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Okayama University research: Artificial intelligence helps to determine cancer invasion

(Okayama, 09 February) **Researchers at Okayama University present in the *Journal of Gastroenterology and Hepatology* a tool, based on artificial intelligence, to assist with evaluating the depth of invasion of early gastric cancer. The method delivers results that are comparable to those obtained by specialists analyzing images of tumors.**

One of the ways to treat early gastric (stomach) cancer is endoscopic submucosal dissection (ESD), a technique with which a gastrointestinal tumor is removed by means of a tube inserted into the body. The advantage of ESD is its low level of invasiveness. However, ESD should only be performed when the tumor is confined to the mucosa, which is the layer of tissue lining the stomach. For tumors spread to the submucosa (the next layer of tissue, lying between the mucosa and the muscle layer), another, more invasive surgical procedure is required. Unfortunately, there is currently no reliable method to determine the depth of invasion of early gastric cancer, which makes it difficult to decide which treatment to pursue. Now, Professor KAWAHARA Yoshiro(M.D.) from Okayama University and colleagues have investigated the feasibility of an artificial intelligence (AI) algorithm as a tool to help evaluating the depth of invasion of early gastric cancers. By 'training' the algorithm using images of tumors, the scientists obtained encouraging results, confirming the diagnostic capabilities of artificial intelligence.

The scientists used 3508 images of lesions (tumors) from 200 patients, with 100 having mucosal (M) and 100 having submucosal (SM) early gastric cancer. For each class (M and SM), two thirds of the images were used as training images for the AI algorithm. By 'studying' training images, the algorithm devised its own set of rules to determine whether an image shows an M or an SM tumor. To evaluate the effectiveness of this so-called deep learning approach, the remaining third of the images were used as test images. Comparing the prediction from the algorithm with the known, correct diagnosis then led to an accuracy score.

The researchers realized that one image is normally not enough to decide whether a tumor is mucosal or submucosal — tumors appear differently from different angles and their appearance also depends on the volume of air in the stomach. Therefore, they also looked at the results when combining several images (taken from different angles) of one and the same lesion. The 'majority vote' was then applied to decide whether a tumor was of the M or the SM type. This approach led to a generally better accuracy; for M cancer, the accuracies were 83.8 % (multiple images, majority vote) and 78.9 % (single image). Both results are comparable to the correctness rate window of 74–85 % typically achieved by medical experts examining images.

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Professor KAWAHARA and colleagues point out that their study has some limitations, including the small sample size, and the fact that the data originated from a single institution — a larger dataset, collected from multiple institutions, would be beneficial. Nevertheless, the obtained results are very promising, and, quoting the researchers: “diagnosis of the depth of early gastric cancer invasion by AI system proved to be feasible, and it is worth investing more effort to put this new technology into practical use”.

Background

Early gastric cancer

Stomach cancer not invading more deeply than the submucosa (the layer between the mucosa, lining the stomach, and the muscle layer) is referred to as early gastric cancer. Treatments include surgery and endoscopic resection techniques such as endoscopic submucosal dissection (ESD). The latter, involving the dissection of stomach tissue using a tube inserted into the gastrointestinal tract, is only an option for particular patients meeting specific criteria — and in any case, a relatively detailed picture of the tumor needs to be available to be able to decide whether ESD will highly likely be curative or not. Specifically, it is necessary to determine how deep the tumor has invaded. There is at present no reliable method for assessing the invasion depth of early gastric cancer; specialists typically examine sets of endoscopic images of the tumor. Professor KAWAHARA Yoshiro from Okayama University and colleagues have now shown that image processing techniques using artificial intelligence can help to determine cancer invasion depth.

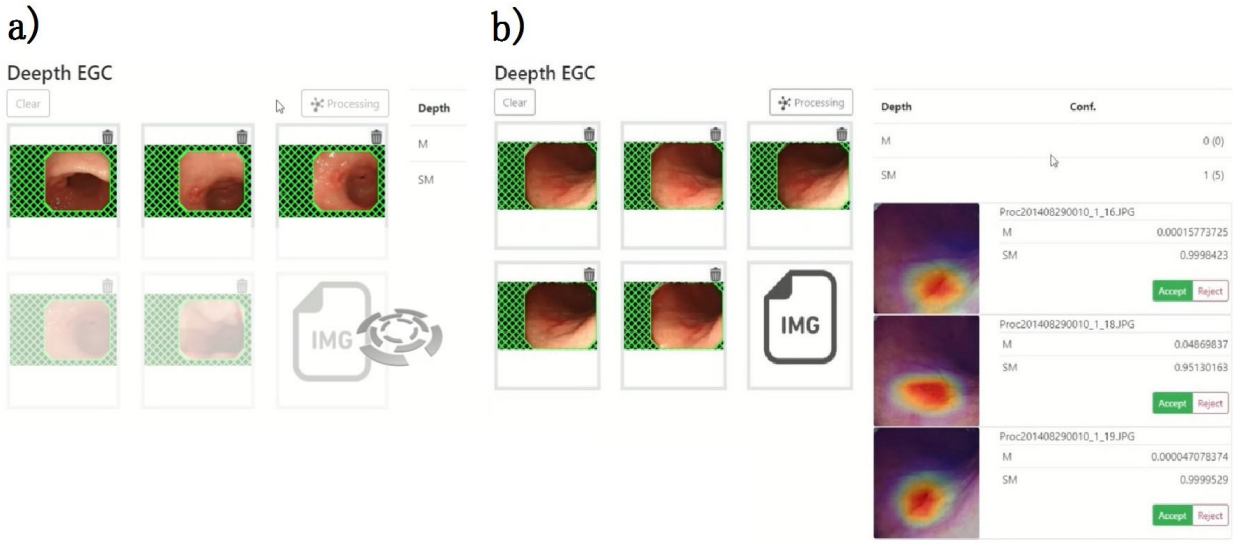

Figure:

Actual image of the application of artificial intelligence for early stage gastric cancer depth diagnosis.

a) Image of diagnosis in progress.

b) Image of diagnosis result

Reference

Kenta Hamada, Yoshiro Kawahara, Takayoshi Tanimoto, Akimitsu Ohto, Akira Toda, Toshiaki Aida, Yasushi Yamasaki, Tatsuhiro Gotoda, Taiji Ogawa, Makoto Abe, Shotaro Okanoue, Kensuke Takei, Satoru Kikuchi, Shinji Kuroda, Toshiyoshi Fujiwara and Hiroyuki Okada. Application of convolutional neural networks for evaluating the depth of invasion of early gastric cancer based on endoscopic images. *Journal of Gastroenterology and Hepatology*. 2021 Oct 28.
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Reference (Okayama Univ. e-Bulletin): Professor KAWAHARA's team

OU-MRU Vol.69: Early gastric cancer endoscopic diagnosis system using artificial intelligence

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Okayama University is one of the largest comprehensive universities in Japan with roots going back to the Medical Training Place sponsored by the Lord of Okayama and established in 1870. Now with 1,300 faculty and 13,000 students, the University offers courses in specialties ranging from medicine and pharmacy to humanities and physical sciences.

Okayama University is located in the heart of Japan approximately 3 hours west of Tokyo by Shinkansen.

Website: http://www.okayama-u.ac.jp/index_e.html

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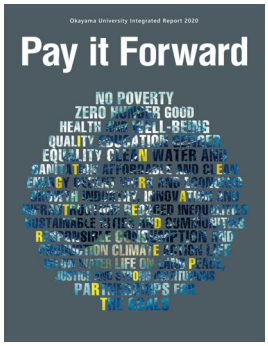

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