VOLUME - 11, ISSUE - 03, MARCH - 2022 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Gastroenterology

ARTIFICIAL INTELLIGENCE IN ENDOSCOPY

Dr. Kshitiz Sharan* Senior Resident Department of Gastroenterology AIIMS RISHIKESH Pin 249203. *Corresponding Author

Dr. Sugandha Arya Senior Resident Department of Surgical oncology King George Medical college,Lucknow Pin 226003.

ABSTRACT

Artificial intelligence is a computer algorithm that can be used to solve problems. It has the ability to classify a data set correctly once it is trained properly. There are increasing complexities of artificial intelligence from one where the best set of characteristic that define data is chosen by the programmer to where it is selected by the machine itself. Artificial intelligence is particularly useful in pattern recognition and as endoscopy deals with images it has found its use in this medical field.Artificail intelligence can be utilized in whole range of endoscopic procedures. If trained properly its efficacy is comparable to the experts and sometimes even exceeds them. It can simplify work in a busy endoscopy suite and even is cost effective.

The term Artificial intelligence was coined by John McCarthy and in its simplest terms refers to creating algorithms to solve problems, which need human intelligence. Artificial intelligence has become a vital part of life, thanks to tech giants like apple and amazon, which have launched Siri and Alexa. It is an umbrella term and has many subsets with increasing complexities. In classic machine learning humans choose the best feature to define and classify the data set where as in deep learning the machine itself learns and chooses the characteristics of data set which best classifies them. The artificial neural network simulated human brain. Multiple inputs are converged into the algorithm and is given specific weight and finally output is generated. For creation of any artificial intelligence system there is an initial training phase where the artificial intelligence model learns to classify the data set .During validation phase, if a wrong output is generated there is a mechanism for correction called backpropagation where weight of input is adjusted and data is reclassified.

KEYWORDS :

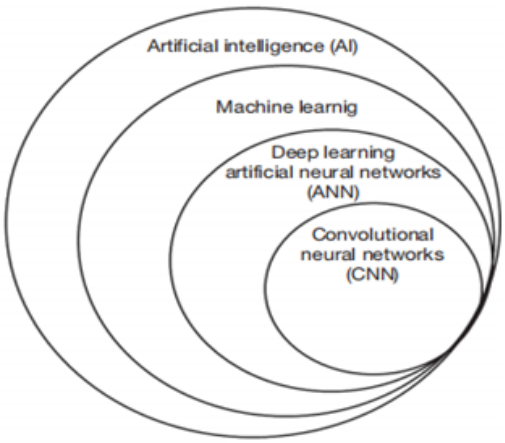

Figure 1-Layers of artificial intelligence

Artificial intelligence finds its use in many branches of medicine because of its ability to recognize patterns in image and accurately classify them. One of the earliest branches to utilize artificial intelligence is radiology. CARDIO AI analyses cardiac MRI in seconds. Artificial intelligence has been used in diagnosing and grading the severity of diabetic retinopathy and identification of melanoma and non-melanoma cancers.

As endoscopy deals with images ,naturally artificial intelligence has vast role in intuit can help in early diagnosis of lesions, gives confidence in diagnosis made by a trainee and can be used to assess the skill of endoscopists.

Role of Artificial intelligence in upper gastrointestinal tract lesions A meta-analysis of 23 studies reveals a good sensitivity and specificity for upper gastrointestinal lesions.The pooled specificity for diagnosis of carcinoma stomach, carcinoma in barret's esophagus, ca esophagus and h pylori gastritis has been approx. 90%[2].The artificial intelligence had best performance was with ca stomach and Barret's esophagus because mostly these lesions are Paris II a or IIc with good demarcation line. In carcinoma stomach the treatment depends on depth of invasion. Present system of macroscopic feature to predict invasion is not very accurate.EUS requires technical expertise .Nagao et al used artificial intelligence to predict depth of lesion in white light endoscopy,NBI and indigo carmine chromoendoscopy examination and achieved an accuracy of 95%.[3].Fakuda et al compared artificial intelligence and expert endoscopist for esophageal carcinoma detection and found that though specificity was more for expert endoscopist, AI had better performance with video images and greater sensitivity of detection of small lesions especially smaller than 30 mm.[4]

Role of Artificial intelligence in small intestinal lesions

Small bowel evaluation is needed for many diseases like inflammatory bowel disease ,obscure GI bleeding which forms about 5-10% of GI bleeding, unexplained colicky pain abdomen, small bowel strictures, tumors and many more[5]. The evaluation of small bowel is difficult. However, recent advances in endoscopy which includes spiral or double bowel enteroscopy has created a new horizon. These modalities are both diagnostic and therapeutic. However it is a time taking procedure and needs expertise. Small bowel capsule endoscopy helps in targeting the area of interest prior to an enteroscopy.Small bowel capsule endoscopy captures approx. 12000 frames and the recordings generated are of of 8-9 hours which has to be screened by endoscopist.Due to this long duration of video there is definite risk of missing lesions especially by trainees. Soffler et al in their meta-analysis found that artificial intelligence was approx. 95% sensitive and specific for ulcer detection. Its sensitivity and specificity approached 99% for bleeding and detection of bleeding source. Interestingly Akoi et al found that artificial intelligence picked up 3 ulcers which were missed by expert endoscopists[6].The average time to read the whole video decreased to a mean of <3.5 minutes. Artificial intelligence also excellent positive predictive value for active and inactive bleeding bleeding spots. Another multicenter study was conducted by ding et al, where investigators trained the artificial intelligence with more than 1.5 lakh images .The

model was then validated in 5000 patients and found to be more than 99% sensitive for lesion detection compared to approx. 75% by experts[7].This impressive improvement was even associated with significant less reading time.(Artificial intelligence vs expert:5.9±2.23 vs 96.6±22.53 minutes)

Role of Artificial intelligence in colonic lesions

Colonoprev trial established the role of colonoscopy and polyp detection for prevention of colorectal cancer. All major gastrointestinal societies have made extensive evidence based guidelines for colonoscopic screening. The main aim is polyp detection and resection. This strategy however has led to burden over pathology department and increased cost. To circumvent this some strategies like 'Leave in situ'' or 'Resect and discard'' has been developed. However, the endoscopist must be confident that a neoplastic polyp or polyp with advanced pathology is not missed. This requires significant expertise in the part of endoscopist and familiarity with advance imaging like narrow band imaging. In an RCT in japan with over 1000 patients results of artificial intelligence was exciting. Adenoma detection rate was 29%(vs 20% for experts).Other parameters like mean adenoma detected per patient and detection of diminutive hyperplastic and larger polyp all were significantly better in the artificial intelligence group. Studies have proven excellent accuracy of artificial intelligence in predicting invasive colorectal cancer detection and malignant polyp detection.EndoBrain is a system developed and studied by Kudo et al for both detection and characterization of lower gastrointestinal tract polyp [8]. Hassan et al pointed out that artefacts from bowel wall (like folds ,ic valve,diverticula,suction polyps) or artefacts from bowel content (like stool,mucus,water,bubbles) can cause false positive adenoma detection[9].However even with increased false positive adenoma detection rate the time to compete procedure was not significantly increased because a skilled endoscopist will promptly recognize it and move forward.

Role of Artificial intelligence in EUS

The detection of pancreatic malignancy in a case of chronic pancreatitis ,which is a high risk group for development of pancreatic adenocarcinoma, poses a significant challangs. Artificial intelligence was used in this setting and an accuracy of 94 % was achieved[10].BP MASTER has been created for EUS training and quality control mainly by station recognition.

Due to this development in technology the American society of Gastrointestinal endoscopy released a position statement for priorities for artificial intelligence in endoscopy. It categorised its statement in 3 parts-a)Priority use case b)Data science properties c)Research priorities. They also emphasized that the application of artificial intelligence can simplify work flow in a busy endoscopy room. Artificial intelligence can record qualities measures, notify patients regarding the follow up and cut cost in pathology[11].

With this new technology, however, there is some concern regarding the cost of implementation and maintaing it.Mori et al compared the average colonoscopy cost in 2 scenarios; a)Diagnose and-leave strategy supported by the AI prediction b)Resect-all-polyps strategy. Significant cost reduction was seen with artificial intelligence application. Similar cost reduction was observed when such model was applied in England,USA and Norway. This cost reduction was seen mainly due to reduced work staff in endoscopy suite and also reduced pathology and radiology costs which comes with a lesion detection.

However in all its glory there are some concerns regarding this new technology like over reliance on artificial intelligence may lead to deskilling of endoscopist ,initial implementation may lead to increase costs. As shown in studies implementation of artificial intelligence in an endoscopy suite may be a onetime investment, which is cost effective in long run. The deskilling of enoscopist will not occur because the final say is of the endoscopist only.Other important ethical concern is if a mistake is made then who will be responsible the endoscopist, artificial intelligence or the manufacturer.

There are certain systems which have been approved for use and the science has reached the bedside from lab. ENDOANGEL is a convoluted neural network based system which provides objective assessment of bowel preparation every 30 second during the withdrawal phase of colonoscopy. It has shown to significantly increase adenoma detection rate.GI GENIUS is other system used in USA which helps in adenoma detection and is more sensitive than expert for adenoma detection. In India ,AIG hospital has collaborated with Satisfi Health inc for development and implementation of artificial intelligence[12].

To conclude it can be said that artificial intelligence has progressed a lot and is being utilized in endoscopy. Future of this field looks bright and its widespread implementation will greatly help patient care.

REFERENCES

1 Klang E. Deep learning and medical imaging. J Thorac Dis. 2018 Mar;10(3):1325.
2 Lui TK, Tsui VW, Leung WK. Accuracy of artificial intelligence–assisted detection of upper GI lesions: a systematic review and meta-analysis. Gastrointest Endosc. 2020 Oct 1;92(4):821-30.
3 Nagao et al. "Highly accurate artificial intelligence systems to predict the invasion depth of gastric cancer: efficacy of conventional white-light imaging, non magnifying narrow-band imaging, and indigo-carmine dye contrast imaging." Gastrointest Endosc 92.4 (2020): 866-873.
4 Fukuda, Hiromu , . "Comparison of performances of artificial intelligence versus expert endoscopists for real-time assisted diagnosis of esophageal squamous cell carcinoma (with video)." Gastrointest Endosc 92.4 (2020): 848-855.
5 Raju GS, Gerson L, Das A, Lewis B. American Gastroenterological Association (AGA) Institute technical review on obscure gastrointestinal bleeding. Gastroenterol. 2007 Nov 1;133(5):1697-717.
6 Soffer, Shelly, et al. "Deep learning for wireless capsule endoscopy: a systematic review and meta-analysis." Gastrointest Endosc (2020).7 Ding, Zhen, et al. "Gastroenterologist-level identification of small-bowel diseases and normal variants by capsule endoscopy using a deep-learning model." Gastroenterol 157.4 (2019): 1044-1054.
8 Kudo SE, Misawa M, Mori Y, Hotta K, Ohtsuka K, Ikematsu H, Saito Y, Takeda K, Nakamura H, Ichimasa K, Ishigaki T. Artificial intelligence-assisted system improves endoscopic identification of colorectal neoplasms. Clin Gastroenterol and Hepatol. 2020 Jul 1;18(8):1874-81.
9 Hassan, Cesare, et al. "Computer-aided detection-assisted colonoscopy: classification and relevance of false positives." Gastrointest Endosco 92.4 (2020): 900-904.
10 Zhu, Maoling, et al. "Differentiation of pancreatic cancer and chronic pancreatitis using computer-aided diagnosis of endoscopic ultrasound (EUS) images: a diagnostic test." PloS one 8.5 (2013): e63820.
11 Berzin, Tyler M., et al. "Position statement on priorities for artificial intelligence in GI endoscopy: a report by the ASGE Task Force." Gastrointest Endosc 92.4 (2020): 951-959.
12 Kaul V, Enslin S, Gross SA. History of artificial intelligence in medicine. Gastrointest Endosc. 2020 Oct 1;92(4):807-12.