REVIEW ARTICLE

Deep Paediatric Gastroenterology With Blockchain

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Introduction:

Deep learning and Block chain are the systems where one can generate and explore further medical sciences. Current medical systems and its developmental process are restricted to randomised control trials and their associates. Both deep learning and block chain are underused either due to ignorance or fear. Block chain can give trust to the developed deep learnt algorithms .Both can speed up medical science without biases and can take clinical subjects to their full potential.

What is Deep Learning?

Deep learning is the part of machine learning based on artificial neural networks .It uses algorithms to derive conclusions from the given inputs. Deep medicine, a concept now accepted has three stages[1]. First is data gathering or deep pheno-typing which includes detail history, clinical exam finding, investigations, and genetic records in digitised form. Deep learning in the developed neural networks is the second component. The third component is machine learnt result applications. The resultant output would give us the probabilities and certainties of the clinical condition that would explore the natural history of progression of disease.

Deep learning in clinical medicine is composed of algorithms that permit software to train itself to perform tasks by processing multi-layered network of clinical data giving us results[2] .These results needs further applications. Clinical data is fed through the layers of computations. Deeper the layers of computation subjected more are the derived inferences. Thus Deep learning enables computers to learn from data for better inferences.[3]

Endoscopic images, histopathology slides, clinical images, associated history and clinical findings are the raw data subjected to deep neural networks. Image segmentation, clinical data correlation can be done easily with the well-described neural network. The application of deep Paediatric Gastroenterology in field of metabolic liver disease is worth considering .Enzyme analysis, genetic/epigenetic results, histopathological liver findings, clinical phenotypes and genetic variable expression of metabolic liver diseases; all can be studied by artificial intelligence. Histopathological diagnosis like non specific colitis and non specific duodenitis can be revised with machine learning. More answers are expected on progression of disease with deep neural networks in very early onset inflammatory bowel disease and celiac disease. Deep learning tools for histopath slide analysis for liver fibrosis are now well studied[4]. Deep learning of medical images is undertaken by companies like Enlitic, Merge, health care, Zebra medical vision, RAD logic. Mobile apps like Ada, Your MD, and Babylon use artificial intelligence. Buoy health app draws clinical data from 18000 clinical publications, 1700 medical conditions, more than 5 million patients. More the clinical data be digitised and fed to neural networks more would be the accuracy. Face 2 gene app can help a hepatologist to make diagnosis in syndromic liver/genetic diagnosis.

Published & Proposed Applications:

The University of Tokyo has worked on convolution neural network for liver CT mass calcification with 84% accuracy [5]. Deep neural network can avoid error and biases. Essential collaboration with data scientist can help endoscopist to develop image (endoscopic) interpretation in real time. Dynamic real time imaging can be fortified with AI (Artificial Intelligence) for decision making e.g. site identification for mucosal biopsy for better diagnostic yield or appropriate haemo-clip application location with least chances of dislodgement. It can also help endoscopist to demarcate the mucosa for polypectomy or POEM with least complications. Multi-center study to determine the diagnostic accuracy of EndoBRAIN, an artificial intelligence-based system that analyzes cell nuclei, crypt structure, and micro-vessels in endoscopic images distinguishes neoplastic from non-neoplastic lesions with 96.9% sensitivity, 94.3% specificity ,96.0% accuracy , 96.9% positive-predictive value, and a 94.3% negative-predictive value.[6] Krishnan et al.[7] classified nine types liver disorders with help of neural networks in ultrasound images with accuracy of 79 %. Novel AI diagnostic system which compiles Java and C++ to the application of deep learning algorithm on mobile devices with Android platform [8] are proposed and tested for cholelithiasis. Specific learning modules with teaching aids can help budding endoscopist in dynamic endoscopic image interpretation. Watson for Genomics (WfG) curated actionable gene list identified additional genomic events of potential significance (not discovered by traditional MTB curation) by 32% using cognitive computing [9]. Deep learning can also help endoscopist in not missing polyps while doing endoscopy as shown in various studies.[10, 11, 12]The neural network has demonstrated 90.5% accuracy rate in identifying celiac disease from endoscopic images [13].

Comparative performance of the machine learning prediction model with pre-endoscopic clinical risk scoring systems the Glasgow-Blatchford score [GBS], admission-Rockall score, and AIMS 65 by Shung D L et al revealed better determining risk in patients with gastrointestinal bleeding (UGIB) by artificial intelligence [14]. Machine learning model can increase identification of low-risk patients who can be safely discharged earlier. Supervised learning algorithm is studied and used to analyze laboratory data and to build a prediction model for diagnosis of appendicitis based on relevant biomarkers .The study revealed that a biomarker signature based on learning algorithms is capable of becoming the gold standard for the diagnosis of paediatric appendicitis.[15] AI base - Multi-parameter model is also capable of discriminating between complicated and uncomplicated appendicitis with specificity of 67%, a sensitivity of 93%, accuracy of 90% .Another decision making study [16] for diagnosis of appendicitis with artificial neural networks (ANN) noted 91% sensitivity with a specificity of 85% and 100% sensitivity with a specificity of 97% .

Study comparing the performance[17] of unsedated ultrathin transoral endoscopy, unsedated conventional EGD (Esophagogastroduodenoscopy), and sedated EGD, with or without the use of an artificial intelligence (AI) system; notes blind spot rate with AI-assisted sedated Conventional -EGD is significantly lower. Convolution neural network (CNN) system based on deep learning can reduce the reading time of endoscopists without oversight of abnormalities in the capsule-endoscopy [18]. Machine algorithm can also help in diagnosing Chronic liver disease based on AI supported algorithms [19] on ultrasound. Deep learning neural networks can study motility disorders [20] with better accuracy. More validation studies are needed. Deep AI neural network can contribute to personalised nutrition. The paper published [21] on personalised nutrition by prediction of glycemic responses used machine learning in analysis; highlights variable individual food responses to the same food. Thus deep learning can help in studying cow's milk protein allergy, gluten hypersensitivity, unexplained phenomenon of non celiac gluten sensitivity and probiotics and their interactions. Systematic literature review and meta-analysis methods remain time-consuming and labor-intensive. Machine learning directed meta-analysis [22] can reduce the labour as well as costs.

Deep learning in Paediatric gastroenterology can help a gastroenterologist by incorporating all patient data. Analysis can be improved without personal biases. Deep Paediatric Gastroenterology would not substitute but help gastroenterologist in future for right decision making.The major limitation of deep learning is the data feeding .If inaccurate data is provided to deep neural networks;we can get wrong interpretation .Trials comparing specific deep neural network with clinical trials would help in optimising/ personalising the treatment of patients. Once established; the combination can be secured with block chain.

Pediatric Gastroenterology Block Chain.

Block chain is software which cannot be changed or hacked [23]. It is based on predominantly distributed network. The basic purpose of block chain is to group digital information into group of collections called as blocks. Blocks are joined together as cells or nodes.

Every node is connected with each other. Altering one node would not be possible without change in pattern of chain. This block chain is represented as Hash. More the nodes of digital information blocked better is the work done by block chain.

Bitcoin [24] is the first generation block chain with basic concepts of data mining and proof of work. Ethereum, Hyperledger, Corda and Ripple are second generation block chain with programmable smart contract, security and added features. IOTA ;Internet of things is third generation block chain which is block-less, secured, quantum proof, scalable, open source with fee less transaction system. It has no separate validator of data blocks. Each user has to validate previous two transactions. IOTA can help each endoscopic processor to have unique identity. It can transmit images over the cloud for multiple interactions. All of the generations of block chains can communicate with Microsoft Co. Data stored on different block chains can communicate and transact with each other with better speed. Multi-centric clinical data analysis with direct endoscopic/ histopathological image processing would be easier.

Use of block chain in clinical paediatric gastroenterology is add- on to digital neural networks. One of the best uses of block chain in paediatric gastroenterology can be for research. Once data is digitised and blocked one cannot change it. The trust-worthy nature of trial is reinforced. Endoscopic images can be digitised and blocked making them easier to access and their originality is preserved. Medical records/ confidential information also can be stored in nodes making it unalterable. Storage of personal identification in each patient case cannot be challenged. Issues of intellectual property or trademark would not arise. Algorithms approached in each case would be preserved. Clinical decision making protocol can be standardised and used for comparison. Biases would minimize. Result of each clinical trial can be tied to the methods. More specific outcome in a given clinical situation can be meta-analysed with large data. Patient confidentiality can easily be preserved on block chain.

The major limitation of block chain is the information supplied to each block is taken for granted as truth. Hence once mistake is blocked; results would be difficult to analyse. Block chain are slow at present, need lot of electricity and nodal validation.

Combining deep learning and block chain would definitely make field of paediatric gastroenterology interesting both in research and clinical sciences. The way of Meta analysis and Meta review would change. Guidelines would be more uniform and populations specific. Multiple point coordination would be easily possible .Generating library of blocks which are trustworthily managed with block chain is easily possible in future. Integrated decision making by Clinical data, histopathological data, endoscopic images and radiological pattern in disease in specific manner would give more clarity on patient state. Both systems would work as a support to clinical sciences .Only underlying condition necessary is the truth of data mining and data entry.

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