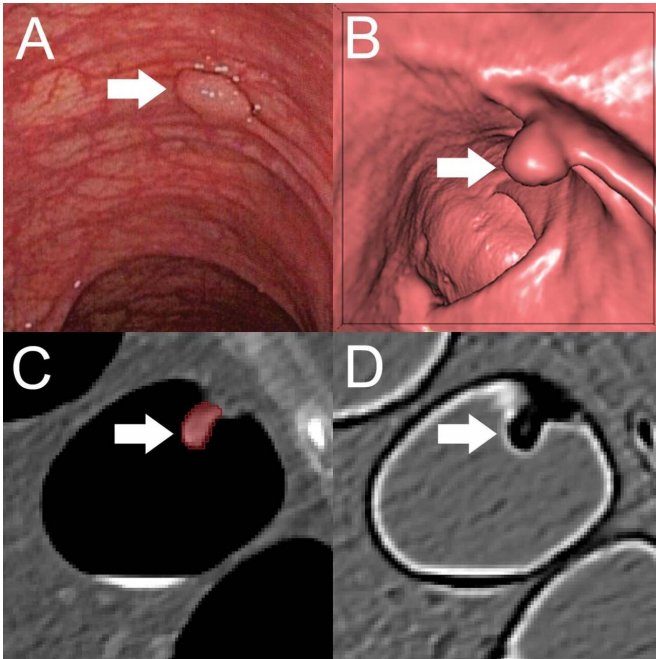


Machine learning method identifies precancerous colon polyps

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A, Optical colonoscopy and, B-D, CT colonography of a 9-mm polyp (arrow) in the descending colon of a 78-year-old woman. B, Virtual fly-through three-dimensional reconstructions were used for exact polyp localization. C, Manual polyp segmentation was performed in multiplanar two-dimensional CT colonography images. D, CT colonography images were preprocessed for image feature extraction by application of a dedicated filter. Credit: Radiological Society of North America

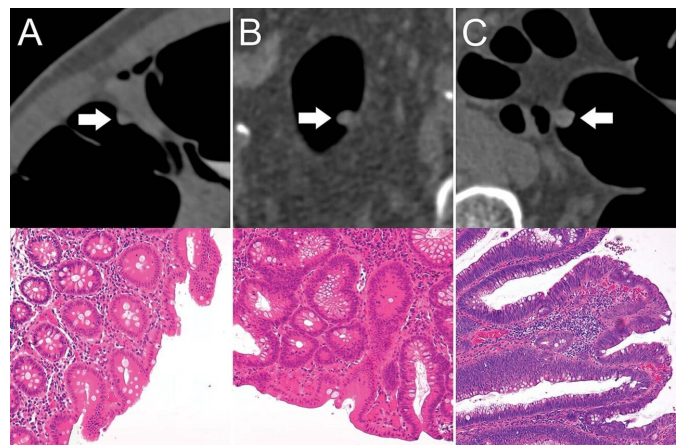
A machine learning algorithm helps accurately differentiate benign and premalignant colorectal polyps on CT colonography scans, according to a study published in the journal *Radiology*.

Colorectal cancer is among the three most common causes of cancer-related death among men and women in industrialized countries. Most types of colorectal cancer originate from [adenomatous polyps](#)—gland-like growths on the mucous membrane lining the [large intestine](#)—that

develop over several years. Early detection and removal of these precancerous polyps can reduce the incidence and mortality of colorectal cancer.

During the last two decades, CT colonography emerged as a noninvasive alternative to colonoscopy in screening for colorectal cancer. It is comparable to colonoscopy in detecting most polyps and is effective at visualizing portions of the colon that in cases of complex anatomical conditions cannot always be evaluated by colonoscopy. However, CT colonography does not enable a definite differentiation between benign and premalignant polyps, which is crucial for individual risk stratification and therapy guidance.

For the new study, researchers leveraged the power of radiomics, a process of extracting quantitative features from [medical images](#), to characterize polyps beyond what was apparent to the naked eye.



Top: Axial CT colonography images show representative colorectal polyps (arrow) in the training set. Bottom: Corresponding histopathologic work-up. (Hematoxylin-eosin staining; original magnification 320.) A, An 8-mm hyperplastic polyp in the ascending colon of a 54-year-old woman with hyperplastic epithelia. B, An 8-mm tubular adenoma in the sigmoid colon of a 68-year-old

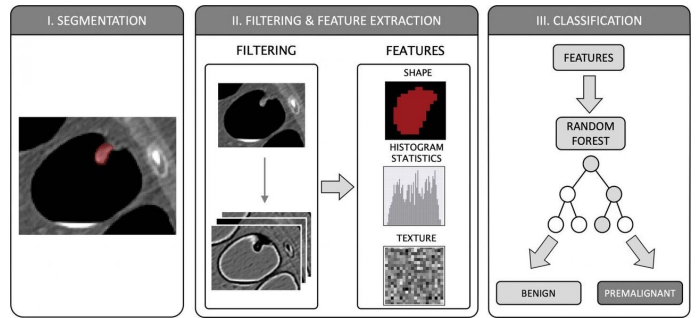
man with tubular growth pattern and elongated nuclei. C. An 11-mm tubulovillous adenoma in the rectum of a 73-year-old man with tubulovillous growth pattern and elongated nuclei. Credit: Radiological Society of North America

The researchers developed a [machine learning algorithm](#) to predict the character of the individual polyps based on quantitative image features extracted through radiomics. They applied the noninvasive, radiomics-based machine learning method on CT colonography images from a group of asymptomatic patients at average risk of colorectal cancer. The machine learning algorithm was trained on a set of more than 100 colorectal polyps in 63 patients and then tested on a set of 77 polyps in 59 patients.

In the test set, the machine learning approach enabled noninvasive differentiation of benign and premalignant CT colonography-detected colorectal polyps, with a sensitivity of 82%, and specificity of 85%. The area under the curve (AUC), a graphical measurement that reflects how much the model is capable of distinguishing between benign and precancerous polyps, was excellent.

"These results serve as proof-of-concept that machine learning-based [image analysis](#) allows the noninvasive differentiation of benign and premalignant colorectal [polyps](#) in CT colonography data sets," said study lead author Sergio Grosu, M.D., radiologist from University Hospital, Ludwig Maximilian University of Munich, in Munich, Germany. "The AUC of 0.91 indicates that this method works well."

The findings point to a role for machine learning-derived algorithms in boosting the effectiveness of CT colonography as a screening tool for colorectal cancer.



The radiomics workflow comprised three steps: manual segmentation of colorectal polyps in multiplanar two-dimensional CT colonography images; image filtering and feature extraction characterizing shape, histogram statistics, or texture; and feature-based training of a random forest classification algorithm to differentiate between benign and premalignant colorectal polyps according to the histopathologic reference standard. Credit: Radiological Society of North America

"Adding machine learning-assisted image analysis to conventional, radiological image reading could further improve the clinical significance of CT colonography-based [colorectal cancer](#) screening by allowing for a more precise selection of patients eligible for subsequent polypectomy," Dr. Grosu said. "This method could be used routinely as a second reader in all CT colonography examinations in the distant future."

Dr. Grosu said that additional studies with larger numbers of patients are needed to validate the findings. He added that these studies should also help drive improvements in the machine learning algorithm.

"Further refinement of the [machine learning](#)-based image analysis is necessary to achieve higher precision in polyp differentiation as well as workflow optimization for better applicability in clinical routine," Dr. Grosu said.

More information: Sergio Grosu et al. Machine Learning-based Differentiation of Benign and Premalignant Colorectal Polyps Detected with CT Colonography in an Asymptomatic Screening Population: A Proof-of-Concept Study, *Radiology* (2021). [DOI: 10.1148/radiol.2021202363](https://doi.org/10.1148/radiol.2021202363)

Provided by Radiological Society of North America

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