Искусственный интеллект в эндоскопии

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Медицинский ф-т.

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The Telegraph

DEEPIKA AND SABYA TALK In t2

AI: THE FUTURE OF JOBS You P15

HAFEEZ ST... PAK W... Sport P17

CALCUTTA TUESDAY 4 JUNE 2019 Rs 4.00

BEYOND CAMPUS

AI on the futu

Artificial intelligence will lead to an estimated tw... the near future, writes **Omkar Rai.** This is a goo... the study of AI and machine le...

According to a report published by Accenture, a technology consulting company, artificial intelligence or AI has the potential to add $957 billion — or 15 per cent of the current gross value — to the Indian economy by 2035. AI can provide large incremental value to sectors such as agriculture, education, healthcare, manufacturing, retail and ener... That will, of course, mean the creation of... all these sectors, both ... experts and others.

To leverage these opportunities, Indian IT companies and tech startups should first upgrade technologies and build up AI skills at enterprise level. Right skilling is the most critical factor for success in technology adoption. And given the rapid adoption of AI in industry, about two lakh jobs in the sector are expected to be created by 2020.

What gives India the edge is the country's large technology and engineering talent pool. Around 2.6 million Indians graduate every year with degrees in science, technology, engineering and mathematics (STEM). This is more than the total number of such graduates produced by all the G7 countries put together.

While our universities and premier technology institutes are carrying out research in AI, tech startups and enterprises are taking the research further — and creating jobs — to come up with innovative solutions and products based on AI. Today, India is home to 7,700 tech startups. During the last five years, more than 400 AI software product startups were incorporated in India. This reflects how Indian tech startups are focused on AI product development.

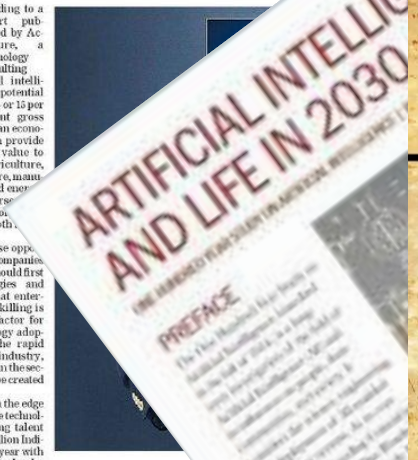
According to another Accenture report, in 2016 India ranked third among G20 countries on the basis of the number of AI startups. Indian IT behemoths have already started delivering AI solutions to their global clients. In addition, most Fortune 500 companies working on research and development in AI have their bases in India. Anyone studying AI or incidentals is, therefore, assured a job.

Innovation and R&D (research and development) will be the mainstay of the Indian IT industry in coming years. Going by Nasscom figures, ER&D or engineering R&D brought in $26.9 billion revenue in 2018. By 2025, ER&D revenue is expected to reach $70 billion.

AI also has the potential to solve numerous challenges in the education sector. As the Indian government aims to connect 2,50,000 gram panchayats through broadband, schools in rural areas can be augmented with last-mile connectivity to enhance the learning experience of students using augmented reality and virtual reality. With the help of AI solutions, learning elements can be customised, based upon the assessment of students.

While the opportunities are huge, India needs to leverage the capability and domain competency of a mature IT industry to achieve the goals.

According to a report by Frost & Sullivan, a market research company, the AI-driven healthcare market is expected to reach $6.6 billion by 2021 from



THE DAILY NEWS

NOVEMBER 1 - FASTEST DELIVERY GREENVILLE, SB9551 USA

EXTRA! EXTRA!

ARTIFICIAL INTELLIGENCE

...r footing

...very industry and sector in the country

PHOTOS: ISTOCK

...ence will boost India's GDP growth rate by 1.3 percentage points by ...dia was ranked third among G20 countries in 2016

...ical diagnosis is inadequate. This biobank can build ...p capabilities for analysing and predicting diseas... ...pots in India, helping the government to plan ...interventions at the regional level for improv... ...nd nutrition outcomes. ...t has already designed architectur... ...erable electronic medical record ...which is secure, ensure ...ssible to patients on thei... ...le EMR on blockchai... ...novations in healt... ...ance penera... ...and elim... ...data

Workforce to ...om in future

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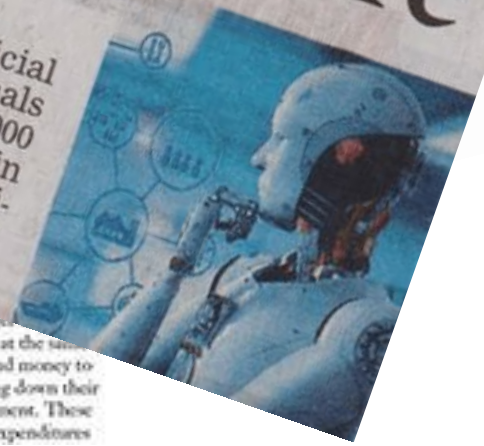
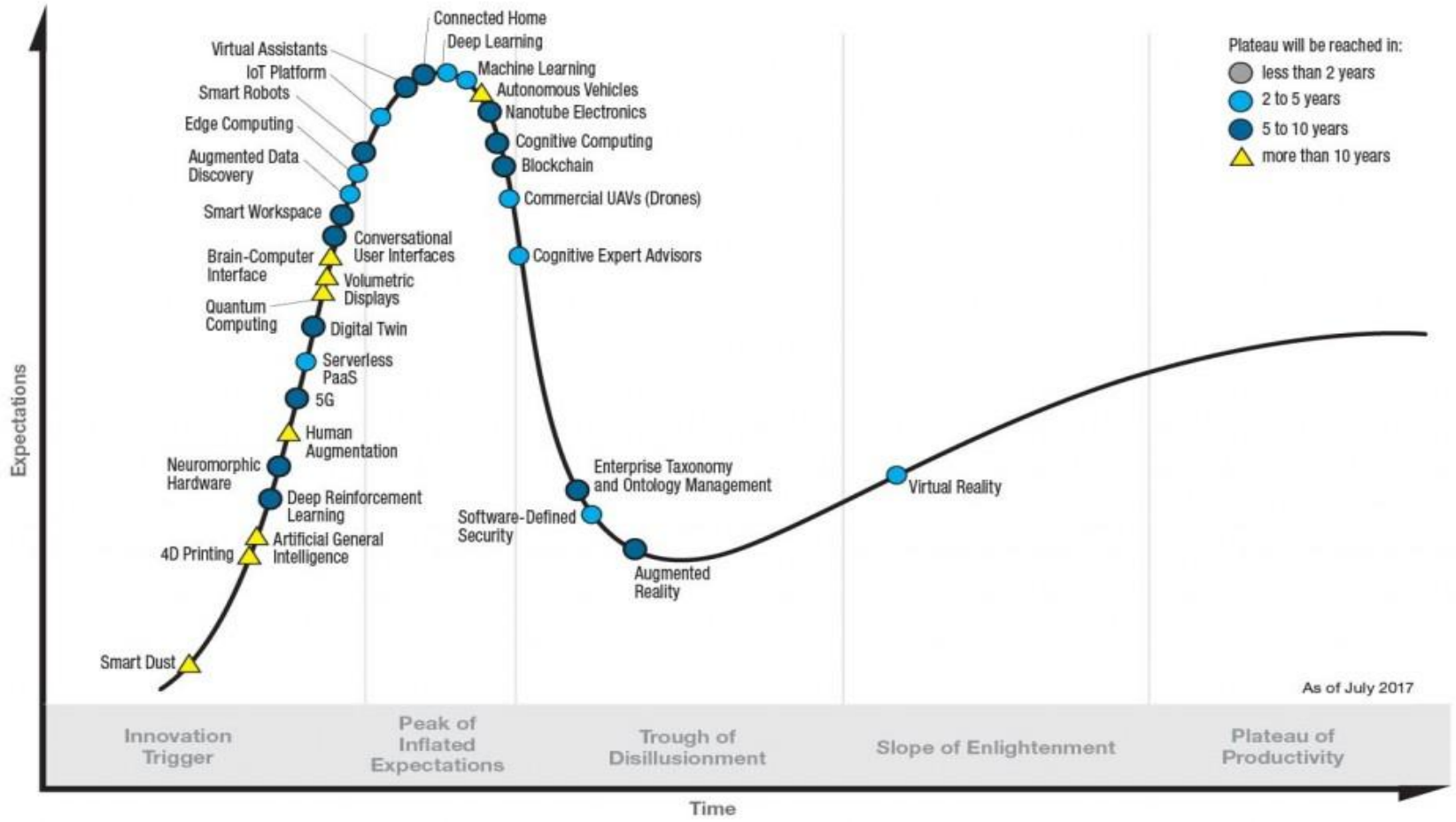


...nter. No long... ...unded – and at the ... ...more time and money to ...ducts, slowing down their ... lines, hiring more sorters and adding equipment. These changes inherently mean increased capital expenditures

Gartner Hype Cycle for Emerging Technologies, 2017

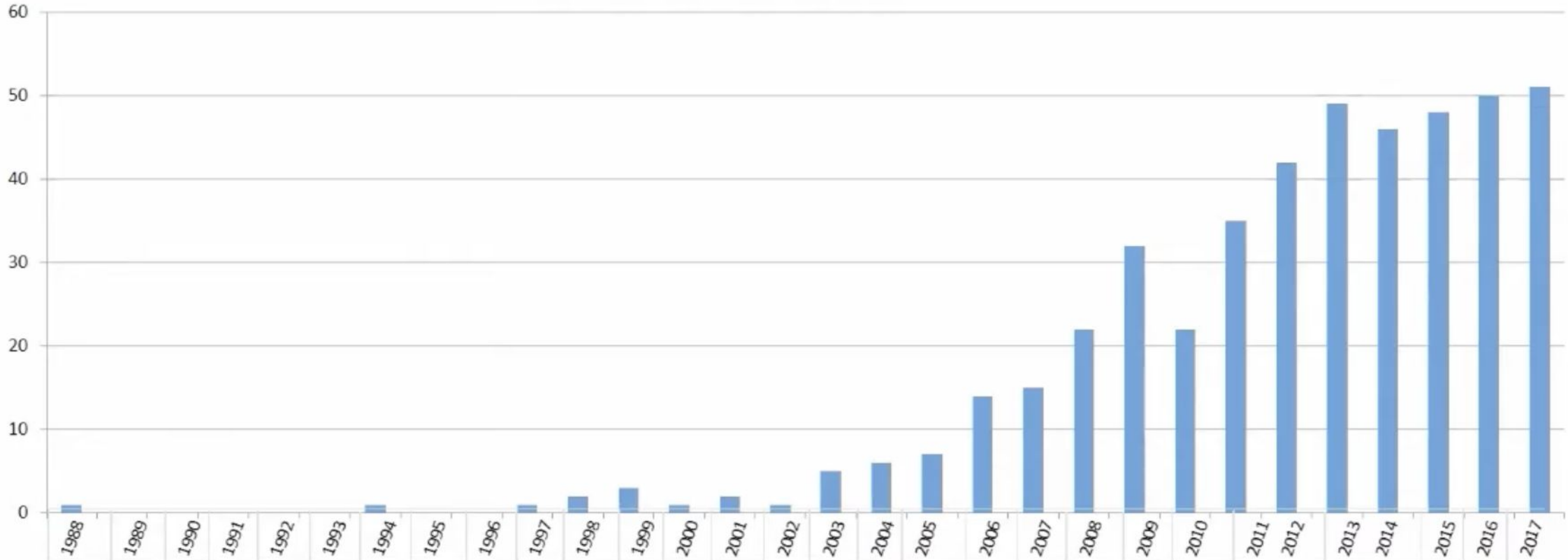


gartner.com/SmarterWithGartner

Source: Gartner (July 2017)

Gartner

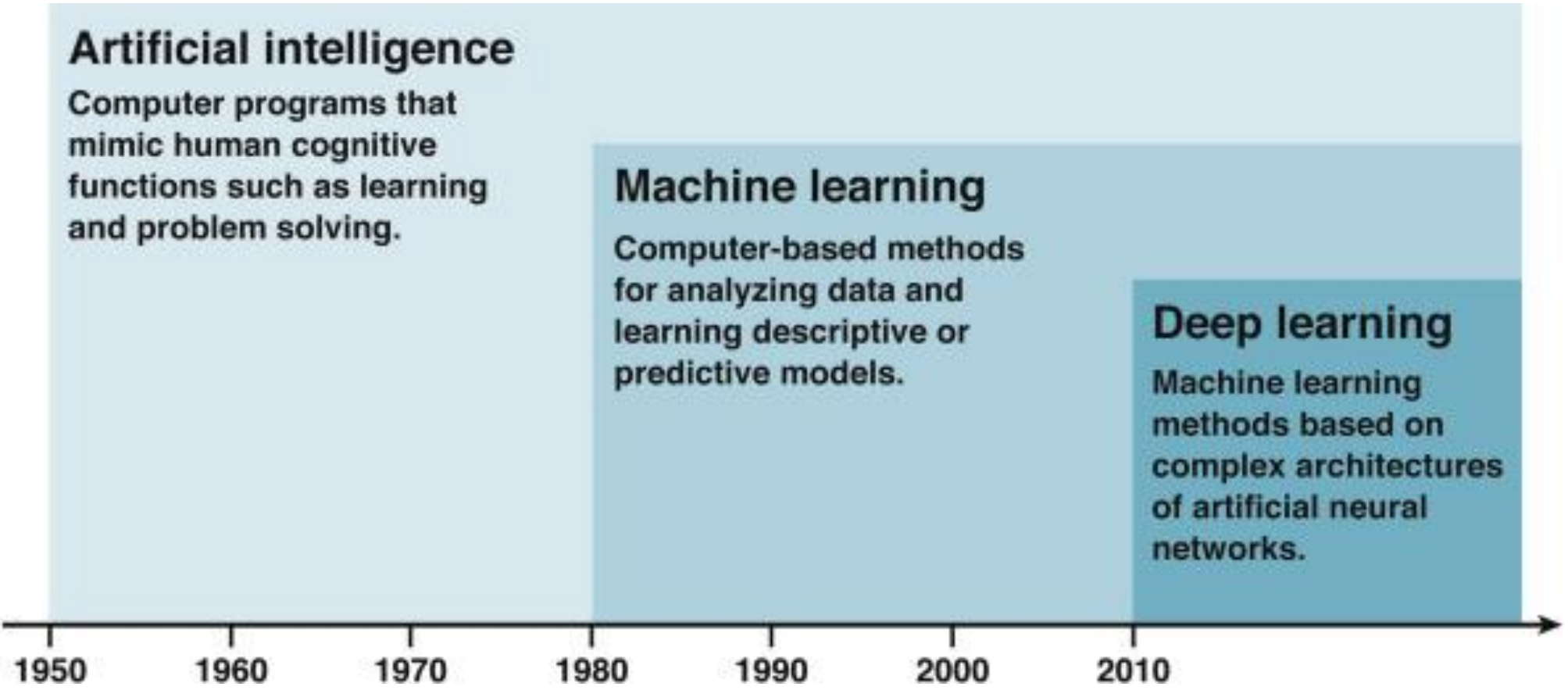
Scientific Interest in Computer-Aided Diagnosis in Endoscopy (CAD): The Number of Publications Is Rising



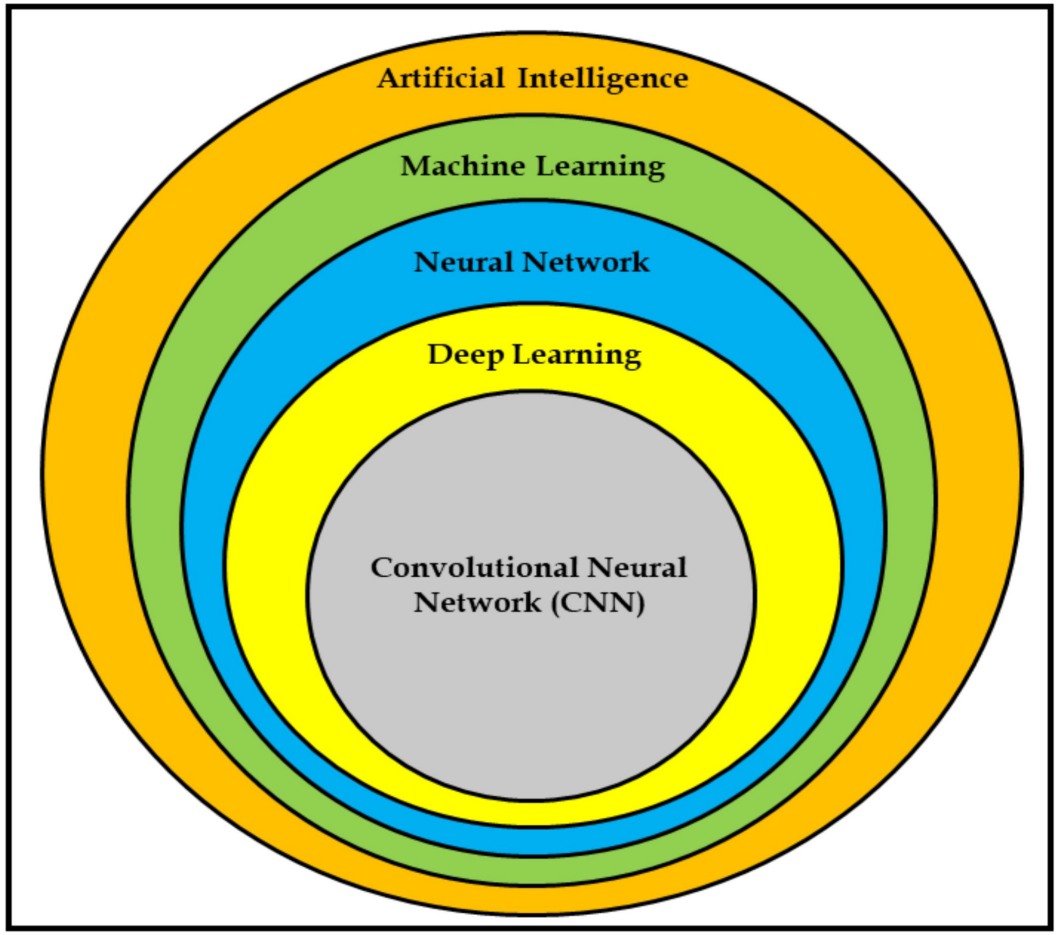
DDW 2017 – 3 abstracts, DDW 2018 – 16 abstracts, UEGW 2018 – 26 abstracts, DDW 2019 -38

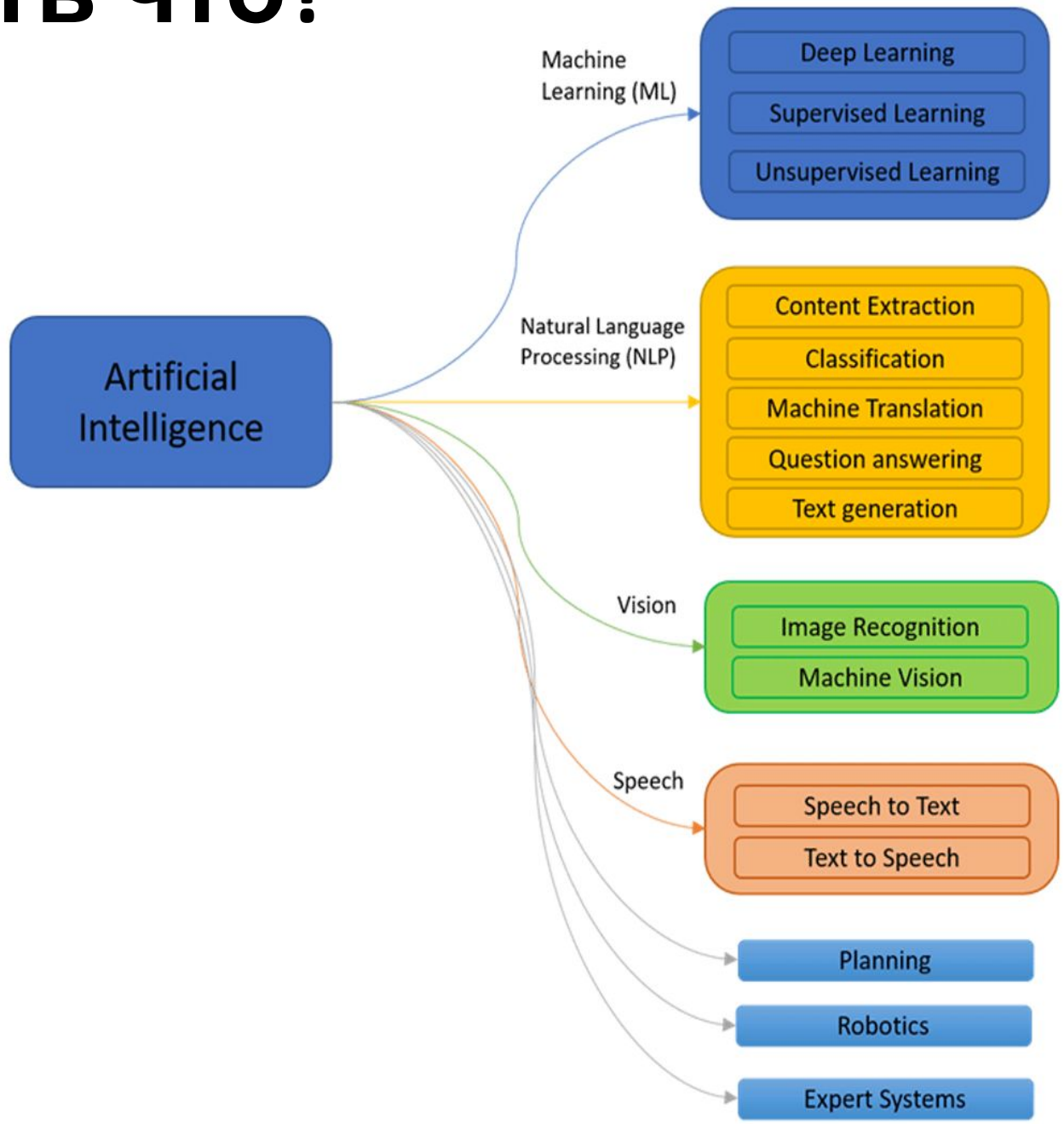
Based on M. Liedlgruber , A. Uhl. Endoscopic image processing - an overview ISPA'1998 - 2009, PubMed, ScienceDirect Search 2010-2017

Как все было?

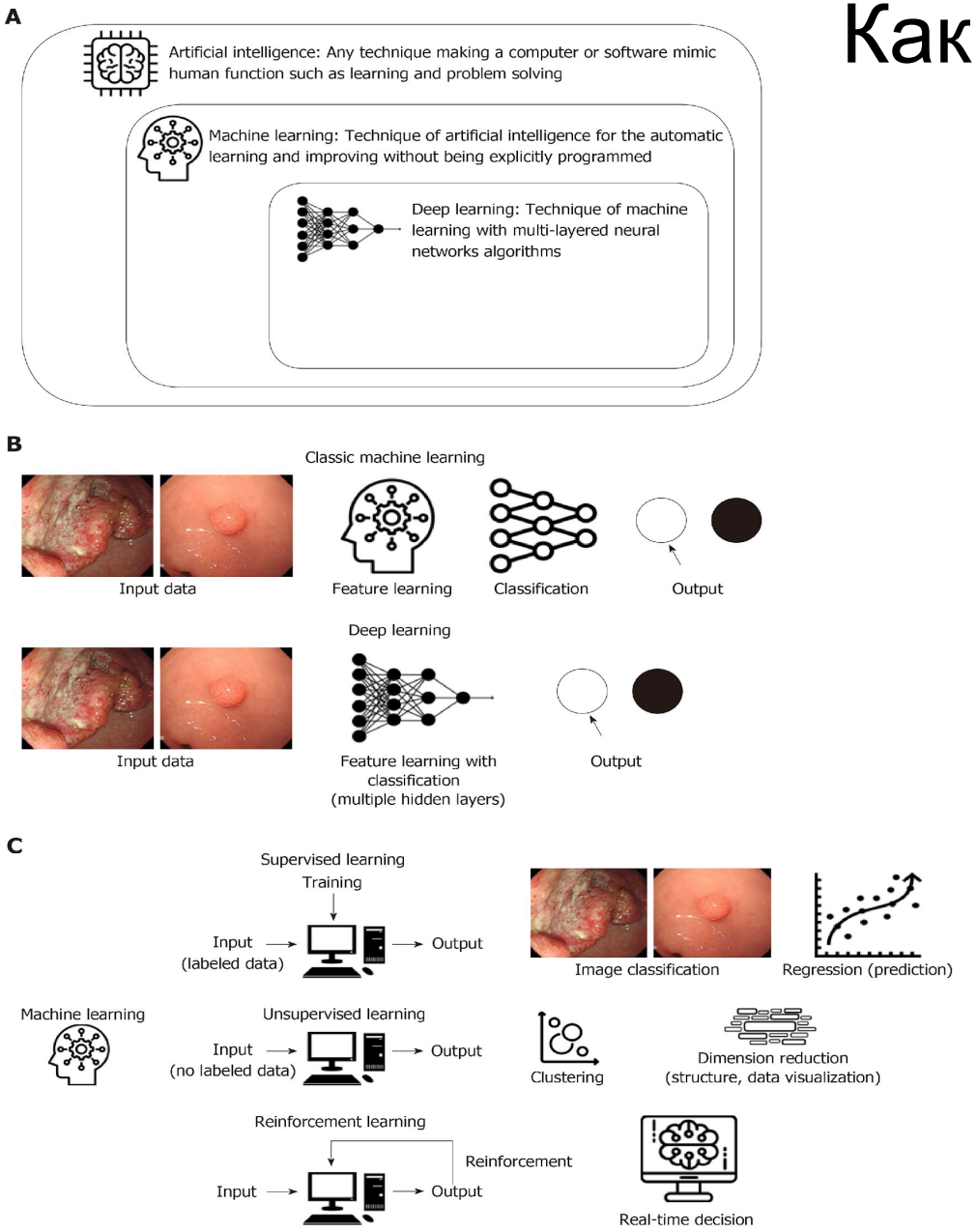

Artificial intelligence
Computer programs that mimic human cognitive functions such as learning and problem solving.
Machine learning
Computer-based methods for analyzing data and learning descriptive or predictive models.
Deep learning
Machine learning methods based on complex architectures of artificial neural networks.
1950
1960
1970
1980
1990
2000
2010

Что есть что?


Artificial Intelligence
Machine Learning
Neural Network
Deep Learning
Convolutional Neural Network (CNN)


Artificial Intelligence
Machine Learning (ML)
Deep Learning
Supervised Learning
Unsupervised Learning
Natural Language Processing (NLP)
Content Extraction
Classification
Machine Translation
Question answering
Text generation
Vision
Image Recognition
Machine Vision
Speech
Speech to Text
Text to Speech
Planning
Robotics
Expert Systems

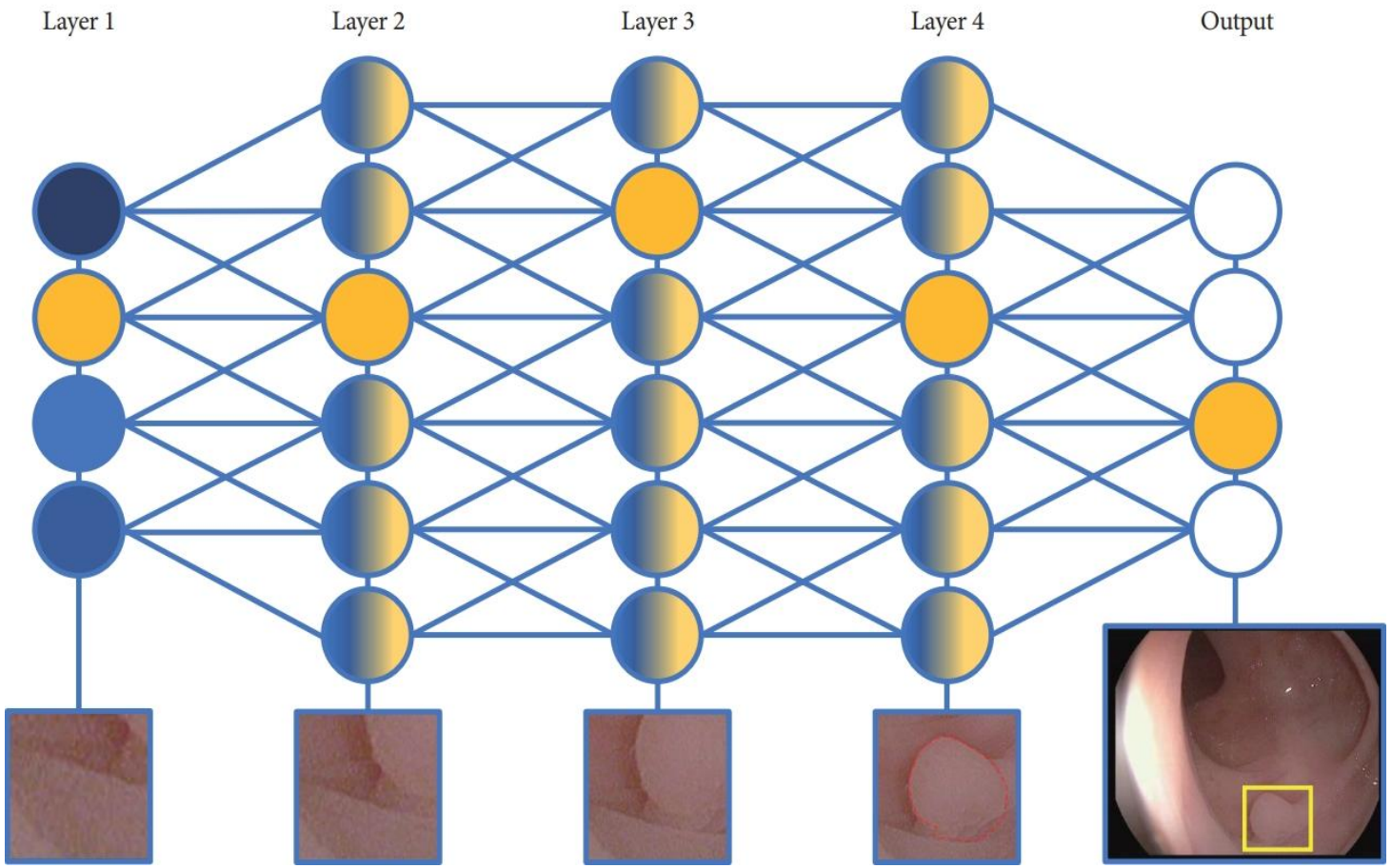
Как это работает?



- ML automatically builds mathematical algorithms from given data (known as input training data) and predicts or makes decisions in uncertain conditions without human instructions
- In the medical field, ML methods such as Bayesian networks, linear discriminants, SVMs, and ANNs have been used
- The ANN as a hierarchical structure consists of an input, hidden connection (between the input and output layer), and output layer.
- The connection in the hidden layer has a strength (known as weight) that is used for the learning process of the network
- Among several AI methods, DL received the attention of the public and has shown excellent performance in the computer vision area using CNNs.

Yang YJ, et al. World J Gastroenterol 2019; 25(14): 1666-1683 DOI: [10.3748/wjg.v25.i14.1666](https://doi.org/10.3748/wjg.v25.i14.1666)

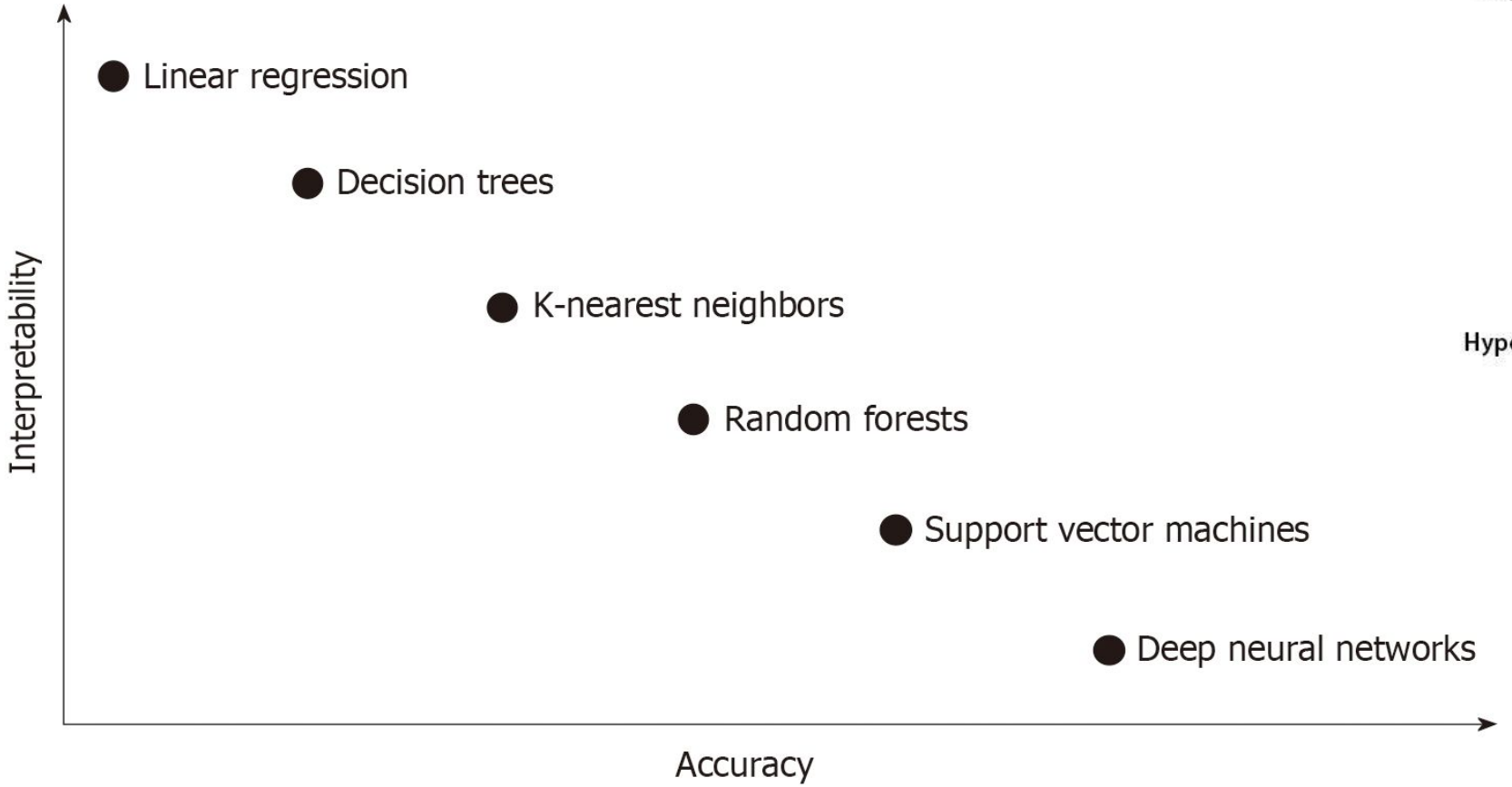
CONVOLUTIONAL NEURAL NETWORK (CNN)

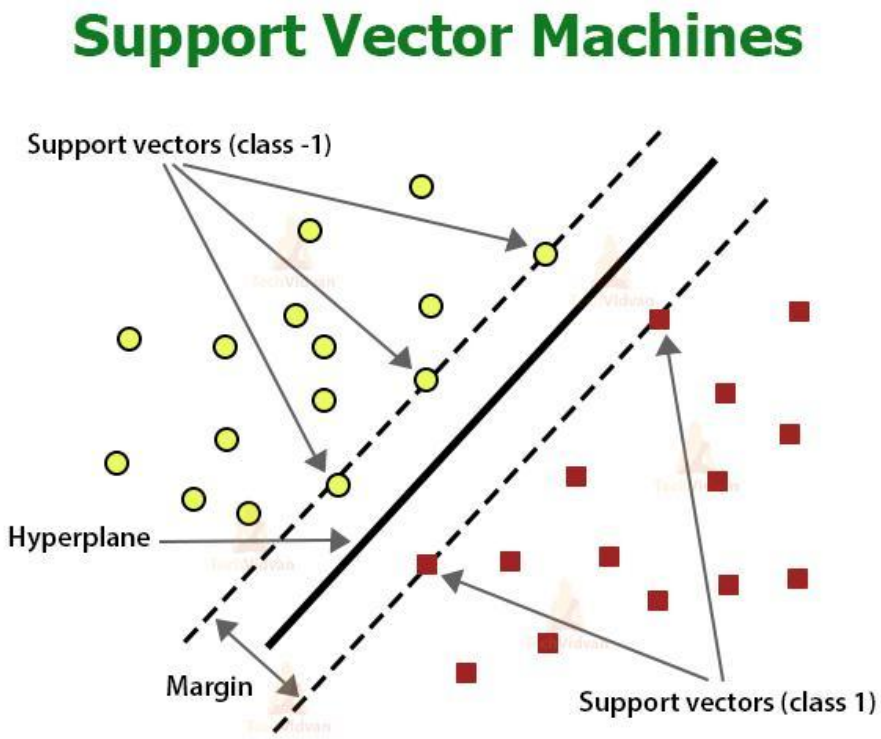


- A CNN is designed to think similarly to the human brain, using large image datasets to learn patterns in correlating images
- These models are trained with datasets containing images that have an element of interest versus datasets that do not
- A CNN makes inferences and predictions as if it believes that the element of interest is present within any given image, even if it has never seen that specific image before

Сравним?

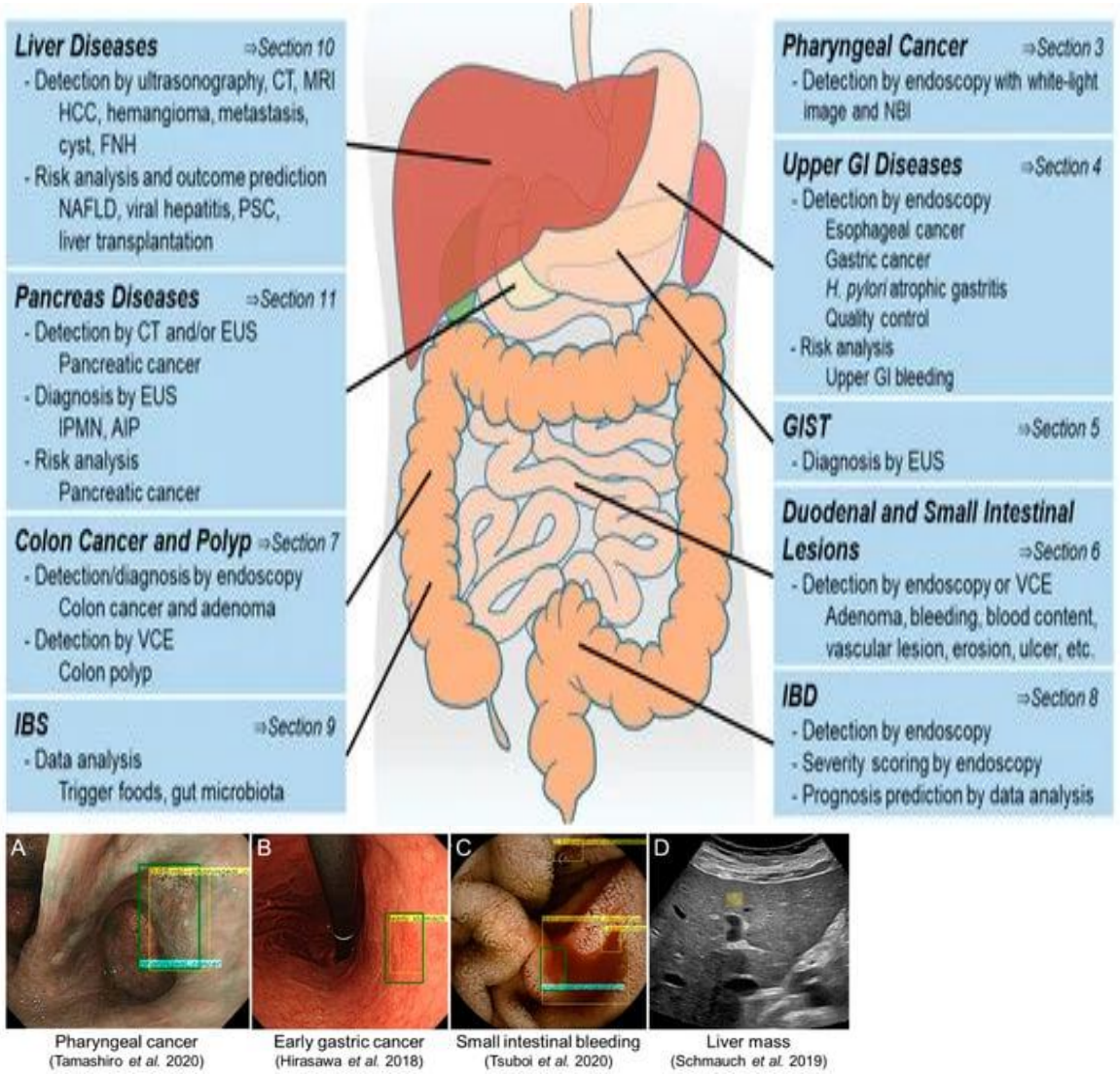
Interpretability-accuracy tradeoff
in classification algorithms of machine learning.





Yang YJ, Bang CS. Application of artificial intelligence in gastroenterology.
World J Gastroenterol 2019; 25(14): 1666-1683 DOI: 10.3748/wjg.v25.i14.1666]

А что же с эндоскопией?



AI system categories	Areas of assistance
Technical	Scope guidance for colonoscope insertion[2]
Detection (CADe)	Polyps detection[3,4]
	Bleeding detection*[5,6]
Diagnostic (CADx)	Early cancer identification[7,8]
	Cancer staging (estimation of invasion depth)[9,10]
	Polyp characterization or classification[11,12]
	Diagnosis of normal *vs.* inflammatory mucosa in IBD[13]
	GI disease prediction from patient data[14]
Therapeutic	Lesion delineation[7,15]
	Assistance in therapeutic decisions (such as complementary surgical resection post-endoscopic resection for malignant lesions)[16]
	Risk stratification, prediction of outcomes, and potential need for therapeutic intervention (in GI bleeding)[17]

* Mainly in small bowel exploration for obscure GI bleeding. AI: Artificial intelligence; CADe: Computer-assisted detection; CADx: Computer-assisted diagnosis; IBD: Inflammatory bowel disease; GI: Gastrointestinal.

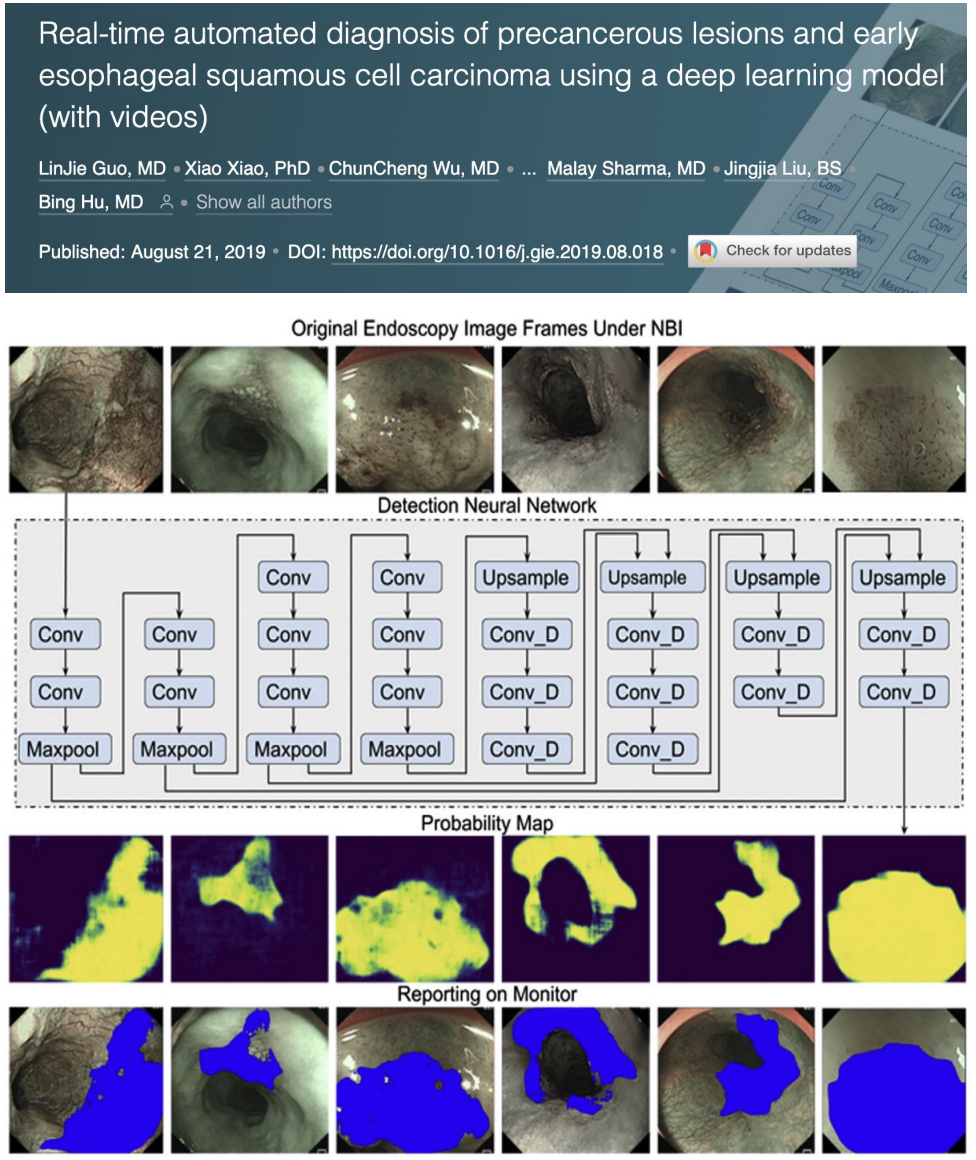
El Hajjar A, Rey JF. Artificial intelligence in gastrointestinal endoscopy: general overview. Chin Med J (Engl). 2020;133(3):326-334. doi:10.1097/CM9.0000000000000623

Oka, Akihiko, et al. "A New Dawn for the Use of Artificial Intelligence in Gastroenterology, Hepatology and Pancreatology." Diagnostics 11.9 (2021): 1719.

Upper gastrointestinal diseases

Application of artificial intelligence in upper gastrointestinal diseases

Ref.	Study aim	Study type	Diagnostic modality	AI classifier	Training data set	Test data set	AI performance (Acc/Sen/Spe)	Physician performance (Acc/Sen/Spe)
Cho *et al.* (9), 2020	Identify the depth of mucosal invasion of gastric cancer	Retrospective	WLI	DenseNet161 + Inception-ResNet-v2	2,590 images	Data set A: 309 images; Data set B: 206 images	77.30/80.40/80.70	–
Everson *et al.* (15), 2019	Classification of ESCN on the basis of capillary loop in the nipple	Retrospective	ME-NBI	CNN	7,046 images	–	93.30/89.70/96.90	–
Horiuchi *et al.* (16), 2020	Distinguish gastric cancer from gastritis	Retrospective	ME-NBI	GoogLeNet	2,570 images	258 images	85.30/95.40/71	–
Hirasawa *et al.* (18), 2018	Diagnosis of gastric cancer	Retrospective	WLI, NBI, and chromoendoscopy	SSD	13,584 images	2,296 images	NA/92.20/NA	–
Ikenoyama *et al.* (19), 2020	Comparison of the ability of CNN system and physicians in detecting gastric cancer	Retrospective	WLI	SSD	13,584 images	2,940 images	NA/58.40/87.30	NA/31.90/97.20
Kumagai *et al.* (20), 2019	Diagnosis of ESCC	Retrospective	EC	GoogLeNet	4,715 images	1,520 images	90.90/92.60/89.30	100/89.30/90
Guo *et al.* (24), 2020	Diagnosis of early esophageal cancer	Retrospective	NBI	SegNet	6,473 images	Data set A: 59 patients, Data set B: 2004 patients, Data set C: 47 videos, Data set	NA/98.04/95.03	–



Zhou J, et al. Application of artificial intelligence in gastrointestinal disease: a narrative review. Ann Transl Med. 2021;9(14):1188. doi:10.21037/atm-21-3001

Computer-Aided Diagnostic System

Characterization of Colorectal Lesions Using a Computer-Aided Diagnostic System for Narrow-Band Imaging Endocytoscopy

Masashi Misawa • Shin-ei Kudo • Yuichi Mori • ... Haruhiro Inoue • Yukitaka Nimura • Kensaku Mori •
Show all authors

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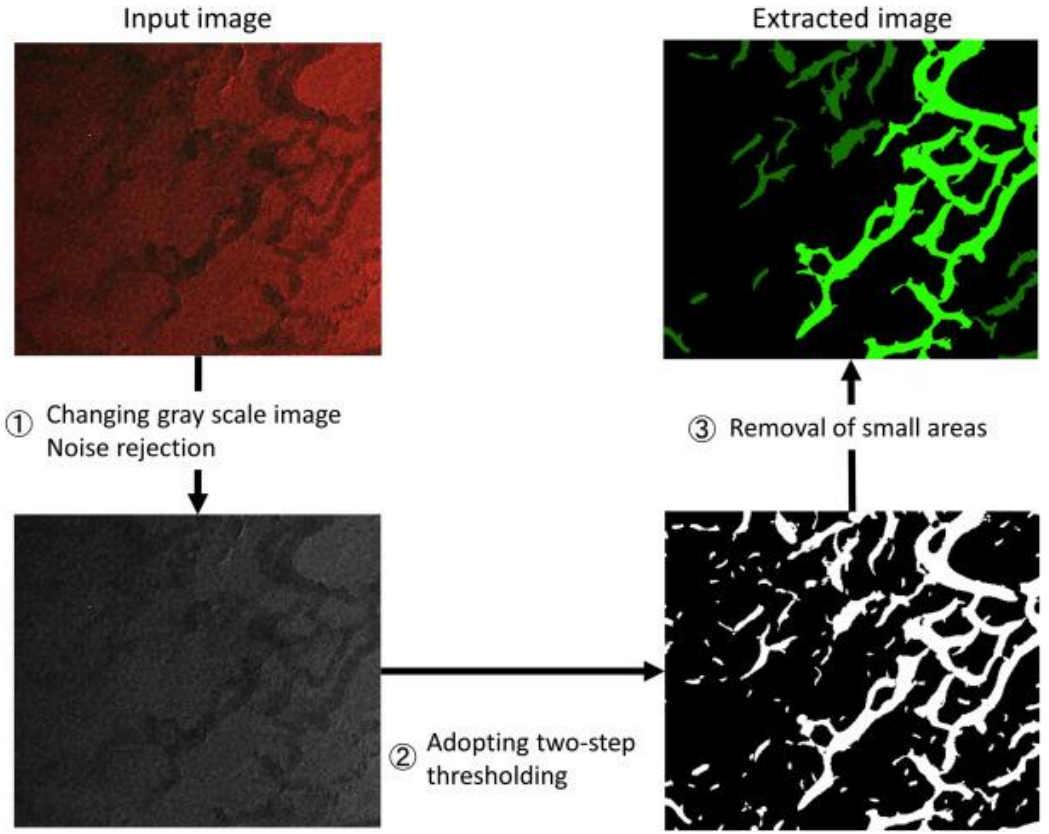
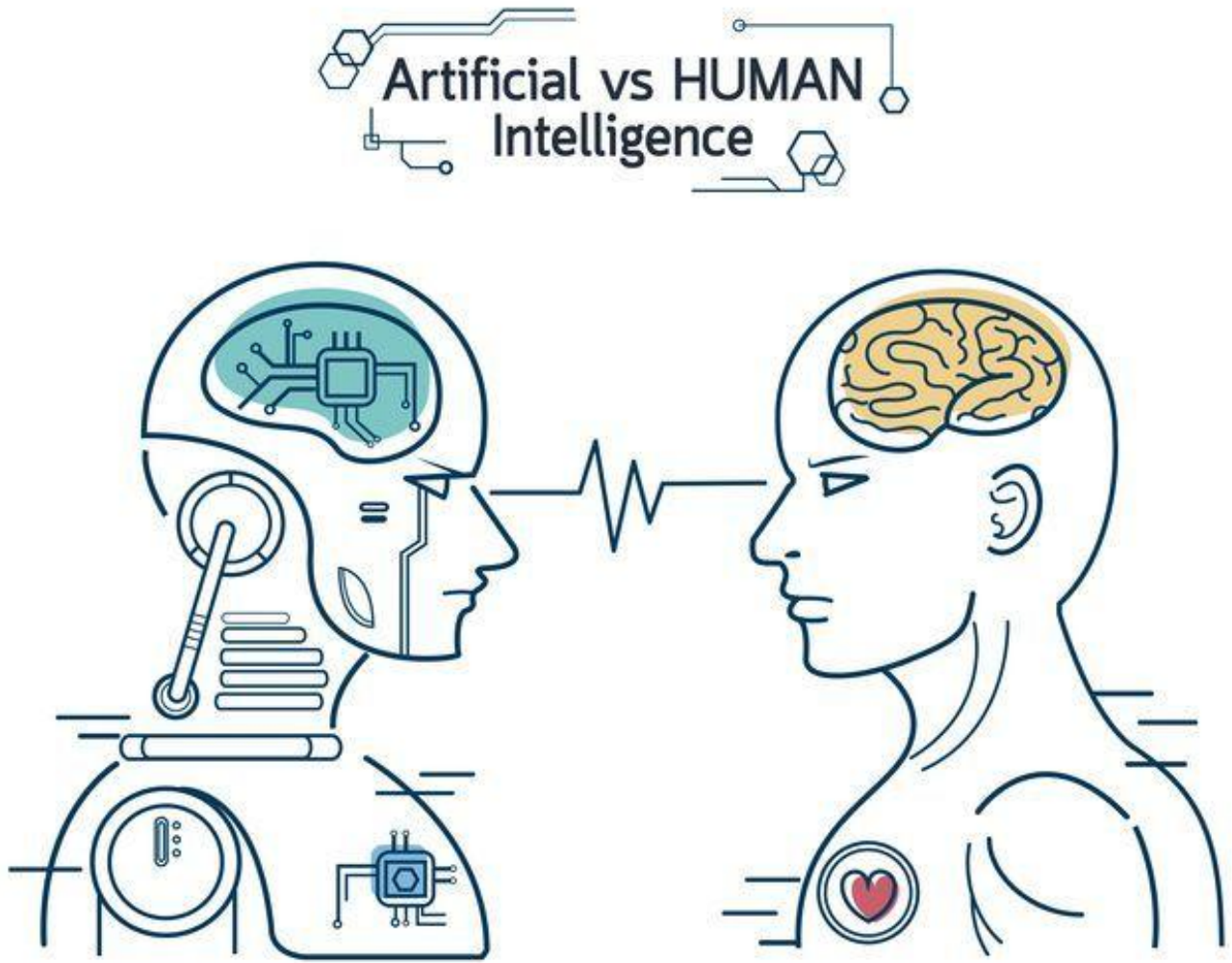


И что по итогу ?



Ну вот и все!