SISTEMA SANITARIO REGIONALE

AZIENDA OSPEDALIERA
SAN CAMILLO FORLANINI

VERSO IL NUOVO CODICE DI DEONTOLOGIA MEDICA

Etica e bioetica nell'era dell'Intelligenza Artificiale in una nuova realtà professionale

NUOVE TECNOLOGIE ED INTELLIGENZA ARTIFICIALE, L'IMPATTO SUL PERCORSO CLINICO-DIAGNOSTICO E SUL RAPPORTO CON IL PAZIENTE

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Consigliere radiodiagnostica Sindacato Nazionale Radiologi

Art. 78

Tecnologie informatiche

Il medico, nell'uso degli strumenti informatici, garantisce l'acquisizione del consenso, la tutela della riservatezza, la pertinenza dei dati raccolti e, per quanto di propria competenza, la sicurezza delle tecniche.

Il medico, nell'uso di tecnologie di informazione e comunicazione di dati clinici, persegue l'appropriatezza clinica e adotta le proprie decisioni nel rispetto degli eventuali contributi multidisciplinari, garantendo la consapevole partecipazione della persona assistita.

Il medico, nell'utilizzo delle tecnologie di informazione e comunicazione a fini di prevenzione, diagnosi, cura o sorveglianza clinica, o tali da influire sulle prestazioni dell'uomo, si attiene ai criteri di proporzionalità, appropriatezza, efficacia e sicurezza, nel rispetto dei diritti della persona e degli indirizzi applicativi allegati.

TECNOLOGIE INFORMATICHE
INDIRIZZI APPLICATIVI ALLEGATI ALL'ART. 78

Il medico nell'uso di strumenti derivanti dall'uso di tecnologie di informazione e comunicazione di dati clinici deve attenersi alle seguenti precauzioni e prescrizioni.

…

2. eliminare ogni forma di discriminazione nell'uso delle tecnologie informatiche e a garantire uguaglianza nell'accesso e nell'utilizzo dei servizi sanitari nonché il recupero del tempo necessario per la relazione di cura.

…

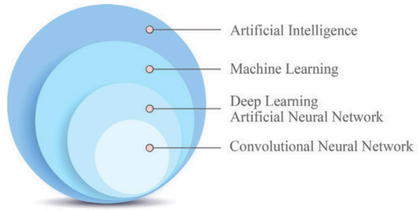
6. Il medico, facendo uso dei sistemi telematici, non può sostituire la visita medica che si sostanzia nella relazione diretta con il paziente, con una relazione esclusivamente virtuale; può invece utilizzare gli strumenti di telemedicina per le attività di rilevazione o monitoraggio a distanza, dei parametri biologici e di sorveglianza clinica.

….

13. In ogni caso, il consulto e le consulenze mediante le tecnologie informatiche della comunicazione "a distanza" devono rispettare tutte le norme deontologiche che regolano la relazione medico-persona assistita.

14. Il medico contrasta ogni uso distorto o illusorio delle tecnologie di informazione e comunicazione di dati clinici sul versante commerciale, dell'informazione ai cittadini e della pubblicità sanitaria nonché l'intrusione nelle banche dati e si pone sempre come garante della correttezza, scientificità e deontologia dell'uso dello strumento informatico, assumendosi l'obbligo di segnalare all'Ordine eventuali violazioni di tali comportamenti.

Perché questo grande interesse dell'AI in medicina ed in particolare, Perché la radiologia sta facendo da pioniere per l'AI in medicina?



I radiologi lavorano nell'ambiente più digitalizzato della Medicina

Ezekiel Emanuel, uno degli inventori del Affordable Care Act, oncologo ed esperto di bioetica alla Università della Pennsylvania afferma al meeting dell'ACR del 2016 che il machine learning potrà ***"sostituire molto del lavoro dei radiologi"***

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SAN CAMILLO FORLANINI

AI e medicina: digitalizzazione

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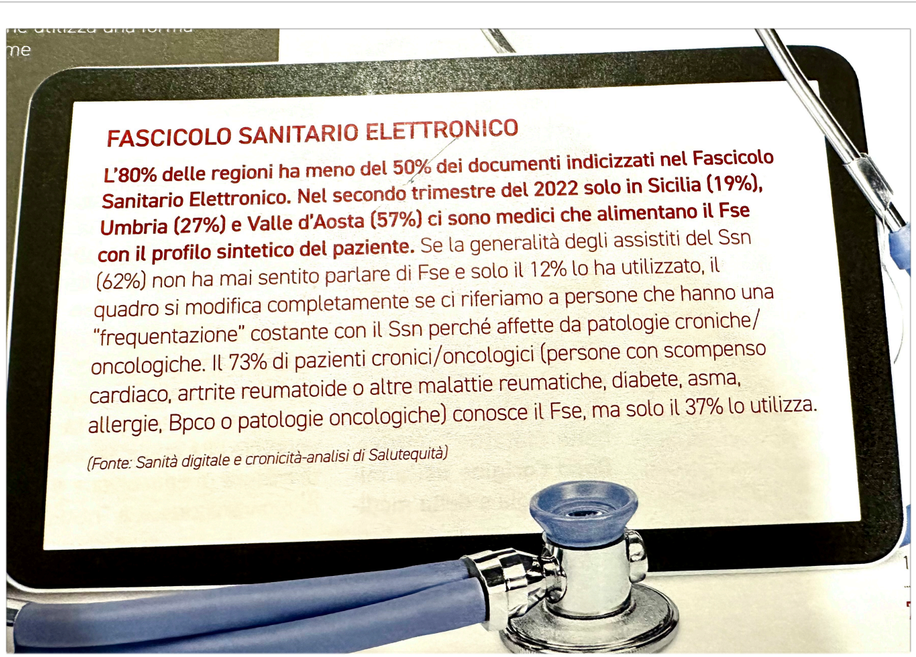

Come cambia il **Servizio sanitario nazionale**

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LIMITI DELL'INTELLIGENZA ARTIFICIALE

- **Variabilità biologica**
- **Variabilità tecnica** di acquisizione delle immagini in particolare di RM il cui segnale è relativo e le cui immagini necessitano di processi di omogenizzazione per essere confrontabili; ma anche i protocolli di somministrazione di mdc in TC sono piuttosto varibili e rischiano di dare in pasto informazioni non omogene alle macchine.
- **Database** necessario ad imparare per i software di IA, che vuol dire mettere insieme tanti casi con le medesime patologie.
- **Tematiche Medico Legali**
- **ETICA!!**

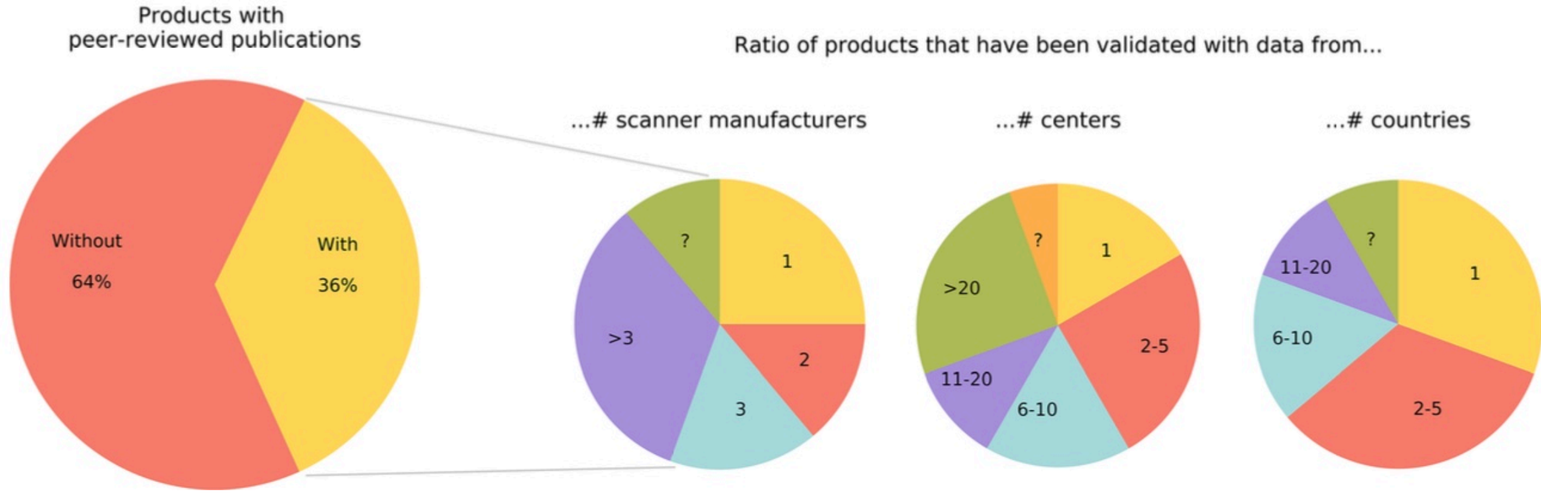
Le domande:

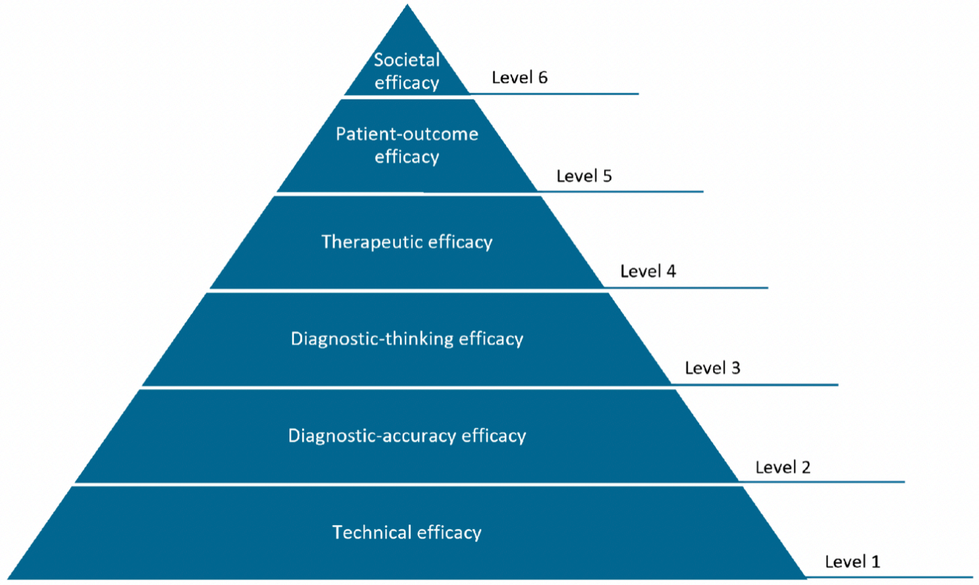
1) Il nostro lavoro è solo riconoscere le immagini patologiche e seguire le flowchart diagnostiche?

2) Può essere scisso da considerazioni cliniche e mediche anamnestiche?

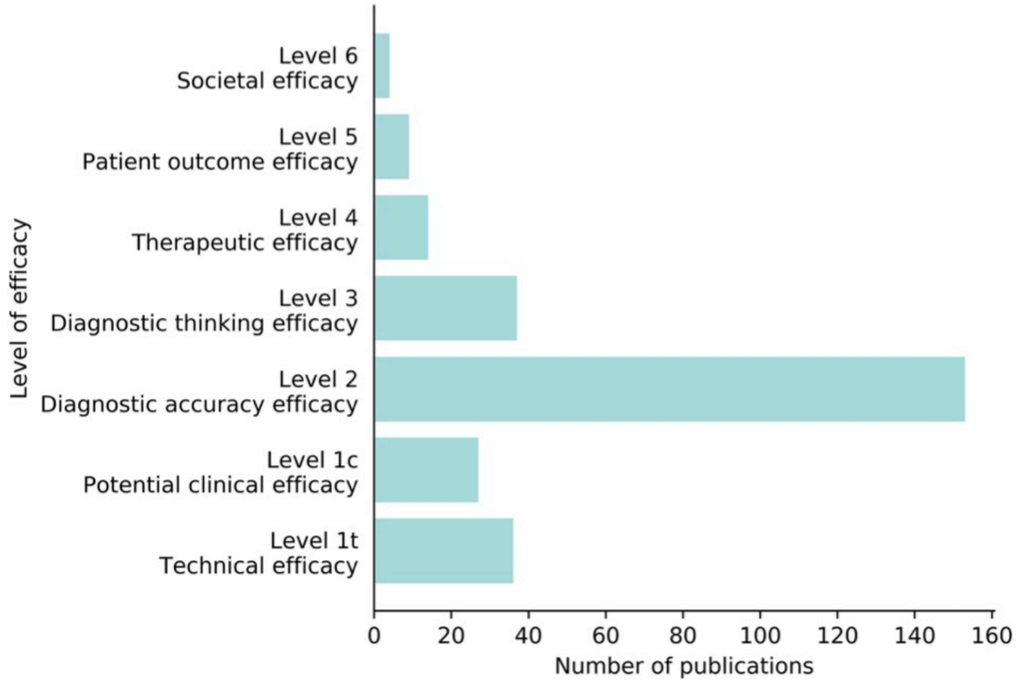
3) Non è necessaria la comunicazione e l'empatia con il paziente?

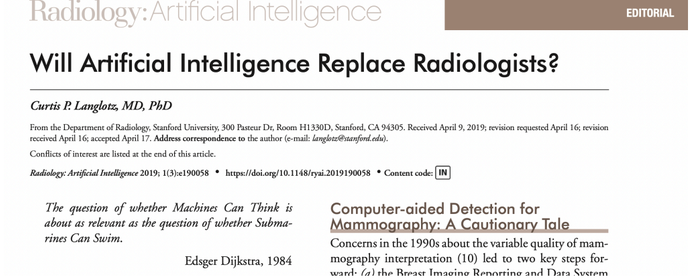
LIMITI TECNICI ATTUALI: VARIABILITÀ TECNICA





Hierarchical model of efficacy by Fryback and Thornbury, 1991



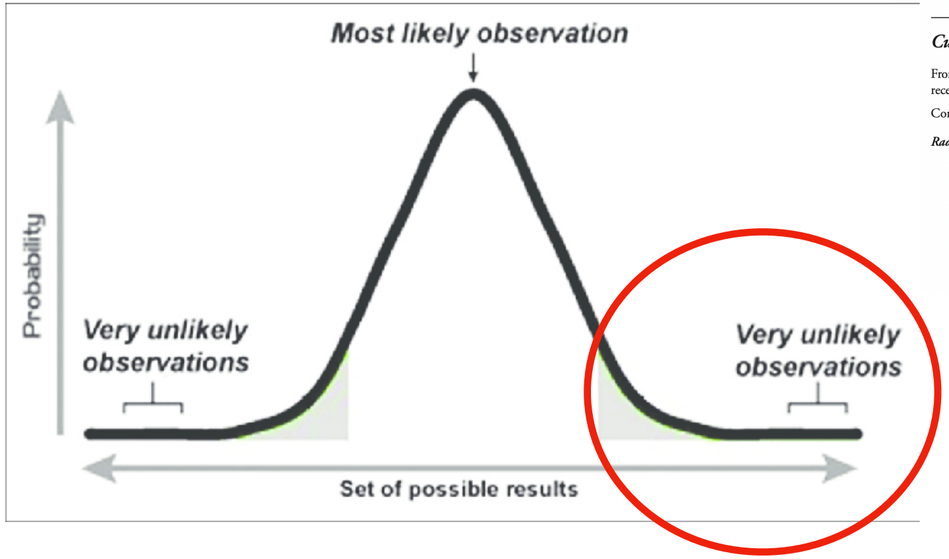


L'intelligenza Artificiale sostituirà i radiologi?

Bradley Erickson, Director of the Radiology Informatics Lab at Mayo Clinic told me that some of the hype we hear from some of the machine learning and deep learning experts saying that AI would replace radiologists is for them looking at radiologists as just looking at pictures. *That would be me saying while I look at programmers, all they do is typing, so we can replace a programmer with a speech recognition system*, he added. Langlotz compared the situation to that of the autopilot in aviation. The innovation did not replace real pilots, it augmented their tasks. On very long flights, it is handy to turn on the autopilot, but they are useless when you need rapid judgment. So, the combination of humans and machines is the winner solution. And it will be the same in healthcare.

Thus, I agree with Langlotz completely when he says that *artificial intelligence will not replace radiologists. Yet, those radiologists who use AI will replace the ones who don't*. Let me show you why.

"…Artificial intelligence will not replace radiologists. Yet, those radiologists who use AI will replace the ones who don't…"



Radiologists Know "The Long Tail"

Radiology: Artificial Intelligence EDITORIAL

Will Artificial Intelligence Replace Radiologists?

Curtis P. Langlotz, MD, PhD

From the Department of Radiology, Stanford University, 300 Pasteur Dr, Room H1330D, Stanford, CA 94305. Received April 9, 2019; revision requested April 16; revision received April 16; accepted April 17. **Address correspondence to** the author (e-mail: *langlotz@stanford.edu*).

Conflicts of interest are listed at the end of this article.

Radiology: Artificial Intelligence 2019; 1(3):e190058 • https://doi.org/10.1148/ryai.2019190058 • Content code: IN

The question of whether Machines Can Think is about as relevant as the question of whether Submarines Can Swim.

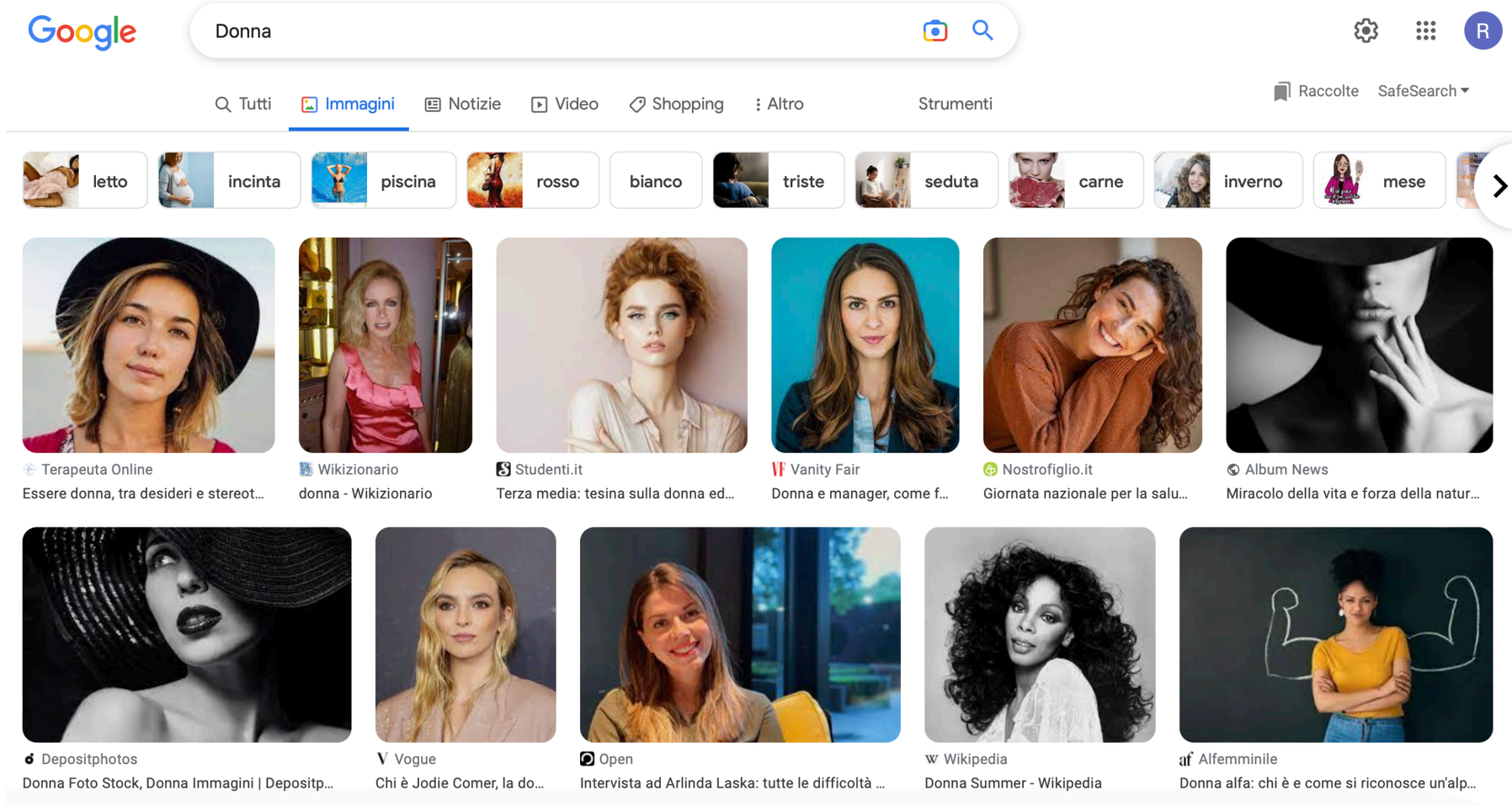
Edsger Dijkstra, 1984

Computer-aided Detection for Mammography: A Cautionary Tale

Concerns in the 1990s about the variable quality of mammography interpretation (10) led to two key steps forward: (a) the Breast Imaging Reporting and Data System

These assessments dramatically oversimplify what radiologists do. A comprehensive catalog of radiology diagnoses lists nearly 20000 terms for disorders and imaging observations and over 50000 causal relations (20).

But human radiologists are also trained to detect uncommon diseases **in the long tail** of the distribution, including rheumatoid arthritis, sickle cell disease, and post-transplantation lymphoproliferative disorder.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SABATO 20 MAGGIO 2023
VERSO IL NUOVO CODICE
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Etica e bioetica nell'era dell'Intelligenza Artificiale in una nuova realtà professionale

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Review

The future of radiology augmented with Artificial Intelligence: A strategy for success

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ARTICLE INFO

Keywords:
Artificial Intelligence
Deep learning
Informatics
Business
Strategy
Health policy

ABSTRACT

The rapid development of Artificial Intelligence/deep learning technology and its implementation into routine clinical imaging will cause a major transformation to the practice of radiology. Strategic positioning will ensure the successful transition of radiologists into their new roles as augmented clinicians. This paper describes an overall vision on how to achieve a smooth transition through the practice of augmented radiology where radiologists-in-the-loop ensure the safe implementation of Artificial Intelligence systems.

AI dovrà favorire il concetto di MEDICINA AUMENTATA (mutuato da quello di realtà aumentata) semplificando le azioni ripetitive e mnemoniche del nostro lavoro ma lasciando la possibilità di guardare bene la realtà medica dei pazienti che è complessa e spesso presente nella coda della distribuzione gaussiana dei dati

1. ***Automated image segmentation, lesion detection, measurement, labelling and comparison with historical images***
2. ***Generating radiology reports:***
3. ***Semantic error detection in reports:***
4. ***Data mining for research:***
5. ***Business Intelligence for radiologists:***

ETICA ED AI UNA QUESTIONE ATTUALE

INTERAZIONI UOMO MACCHINA

frontiers in Psychology

REVIEW
published: 28 September 2021
doi: 10.3389/fpsyg.2021.710982

Human, All Too Human? An All-Around Appraisal of the "Artificial Intelligence Revolution" in Medical Imaging

Francesca Coppola[1,2†], Lorenzo Faggioni[3†], Michela Gabelloni[3], Fabrizio De Vietro[3], Vincenzo Mendola[3], Arrigo Cattabriga[1], Maria Adriana Cocozza[1], Giulio Vara[1], Alberto Piccinino[1], Silvia Lo Monaco[1], Luigi Vincenzo Pastore[1], Margherita Mottola[4], Silvia Malavasi[4], Alessandro Bevilacqua[4], Emanuele Neri[2,3‡] and Rita Golfieri[1‡]*

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Artificial intelligence (AI) has seen dramatic growth over the past decade, evolving from a niche super specialty computer application into a powerful tool which has revolutionized many areas of our professional and daily lives, and the potential of which seems to be still largely untapped. The field of medicine and medical imaging, as one of its various specialties, has gained considerable benefit from AI, including improved diagnostic accuracy and the possibility of predicting individual patient outcomes and options of more personalized treatment. It should be noted that this process can actively support the ongoing development of advanced, highly specific treatment strategies (e.g., target therapies for cancer patients) while enabling faster workflow and more efficient use of healthcare resources. The potential advantages of AI over conventional methods have made it attractive for physicians and other healthcare stakeholders, raising much interest in both the research and the industry communities. However, the fast development of AI has unveiled its potential for disrupting the work of healthcare professionals, spawning concerns among radiologists that, in the future, AI may outperform them, thus damaging their reputations or putting their jobs at risk. Furthermore, this development has raised relevant psychological, ethical, and medico-legal issues which need to be addressed for AI to be considered fully capable of patient management. The aim of this review is to provide a brief, hopefully exhaustive, overview of the state of the art of AI systems regarding medical imaging, with a special focus on how AI and the entire healthcare environment should be prepared to accomplish the goal of a more advanced human-centered world.

Keywords: artificial intelligence, medical imaging, ethics, medico-legal issues, patient data, communication, psychology

Scenario	AI recommendation	AI accuracy	Physician action	Patient outcome	Legal outcome (probable)	Empirical Study Findings (Tobia et al.)
1	Standard of care	Correct	Rejects	Injury	Liability	☑ ★
2		Incorrect (standard of care is incorrect)	**Follows**	Injury	No liability	☑ ★★★★
3	Nonstandard care	Correct (standard of care is incorrect)	Rejects	Injury	*No liability*	◈ ★★
4		Incorrect	**Follows**	Injury	*Liability*	☒ ★★★

FIGURE 3 | Comparison of potential legal outcomes under current law according to analysis of Price et al. (2019) and empiric study findings of Tobia et al. (2021). ★ = agreement that physician decision was reasonable (highest is ★★★★; lowest is ★). Greater agreement indicates lower likelihood of liability; ☑ = study results confirming Price et al.'s analysis of current tort law; ◈ study results suggesting that jury outcome may also be liability; ☒ study results suggesting that jury might decide no liability. Reproduced from Price et al. (2021). © SNMMI.

Indicazione dell'IA	Risultato dell'IA	Decisione medica	Effetto sul paziente	Possibile risvolto medico-legale
Trattamento standard	Corretto	Rifiuta l'indicazione dell'IA	Danno	Medico perseguibile
	Errato (il trattamento standard è errato)	Segue l'indicazione dell'IA	Danno	Medico non perseguibile
Trattamento non standard	Corretto (il trattamento standard è errato)	Rifiuta l'indicazione dell'IA	Danno	Medico non perseguibile
	Errato	Segue l'indicazione dell'IA	Danno	Medico perseguibile

Tabella 1. Possibili conseguenze medico-legali dell'uso dell'IA nella professione medica. Adattato da Pryce [15].

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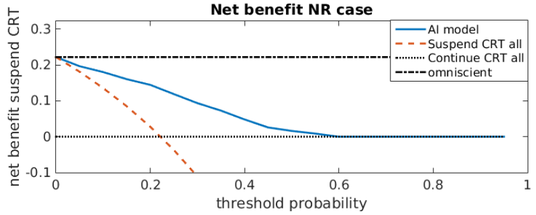
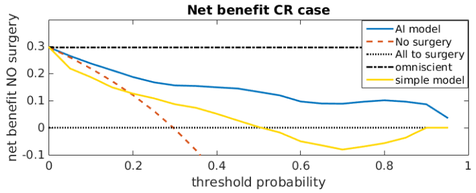
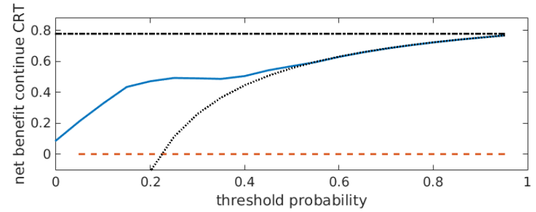
ETICA ED AI UNA QUESTIONE ATTUALE

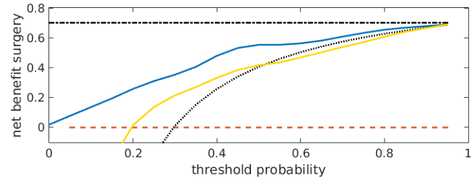
INTERAZIONI UOMO MACCHINA

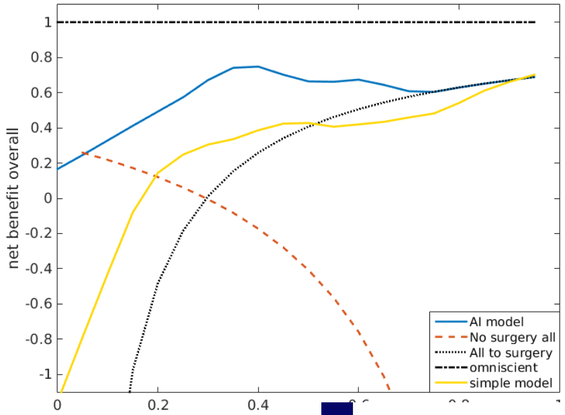
MODELLO DI INTELLIGENZA ARTIFICIALE CHE GESTISCA L'ENORME MOLE DI INFORMAZIONI NUMERICHE ESTRATTE DALLA TEXTURE CREANDO CURVE DI DECISIONE E VALUTAZIONI PROGNOSTICHE

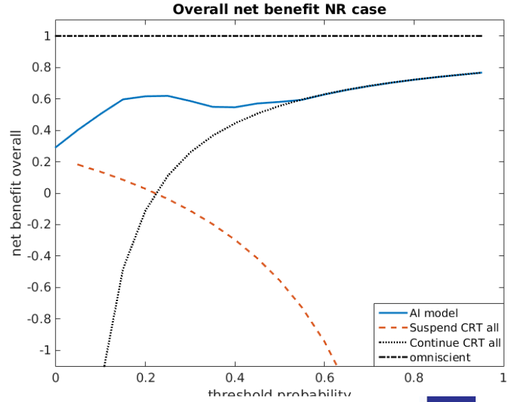












Research article

MR-based artificial intelligence model to assess response to therapy in locally advanced rectal cancer

R. Ferrari[a], C. Mancini-Terracciano[b], C. Voena[b,*], M. Rengo[c], M. Zerunian[c], A. Ciardiello[b,d], S. Grasso[d], V. Mare[d,e], R. Paramatti[b,d], A. Russomando[f], R. Santacesaria[b], A. Satta[g], E. Solfaroli Camillocci[b,d,h], R. Faccini[b,d], A. Laghi[i]

Published OnlineFirst September 5, 2017; DOI: 10.1158/1078-0432.CCR-17-1510

Personalized Medicine and Imaging

Clinical Cancer Research

A Radiomics Nomogram for the Preoperative Prediction of Lymph Node Metastasis in Bladder Cancer

Shaoxu Wu[1,2], Junjiong Zheng[1,2], Yong Li[3], Hao Yu[1,2], Siya Shi[3], Weibin Xie[1,2], Hao Liu[1,2], Yangfan Su[1,2], Jian Huang[1,2], and Tianxin Lin[1,2]

PNAS PLUS

Automatic classification of prostate cancer Gleason scores from multiparametric magnetic resonance images

Duc Fehr[a,1], Harini Veeraraghavan[a,1,2], Andreas Wibmer[b], Tatsuo Gondo[c], Kazuhiro Matsumoto[c], Herbert Alberto Vargas[b], Evis Sala[b], Hedvig Hricak[b], and Joseph O. Deasy[a]

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La radiologia medica
https://doi.org/10.1007/s11547-020-01205-y

COMPUTER APPLICATION

Check for updates

Artificial intelligence: radiologists' expectations and opinions gleaned from a nationwide online survey

Francesca Coppola[1] · Lorenzo Faggioni[2] · Daniele Regge[3] · Andrea Giovagnoni[4] · Rita Golfieri[1] · Corrado Bibbolino[5] · Vittorio Miele[6] · Emanuele Neri[2] · Roberto Grassi[7]

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SURVEY SOCIETA' ITALIANA DI RADIOLOGIA

DOVE SIAMO?

Abstract

Purpose To report the results of a nationwide online survey on artificial intelligence (AI) among radiologist members of the Italian Society of Medical and Interventional Radiology (SIRM).

Methods and materials All members were invited to the survey as an initiative by the Imaging Informatics Chapter of SIRM. The survey consisted of 13 questions about the participants' demographic information, perceived advantages and issues related to AI implementation in radiological practice, and their overall opinion about AI.

Results In total, 1032 radiologists (equaling 9.5% of active SIRM members for the year 2019) joined the survey. Perceived AI advantages included a lower diagnostic error rate (750/1027, 73.0%) and optimization of radiologists' work (697/1027, 67.9%). The risk of a poorer professional reputation of radiologists compared with non-radiologists (617/1024, 60.3%), and increased costs and workload due to AI system maintenance and data analysis (399/1024, 39.0%) were seen as potential issues. Most radiologists stated that specific policies should regulate the use of AI (933/1032, 90.4%) and were not afraid of losing their job due to it (917/1032, 88.9%). Overall, 77.0% of respondents (794/1032) were favorable to the adoption of AI, whereas 18.0% (186/1032) were uncertain and 5.0% (52/1032) were unfavorable.

Conclusions Radiologists had a mostly positive attitude toward the implementation of AI in their working practice. They

SISTEMA SANITARIO REGIONALE

AZIENDA OSPEDALIERA

Current practical experience with artificial intelligence in clinical radiology: a survey of the European Society of Radiology

European Society of Radiology (ESR)*

Abstract

A survey among the members of European Society of Radiology (ESR) was conducted regarding the current practical clinical experience of radiologists with Artificial Intelligence (AI)-powered tools. 690 radiologists completed the survey. Among these were 276 radiologists from 229 institutions in 32 countries who had practical clinical experience with an AI-based algorithm and formed the basis of this study. The respondents with clinical AI experience included 143 radiologists (52%) from academic institutions, 102 radiologists (37%) from regional hospitals, and 31 radiologists (11%) from private practice. The use case scenarios of the AI algorithm were mainly related to diagnostic interpretation, image post-processing, and prioritisation of workflow. Technical difficulties with integration of AI-based tools into the workflow were experienced by only 49 respondents (17.8%). Of 185 radiologists who used AI-based algorithms for diagnostic purposes, 140 (75.7%) considered the results of the algorithms generally reliable. The use of a diagnostic algorithm was mentioned in the report by 64 respondents (34.6%) and disclosed to patients by 32 (17.3%). Only 42 (22.7%) experienced a significant reduction of their workload, whereas 129 (69.8%) found that there was no such effect. Of 111 respondents who used AI-based algorithms for clinical workflow prioritisation, 26 (23.4%) considered algorithms to be very helpful for reducing the workload of the medical staff whereas the others found them only moderately helpful (62.2%) or not helpful at all (14.4%). Only 92 (13.3%) of the total 690 respondents indicated that they had intentions to acquire AI tools. In summary, although the assistance of AI algorithms was found to be reliable for different use case scenarios, the majority of radiologists experienced no reduction of practical clinical workload.

Keywords: Professional issues, Artificial intelligence in imaging, Artificial intelligence and workload, Artificial intelligence in radiology

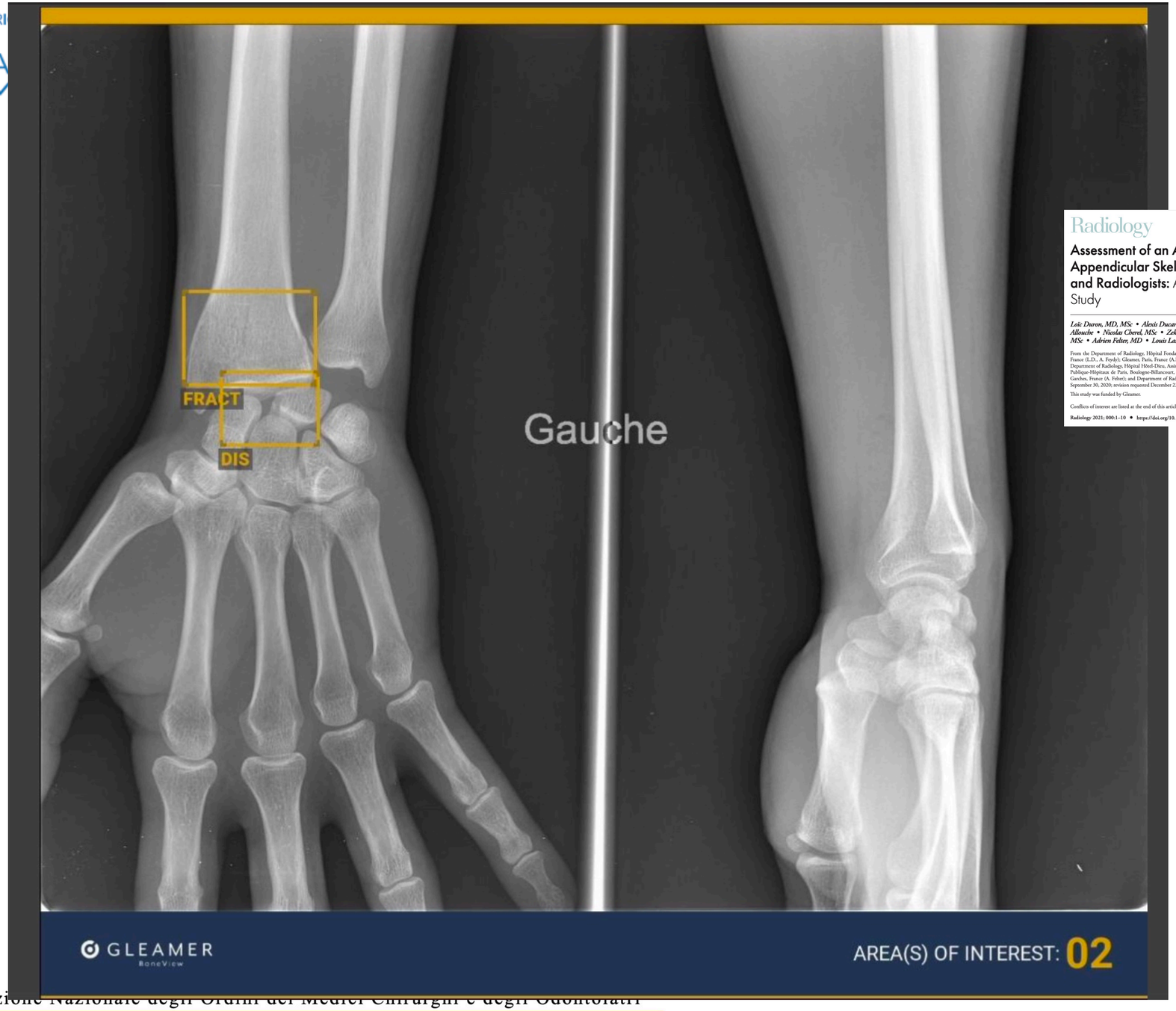
SURVEY SOCIETA' EUROPEA DI RADIOLOGIA

DOVE SIAMO?

34,6% ha usato AI per diagnosi riportato nel referto
32% ha chiesto il consenso al paziente
69,8% non ha rilevato nessuna riduzione
26% considera molto utile l'utilizzo degli algoritmi di AI
13,3% ha dichiarato che intende acquistarne uno
Conclusioni: Nonostante gli algoritmi di AI siano stati giudicati utili nei differenti scenari radiologici la maggioranza dei radiologici non ha rilevato una particolare riduzione dei carichi di lavoro.

SOFTWARE AI DISPONIBILI

DETECTION



Radiology

ORIGINAL RESEARCH · MUSCULOSKELETAL IMAGING

Assessment of an AI Aid in Detection of Adult Appendicular Skeletal Fractures by Emergency Physicians and Radiologists: A Multicenter Cross-sectional Diagnostic Study

Loïc Duron, MD, MSc • Alexis Ducarouge, MSc • André Gillibert, MD, MSc • Julia Lainé, MD, MSc • Christian Allouche • Nicolas Cherel, MSc • Zehun Zhang, MSc • Nicolas Nitche, MSc • Elise Lacave, MSc • Aloïs Pourchot, MSc • Adrien Felter, MD • Louis Lassalle, MD, MSc • Nor-Eddine Regnard, MD, MSc • Antoine Feydy, MD, PhD

From the Department of Radiology, Hôpital Fondation A. de Rothschild, 25 rue Manin, 75019 Paris, France (L.D.); Faculty of Medicine, Université de Paris, Paris, France (L.D., A. Feydy); Gleamer, Paris, France (A.D., C.A., N.C., Z.Z., N.N., E.L., A.P., N.E.R.); Department of Biostatistics, CHU Rouen, Rouen, France (A.G.); Department of Radiology, Hôpital Hôtel-Dieu, Assistance Publique-Hôpitaux de Paris, Paris, France (J.L.); Department of Radiology, Hôpital Ambroise-Paré, Assistance Publique-Hôpitaux de Paris, Boulogne-Billancourt, France (A. Felter); Department of Radiology, Hôpital Raymond-Poincaré, Assistance Publique-Hôpitaux de Paris, Garches, France (A. Felter); and Department of Radiology B, Hôpital Cochin, Assistance Publique-Hôpitaux de Paris, Paris, France (L.L., N.E.R., A. Feydy). Received September 30, 2020; revision requested December 23; revision received January 26, 2021; accepted March 4. **Address correspondence to** L.D. (e-mail: *ldurex@gfr.paris*).

This study was funded by Gleamer.

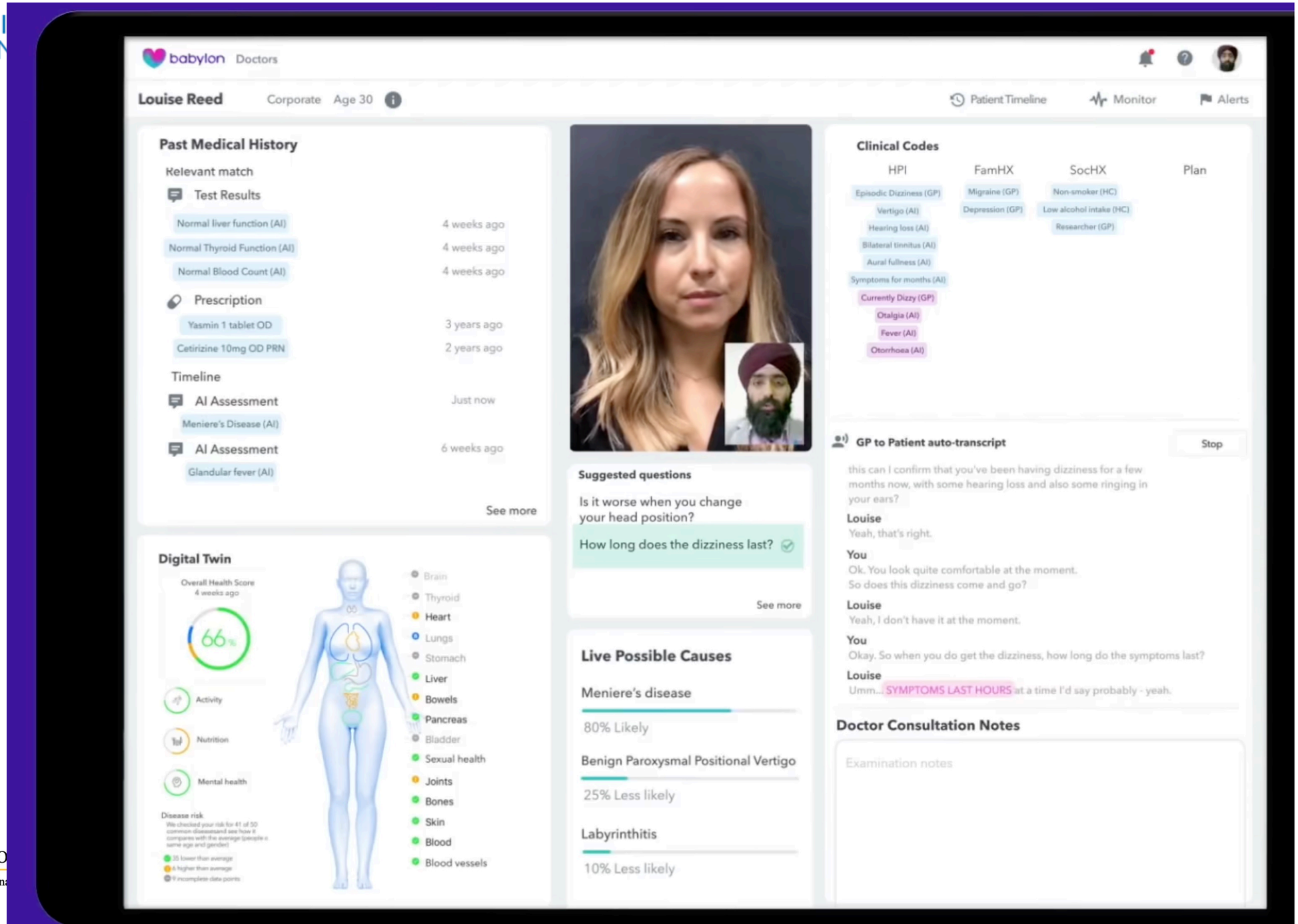
Conflicts of interest are listed at the end of this article.

Radiology 2021; 000:1–10 • https://doi.org/10.1148/radiol.2021203886 • Content codes: MSK AI

PRIORIZZAZIONE DELLA LISTA DI LAVORO

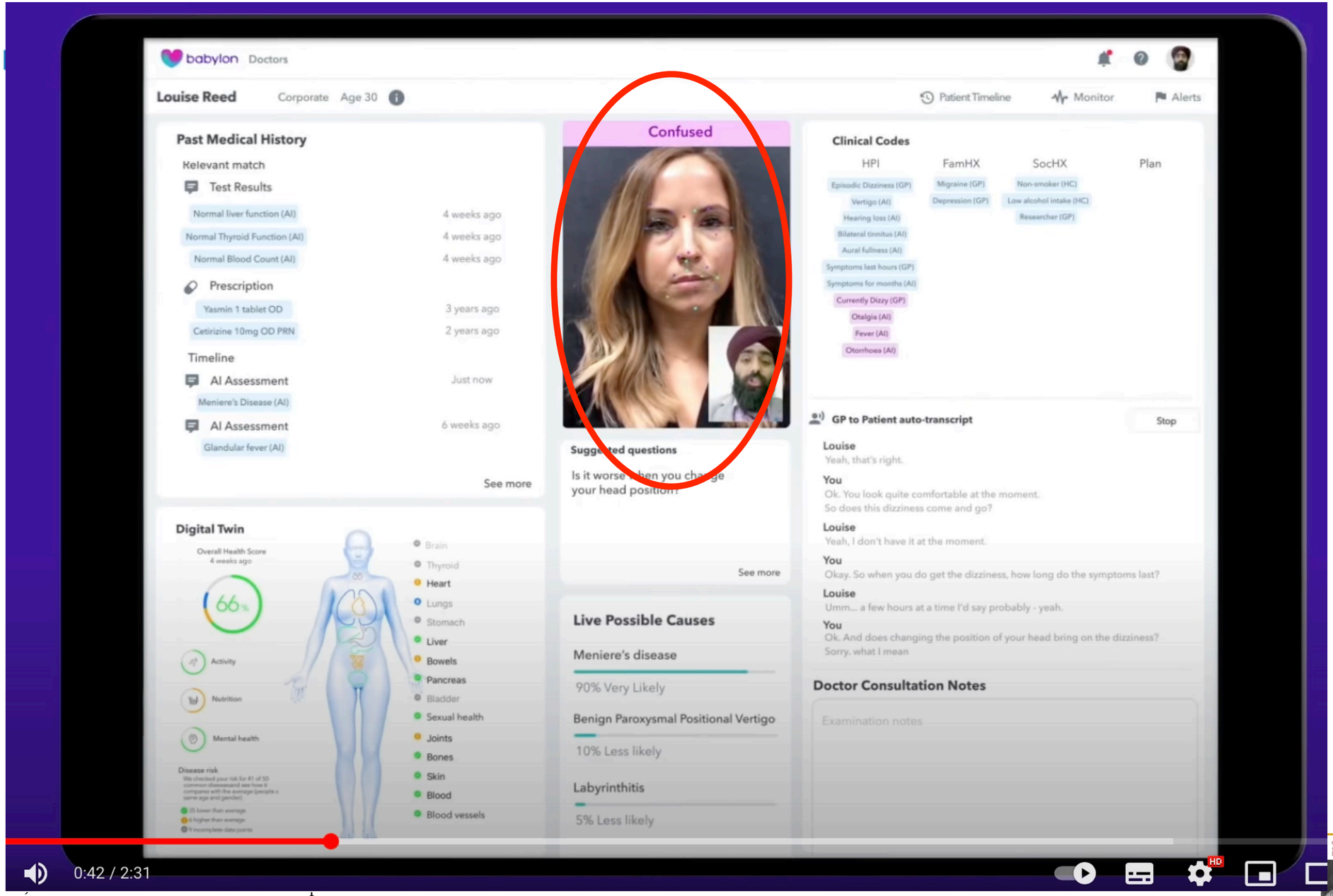
AI Result	Patient ID	Name	Surname	Description	Date
POSITIVE	400-608-4467	Johnston	Lucinda	Left ankle	Thursday 08-10-2019 10h34 AM
POSITIVE	401-612-1256	Lewis	Smith	Pelvis	Thursday 08-10-2019 10h12 AM
DOUBT	407-003-9332	Dominic	Watts	Right Hand	Thursday 08-10-2019 10h01 AM
DOUBT	512-724-5758	Nicolas	Hamilton	Left Foot	Thursday 08-10-2019 09h52AM
NEGATIVE	008-392-2699	Eli	Cook	Spine	Thursday 08-10-2019 09h34 AM
NEGATIVE	402-458-0003	Jason	Francis	Rib Cage	Thursday 08-10-2019 09h05 AM

PREGI E DIFETTI DELLA TELEMEDICINA CON AI, L'ESPERIENZA INGLESE CON BABYLON



FNOMCeO
Via Ferdina

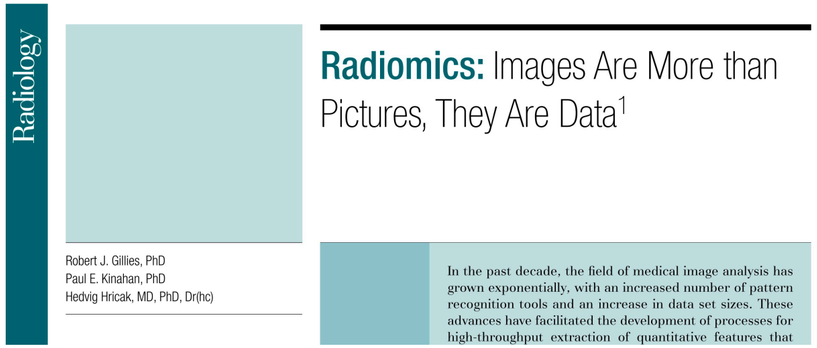
PREGI E DIFETTI DELLA TELEMEDICINA CON AI, L'ESPERIENZA INGLESE CON BABYLON



RADIOMICA

Imaging quantitativo (radiomica) necessita di misurazioni accurate dei biomarker estraibili dalle immagini come indicatori di malattia tramite processi di texture analisi.

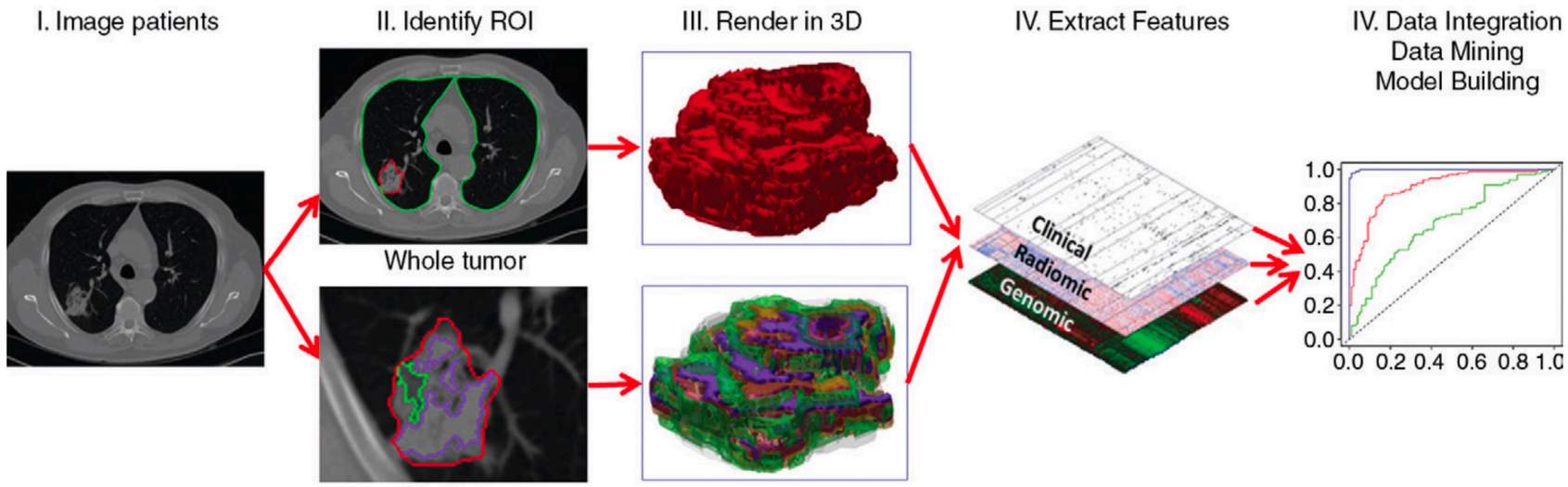
Le misurazioni e valutazioni dei risultati ottenuti necessitano di processi di automazione molto complessi che solo l'IA ci fornisce


Radiology

Radiomics: Images Are More than Pictures, They Are Data[1]

Robert J. Gillies, PhD
Paul E. Kinahan, PhD
Hedvig Hricak, MD, PhD, Dr(hc)

In the past decade, the field of medical image analysis has grown exponentially, with an increased number of pattern recognition tools and an increase in data set sizes. These advances have facilitated the development of processes for high-throughput extraction of quantitative features that

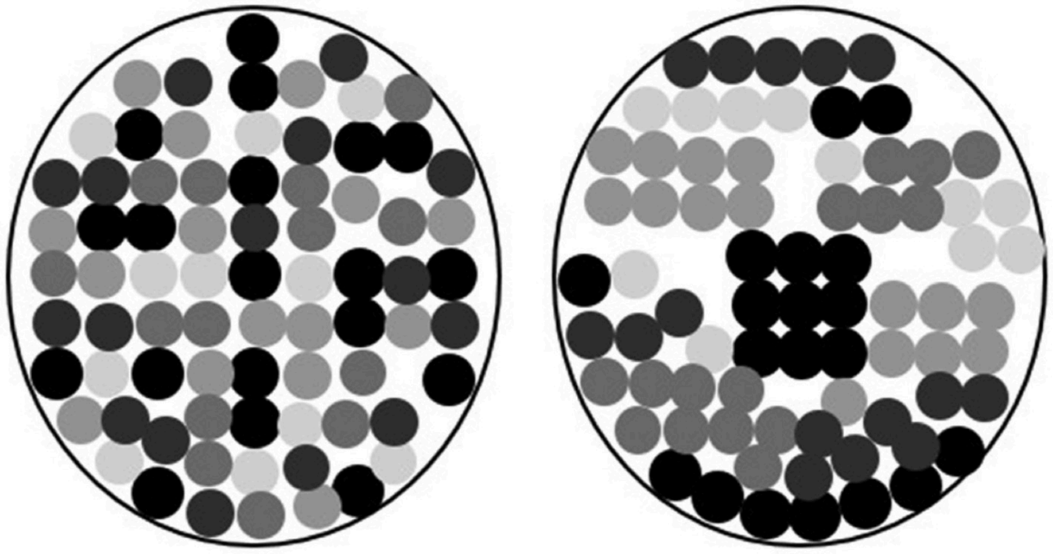


Applicazioni in oncologia
Caratterizzazione istologica

PRIMO PASSO: SEGMENTAZIONE ED ESTRAZIONE PARAMETRI TEXTURE

Table 1: Spectrum of Statistical-based First-Order and Higher-Order Texture Features

Texture Feature	Level/Order	Description	Examples	Comments
Intensity of pixel histogram	First order	Histogram where x-axis represents pixel/voxel gray level and y-axis represents frequency of occurrence (Fig 2)	Mean gray-level intensity, threshold, standard deviation or variance of the pixel histogram, skewness, kurtosis, first-order entropy, mean of the positive pixels (MPP)	Takes into account only pixel intensity, not spatial location or relationship of pixels First-order entropy is the irregularity or complexity of pixel intensities
Run-length matrix	Second order	Adjacent or consecutive pixels/voxels of a single gray level in a given direction	Run-length nonuniformity, gray-level nonuniformity, long-run emphasis, short-run emphasis, fraction	Similar to co-occurrence matrix, takes into account both pixel intensity and spatial relationships
Gray-level co-occurrence matrix	Second order	How often pairs of pixels with specific values in a specified spatial range occur in an image	Contrast, uniformity, second-order entropy, sum of variance, sum of averages, sum of entropy	…
Advanced metrics	Higher order	Comparing differences and relationships between multiple pixels/voxels	Hundreds: autoregressive model, Haar wavelet (wavelet energy), geometry parameters, neighborhood gray-tone difference matrix	…



Same number of grey circle different distribution different texture parameters

Original Investigation

Noninterpretive Uses of Artificial Intelligence in Radiology

Michael L. Richardson, MD, Elisabeth R. Garwood, MD, Yueh Lee, MD, Matthew D. Li, MD, Hao S. Lo, MD, MBA, Arun Nagaraju, MD, Xuan V. Nguyen, MD, PhD, Linda Probyn, MD, Prabhakar Rajiah, MD, Jessica Sin, MD, Ashish P. Wasnik, MD, Kali Xu, MD

Accademic Radiology, 2020

We deem a computer to exhibit artificial intelligence (AI) when it performs a task that would normally require intelligent action by a human. Much of the recent excitement about AI in the medical literature has revolved around the ability of AI models to recognize anatomy and detect pathology on medical images, sometimes at the level of expert physicians. However, AI can also be used to solve a wide range of noninterpretive problems that are relevant to radiologists and their patients. This review summarizes some of the newer noninterpretive uses of AI in radiology.

Key Words: Artificial intelligence; Deep learning; Radiology applications; Radiology education.

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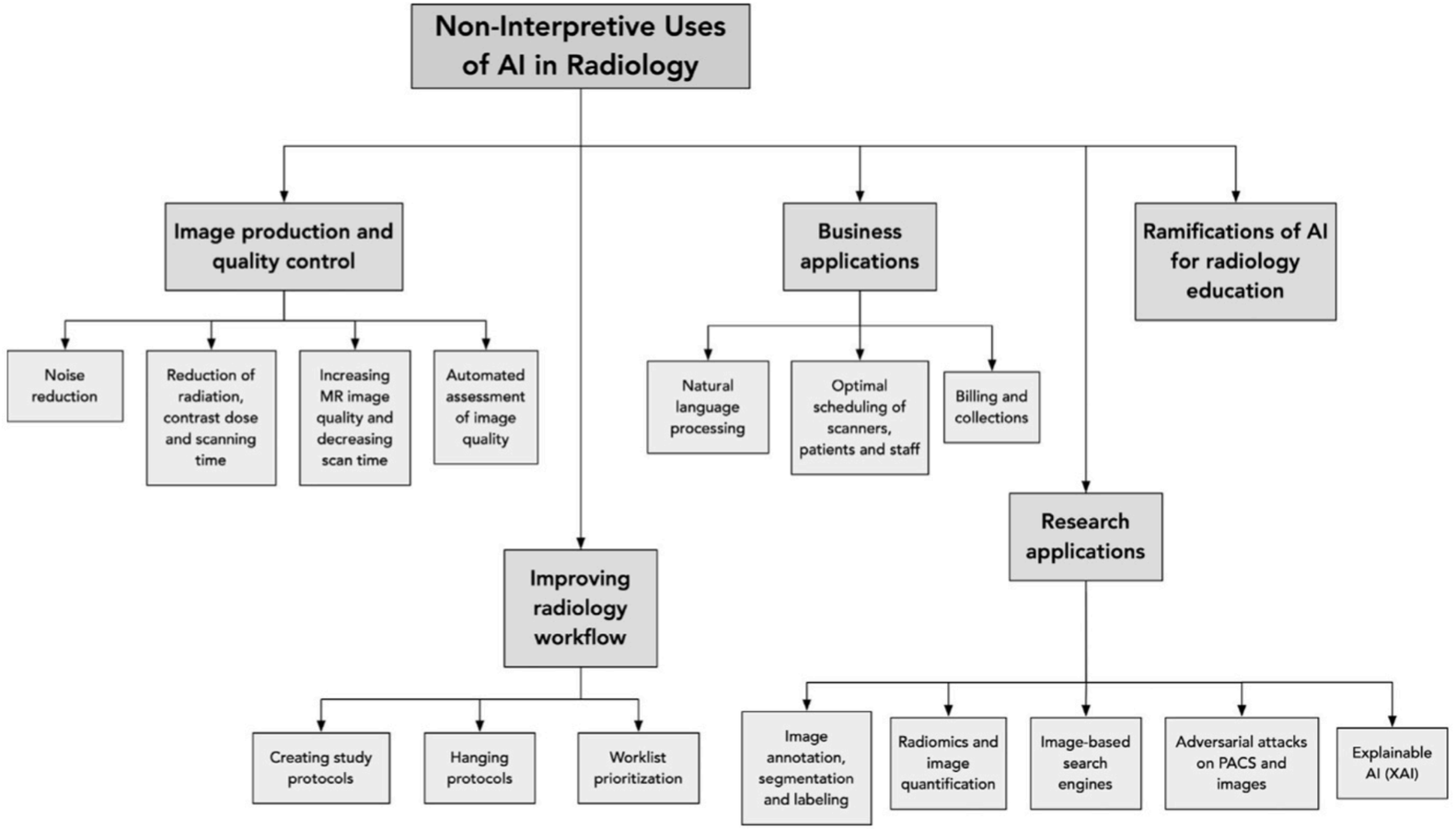

SABATO 20 MAGGIO 2023
VERSO IL NUOVO CODICE
DI DEONTOLOGIA MEDICA
Etica e bioetica nell'era dell'Intelligenza Artificiale in una nuova realtà professionale

APPLICAZIONI NON INTERPRETATIVE DELL'AI

Accademic Radiology, 2020

Original Investigation

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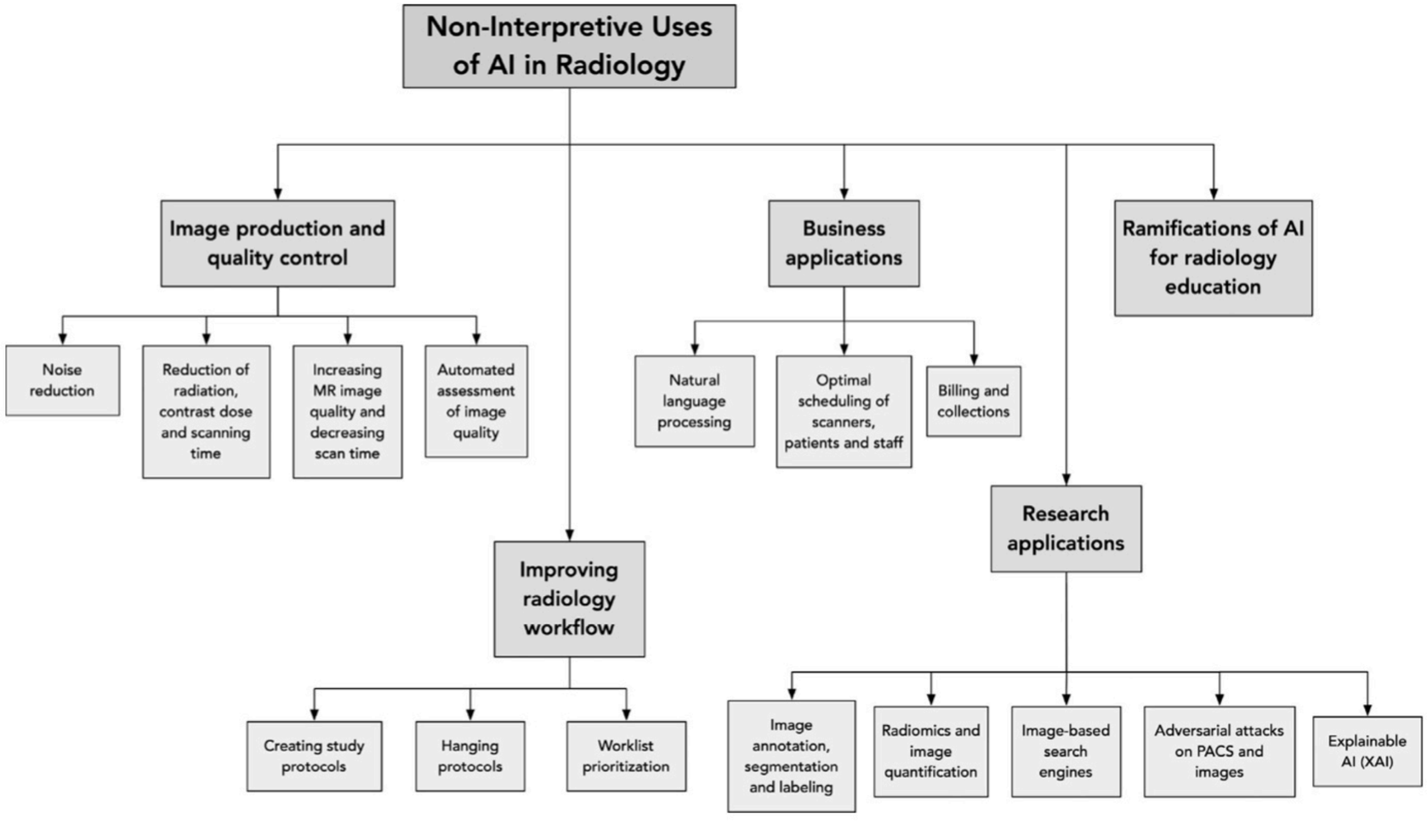


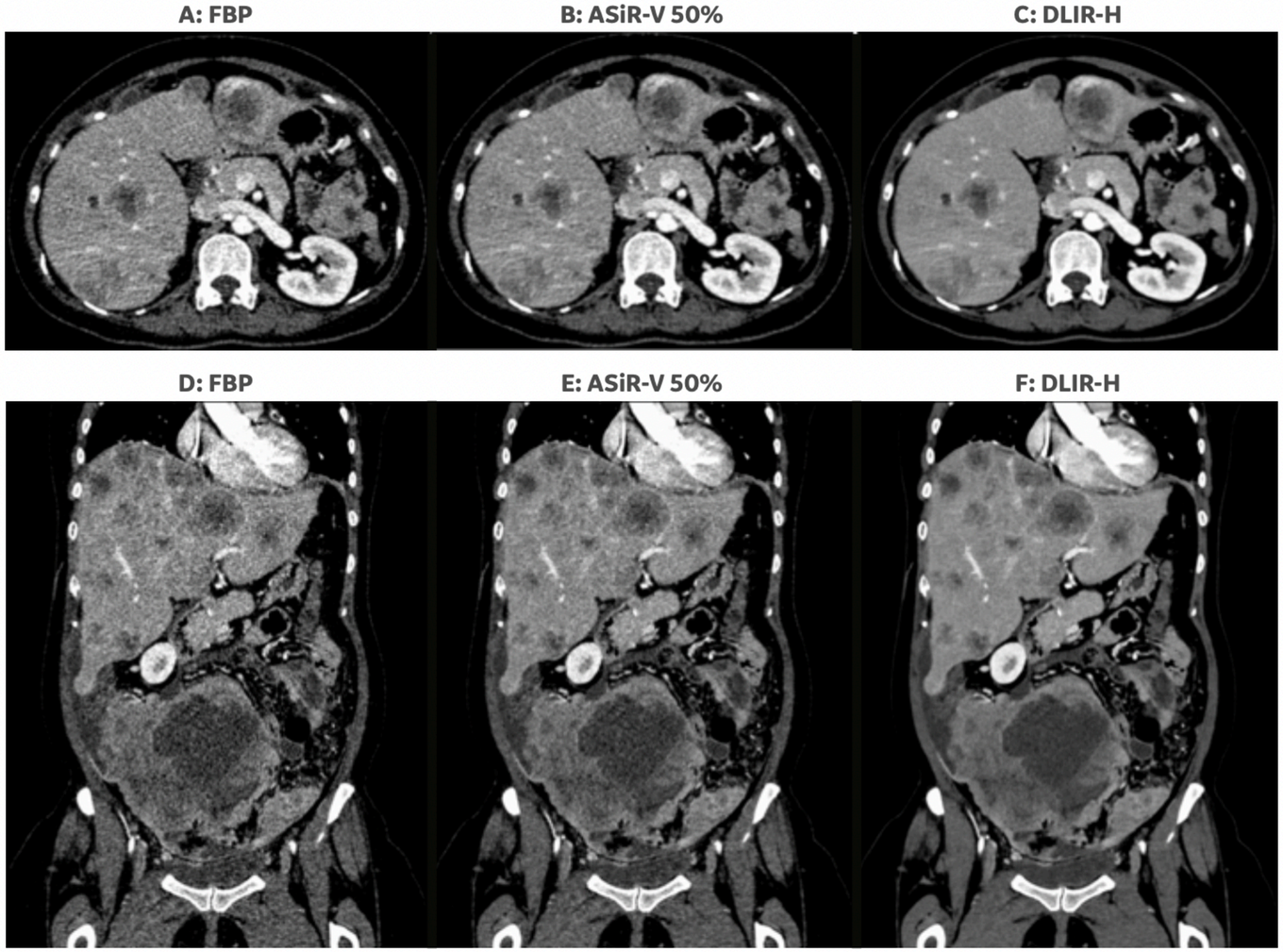
Imaging production and quality control

- Noise Reduction
- Reduction of Radiation, Contrast Dose, and Scanning Time
- Increasing MR Image Quality and Decreasing Scan Time
- Increasing MR Image Quality and Decreasing Scan Time
- Automated Assessment of Image Quality
- Hanging Protocols

SISTEMA SANITARIO REGIONALE

AZIENDA OSPEDALIERA
SAN CAMILLO FORLANINI

Scan type	Helical
Rotation time, s	0.5
Pitch	1.375
kV	120
mA	Smart mA
Slice, mm	0.625
Noise index	13
CTDIvol, mGy	6.7
DLP, mGy-cm	311
Eff. dose, mSv	4.7
k, *DLP	0.015



AI PER RIDUZIONE DELLA DOSE DI ESPOSIZIONE,

QUESTO PUO' VALERE PER FARMACI E TERAPIE SEMPRE PiU' PERSONALIZZATE

BUSINESS APPLICATIONS

- Natural languages processing
- Hanging Protocols
- Optimal Scheduling of Scanners, Patients, and Staff
- Billing and collection

SISTEMA SANITARIO R

AZIENDA (
SAN CAMIL

Using machine learning with dynamic exam block lengths to decrease patient wait time and optimize MRI schedule fill rate.

Michael C. Muelly[1], Paul B. Stoddard[1], and Shreyas S. Vasanwala[1]

[1]*Department of Radiology, Stanford University, Stanford, CA, United States*

Synopsis

MRI has advantages compared to other radiologic modalities in terms of tissue visualization, versatility, and lack of risks associated with ionizing radiation. However, cost of MRI is often the limiting factor favoring other modalities. Using historical scanner data and a Monte Carlo type discrete event simulation, we investigated how estimating exam length on the basis of patient demographics and dynamic block lengths affect mean patient wait times and schedule fill rate. In our simulation we are able to significantly lower mean patient wait times and optimize the schedule fill rate, which would theoretically result in lower cost per exam while enhancing patient satisfaction.

utilization and prospective determination of optimal time allocation per scan. The transition of the US healthcare system to electronic medical records systems, digitized radiology ordering, reporting, and image storage have created rich data sources that may be used by AI applications to address inefficiencies in utilization and scheduling [7] and to predict patient wait times and appointment delays [68].

One preliminary study developed a machine learning based approach using a feed-forward type of neural network to predict length of MRI exam based on patient demographics and exam type [67]. This algorithm created an optimized schedule simulation using dynamic slot lengths as compared to the traditional method of fixed slot lengths based only on MRI exam type. Using this method, the authors report decreased

Intelligenza artificiale organizza gli appuntamenti a seconda dell'età e del tipo di patologia per variare gli appuntamenti e regolare al meglio l'agenda

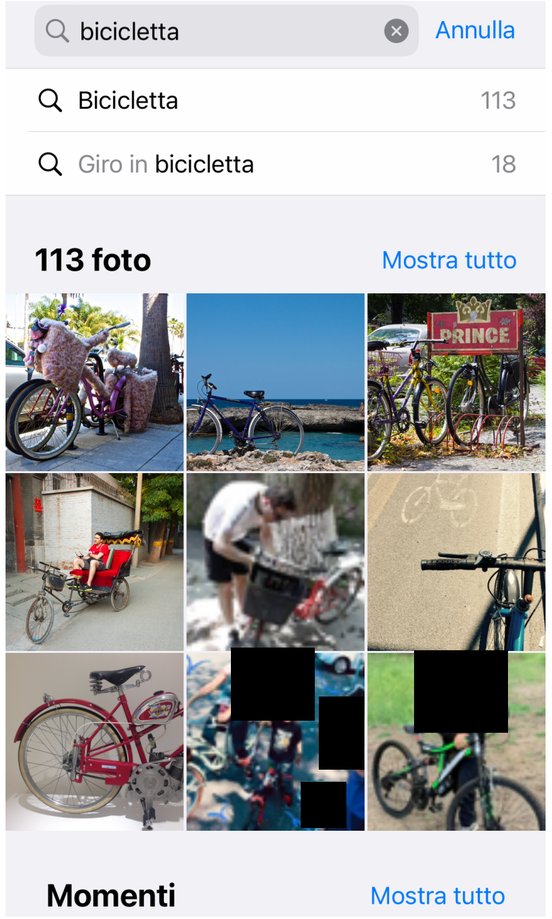
RESEARCH

Image Annotation, Segmentation, and Labeling

Radiomics and Image Quantification

Image-Based Search Engines

Explainable Artificial Intelligence

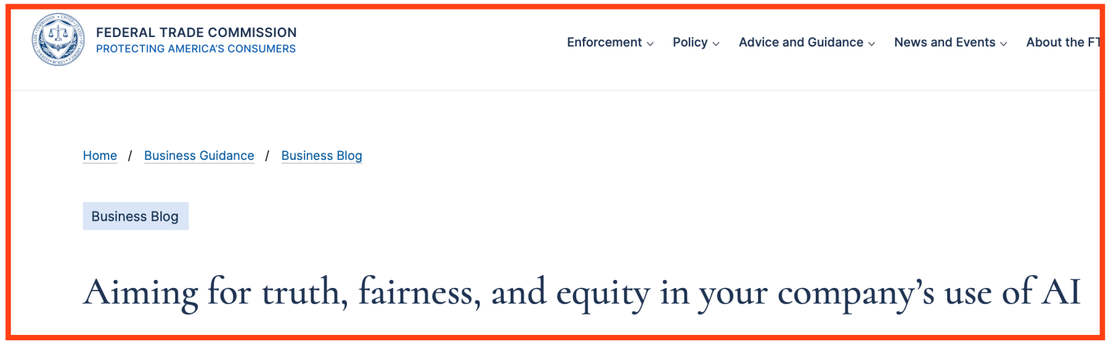


RAMIFICATIONS OF AI FOR RADIOLOGY EDUCATION

Business Blog

Keep your AI claims in check

By: Michael Atleson, Attorney, FTC Division of Advertising Practices February 27, 2023



Are you exaggerating what your AI product can do? Or even claiming it can do something beyond the current capability of any AI or automated technology? For example, we're not yet living in the realm of science fiction, where computers can generally make trustworthy predictions of human behavior. Your performance claims would be deceptive if they lack scientific support or if they apply only to certain types of users or under certain conditions.

Are you promising that your AI product does something better than a non-AI product? It's not uncommon for advertisers to say that some new-fangled technology makes their product better – perhaps to justify a higher price or influence labor decisions. You need adequate proof for that kind of comparative claim, too, and if such proof is impossible to get, then don't make the claim.

Are you aware of the risks? You need to know about the reasonably foreseeable risks and impact of your AI product before putting it on the market. If something goes wrong – maybe it fails or yields biased results – you can't just blame a third-party developer of the technology. And you can't say you're not responsible because that technology is a "black box" you can't understand or didn't know how to test.

Does the product actually use AI at all? If you think you can get away with baseless claims that your product is AI-enabled, think again. In an investigation, FTC technologists and others can look under the hood and analyze other materials to see if what's inside matches up with your claims. Before labeling your product as AI-powered, note also that merely using an AI tool in the development process is not the same as a product having AI in it.

FEDERAL TRADE COMMISSION
PROTECTING AMERICA'S CONSUMERS

Aiming for truth, fairness, and equity in your company's use of AI

Start with the right foundation. With its mysterious jargon (think: "machine learning," "neural networks," and "deep learning") and enormous data-crunching power, AI can seem almost magical. But there's nothing mystical about the right starting point for AI: a solid foundation. If a data set is missing information from particular populations, using that data to build an AI model may yield results that are unfair or inequitable to legally protected groups. From the start, think about ways to improve your data set, design your model to account for data gaps, and – in light of any shortcomings – limit where or how you use the model.

Watch out for discriminatory outcomes. Every year, the FTC holds PrivacyCon, a showcase for cutting-edge developments in privacy, data security, and artificial intelligence. During PrivacyCon 2020, researchers presented work showing that algorithms developed for benign purposes like healthcare resource allocation and advertising actually resulted in racial bias. How can you reduce the risk of your company becoming the example of a business whose well-intentioned algorithm perpetuates racial inequity? It's essential to test your algorithm – both before you use it and periodically after that – to make sure that it doesn't discriminate on the basis of race, gender, or other protected class.

Embrace transparency and independence. Who discovered the racial bias in the healthcare algorithm described at PrivacyCon 2020 and later published in Science? Independent researchers spotted it by examining data provided by a large academic hospital. In other words, it was due to the transparency of that hospital and the independence of the researchers that the bias came to light. As your company develops and uses AI, think about ways to embrace transparency and independence – for example, by using transparency frameworks and independent standards, by conducting and publishing the results of independent audits, and by opening your data or source code to outside inspection.

Don't exaggerate what your algorithm can do or whether it can deliver fair or unbiased results. Under the FTC Act, your statements to business customers and consumers alike must be truthful, non-deceptive, and backed up by evidence. In a rush to embrace new technology, be careful not to overpromise what your algorithm can deliver. For example, let's say an AI developer tells clients that its product will provide "100% unbiased hiring decisions," but the algorithm was built with data that lacked racial or gender diversity. The result may be deception, discrimination – and an FTC law enforcement action.

Tell the truth about how you use data. In our guidance on AI last year, we advised businesses to be careful about how they get the data that powers their model. We noted the FTC's complaint against Facebook, which alleged that the social media giant misled consumers by telling them they could opt in to the company's facial recognition algorithm, when in fact Facebook was using their photos by default. The FTC's recent action against app developer Everalbum reinforces that point. According to the complaint, Everalbum used photos uploaded by app users to train its facial recognition algorithm. The FTC alleged that the company deceived users about their ability to control the app's facial recognition feature and made misrepresentations about users' ability delete their photos and videos upon account deactivation. To deter future violations, the proposed order requires the company to delete not only the ill-gotten data, but also the facial recognition models or algorithms developed with users' photos or videos.

Do more good than harm. To put it in the simplest terms, under the FTC Act, a practice is unfair if it causes more harm than good. Let's say your algorithm will allow a company to target consumers most interested in buying their product. Seems like a straightforward benefit, right? But let's say the model pinpoints those consumers by considering race, color, religion, and sex – and the result is digital redlining (similar to the Department of Housing and Urban Development's case against Facebook in 2019). If your model causes more harm than good – that is, in Section 5 parlance, if it causes or is likely to cause substantial injury to

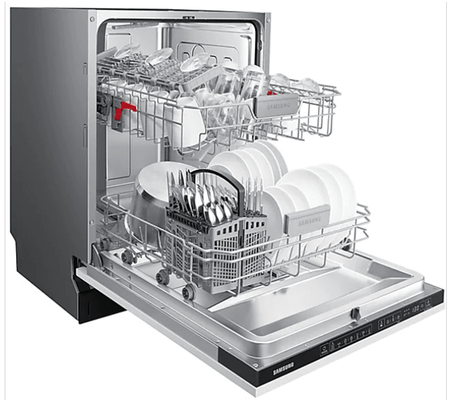
SISTEMA SANITARIO

AZIENDA SAN CAM

INTEGRAZIONE UOMO MACCHINA ED INTELLIGENZA ARTIFICIALE

"Homo ad duas res, ad intellegendum et ad agendum, natus est" (Cicerone)
L'uomo è nato per due cose per capire ed agire

Distinguere l'agire artificiale e l'intelligenza artificiale.
Chiamiamo intelligenti i software che sono nati per eseguire al meglio azioni complesse in poco tempo e meglio dell'uomo ma è difficile dire che essi possano pensare e quindi intellegere



La lavastoviglie fa meglio di un uomo il compito (agere)?
Si ovviamente, ma nessuno la reputa intelligente (intelligere)

- Per fare questo abbiamo dovuto crearle un ambiente idoneo attorno, una struttura fisica. Nessuno si è mai sognato di creare un robot semiumano che pulisca i piatti come un uomo
- E allora perché dovremmo creare dei software che sostituiscano i medici?

ASPETTI ETICI

Chi ha la responsabilità civile dell'intelligenza artificiale?

- Il sistema intelligente potrebbe sbagliare (sistemi predittivi in ambito bancario che provocano minicrisi)

- Dalla decisione può derivare un danno (macchina a guida autonoma se un pedone passa con il rosso che deve fare tutelare l'incolumità del guidatore o del pedone???)

https://www.moralmachine.net/

LIVELLI DI AUTOMATIZZAZIONE

Livello 0 – nessuna autonomia:
il conducente si deve occupare di ogni singolo aspetto della guida del veicolo.

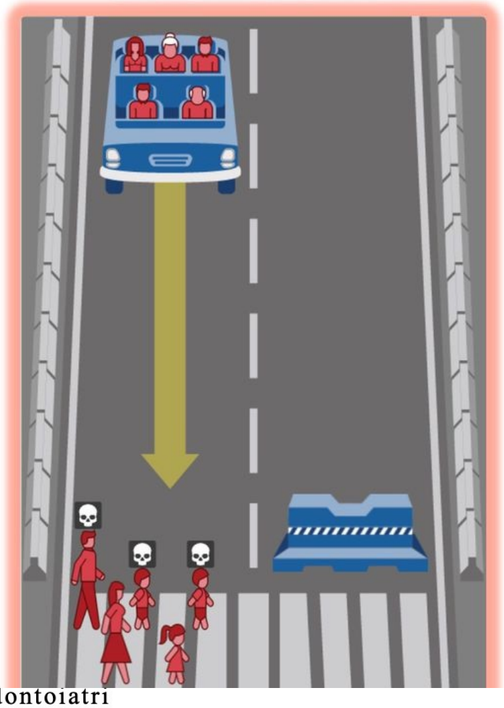
Livello 1 – assistenza alla guida:
l'automobile regola la velocità (Tempomat) oppure è equipaggiata con un sistema di assistenza al mantenimento della corsia; il conducente si deve occupare di ogni ulteriore aspetto della guida. Il conducente deve sorvegliare tutto e, se necessario, riprendere il controllo del mezzo.

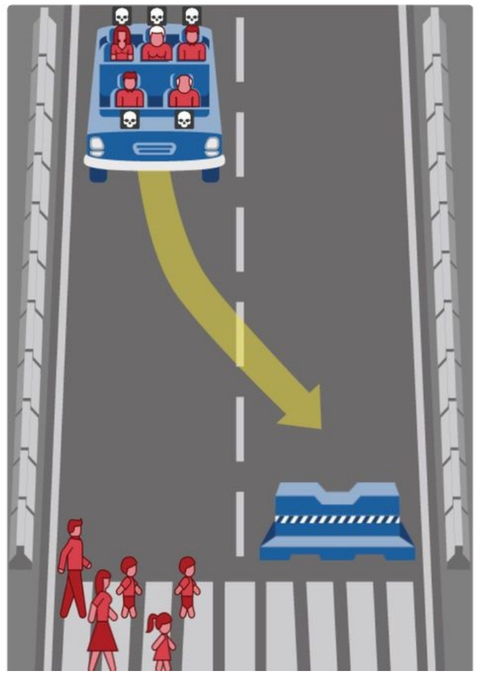
Livello 2 – automazione parziale:
per determinati lassi di tempo o in determinate situazioni (ad es. durante i sorpassi in autostrada), l'auto sterza e regola la velocità, autonomamente. Il conducente, però, deve sempre essere pronto a riprendere i comandi del veicolo.

Livello 3 – automazione condizionata:
anche nel terzo livello, accelerazione/frenata e comandi direzionali (sterzo) sono lasciati al veicolo. Tuttavia, sebbene il conducente non sia tenuto a monitorare di continuo il sistema, deve essere in grado di riprendere i comandi in caso di richiesta del sistema (ad es. in caso di nebbia).

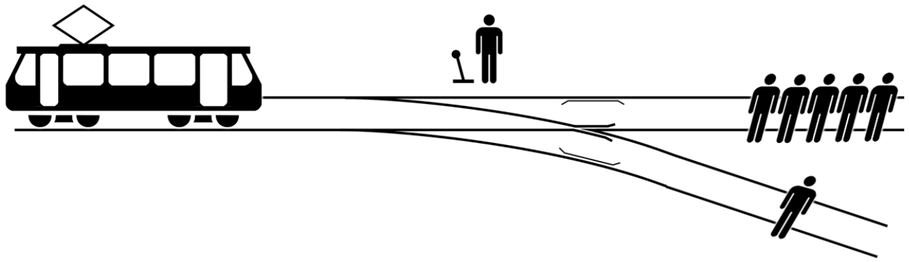
Livello 4 – elevata automazione:
l'automobile assume completamente e svolge autonomamente determinate applicazioni (ad es. guida in autostrada). Soltanto alla fine dell'applicazione (ad es. all'uscita autostradale) il conducente deve riprendere i comandi dell'auto.

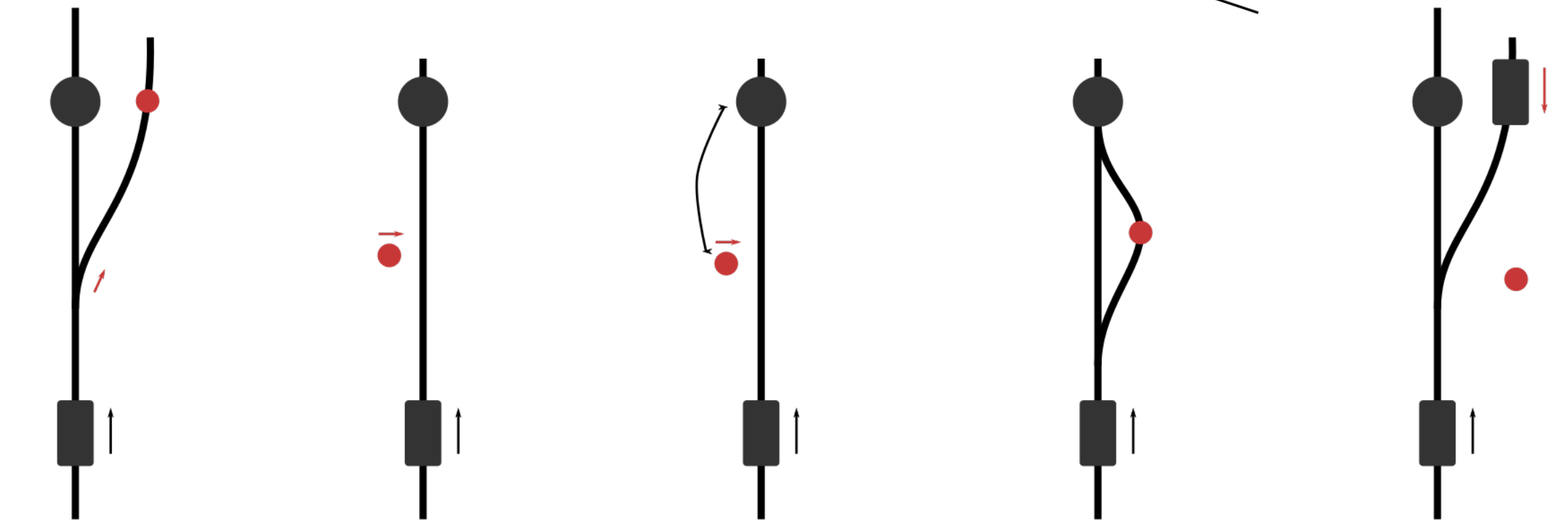
Livello 5 – completa automazione:
il sistema rileva tutti i compiti, dalla partenza all'arrivo a destinazione. Il conducente non è più necessario, a prescindere se nevichi, piova, ci sia nebbia o un cantiere che restringe la carreggiata.





il dilemma del carrello





the switch
Foot, 1967

the fat man
Thomson, 1976

the fat villain

the loop
Costa, 1987

the man in the yard
Unger, 1992

Nel 2001 il neuroscienziato e filosofo Joshua Greene di Harvard, avendo constatato che la maggior parte delle persone considera una scelta morale deviare il carrello verso una sola persona, mentre spingere una persona sulle rotaie un omicidio, tramite scansione cerebrale ha constatato che nelle due situazioni si attivano aree cerebrali distinte, e ha chiamato le due situazioni decisione morale impersonale e decisione morale personale.

INTERAZIONE COMPUTER-UMANO CHE NON FUNZIONA

PILOTA AUTOMATICO IN AVIAZIONE

Piuttosto di ridurre il loro coinvolgimento, molti piloti rilevano che l'automazione ne ha accresciuto il coinvolgimento ed il carico di lavoro soprattutto nelle fasi più delicate di atterraggio e decollo.

"Non fu errore umano, il software era difettoso": così è caduto il Boeing

Il ministro etiope del Trasporti ha anticipato i risultati delle indagini preliminari sull'incidente: "I piloti hanno lottato fino all'ultimo"

Lo schianto del volo dell'Ethiopian Airlines, nel quale hanno perso la vita 157 persone, non è stato causato da un errore umano.

Secondo il rapporto preliminare sulle **cause dell'incidente** del volo 302, i piloti "hanno ripetutamente attuato le procedure raccomandate da Boeing, ma non sono riusciti a controllare il velivolo", che è precipitato al suolo, vicino ad Addis Abeba, solamente sei minuti dopo il decollo.

Il ministro dei Trasporti etiope, Dagmawit Moges, ha dichiarato che "non si è trattato di un errore umano, bensì di un difetto di software". L'attenzione torna quindi sul **sistema anti-stallo**, già sotto la lente di ingrandimento degli inquirenti e delle Nazioni, che poco dopo lo schianto avevano lasciato a terra tutti i **Boeing 737 Max 8**, perché dotati dello stesso sistema di volo, che già in precedenza aveva causato un incidente aereo. Secondo la prima ricostruzione,"il pilota ha tentato varie volte di disattivare il controllo automatico del volo, che ha spinto l'aereo in picchiata pochi minuti dopo il decollo" e ha fatto "diversi tentativi di riprendere il controllo del velivolo". Ma l'attivazione di **picchiata**, avvenuta in automatico, non ha lasciato scampo.

SISTEMA SANITARIO REGIONALE

AZIENDA OSPEDALIERA
SAN CAMILLO FORLANINI

INTERAZIONE COMPUTER-UMANO CHE FUNZIONA

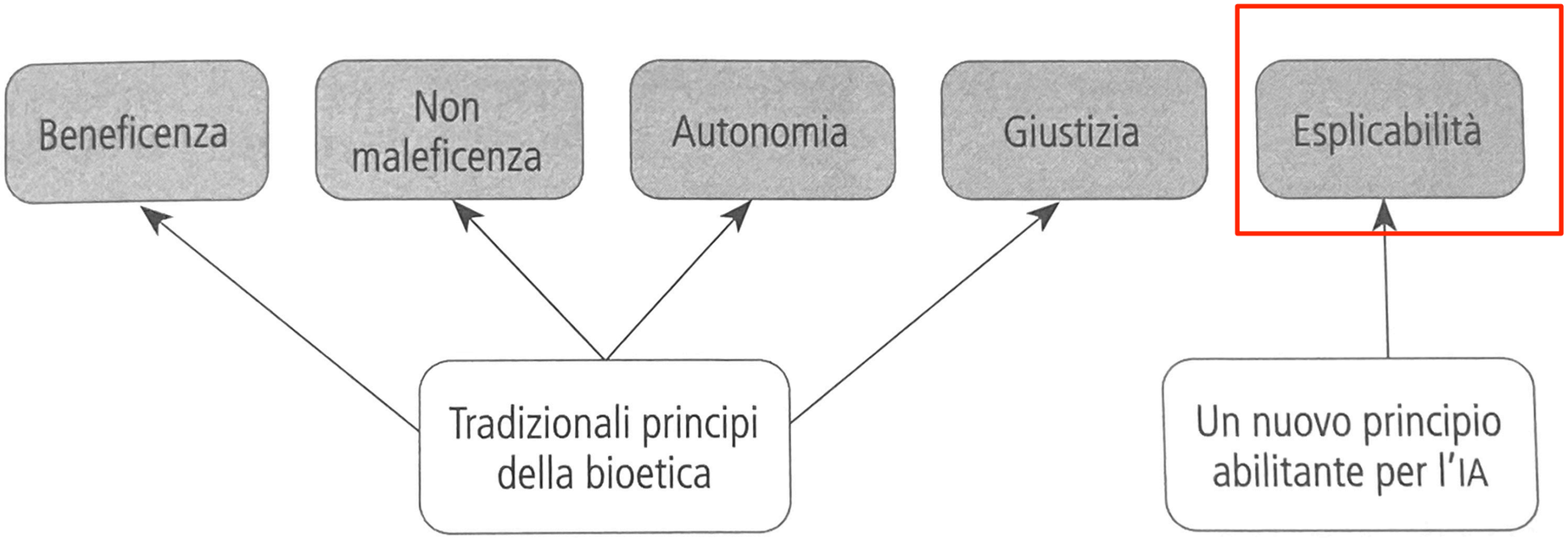
On January 15, 2009, Captain Chesley “Sully” Sullenberger landed an Airbus A320-214 in New York’s freezing Hudson River following a bird strike-induced loss of both engines. All 155 passengers and crew on board US Airways Flight 1549 survived.

Why the ‘Miracle on the Hudson’ in Sully was No Crash Landing

by The Conversation | Jul 18, 2017 | The Conversation

The real miracle

The miracle was enabled because of an optimal system response comprising many human and non-human parts. As is always the case in such recoveries, the human element was central in holding the system together.


Beneficenza
Non maleficenza
Autonomia
Giustizia
Esplicabilità
Tradizionali principi della bioetica
Un nuovo principio abilitante per l'IA


Luciano Floridi
Etica dell'intelligenza artificiale
Sviluppi, opportunità, sfide
Raffaello Cortina Editore
Scienza e Idee
Collana fondata da Giulio Giorello


SABATO 20 MAGGIO 2023
VERSO IL NUOVO CODICE
DI DEONTOLOGIA MEDICA
Etica e bioetica nell'era dell'Intelligenza Artificiale in una nuova realtà professionale

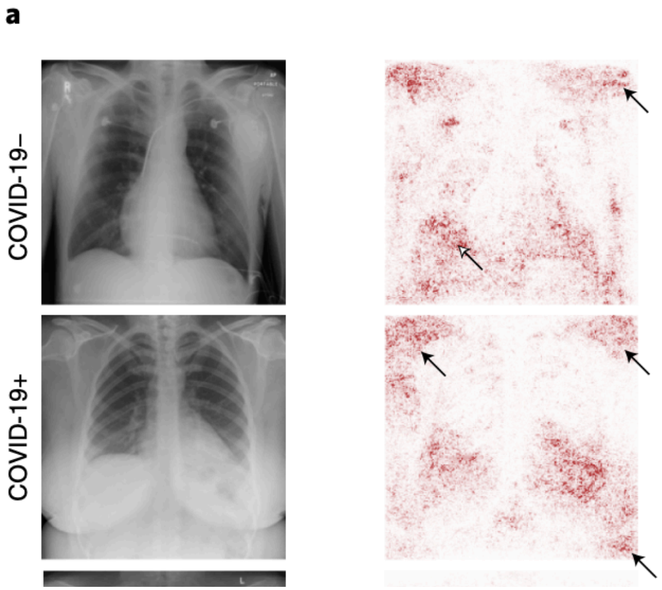
ESPLICABILITA': IL PROBLEMA DELLA BLACK BOX

ARTICLES
https://doi.org/10.1038/s42256-021-00338-7
nature machine intelligence
Check for updates

AI for radiographic COVID-19 detection selects shortcuts over signal

Alex J. DeGrave[1,2,3], Joseph D. Janizek[1,2,3] and Su-In Lee[1]✉

Il sistema aveva avuto un addestramento con immagini radiografiche da diversi siti che presentavano lettere R o L diverse nei vari ospedali
Il sistema ha correlato una particolare forma della lettera con la possibilità di avere il covid non basandosi più sulla immagine radiografica ma sulla posizione e morfologia della lettera
Questo è il tipico problema del black box
La soluzione è stata mostrare delle mappe che riporta quale parte dell'immagine il sistema utilizza per la diagnosi



La radiologia medica (2020) 125:517–521
https://doi.org/10.1007/s11547-020-01135-9

EDITORIAL

Artificial intelligence: Who is responsible for the diagnosis?

Emanuele Neri[1] · Francesca Coppola[2] · Vittorio Miele[3] · Corrado Bibbolino[4] · Roberto Grassi[5]

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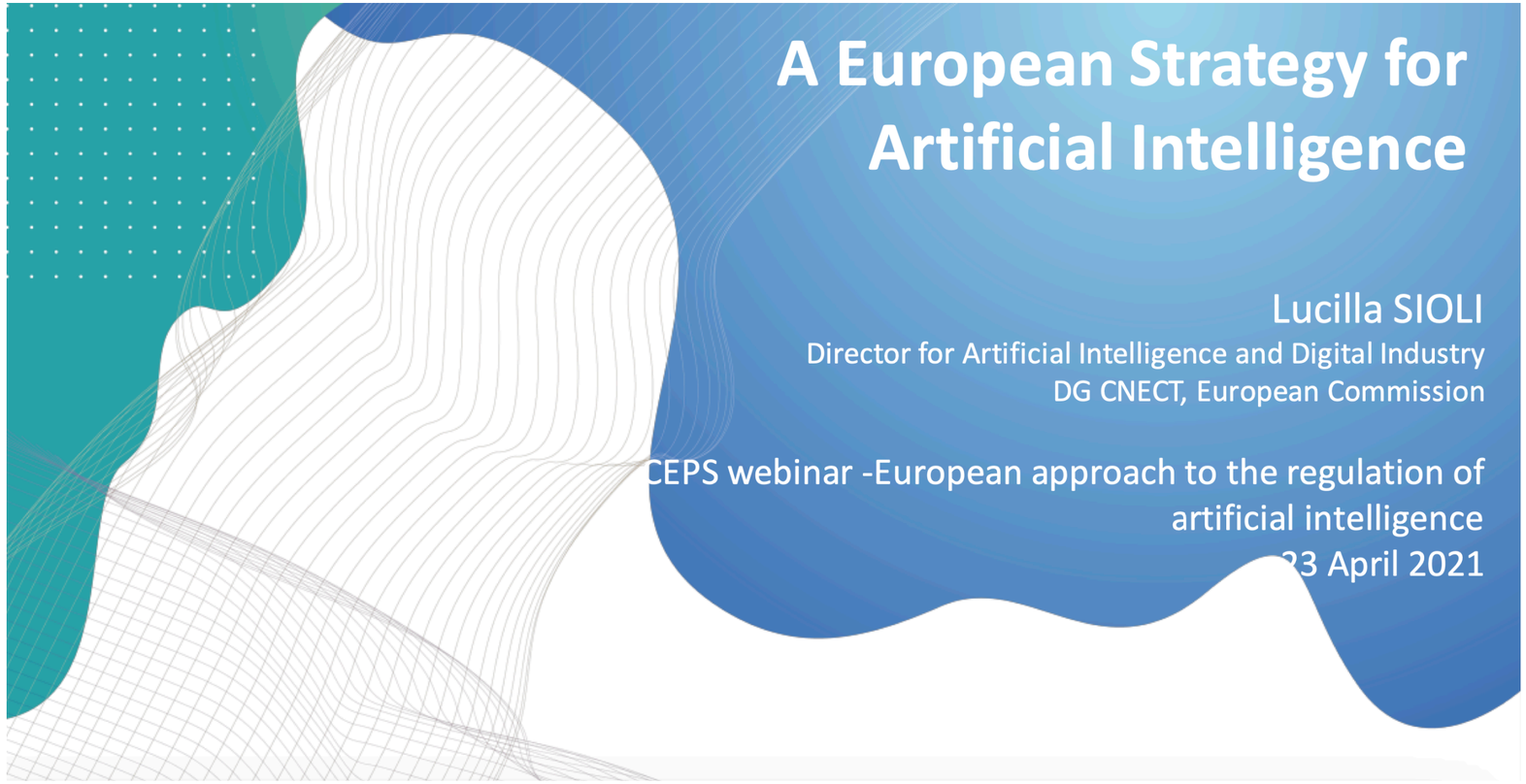
Key point 1 Using AI the radiologist is responsible for the diagnosis.
Key point 2 Radiologists must be trained on the use of AI since they are responsible for the actions of machines
Key point 3 Radiologists involved in R&D have the responsibility to guide the respect of rules for a trustworthy AI.
Key point 4 Radiologist responsibility is at risk of validating the unknown (black box).
Key point 5 Radiologist decision may be biased by the AI automation.
Key point 6 Risk of a paradox: increasing AI tools to compensate the lack of radiologists.
Key point 7 Need for informed consent and quality measures.

CODICE DEONTOLOGICO: Qualunque strumento automatico o semiautomatico di diagnosi o cura deve obbligatoriamente spiegare come ragiona e come è arrivato a quella diagnosi

What is the EU AI Act?

The AI Act is a proposed European law on artificial intelligence (AI) – the first law on AI by a major regulator anywhere. The law assigns applications of AI to three risk categories. First, applications and systems that create an **unacceptable risk**, such as government-run social scoring of the type used in China, are banned. Second, **high-risk applications**, such as a CV-scanning tool that ranks job applicants, are subject to specific legal requirements. Lastly, applications not explicitly banned or listed as high-risk are largely left unregulated.



AI is good …

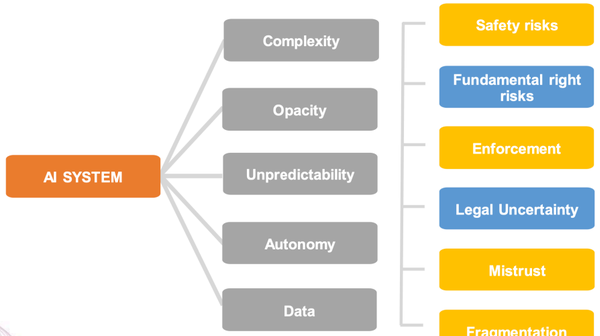
- For citizens
- For business
- For the public interest

… but creates some risks

- For the safety of consumers and users
- For fundamental rights

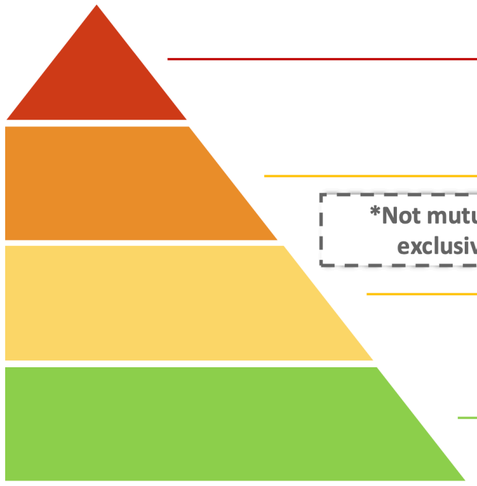
European Commission

Why do we regulate AI use cases?



European Commission

A risk-based approach to regulation



Unacceptable risk
e.g. social scoring
— **Prohibited**

High risk
e.g. recruitment, medical devices
— **Permitted** subject to compliance with AI requirements and ex-ante conformity assessment

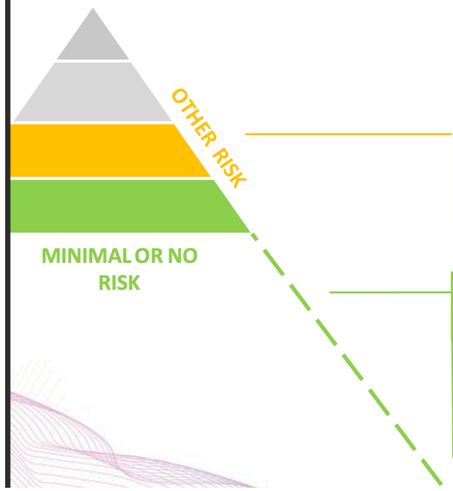
*Not mutually exclusive

AI with specific transparency obligations
'Impersonation' (bots)
— **Permitted** but subject to information/transparency Obligations

Minimal or no risk
— **Permitted** with no restrictions

European Commission

Most AI systems will not be high-risk (Titles IV, IX)

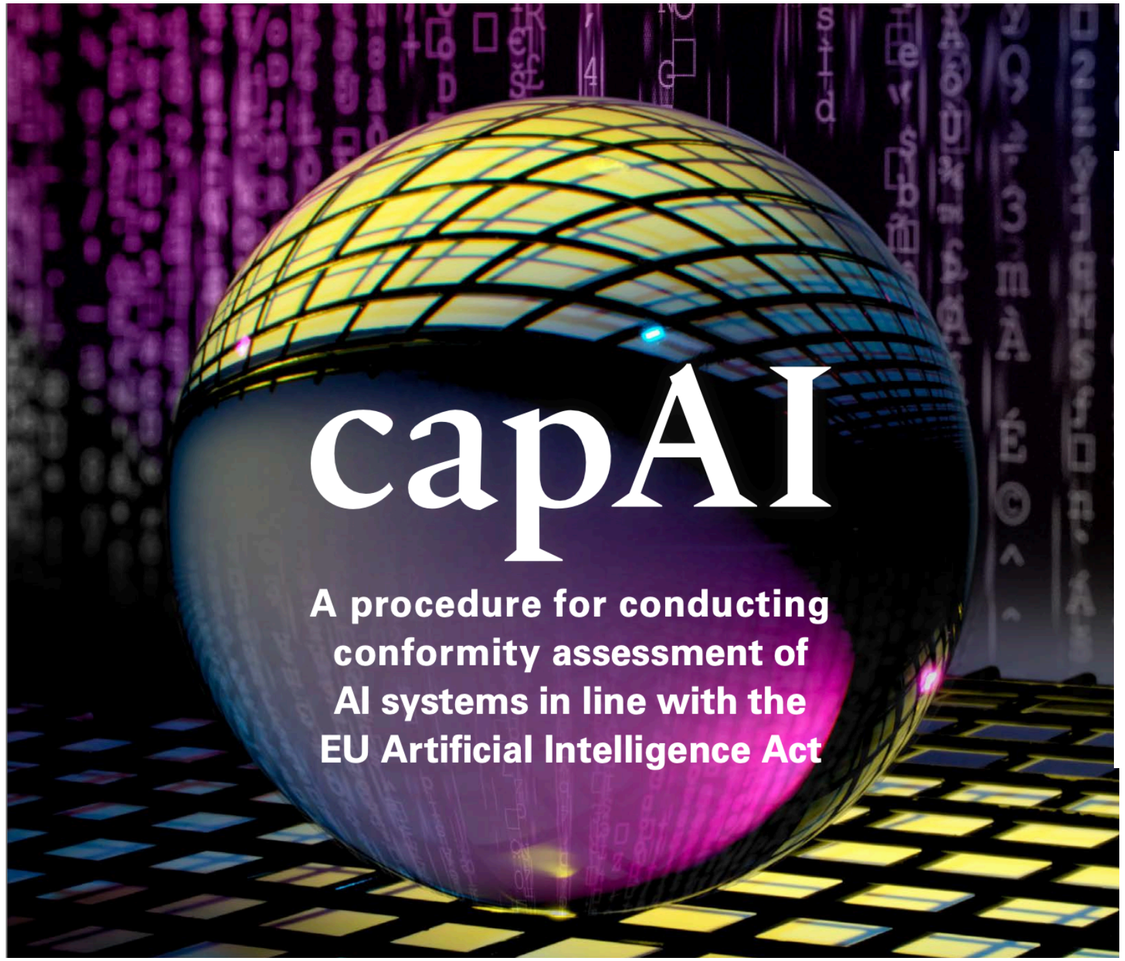


New transparency obligations for certain AI systems (Art. 52)

- **Notify humans** that they are **interacting with an AI system** unless this is evident
- Notify humans that emotional recognition or biometric categorisation systems are applied to them
- Apply **label to deep fakes** (unless necessary for the exercise of a fundamental right or freedom or for reasons of public interests)

Possible voluntary codes of conduct for AI with specific transparency requirements (Art. 69)

- No mandatory obligations
- Commission and Board to encourage drawing up of codes of conduct intended to foster the **voluntary application of requirements to low-risk AI systems**



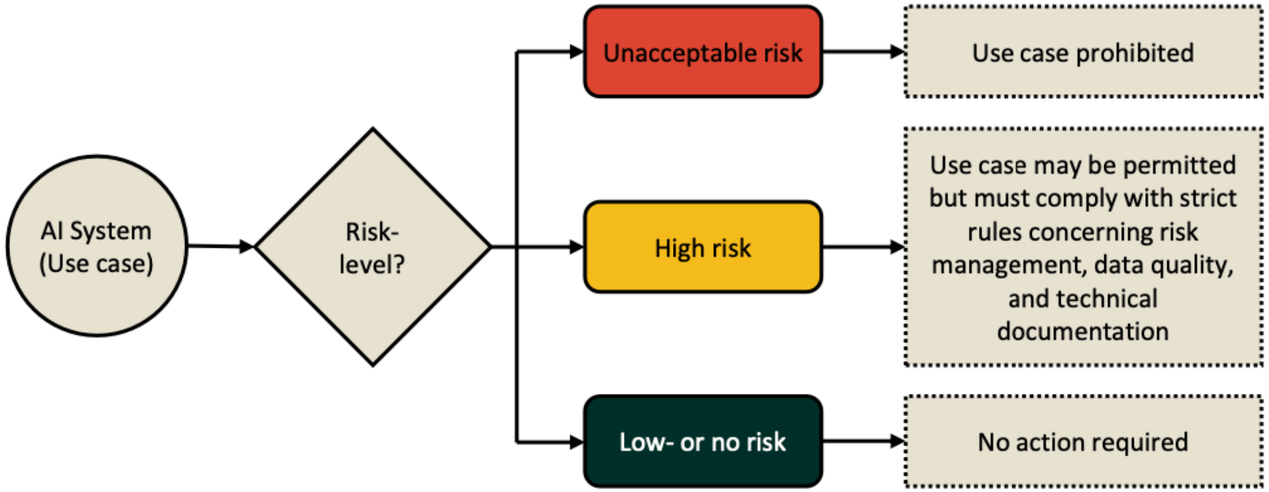


Figure 1: Risk categories for AI use cases under the AIA [14]

- **Prohibited practices denote the highest risk category, and these systems are banned outright. These include:**

- **Real-time biometric systems** that can be used for any type of surveillance, although exceptions do apply here for crime prevention and criminal investigations in law enforcement and national security contexts.
- **Social scoring algorithms** that can be used to evaluate individuals based on personal characteristics and/or their behaviour in a manner that could cause harm or lead to unfavourable treatment of that individual.
- **Manipulative systems** that exploit the vulnerabilities of specific individuals to distort their behaviour in a manner that is likely to cause physical or psychological harm.

- **High-risk AI systems, listed in Annex III and likely to constitute the majority of AI systems. These include:**

Biometric identification and categorisation of natural persons, to the extent these do not fall under the aforementioned prohibited practices.

- **Management and operation of critical infrastructures**, such as AI systems used in safety-relevant components of the management of utilities and traffic.
- **Education and vocational training,** such as AI systems used to assess students in educational settings, or assign people to training offerings.
- **Employment and worker management,** such as AI systems used for the recruitment or assessment of employees, including questions such as promotion, performance management and termination.
- **Access to essential services**, such as AI systems that govern the access to private and public sector services and related actions, including the assessment of creditworthiness, credit scoring, or establishing the order of priority of access to such services. (Note: this aspect applies particularly to AI systems used in the financial services sector).
- **Law enforcement**, which includes a broad range of AI systems used, among other things, to assess the risk of any individual committing an offence, or of re-offending; predicting the likelihood of criminal offences (e.g., predictive policing and profiling), as well as the detection and investigation of fraudulent content;
- **Border control management**, including AI systems used for the control and management of borders, migration and asylum processes, such as validating travel documents and assessing the eligibility for asylum.
- **Administration of justice and democratic processes**, including any AI system used to assist in the judicial process by assessing and interpreting facts, and/or making legal recommendations in response to facts.

Low-risk AI systems, which include systems that neither use personal data nor make predictions that are likely to affect any individual directly or indirectly, like industrial applications in predictive maintenance.

- **Embedded AI systems**, which are components of products or services covered under other EU regulations, such as for toys or medical devices. While these systems do not fall under the AIA, they will still have to be compliant with the requirements set out in the AIA under the harmonisation directive**.**

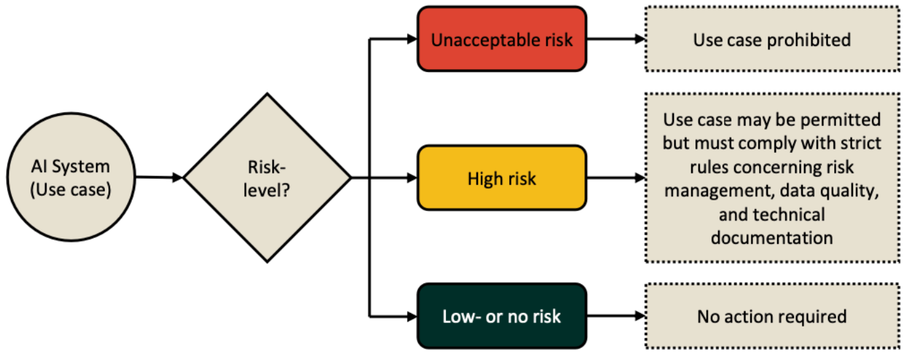


Figure 1: Risk categories for AI use cases under the AIA [14]

SISTEMA SANITARIO REGIONALE

AZIENDA OSPEDALIERA
SAN CAMILLO FORLANINI

Le Intelligenze Artificiali “bevono” tantissimo. Per addestrare ChatGPT sono serviti 3,5 milioni di litri d'acqua

di Sergio Donato - 12/04/2023

È la somma di quanta acqua è stata necessaria per raffreddare il data center mentre addestrava il chatbot e di quella direttamente connessa al funzionamento dell’impianto.

LUCA ZORLONI IL BRACCIO DI FERRO 31.03.2023

Il Garante della privacy blocca ChatGPT in Italia

L'Autorità garante per la protezione dei dati personali ha disposto lo stop del chatbot. Al centro dello scontro l'uso delle informazioni per addestrare l'algoritmo

È la ragione per cui, anche nel caso di GPT-4, si continua a parlare di ***“pappagalli stocastici”***: termine ideato dalla ricercatrice **Timnit Gebru** con il quale si sottolinea la totale mancanza di genuina comprensione da parte di questi modelli, che si limitano invece a **individuare schemi verbali ricorrenti** nel loro database e a ripeterli (sempre Timbit Gebru, peraltro citata nella lettera, ha scritto un interessante e feroce critica della stessa su Twitter)

Servizio | Diritto alla riservatezza

Intelligenza artificiale, il Garante della privacy blocca ChatGPT

Rilevata una raccolta illecita di dati personali e l'assenza di sistemi per la verifica dell'età dei minori

31 marzo 2023

ANDREA DANIELE SIGNORELLI IL CASO 30.03.2023

Perché la lettera per sospendere lo sviluppo dell’intelligenza artificiale è tutta sbagliata

Invece di concentrarci sulle concrete problematiche poste dall’intelligenza artificiale preferiamo dare retta alle chiacchiere fantascientifiche di un gruppo di tecno-miliardari ossessionati dalle loro stesse fantasie nerd

FNOMCeO Federazione Nazionale degli Ordini dei Medici Chirurghi e degli Odontoiatri

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IL PAZIENTE DEVE ESSERE AL CENTRO DELL'EVOLUZIONE TECNOLOGICA

Stephen Hawking, collegato al web summit di Lisbona del 2017, ha sollevato la questione dicendo che "*Le nostre Intelligenze Artificiali devono fare quel che vogliamo che facciano"*, sostenendo che non possiamo ancora prevedere che cosa davvero sarà possibile quando la mente umana sarà amplificata dall'Intelligenza Artificiale, ma che non possiamo ignorare che vi siano anche dei pericoli e il modo migliore di fronteggiarli è quello di identificarli e non ignorare il fatto che le nostre vite verranno trasformate.

Seguendo il ragionamento di Hawking, il vero "potere" sarà la conoscenza approfondita di questo fenomeno. È importante ricordare che *«Ci si preoccupa delle macchine che si umanizzano, ma il vero problema oggi sono i medici che sono diventati delle macchine»*

SISTEMA SANITARIO REGIONALE

AZIENDA OSPEDALIERA
SAN CAMILLO FORLANINI

VERSO IL NUOVO CODICE DI DEONTOLOGIA MEDICA

Etica e bioetica nell'era dell'Intelligenza Artificiale in una nuova realtà professionale

NUOVE TECNOLOGIE ED INTELLIGENZA ARTIFICIALE, L'IMPATTO SUL PERCORSO CLINICO-DIAGNOSTICO E SUL RAPPORTO CON IL PAZIENTE

Dott. Riccardo Ferrari

Radiodiagnostica Emergenza Urgenza
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Consigliere della sez. di studio Radiodiagnostica Urgenza della SIRM
Membro della commissione Intelligenza artificiale in Radiodiagnostica della SIRM
Consigliere radiodiagnostica Sindacato Nazionale Radiologi