

AI en de medisch specialist van de toekomst

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donderdag 28 maart 2024

17e landelijke themadag Radiotherapie



Artificiële Intelligentie: klinische ervaringen en wat brengt de toekomst?

AI voor detectie - classificatie

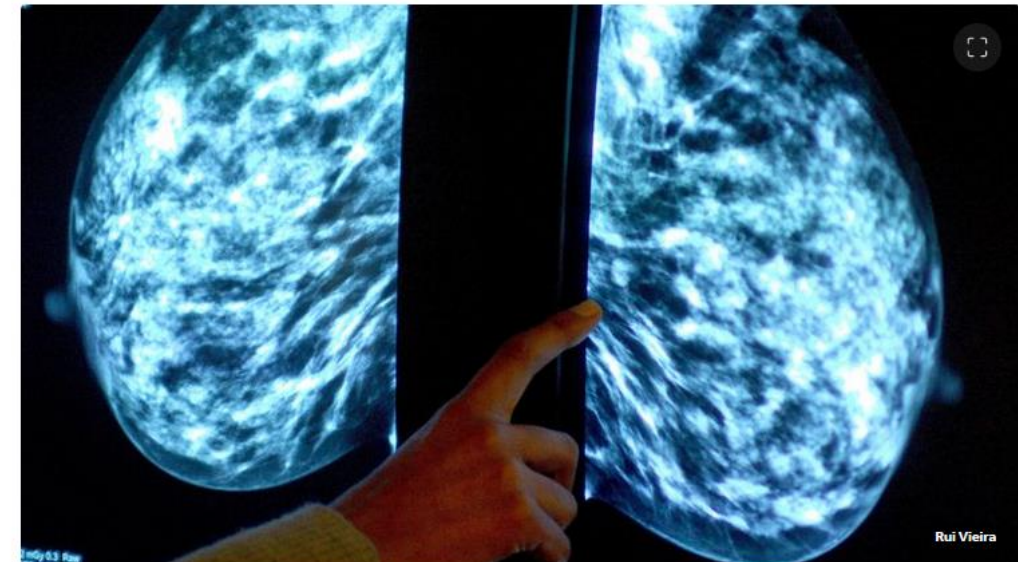
Kunstmatige intelligentie

AI helpt bij opsporen van darmkanker

22 februari 2024 09:13 • Aangepast 22 februari 2024 09:14



Kunstmatige intelligentie (AI) kan artsen in de toekomst gaan helpen bij het opsporen van darmkanker. Dat blijkt uit een internationale studie waar onder andere het Radboudumc in Nijmegen aan meewerkte. In 2022 overleden in Nederland bijna 4500 mensen aan darmkanker.

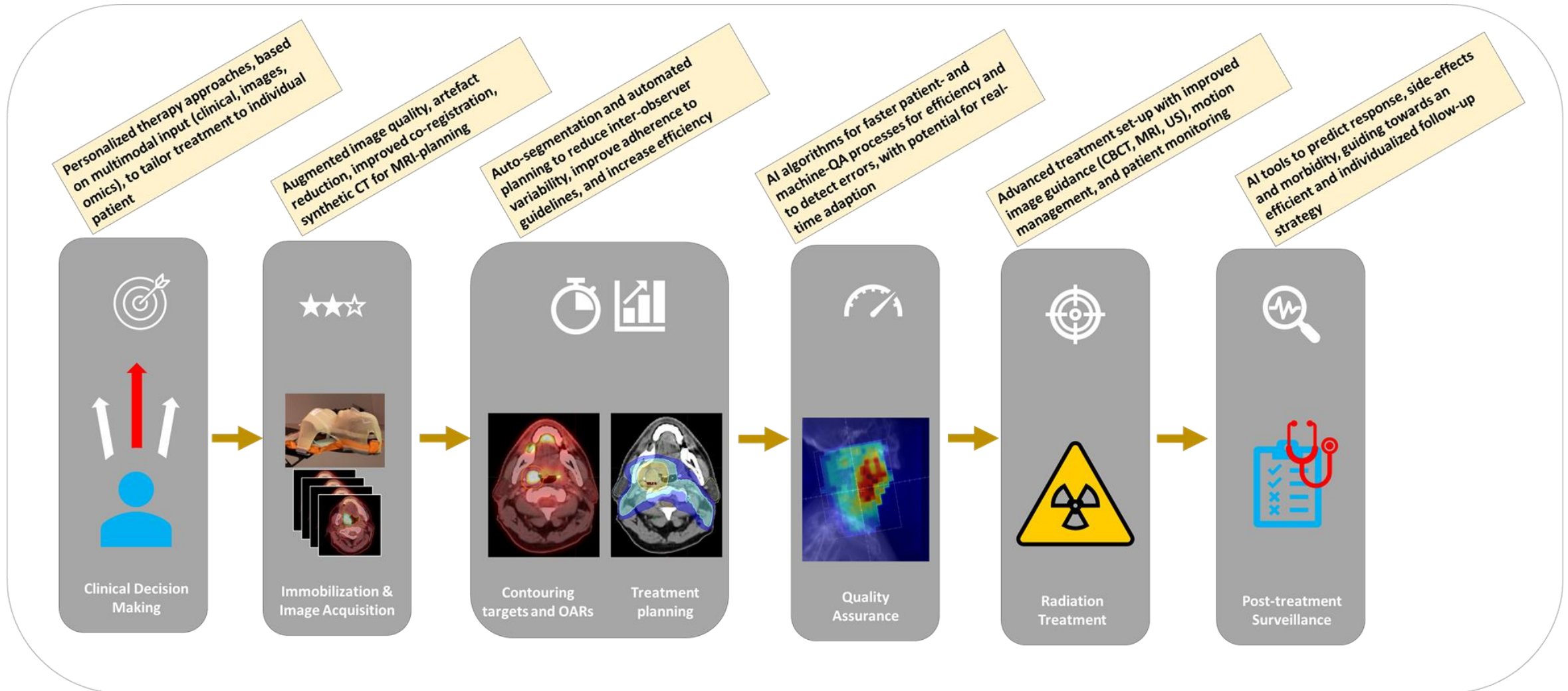


NOS Nieuws • Woensdag 2 augustus 2023, 13:46 •
Aangepast woensdag 2 augustus 2023, 14:04



Kunstmatige intelligentie ontdekt borstkanker vaker dan radiologen

Waar gaan we AI tegen komen in de radiotherapie?



Most AI prediction models are useless in daily clinical practice

Response assessment prediction, survival prediction, based on (DL) model output

ARTICLE

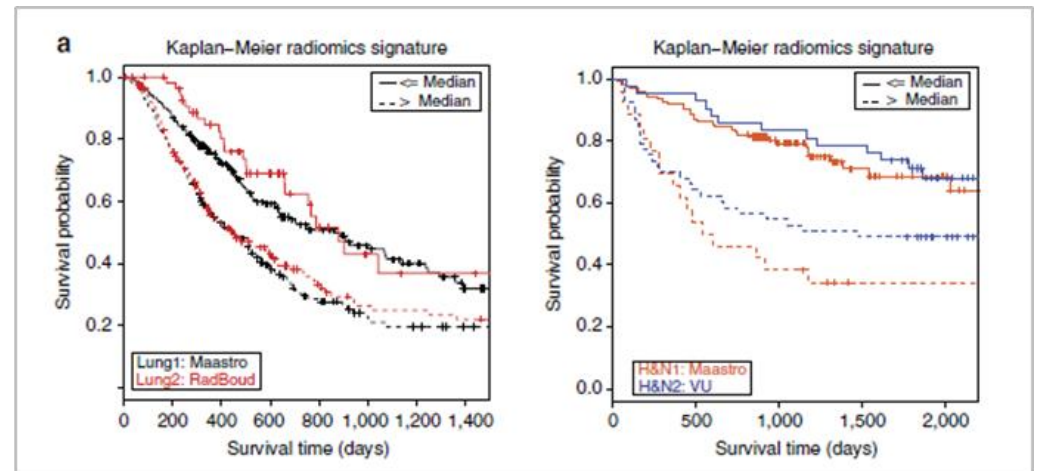
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OPEN

Decoding tumour phenotype by noninvasive imaging using a quantitative radiomics approach

Hugo J.W.L. Aerts^{1,2,3,4,*}, Emmanuel Rios Velazquez^{1,2,*}, Ralph T.H. Leijenaar¹, Chintan Parmar^{1,2}, Patrick Grossmann², Sara Cavalho¹, Johan Bussink⁵, René Monshouwer⁵, Benjamin Haibe-Kains⁶, Derek Rietveld⁷, Frank Hoebers¹, Michelle M. Rietbergen⁸, C. René Leemans⁸, Andre Dekker¹, John Quackenbush⁴, Robert J. Gillies⁹ & Philippe Lambin¹



➔ Need for actionable insights: Predictive rather than prognostic models

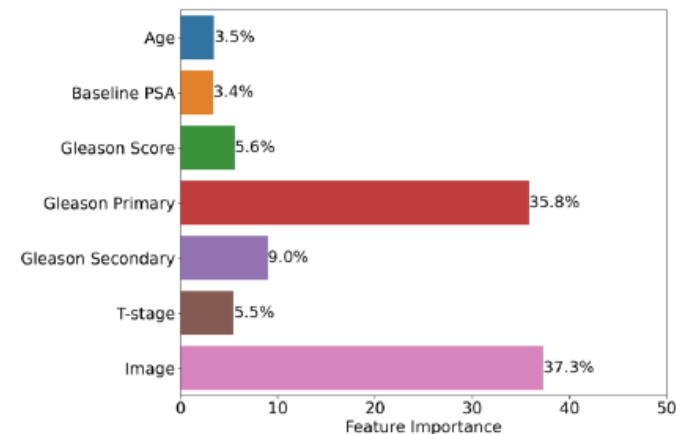
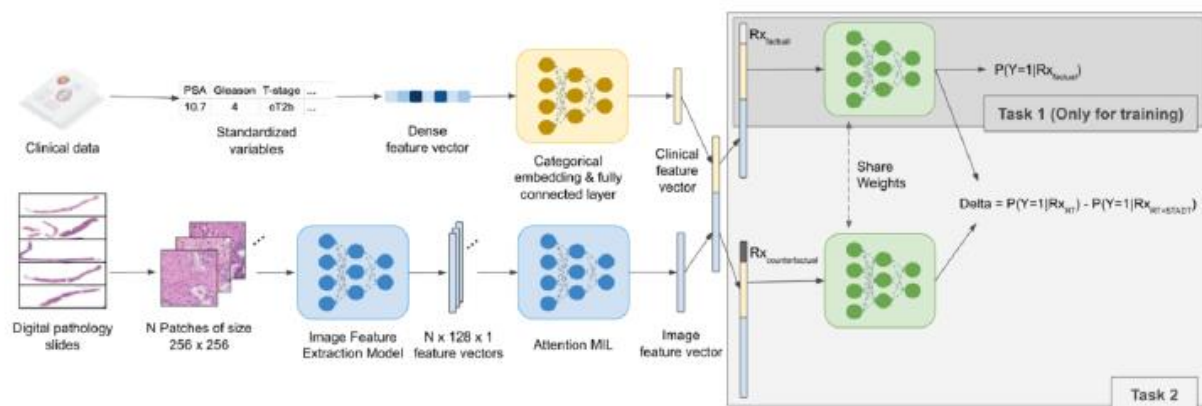
ORIGINAL ARTICLE

Artificial Intelligence Predictive Model for Hormone Therapy Use in Prostate Cancer

Daniel E. Spratt, M.D.,¹ Siyi Tang, Ph.D.,^{2,3} Yilun Sun, Ph.D.,^{1,4} Huei-Chung Huang, M.A.,³ Emmalyn Chen, Ph.D.,³ Osama Mohamad, M.D., Ph.D.,⁵ Andrew J. Armstrong, M.D.,⁶ Jonathan D. Tward, M.D., Ph.D.,⁷ Paul L. Nguyen, M.D.,⁸ Joshua M. Lang, M.D., M.Sc.,⁹ Jingbin Zhang, M.Sc.,³ Akinori Mitani, M.D., Ph.D.,³ Jeffrey P. Simko, M.D., Ph.D.,⁵ Sandy DeVries, M.A.,¹⁰ Douwe van der Wal, M.Sc.,³ Hans Pinckaers, M.D., M.Sc.,³ Jedidiah M. Monson, M.D.,¹¹ Holly A. Campbell, M.D.,¹² James Wallace, M.D.,¹³ Michelle J. Ferguson, M.D.,¹⁴ Jean-Paul Bahary, M.D.,¹⁵ Edward M. Schaeffer, M.D., Ph.D.,¹⁶ Howard M. Sandler, M.D.,¹⁷ Phuoc T. Tran, M.D., Ph.D.,¹⁸ Joseph P. Rodgers, M.S.,^{19,20} Andre Esteva, Ph.D.,³ Rikiya Yamashita, M.D., Ph.D.,³ and Felix Y. Feng, M.D.,⁵ on behalf of NRG Prostate Cancer AI Consortium*

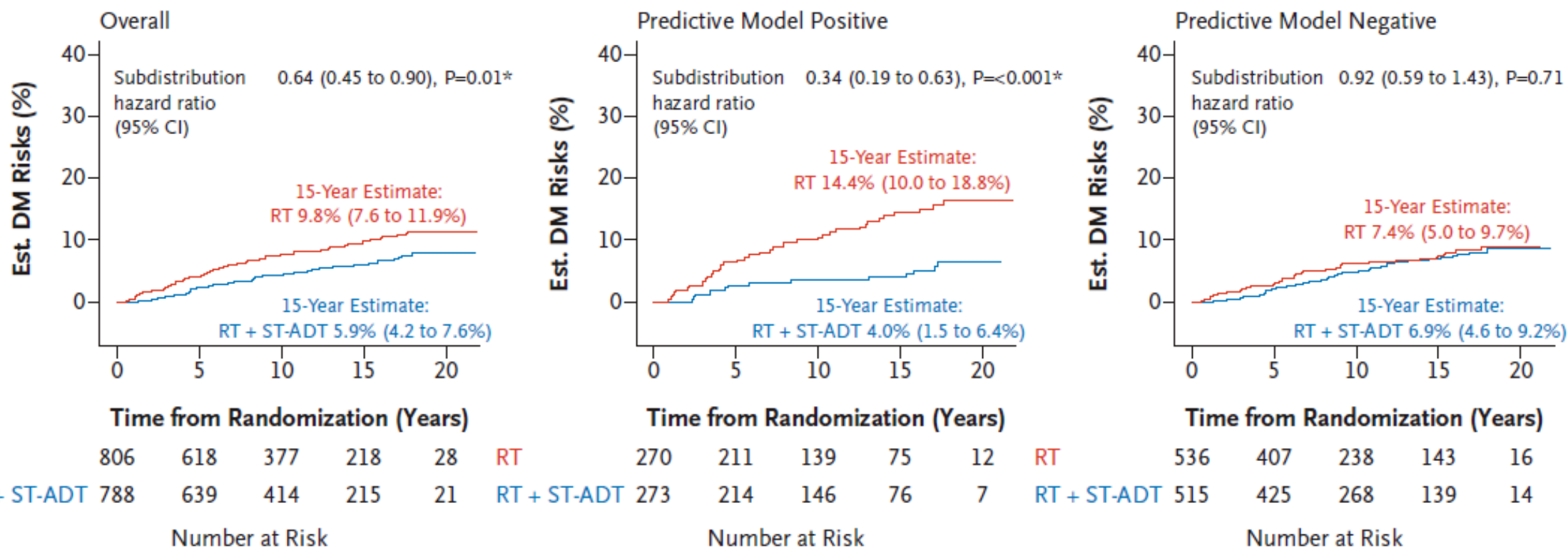
*“Digital pathology image and clinical data from pre-treatment prostate tissue from **5,727** patients enrolled on five phase III randomized trials treated with radiotherapy +/- ADT were used to develop and validate an AI-derived predictive model to assess ADT benefit with the primary endpoint of distant metastasis.”*

A



Artificial Intelligence Predictive Model for Hormone Therapy Use in Prostate Cancer

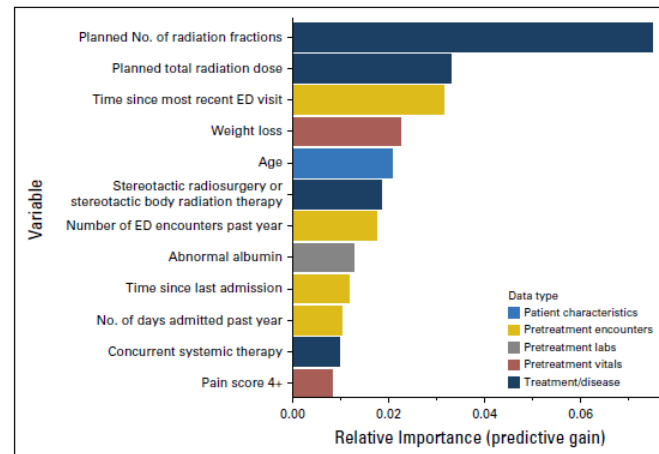
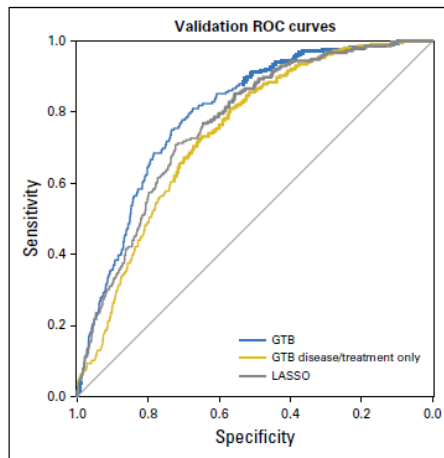
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Shield-RT trial – AI guided triage to prevent admissions

Prediction model for Emergency Room visits and Hospital Admissions during RT

- Model using automated data-extraction from EHR for 8,000 patients (6,000 / 2,000) ¹
- Randomized trial for high-risk (HR) patients to undergo intensified monitoring during RT ²



N = 963, with 311 in HR group

Acute Care Visits:

HR Patients:

- 22% SoC vs. **12% Twice weekly** evaluation

Low-Risk patients:

- 2.7%

System for High-Intensity Evaluation During Radiation Therapy (SHIELD-RT)

(1) Hong et al, JCO Clin Cancer Inform, 2018

(2) Hong et al., JCO, 2020

<https://doi.org/10.1038/s41698-024-00553-6>

All models are wrong and yours are useless: making clinical prediction models impactful for patients

Florian Markowetz

Check for updates

*“All models are wrong, but some are useful”
(statistician George Box)*

Observation 1: *Success in academia is not the same as success in the clinic.*

Observation 2: *Successful models use data that are available in routine practice.*

Observation 3: *Successful models are linked to actions.*

Observation 4: *Successful models are implemented outside of centres of excellence.*

Observation 5: *Success in the clinic is hard earned.*

Large Language Models (LLM)

UMCG beantwoordt vragen patiënten met hulp van AI

Door: Janneke Kruse ⌚ Leestijd: 3 min.

13 november 2023

Het UMCG zet kunstmatige intelligentie (artificial intelligence, afgekort AI) in om zorgverleners te helpen bij het beantwoorden van schriftelijke vragen van patiënten. Dit gebeurt in samenwerking met andere ziekenhuizen vanuit de EPIC Nederlandse Vereniging.



<https://nieuws.umcg.nl/w/umcg-beantwoordt-vragen-pati%C3%ABnten-met-hulp-van-ai>

REMARK:

S. Chen, ..., F. Hoebers, ..., D. Bitterman et al., accepted Lancet Digital Health:

- 100 synthetic cancer patient scenarios paired with patient messages
- 6 physicians – manual; GPT4; AI-assisted responses
- Physician responses were on average:
 - shorter than GPT-4
 - more readable than GPT-4 or AI-assisted responses
- GPT-4 responses 128/156 (82%) had a low risk of causing harm
- Manual responses were more likely to recommend **direct clinical action**
- GPT-4 drafts were more likely **to provide education and self-management recommendations.**
- **AI-assisted responses were overall more similar in content to GPT-4 drafts but added additional direct clinical action**













AI in clinical research



NEJM AI 2023; 1 (1)
[DOI: 10.1056/AIe2300128](https://doi.org/10.1056/AIe2300128)

EDITORIAL

Why We Support and Encourage the Use of Large Language Models in *NEJM AI* Submissions

Daphne Koller , Ph.D.,¹ Andrew Beam , Ph.D.,^{2,3,4} Arjun Manrai , Ph.D.,^{3,4} Euan Ashley , M.B., Ch.B., D.Phil.,⁵ Xiaoxuan Liu , M.B.Ch.B., Ph.D.,^{4,6,7} Judy Gichoya , M.B.Ch.B., M.S.,⁸ Chris Holmes , Ph.D.,^{9,10} James Zou , Ph.D.,¹¹ Noa Dagan , M.D., Ph.D., M.P.H.,^{12,13} Tien Y. Wong , M.D., Ph.D.,^{14,15} David Blumenthal , M.D., M.P.P.,¹⁶ Isaac Kohane , M.D., Ph.D.,^{3,4} on behalf of the editors and editorial board of *NEJM AI**

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You

I need to prepare a powerpoint presentation on the topic of "AI and the medical specialist of the future". Please provide 4-5 short bullets with the most important applications in radiation oncology



ChatGPT

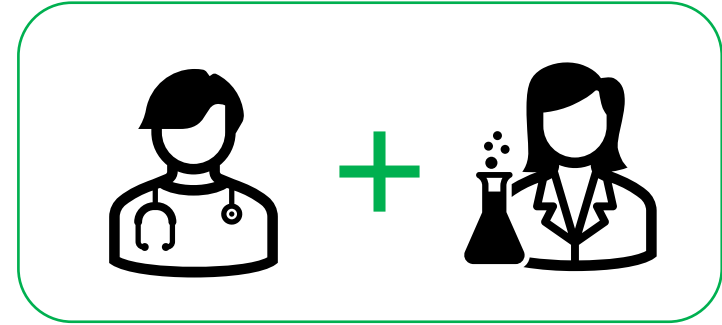
Absolutely, here are some key applications of AI in radiation oncology for your presentation:

1. **Treatment Planning Optimization:** AI algorithms can analyze patient data, including medical imaging and tumor characteristics, to optimize radiation therapy treatment plans. This helps radiation oncologists deliver precise doses of radiation to tumor targets while minimizing exposure to surrounding healthy tissues, reducing side effects and improving treatment outcomes.
2. **Image-Guided Radiation Therapy (IGRT):** AI-powered image analysis techniques enhance the accuracy of tumor localization and tracking during radiation therapy sessions. By continuously monitoring patient anatomy in real-time, AI systems ensure that radiation beams are precisely targeted, improving treatment accuracy and sparing healthy tissues.
3. **Automated Contouring and Segmentation:** AI algorithms can automate the process of contouring and segmenting tumors and organs at risk on medical images, such as CT scans. This saves radiation oncologists valuable time during treatment planning and improves consistency in target delineation, reducing variability between clinicians and ensuring more accurate treatment delivery.
4. **Adaptive Radiation Therapy (ART):** AI enables the development of adaptive radiation therapy techniques that can dynamically adjust treatment plans based on changes in patient anatomy or tumor response over the course of treatment. By continuously adapting to individual patient characteristics, ART improves treatment efficacy and minimizes the risk of underdosing or overdosing.
5. **Outcome Prediction and Prognostication:** AI models trained on large datasets of patient outcomes can predict individual patient responses to radiation therapy and estimate the likelihood of treatment success or failure. This information helps radiation oncologists tailor treatment plans and counseling strategies based on personalized risk assessments, ultimately improving patient care and decision-making.



Role of clinician in development of AI applications

- Partner of data-science team



- “Physician in the loop”:
 - *Guiding / following the process in order to achieve results that may impact clinical decision making*
- Education in AI needed:
 - *Building trust, decrease skepticism,*
 - *Assess limitations*

Education

tomorrow's doctor according to us should ...

- 0** **have a solid base of ready and applicable medical knowledge**
have adequate medical knowledge ready at any time and be able to correctly apply this knowledge. Be able to continuously gather and understand new knowledge and to consider it in a systemic context.
- 1** **have a high degree of digital and technological expertise**
be able to process diverse data to useful information and use this to take decisions. be able to work with Artificial Intelligence and cybernetics in the professional environment. All this in a technologically fast evolving world, in which the human dimension will not be lost sight of.
- 2** **have knowledge of and be able to deal with cultural differences on perceptions towards/ practice of/experience of medicine**
be able to work with both colleagues and patients with different cultural backgrounds that have different world views and be able to adapt the medical approach accordingly.
- 3** **be able to act in a patient-oriented, personalised, health-oriented care model**
be able to think and act in terms of health instead of illness, to keep people healthy and independent within the possibilities and limits of their context, in collaboration with current and future care providers.
- 4** **act from a holistic idea of mankind, in which the human being is an integral part of a natural and socio-technological biotope**
be able to understand the relationships between human health – both physical and mental - and the context, and to play a supportive/guiding role in this field of influence regarding general health, tailor made for every individual.
- 5** **be a critical, passionate, inquisitive and independent team player**
be able, based on these qualities, to motivate and reinvent oneself for life, in order to get the best out of oneself. he/she should also be able to admit and show vulnerability, boundaries, and lack of knowledge.

- 6** **understand and speak the language of other – not necessarily medical - domains**
be able to transfer medical insights to other domains and vice versa. he/she should be able to promote a mindset and language of collaboration across boundaries between disciplines.
- 7** **be adaptive, creative, enterprising, communicative and linguistically skilled**
be able to continuously keep learning, adapting to a fast changing society and care scene, to proactively search for solutions beyond the obvious, to value medical knowledge in health contexts beyond the role of a doctor. he/she should be skilled in language in all his/her relations, also beyond the domain of verbal communication.
- 8** **have a large empathic and ethical consciousness**
be able to not only imagine the medical, social or economic situation of the patient, the family or the community, but to also deal with ethical issues – both at the level of the patient and society – within his/her own work and health care context, the patient and beyond.
- 9** **be aware of the relative and changing position of the doctor with respect to other health care stakeholders and of changing perceptions of the health concept**
be able to critically discuss and redefine his/her own role as a doctor as well as the predominant perception of health, depending on the context.
- 10** **view and practice “the human encounter” as a craft**
be able, driven by a sincere interest in the individual, to create and cherish a context of confidence and collaboration between doctor, patient and each other's environment. communication should be viewed as the creation of dialogue instead of the transfer of information or knowledge.

Conclusies – De specialist van de toekomst

- Combineert zijn expertise op *medisch inhoudelijk vlak* met kennis over *AI-vraagstukken*.
- Kan *meedenken met data scientists* over AI toepassingen.
- Maakt gebruik van AI in de dagelijkse praktijk voor een *efficiëntere en nauwkeurigere gezondheidszorg*.
- Gebruikt mogelijk ook *(enkele) predictie modellen*
- Past *Large Language Models (LLM)* toe in praktijk

npj | digital medicine Comment

Published in partnership with Seoul National University Bundang Hospital 

<https://doi.org/10.1038/s41746-024-01047-2>

Why we should not mistake accuracy of medical AI for efficiency

Karin Rolanda Jongsma, Martin Sand & Megan Milota  Check for updates

Acknowledgments



Andre Dekker

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Maastricht University &
Maastricht UMC+



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Simon Bernatz
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Tafadzwa Chaunzwa
Research Scholar



Keno Bressemer
Research Fellow



Ibrahim Hadžić
Research Scholar



Deborah Plana
Medical Student

Perspective **FREE PREVIEW**

Mind the Gap — Machine Learning, Dataset Shift, and History in the Age of Clinical Algorithms

Andrew S. Lea, M.D., D.Phil., and David S. Jones, M.D., Ph.D.



In the 1970s, developers of an early computerized diagnostic program encountered the problem of “dataset shift” — a challenge that is relevant today as machine-learning algorithms spread throughout clinical practice.

Audio Interview



Interview with Andrew Lea on how experience with a 1970s computerized diagnostic program can inform efforts to implement machine-learning prediction models in medicine. (08:54)

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January 25, 2024

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