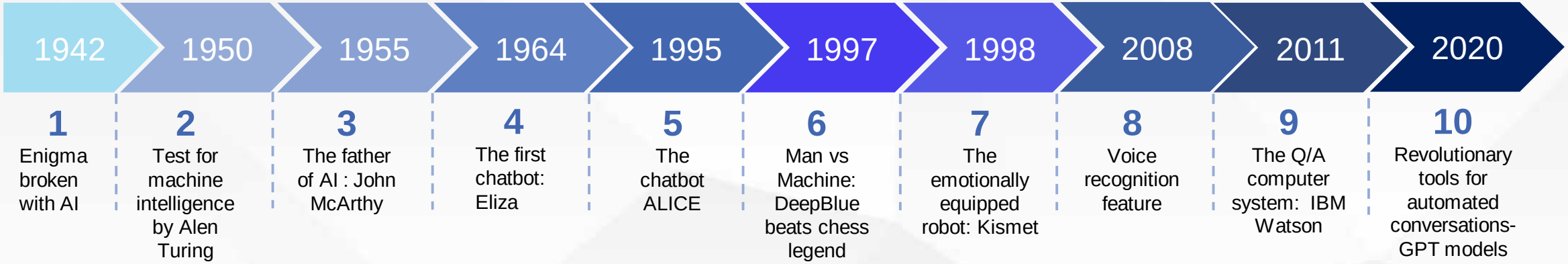
AI in disease diagnosis and treatment

Dr Farzaneh Kermani

PhD in Medical Informatics

Exploring the Historical Journey of Artificial Intelligence



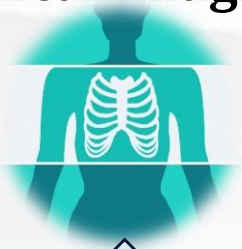
Ref: Alowais SA, Alghamdi SS, Alsuhebany N, Alqahtani T, Alshaya AI, Almohareb SN, Aldairem A, Alrashed M, Bin Saleh K, Badreldin HA, Al Yami MS. Revolutionizing healthcare: the role of artificial intelligence in clinical practice. BMC medical education. 2023 Sep 22;23(1):689.

Table 5 Number of articles in categories (one paper might have dealt with multiple algorithms)

Organic system	Number of papers	Algorithm	Number pf papers
Cardiovascular	34 (27.0%)	Neural Network	71 (42.5%)
Neurological/psychiatric	20 (15.9%)	Support Vector Machine	35 (21.0%)
Cancer	18 (14.3%)	Nearest Neighbor	11 (6.6%)
Gastrointestinal	15 (11.9%)	Random Forest	11 (6.6%)
Infectious	13 (10.3%)	Decision Tree	10 (6.0%)
Metabolic	8 (6.4%)	Logistic Regression	9 (5.4%)
Dermatological	6 (4.8%)	Naive Bayes	7 (4.2%)
Pediatric	4 (3.1%)	Discriminant Analysis	1 (0.6%)
Pulmonary	4 (3.1%)	Convolutional Neural Network	6 (3.6%)
Urogenital	4 (3.1%)	Deep Neural Network	2 (1.2%)
		Recurrent Neural Network	2 (1.2%)
		Others	2 (1.2%)
Total	126	Total	167

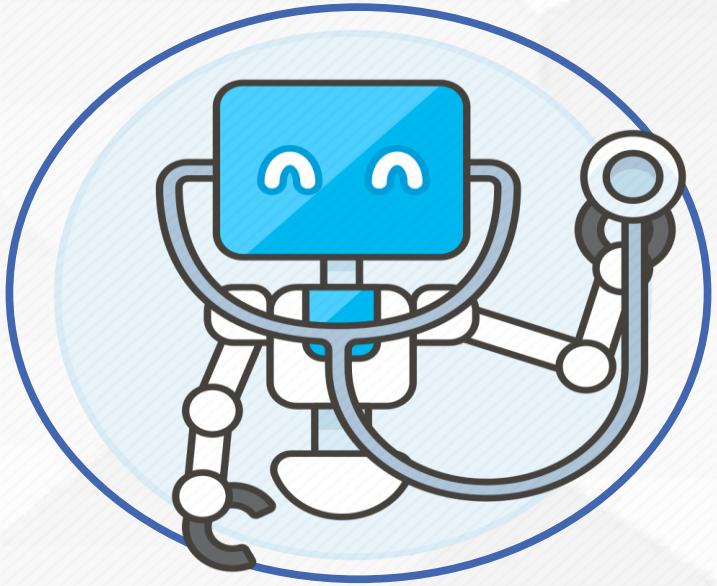
Ref: Alowais SA, Alghamdi SS, Alsuhebany N, Alqahtani T, Alshaya AI, Almohareb SN, Aldairem A, Alrashed M, Bin Saleh K, Badreldin HA, Al Yami MS. Revolutionizing healthcare: the role of artificial intelligence in clinical practice. BMC medical education. 2023 Sep 22;23(1):689.

Medical imaging



Emergency care

Cancer



AI-powered patient care

Personalized medicine

Drug

Type of Cancer	Authors	Year	Country Region				
Prostate Cancer	Kuo et al. [37]	2015	Taiwan	156	N/A	MOCDTBS	Hybrid model of ReliefF-GA-ANFIS	Accuracy(93.81%),AUC (0.9)
Breast Cancer	Zhang et al. [38]	2017	USA	10442	N/A	SEER	GBM, SVM	RMSE(32,15.05) for GBM, SVM
	Sun et al. [31]	2018	China	101	N/A	Hospital	SVM with RFE and RF	Accuracy(71%, 59%)
	Park et al. [33]	2013	USA	168	N/A	Hospital	Naive Bayes, SVM with Gaussian, etc	/
	Delen et al. [34]	2005	USA	84	59.94 ± 11.25	Both	SVM	HR(0.644), CI(95%,0.436–0.952)
	Lu et al. [39]	2019	USA	364	N/A	Both	Unsupervised Hierarchical Clustering	RPV: A Novel Prognostic Signature Discovered
Glioblastoma	Vasudevan et al. [40]	2018	India	469	23–90	Hospital	Fuzzy Forest	Accuracy(80.60 ± 0.5%), Sensitivity(81.40%), Specificity (76.30%)
Bladder Cancer	Tian et al. [41]	2019	China	456	N/A	TCGA	Improved SVM	Accuracy(81.8%), ROC(0.922)
Nasopharyngeal Carcinoma	Hasnain et al. [42]	2019	USA	70	48 ± 15	Hospital	GA and Nelder–Mead ML methods	Sensitivity (86%–98%), Specificity (92%–95%)
Gastric Cancer	Zhang et al. [21]	2019	China	265	N/A	SEER	Boosted DT, SVM, ANN	5-year Survival (67.5%)
Colorectal Cancer	Biglarian et al. [43]	2011	Iran	927	62 ± 13	Hospital	Multiple Additive Regression Trees	/
	Zhu et al. [44]	2013	China	115	61.0 ± 12.	Hospital	RF, SVM	AUC(0.72), Accuracy(70.77), Specificity(73.08), Sensitivity (61.54)
	Bottaci et al. [45]	1997	UK	8422	59(48–69)	SEER	SVM, RF,DL	Accuracy(81.6% ± 1.9%),curve(0.87)
	Wang et al. [46]	2019	China					
	Bychkov et al. [47]	2018	Finland					
Oral Cancer	Zhang et al. [48]	2013	Malaysia					
Lung Cancer	Lynch et al. [49]	2017	USA					
	Sepehri et al. [50]	2018	France					
	Yu et al. [51]	2016	Italy					
Ovarian Cancer	Lu et al. [52]	2019	Taiwan					
	Lu et al. [53]	2019	UK					
Glioma	Acharya et al. [54]	2018	Singapore& Malaysia					
	Lu et al. [55]	2018	Taiwan					
	Papp et al. [56]	2018	Austria					
Spinal Chordoma	Karhade et al. [57]	2018	USA					
Long Bone Metastases	Stein et al. [58]	2015	USA					
Oral Cavity Squamous Cell	Lu et al. [59]	2017	USA					
Pancreatic Neuroendocrine	Kong et al. [122]	2018	China					

*S…e, DNN: Deep Neural Network, ANN: Artificial Neural Network, DT: Decision Tree, GA: Genetic Algorithm Optimizer, KNN: K-Nearest Neighbor, RF: Random Forest, LSTM: Long Short-Term Memory Network, GBM: Gradient Boosting Machines, RFE: Recursive Feature Elimination, TP: True Prediction.

Cancer Letters 471 (2020) 61–71

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Cancer Letters

journal homepage: www.elsevier.com/locate/canlet

Mini-review

Artificial intelligence in cancer diagnosis and prognosis: Opportunities and challenges

Shigao Huang[a,1], Jie Yang[b,c,1], Simon Fong[b,d,**], Qi Zhao[a,*]

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[b] Department of Computer and Information Science, University of Macau, Taipa, Macau, China
[c] Chongqing Industry&Trade Polytechnic, Chongqing, China
[d] Zhuhai Institute of Advanced Technology Chinese Academy of Sciences, Zhuhai, China

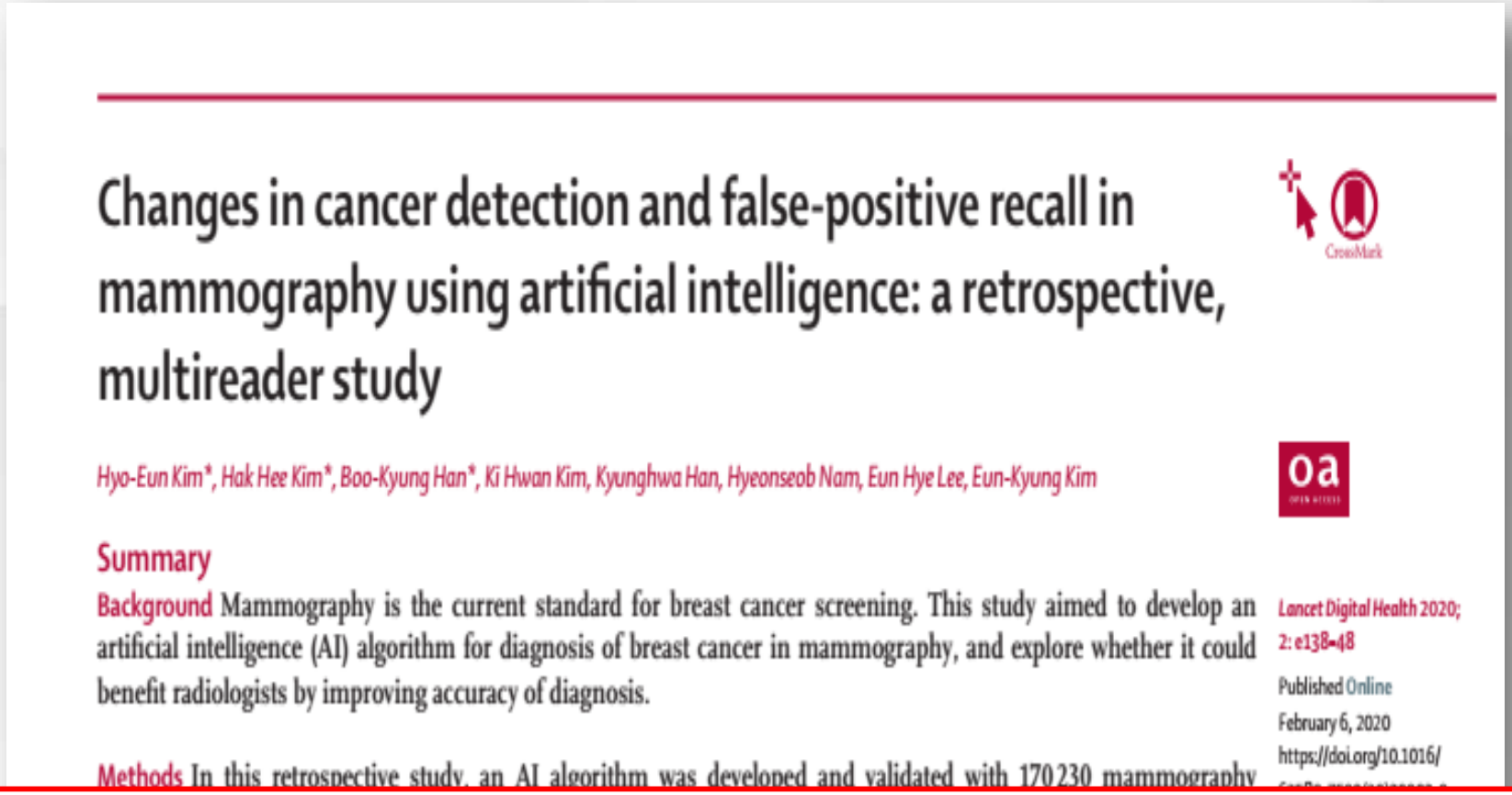
Letter | Published: 25 January 2017

Dermatologist-level classification of skin cancer with deep neural networks

Andre Esteva, Brett Kuprel, Roberto A. Novoa, Justin Ko, Susan M. Swetter, Helen M. Blau & Sebastian Thrun

Nature **542**, 115–118 (2017) | Cite this article

A Corrigendum to this article was published on 29 June 2017



Changes in cancer detection and false-positive recall in mammography using artificial intelligence: a retrospective, multireader study

Hyo-Eun Kim*, Hak Hee Kim*, Boo-Kyung Han*, Ki Hwan Kim, Kyunghwa Han, Hyeonseob Nam, Eun Hye Lee, Eun-Kyung Kim

Summary

Background Mammography is the current standard for breast cancer screening. This study aimed to develop an artificial intelligence (AI) algorithm for diagnosis of breast cancer in mammography, and explore whether it could benefit radiologists by improving accuracy of diagnosis.

Methods In this retrospective study, an AI algorithm was developed and validated with 170 230 mammography

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170230 mammography examinations (36468 cancer, 59544 benign, and 74218 normal) from five institutions in South Korea, the USA, and the UK

14 radiologists participated as readers, first without and then with the assistance of the AI

Performance level AI: 0·940, significantly higher than radiologists without AI assistance.

With AI assistance: radiologists' performance was improved to 0·881.

diagnostics

MDPI

Article

Artificial Intelligence-Based Detection of Pneumonia in Chest Radiographs

Judith Becker [1], Josua A. Decker [1], Christoph Römmele [2], Maria Kahn [2], Helmut Messmann [2], Markus Wehler [3,4], Florian Schwarz [1], Thomas Kroencke [1,*] and Christian Scheurig-Muenkler [1]

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Abstract: Artificial intelligence is gaining increasing relevance in the field of radiology. This study retrospectively evaluates how a commercially available deep learning algorithm can detect pneumonia in chest radiographs (CR) in emergency departments. The chest radiographs of 948 patients with dyspnea between 3 February and 8 May 2020, as well as 15 October and 15 December 2020, were used. A deep learning algorithm was used to identify opacifications associated with pneumonia, and the performance was evaluated by using ROC analysis, sensitivity, specificity, PPV and NPV. Two radiologists assessed all enrolled images for pulmonal infection patterns as the reference standard. If consolidations or opacifications were present, the radiologists classified the pulmonal findings regarding a possible COVID-19 infection because of the ongoing pandemic. The AUROC value of the deep learning algorithm reached 0.923 when detecting pneumonia in chest radiographs with a sensitivity of 95.4%, specificity of 66.0%, PPV of 80.2% and NPV of 90.8%. The detection of COVID-19 pneumonia in CR by radiologists was achieved with a sensitivity of 50.6% and a specificity of 73%. The deep learning algorithm proved to be an excellent tool for detecting pneumonia in chest radiographs. Thus, the assessment of suspicious chest radiographs can be purposefully supported, shortening the turnaround time for reporting relevant findings and aiding early triage.

Keywords: chest radiograph; artificial intelligence; deep learning; early detection; COVID-19; pneumonia

Citation: Becker, J.; Decker, J.A.; Römmele, C.; Kahn, M.; Messmann, H.; Wehler, M.; Schwarz, F.; Kroencke, T.; Scheurig-Muenkler, C. Artificial Intelligence-Based Detection of Pneumonia in Chest Radiographs. *Diagnostics* 2022, *12*, 1465. https://doi.org/10.3390/diagnostics12061465

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Deep learning algorithm AUROC: 0.923
Sensitivity: 95.4%
Specificity: 66.0%

by radiologists, Sensitivity: 50.6%
Specificity:73%

PLOS ONE

RESEARCH ARTICLE

A data-driven artificial intelligence model for remote triage in the prehospital environment

Dohyun Kim[1☯], Sungmin You[2☯], Soonwon So[2], Jongshill Lee[2], Sunhyun Yook[2], Dong Pyo Jang[2], In Young Kim[2], Eunkyoung Park[3], Kyeongwon Cho[3], Won Chul Cha[4,5], Dong Wook Shin[5,6], Baek Hwan Cho[3,7]*, Hoon-Ki Park[8]*

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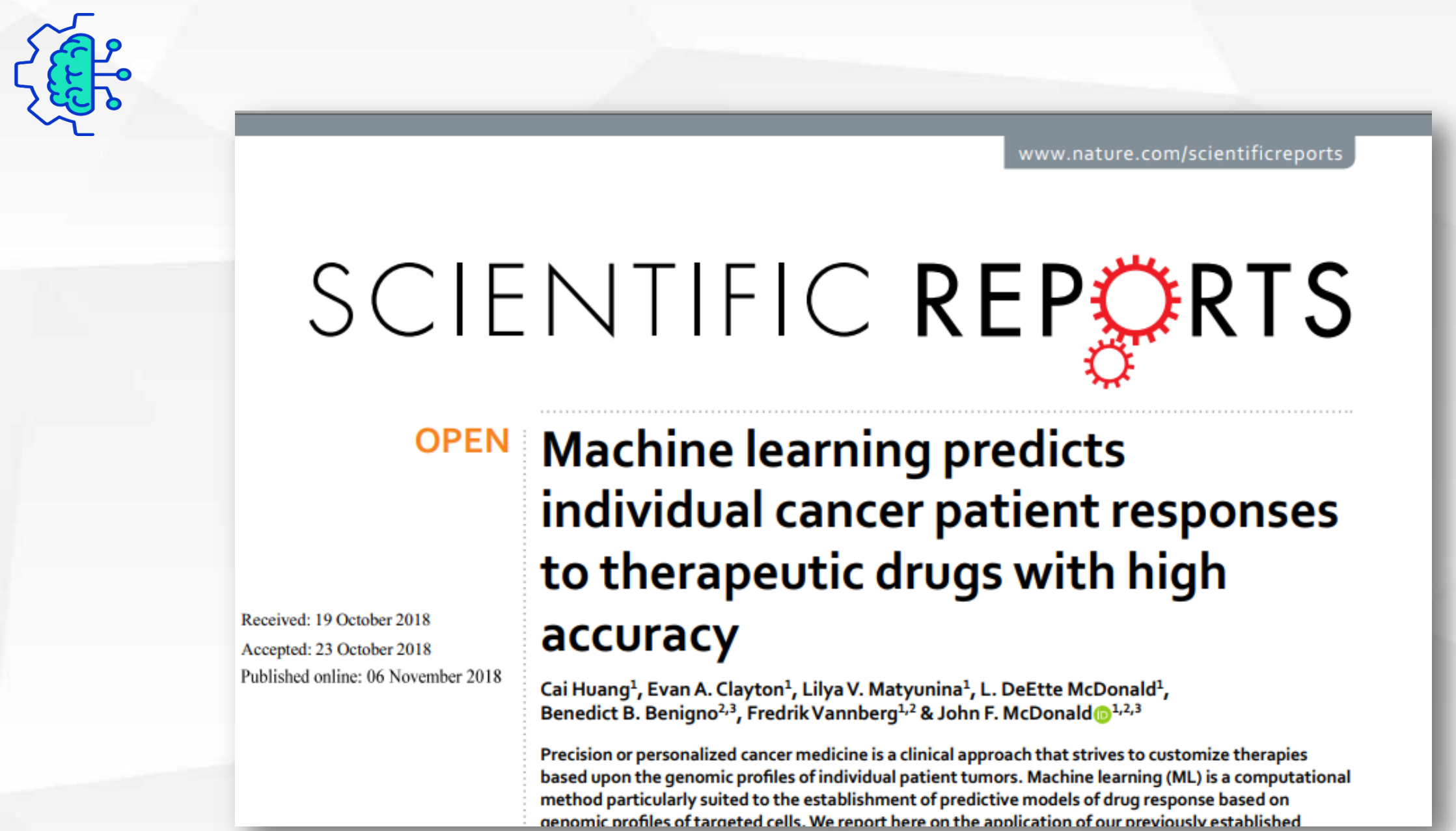

OPEN

Machine learning predicts individual cancer patient responses to therapeutic drugs with high accuracy

Received: 19 October 2018
Accepted: 23 October 2018
Published online: 06 November 2018

Cai Huang[1], Evan A. Clayton[1], Lilya V. Matyunina[1], L. DeEtte McDonald[1], Benedict B. Benigno[2,3], Fredrik Vannberg[1,2] & John F. McDonald[1,2,3]

Precision or personalized cancer medicine is a clinical approach that strives to customize therapies based upon the genomic profiles of individual patient tumors. Machine learning (ML) is a computational method particularly suited to the establishment of predictive models of drug response based on genomic profiles of targeted cells. We report here on the application of our previously established

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CURRE

FREE ACCESS | Care Delivery and Regulatory Policy | June 02, 2022

PRECISE CURATE.AI: A prospective feasibility trial to dynamically modulate personalized chemotherapy dose with artificial intelligence.

Authors: Agata Blasiak, Anh Truong, Wen Jeit, Lester Tan, Kirthika Senthil Kumar, Shi Bei Tan, Chong Boon Teo, Benjamin Kye Jyn Tan, ... SHOW ALL ..., and Raghav Sundar | AUTHORS INFO & AFFILIATIONS

Publication: Journal of Clinical Oncology • Volume 40, Number 16_suppl • https://doi.org/10.1200/JCO.2022.40.16_suppl.1574

Scientists discover the first new antibiotics in over 60 years using AI

pharmaceutics

MDPI

Review

Artificial Intelligence in Drug Metabolism and Excretion Prediction: Recent Advances, Challenges, and Future Perspectives

Thi Tuyet Van Tran [1,2,3], Hilal Tayara [4,*] and Kil To Chong [5,*]

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MATT BURGESS BUSINESS JAN 5, 2017 1:30 AM

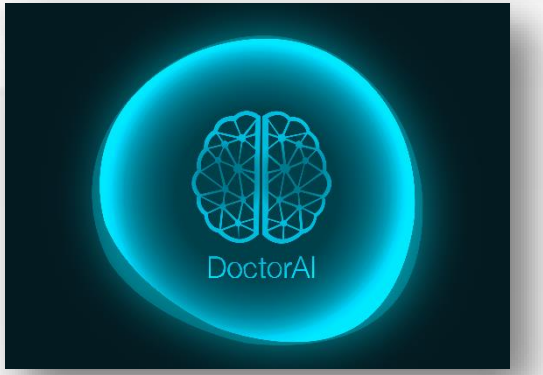
The NHS is trialling an AI chatbot to answer your medical questions

1.2 million people living in North London can use the app instead of calling the NHS 111 number

IN AN EXPERIMENTAL trial, the National Health Service across parts of London is going to test an artificial intelligence app as a way for potential patients to find out how urgent their problems are.

AI Tools in Medicine

Isearch Biomed
This technology uses natural language AI to mine the PubMed database regarding a scientific topic or clinical question

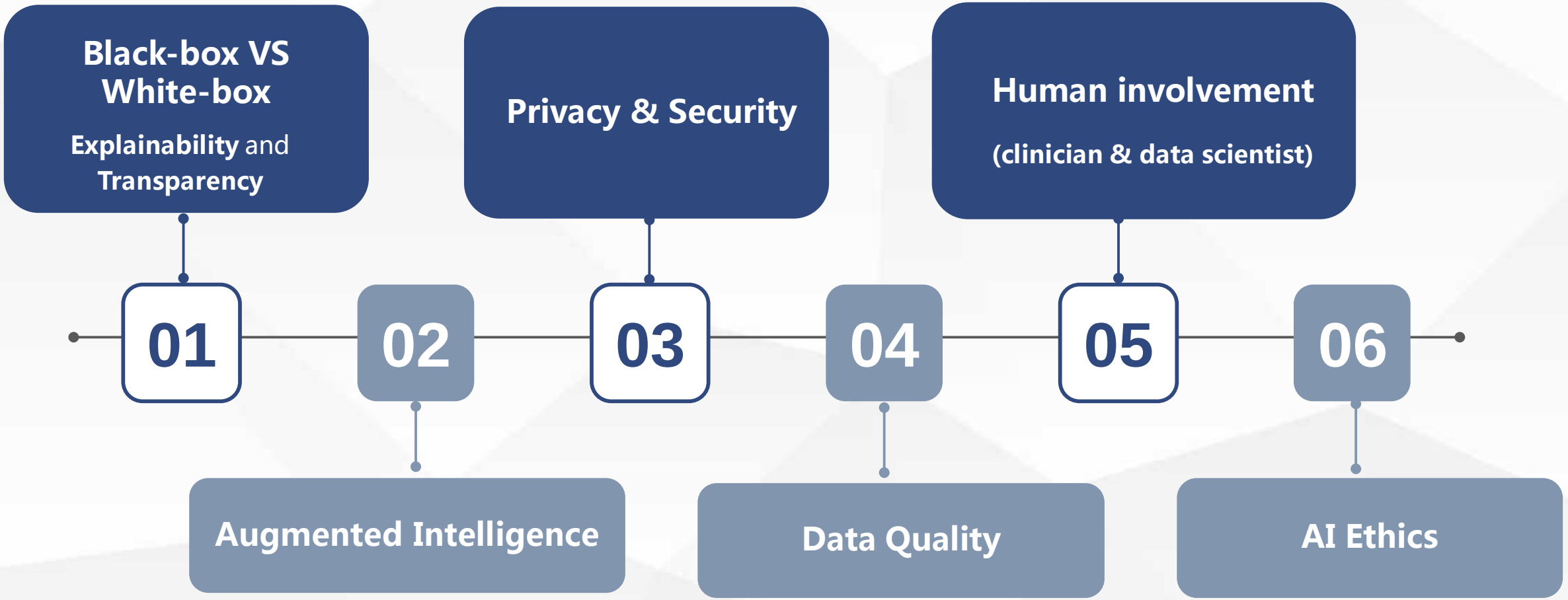


DoctorAI:
An intelligent medical assistant with the ability to interpret radiology images

CodyMD
Medical consultation and checking the patient's symptoms

PatientNotes
a clinical note-taking tool that uses AI to write clinical notes, patient summaries, and medical letters.

AI Challenges in Medicine



Thank you very much

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