IA en dermatología: el futuro en 5 años

Josep Malvehy
Servicio de Dermatología
Hospital Clínic de Barcelona

Conflicts of interest

SPEAKER: Almirall, BMS, ISDIN, La Roche Posay, Leo, Novartis, Pierre Fabre, Roche, Sanofi

HONORARIA OR CONSULTATIONS FEES : Almirall, BMS, Biofrontera, GSK, ISDIN, La Roche Posay, Leo, Novartis, Polychem

GRANTS & RESEARCH SUPPORT: Almirall, Amgen, BMS, Biofrontera, Canfield, Cantabria, Fotofinder,

GSK, ISDIN, La Roche Posay, Leo, Mavig, Nevisense, Novartis, Polychem, Roche,iTOBOs (EU Grant)

Spouse/partner: Almirall, Amgen, BMS, Biofrontera, Canfield, Cantabria, Fotofinder, GSK, ISDIN, La Roche Posay, Leo, Mavig, Nevisense, Novartis, Pierre Fabre, Polychem, Roche

Other support (please specify): Abbie (educational activities), Lilly (educational activities), Novartis

Co-founder of Diagnosis Dermatologica sl and Athena Tech, Investor of Dermavision iToBoS

MELCAYA

TRANSCAN

Fundació
La Marató de TV3

EADV European Academy of Dermatology and Venereology

GenoMEL
the Melanoma Genetics Consortium

M-Skip

GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD
Instituto de Salud Carlos III

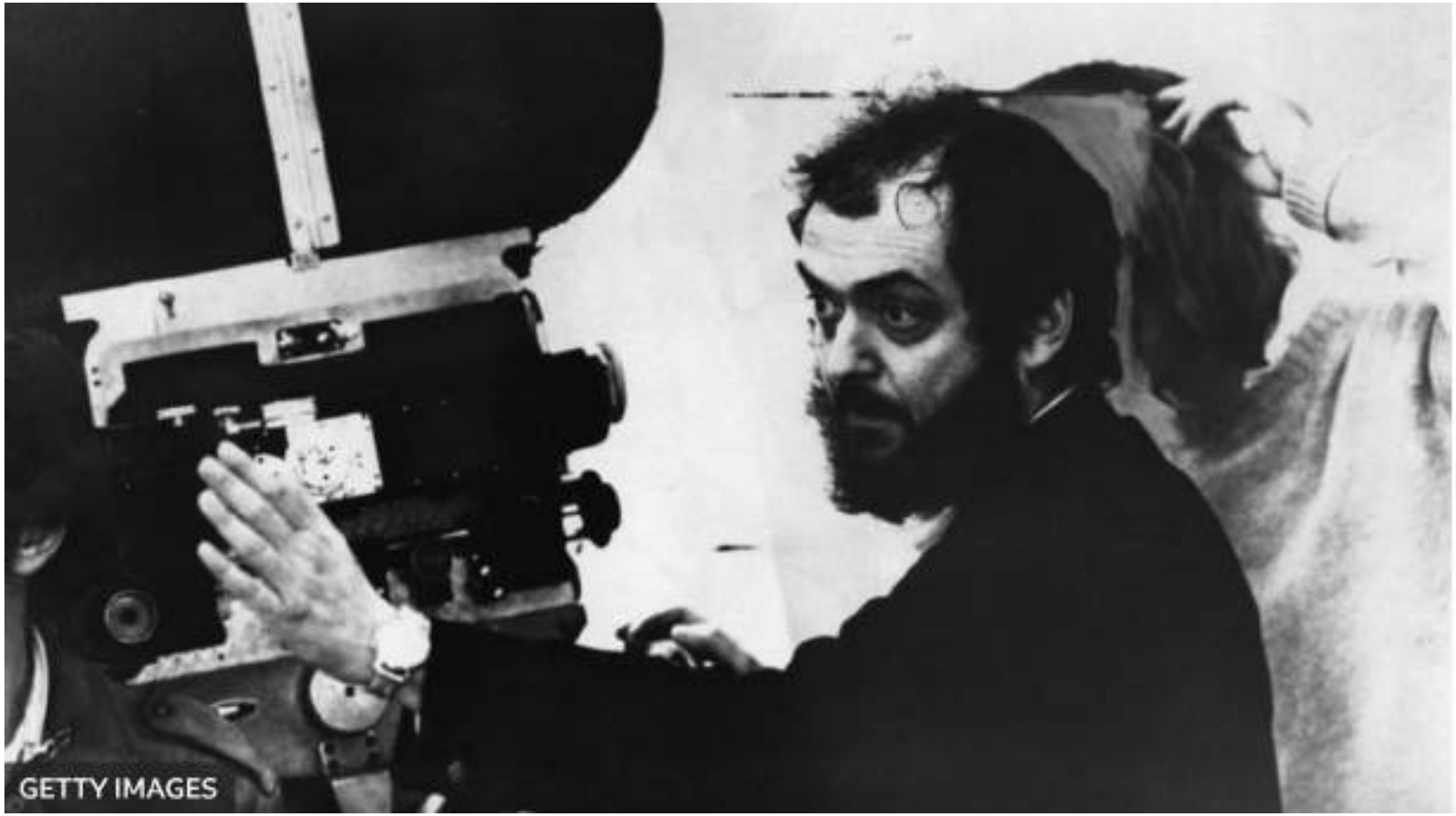
IDIBAPS
Institut d'Investigacions Biomèdiques August Pi i Sunyer

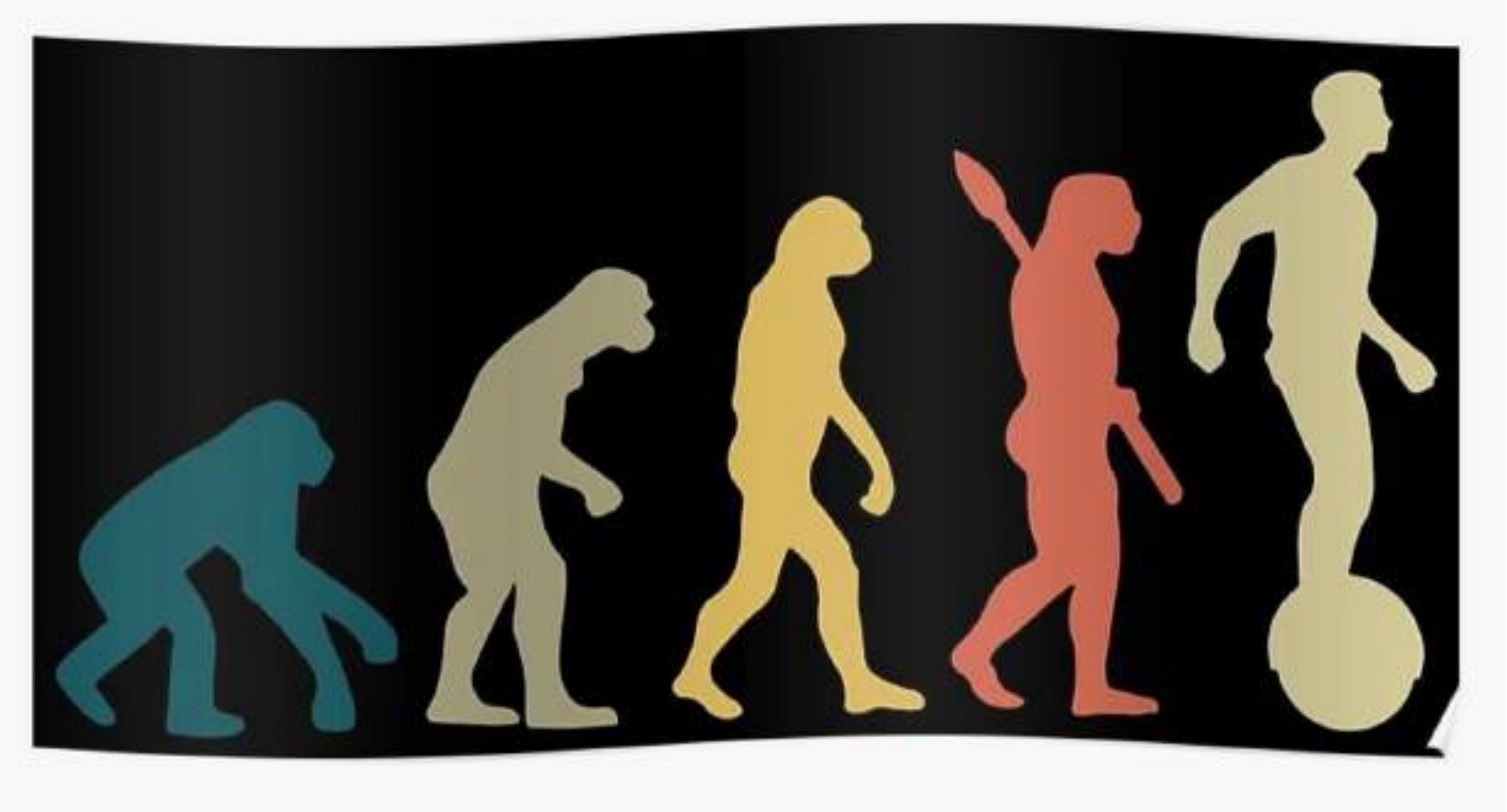
BioGenoMEL

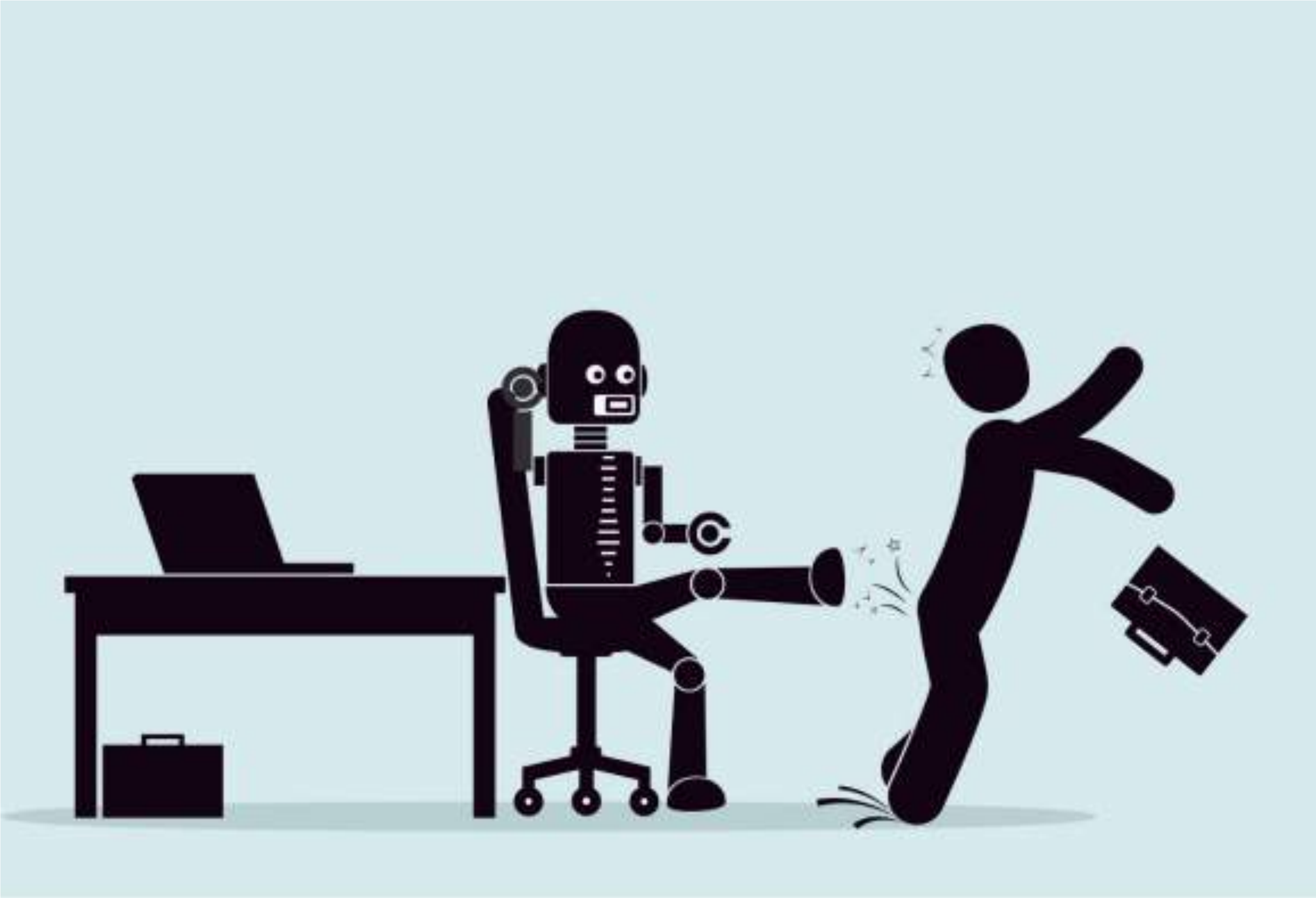
ciberer
CENTRO DE INVESTIGACIÓN BIOMÉDICA EN RED DE ENFERMEDADES RARAS

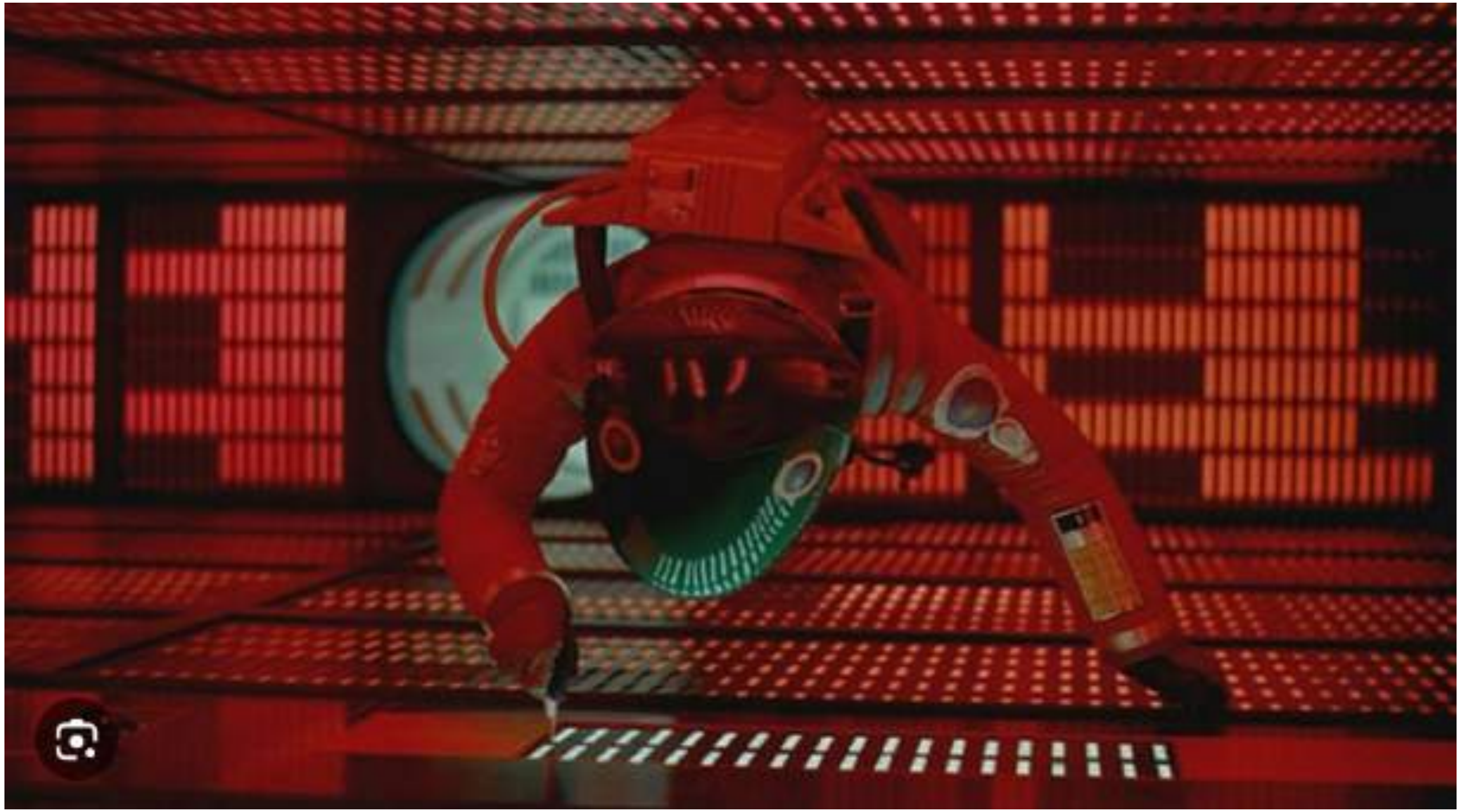
digitalgarden
powered by Almirall

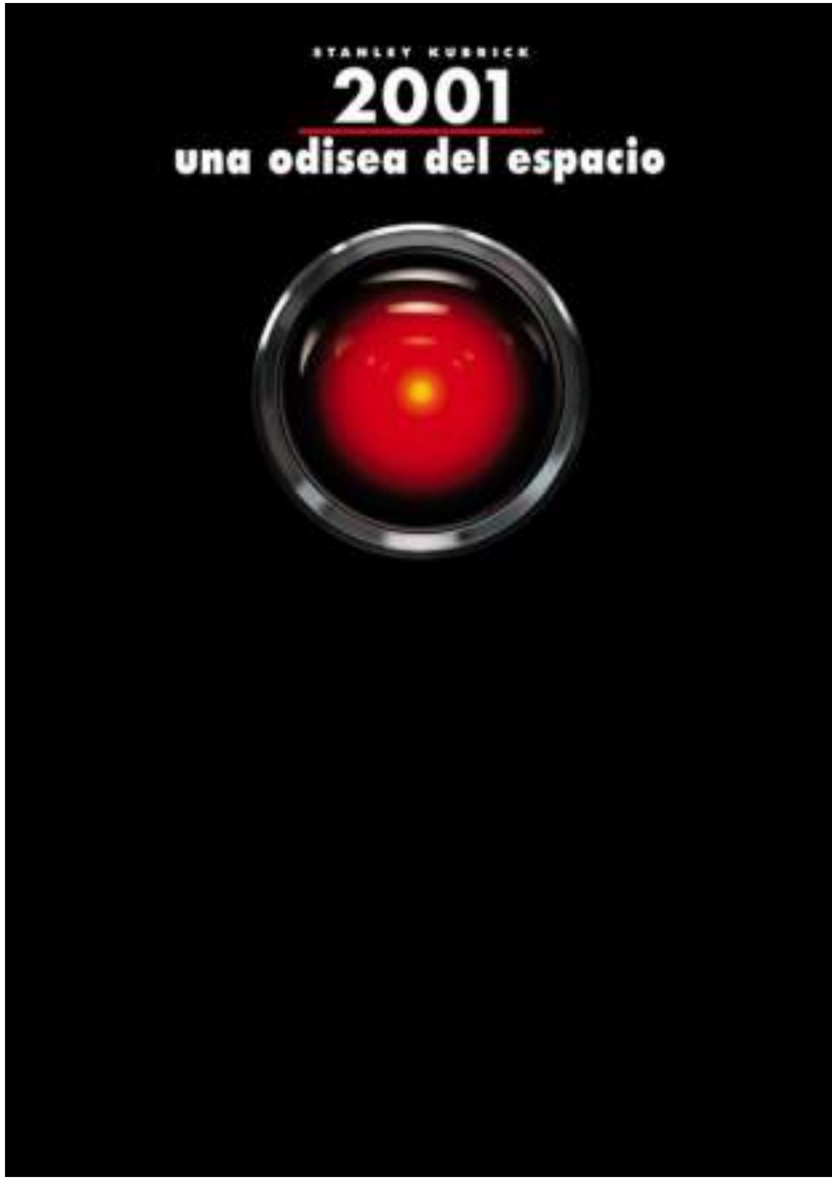
AGAUR
Agència de Gestió d'Ajuts Universitaris i de Recerca


GETTY IMAGES

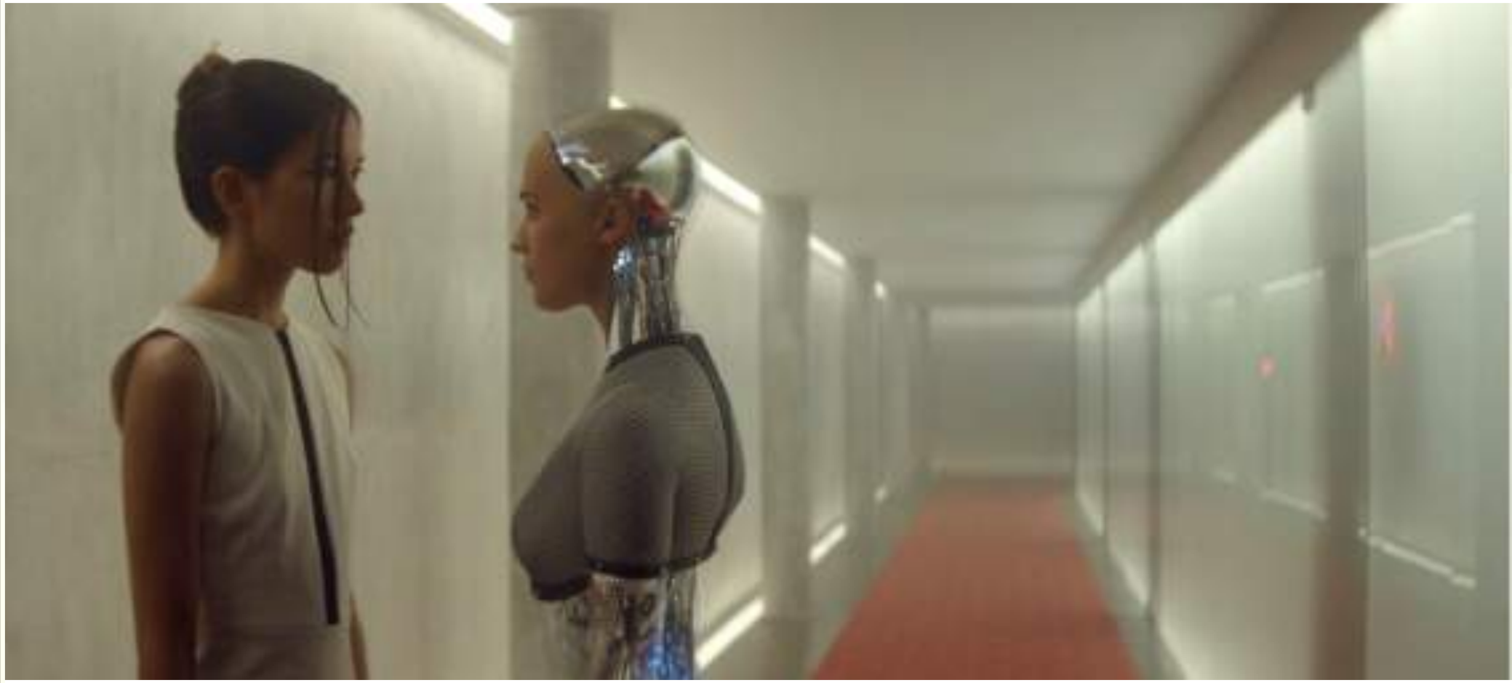







STANLEY KUBRICK
2001
una odisea del espacio

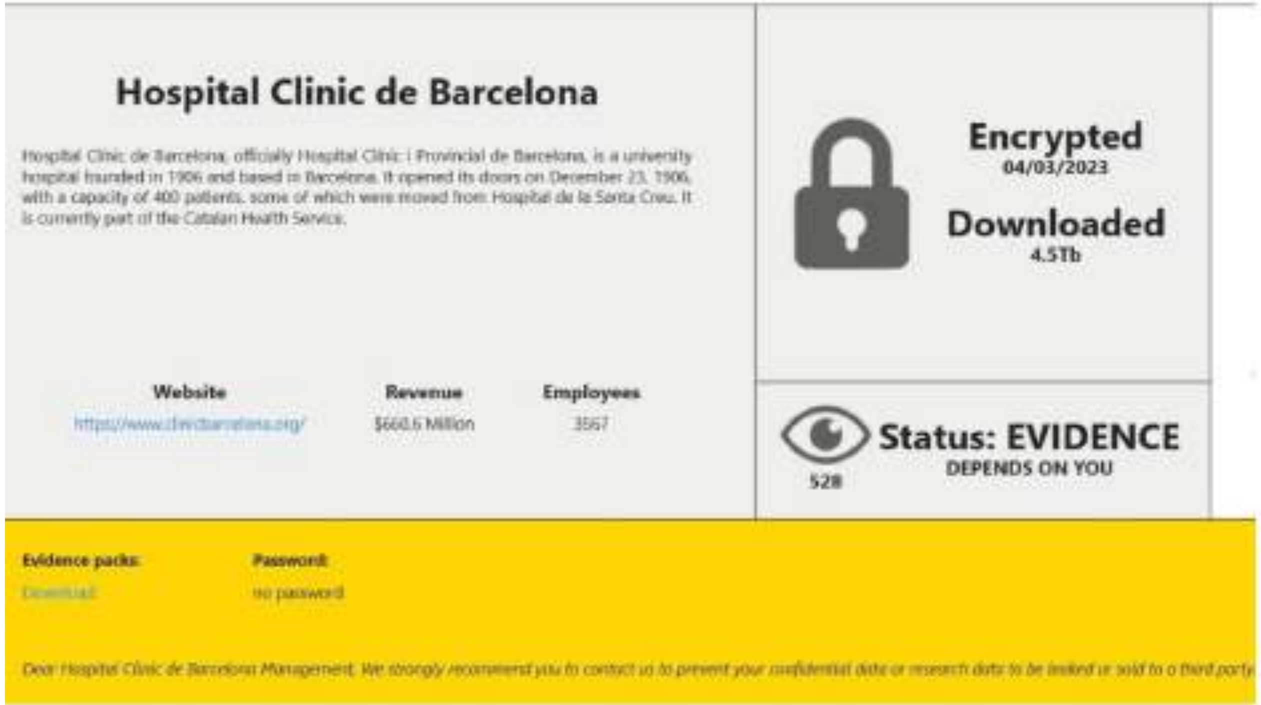

THERE IS NOTHING MORE HUMAN THAN THE WILL TO SURVIVE
AN ALEX GARLAND FILM
EX_MACHINA



ESTÁ DISPONIBLE EN LA 'DARKWEB'

Ponen a la venta datos de pacientes robados al Hospital Clínic y piden un rescate de 4,5 M

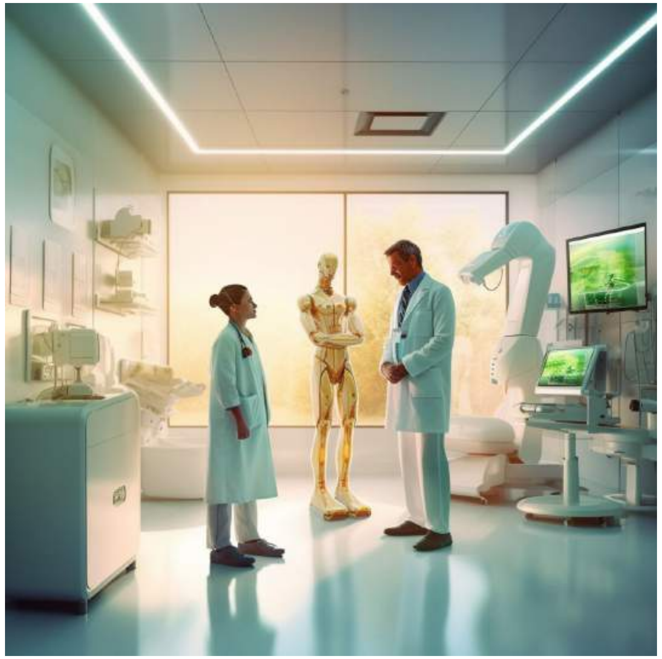
El grupo de ciberdelincuentes RansomHouse ha reconocido que está detrás del ataque y ha colgado un archivo de 4,5 terabytes con información de pacientes y trabajadores



El paquete de datos del Clínic de Barcelona robado por RansomHouse.

The Deep Learning Era

- Some definitions
- What is Deep Phenotyping?
- Avatars, sensors and predictive tests
- Impacted fields from the use of AI in medicine
- AI in Dermatology now
- Transparency, validation, education, legal aspects
- Optimistic conclusion

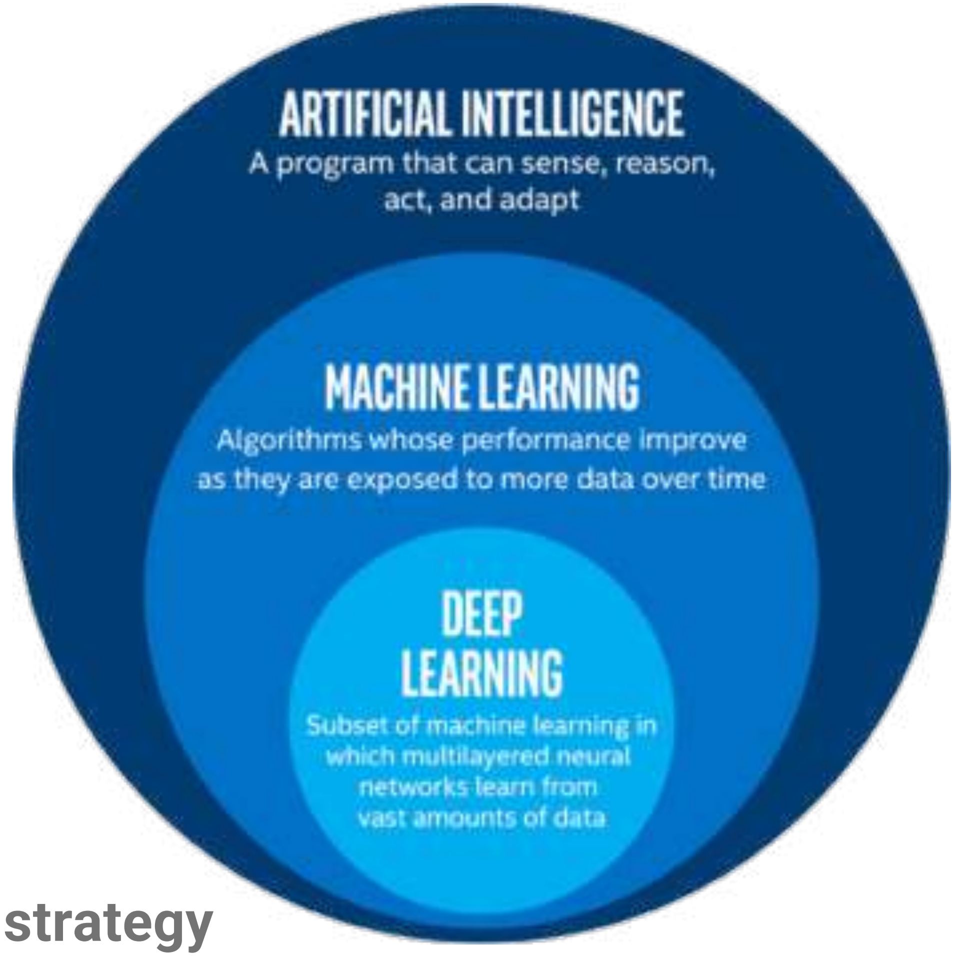


Some definitions...

Artificial intelligence: study of intelligent agents; any device that perceives its **environment** and takes **actions** that maximize its chance of successfully achieving its **goals.**

Machine learning: Field of study that explores the construction of algorithms that can learn from data.

Deep learning: subset of machine learning algorithms composed by neural network which learn from vast amount of data.



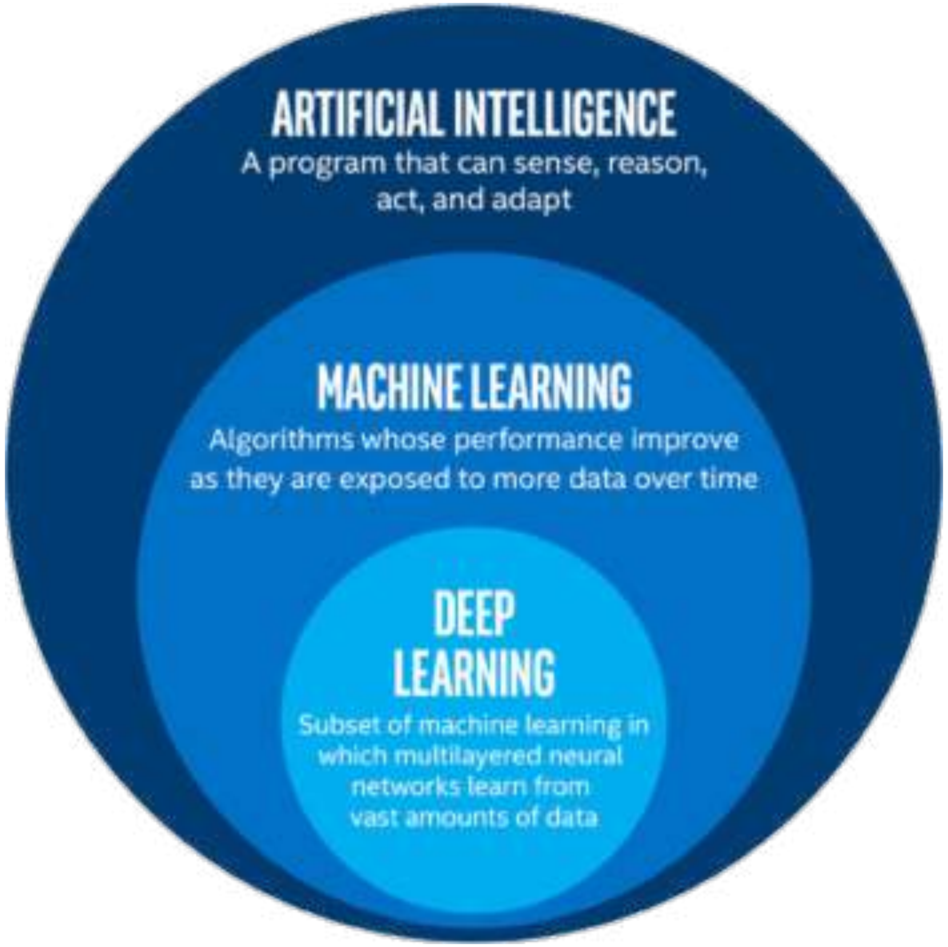
First Architecture → Deep learning term → First training strategy

1965 1986 2006

https://towardsdatascience.com/cousins-of-artificial-intelligence-dda4edc27b55

Impacted fields from the use of AI technologies in medical applications

1. Image-based diagnosis for radiology, dermatology, ophthalmology, and pathology
2. Genome interpretation
3. Biomarker Discovery
4. Inferring health status through wearable devices
5. Autonomous robotic surgery
6. Clinical outcome prediction
7. Patient monitoring



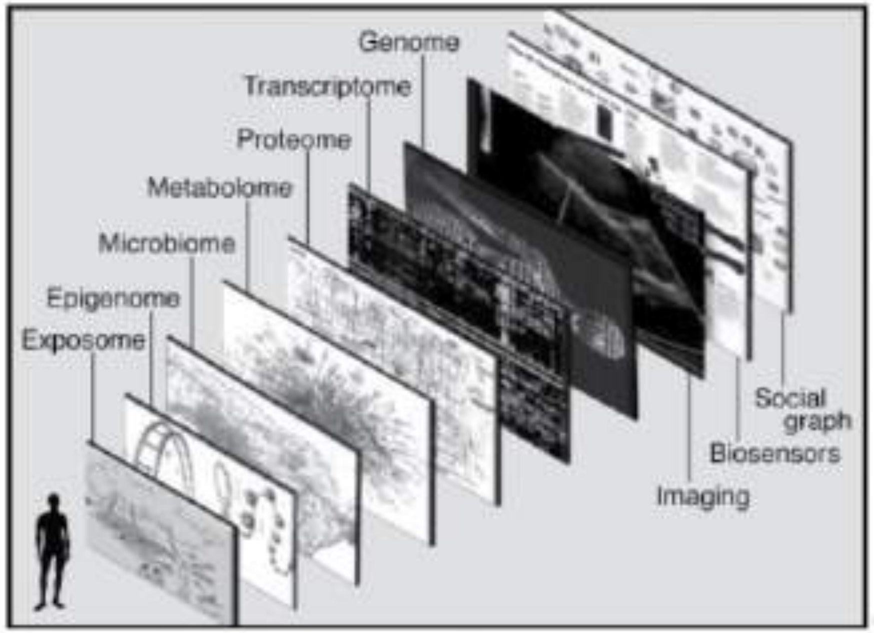
Yu KH, Beam AL, Kohane IS. Artificial intelligence in healthcare. Nature Biomedical Engineering. 2018; 2:719–31. https://doi.org/10.1038/s41551-018-0305-z PMID: 31015651

- Natural language Processing
- Avatars an Deep imaging
- Sensors, biometrics
- ML for complex analytics
- Generative AI
- Robotics for surgery, laser,
- Drug delivery by nanotech
- AI for monitoring of patients
- AI for support for patients

Clínic Barcelona

Clínic
Barcelona

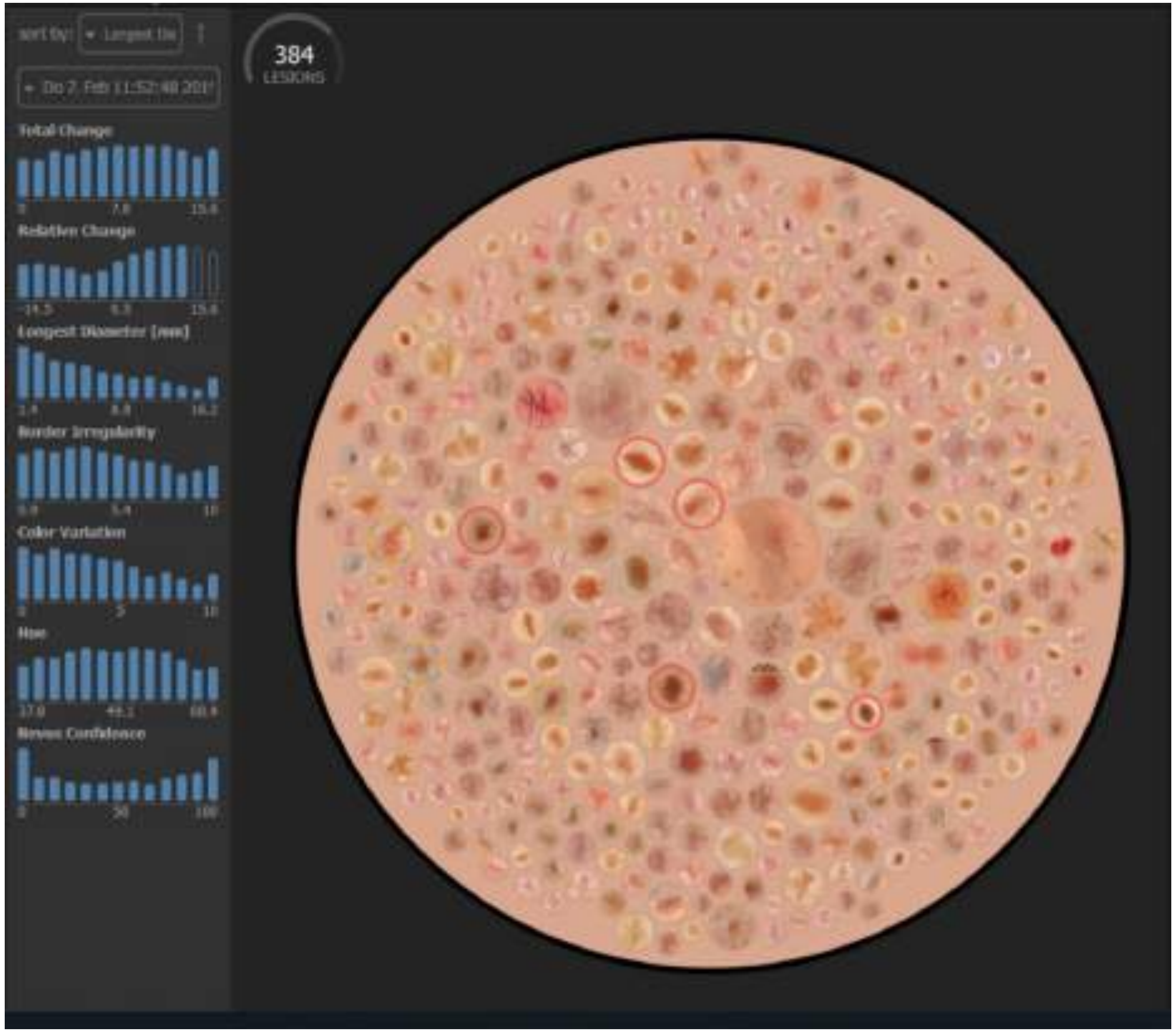
DEEP PHENOTYPE AND PRECISION MEDICINE

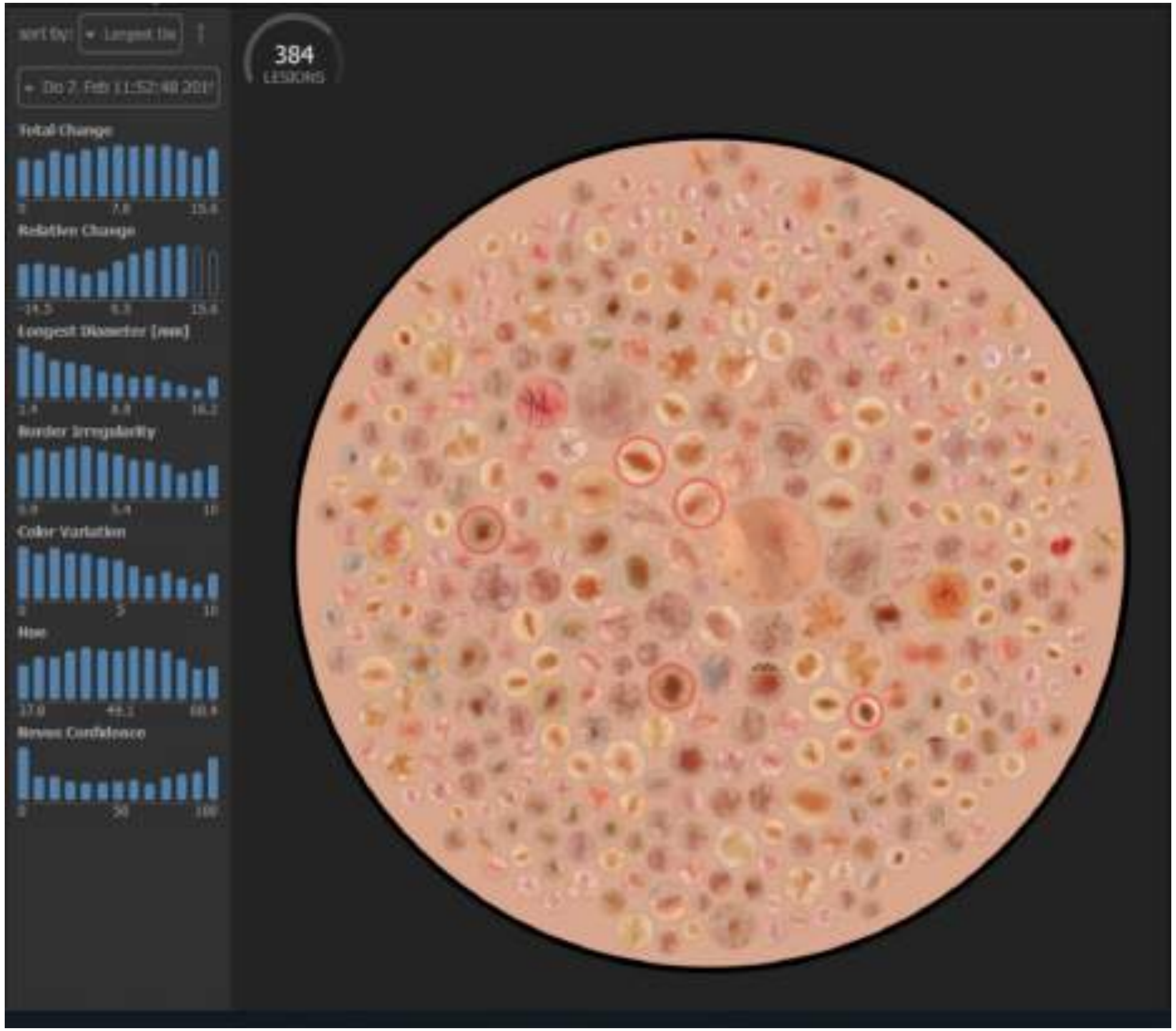


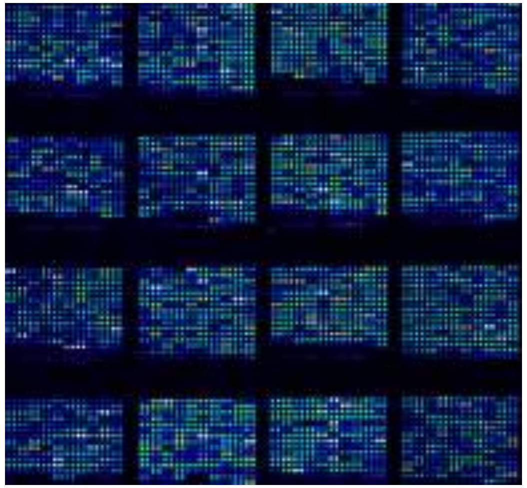
- Demographics
- Clinical data
- Imaging
- Biosensors
- Genomic
- Transcriptomics
- Proteomics
- Metabolomics
- Microbiomics
- Epigenomics
- Exposomics
- Radiomics
- Dermatomics: “Deep” imaging phenotype

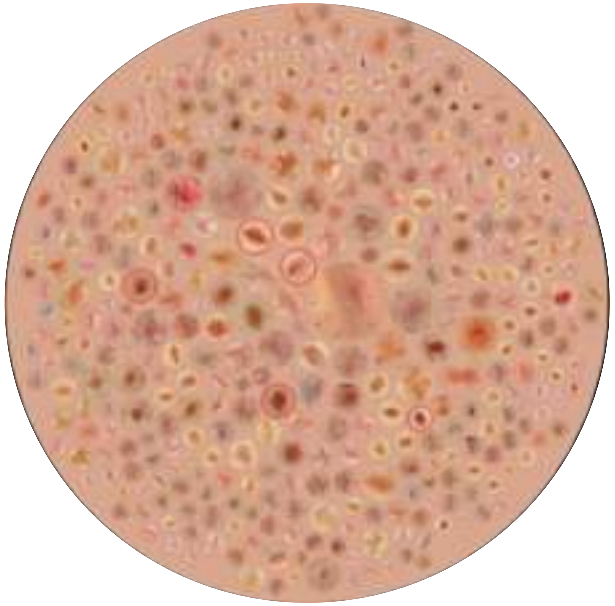
Eric Topol. Deep Medicine. How AI can make medicine human again **SBN-13:** 978-1541644632

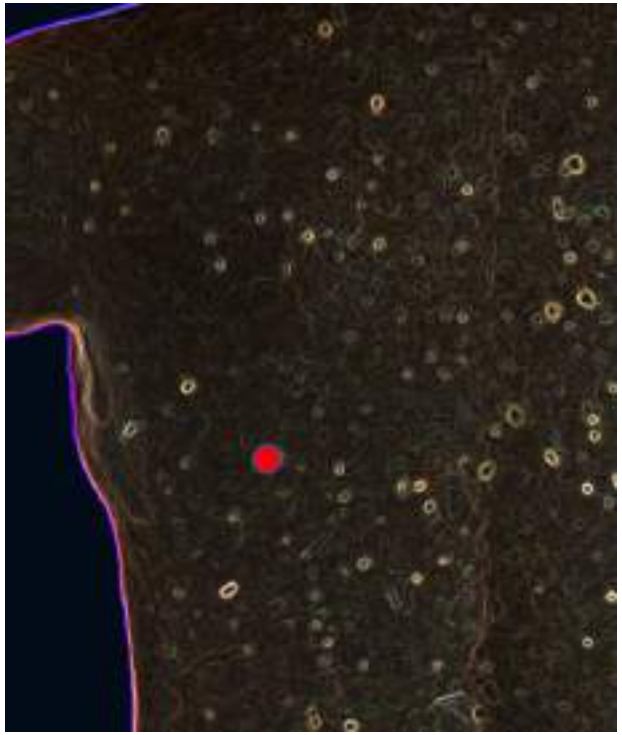
Avatars of Patients



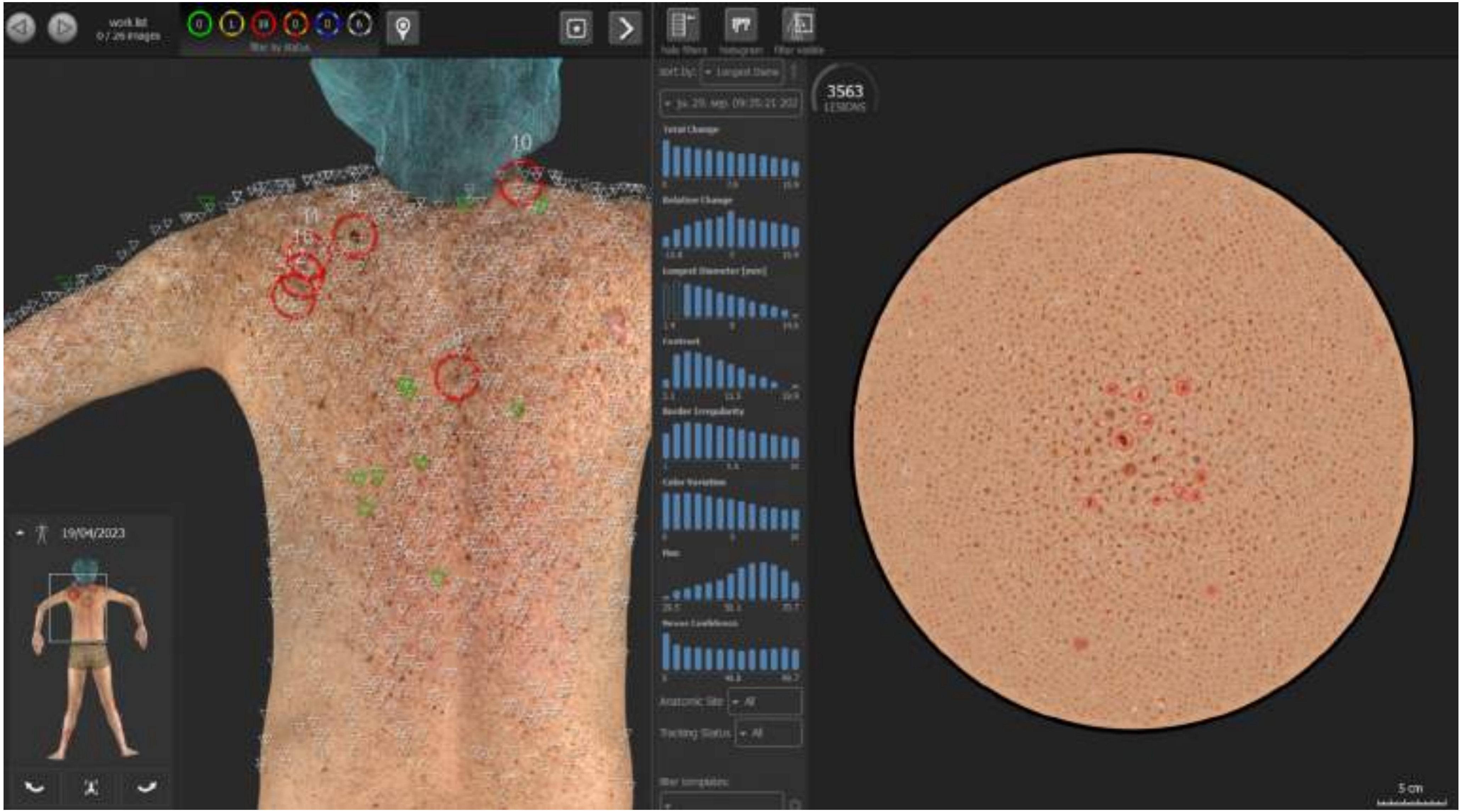

384
LESIONS
Total Change
Longest Diameter (mm)
Border Irregularity
Color Variation



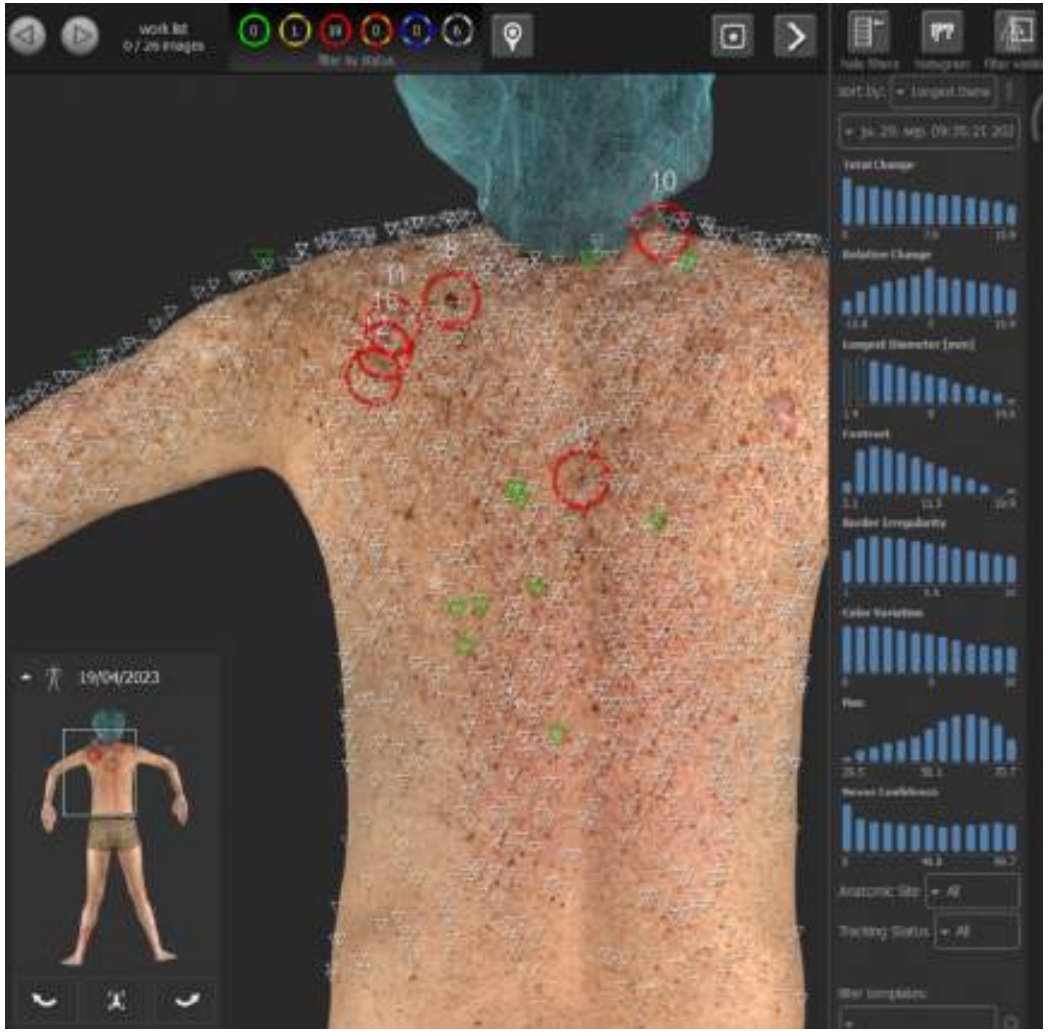


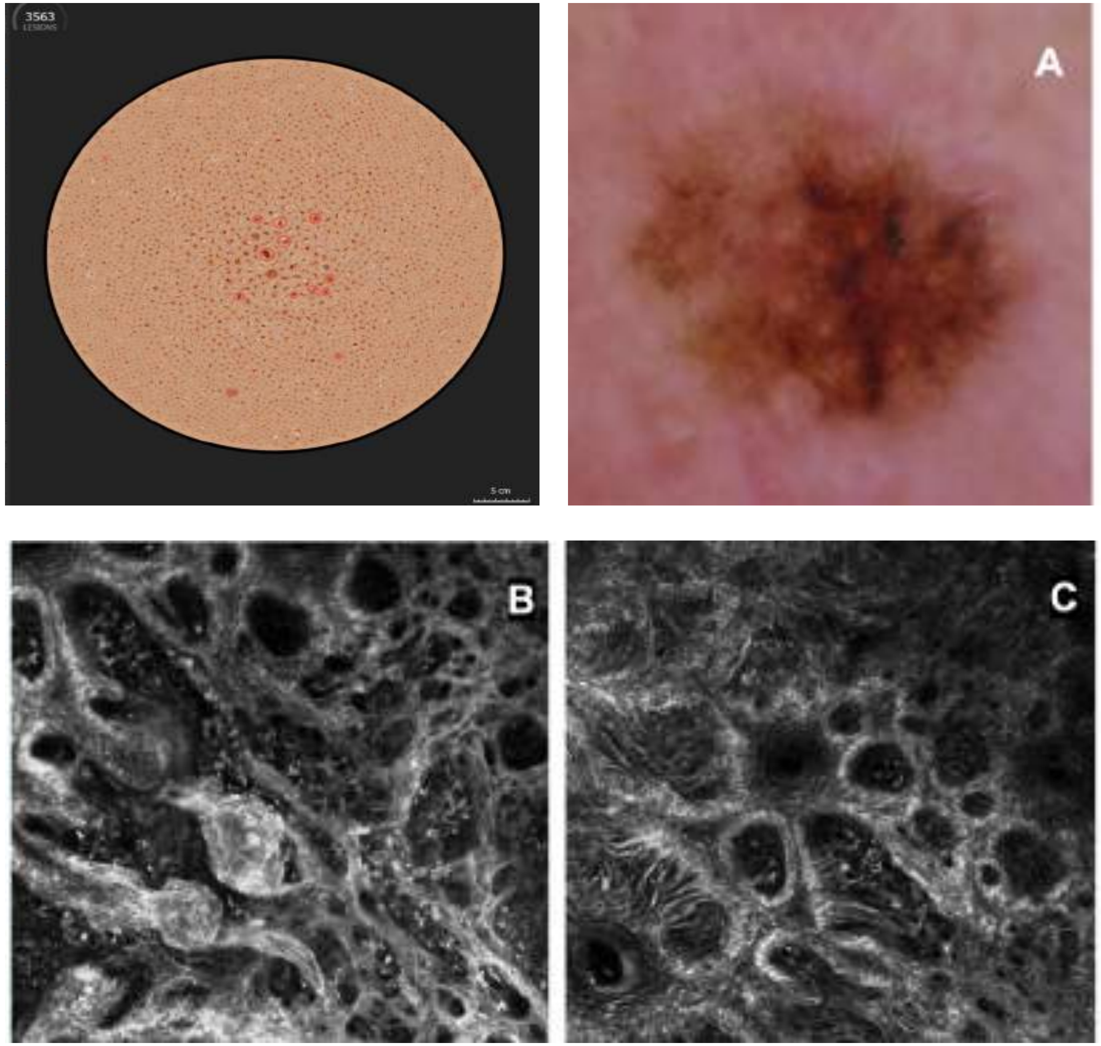


CLÍNIC
BARCELONA
Hospital Universitari



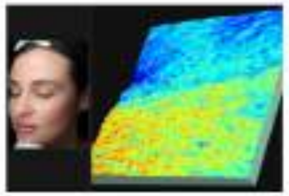
Rivas AC, Luna A, Serra E, Luque M, Caño A, Alejo B, Castrejón N, Rezze G, Alkhawaja A, Podlipnik S, Puig S, Malvehy J, Carrera C.
Xeroderma pigmentosum: 12 years of experience combining multiple imaging techniques for follow-up. Hospital Clinic of Barcelona.
Poster . World Congress of Confocal Microscopy. 1-3 June, 2023





Rivas AC, Luna A, Serra E, Luque M, Caño A, Alejo B, Castrejón N, Rezze G, Alkhawaja A, Podlipnik S, Puig S, Malvehy J, Carrera C.
Xeroderma pigmentosum: 12 years of experience combining multiple imaging techniques for follow-up. Hospital Clinic of Barcelona. Poster . World Congress of Confocal Microscopy. 1-3 June, 2023

Measurement of phoageing: skin surface topography

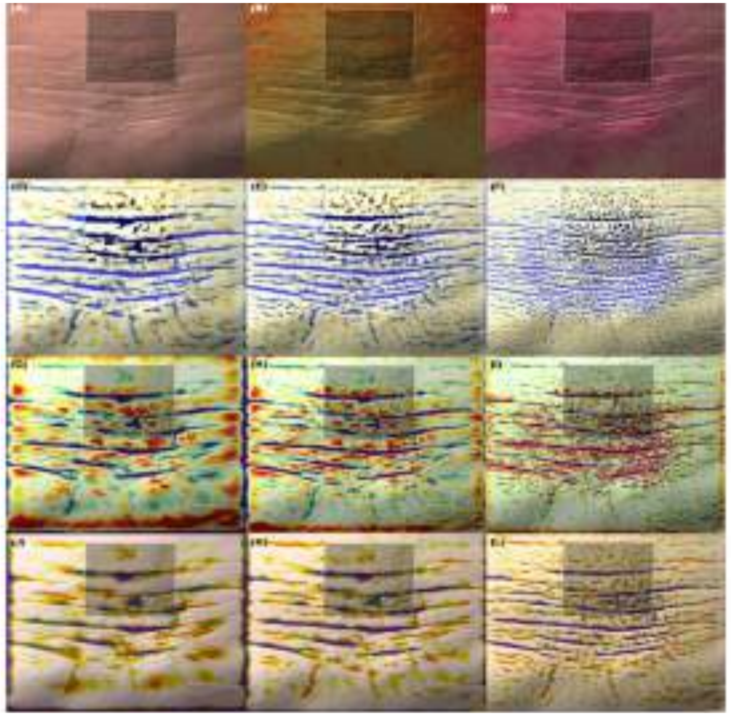


3D VIEWER

AGING SIMULATION

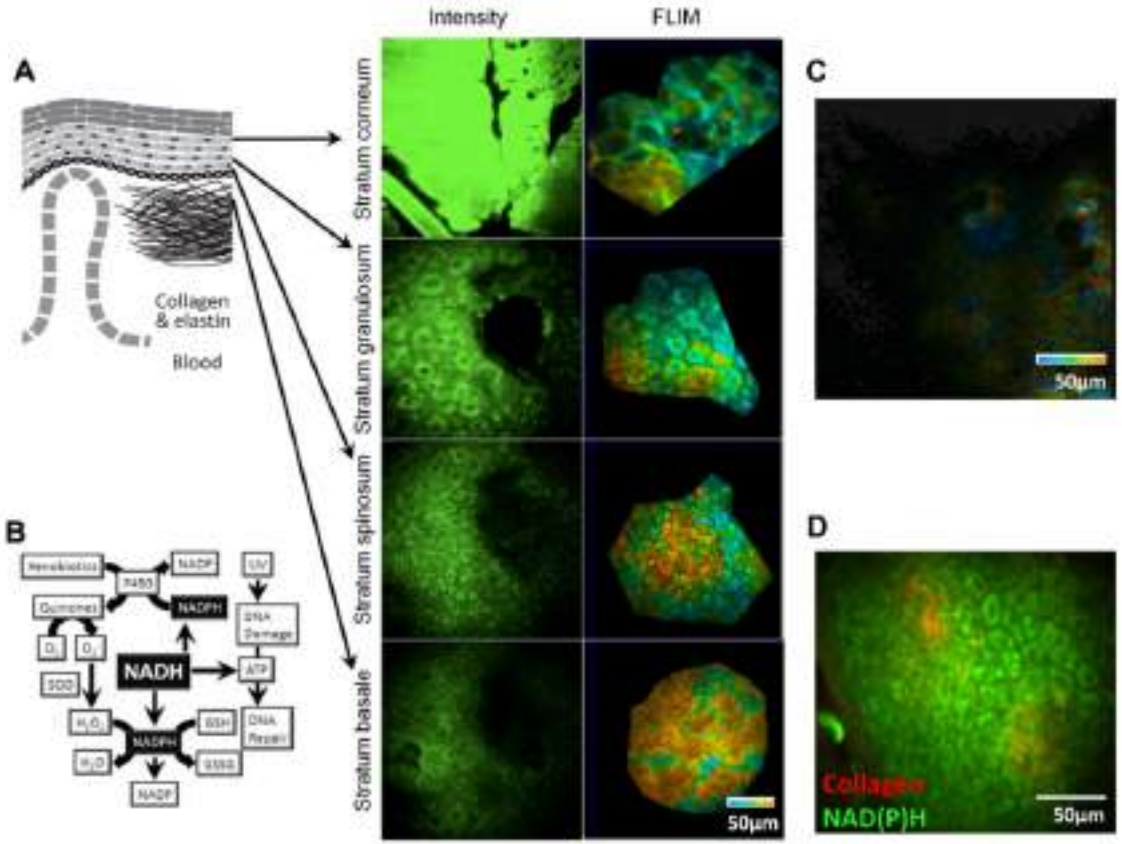
Computer assisted tools for the evaluation of UV spots and red areas

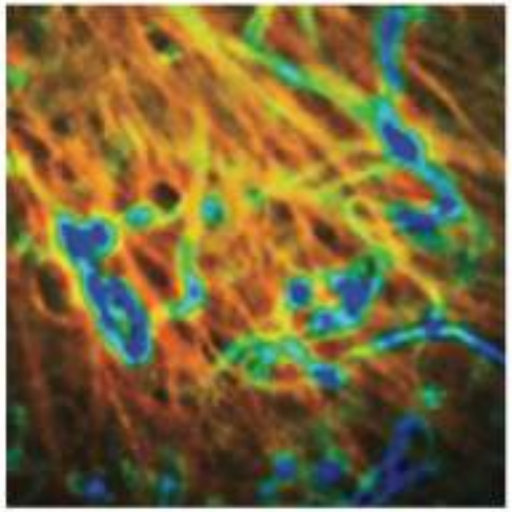
Goldsberry A, Hanke CW, Hanke KE. VISIA system: a possible tool in the cosmetic practice. J Drugs Dermatol. 2014 Nov;13(11):1312-4. PMID: 25607694.

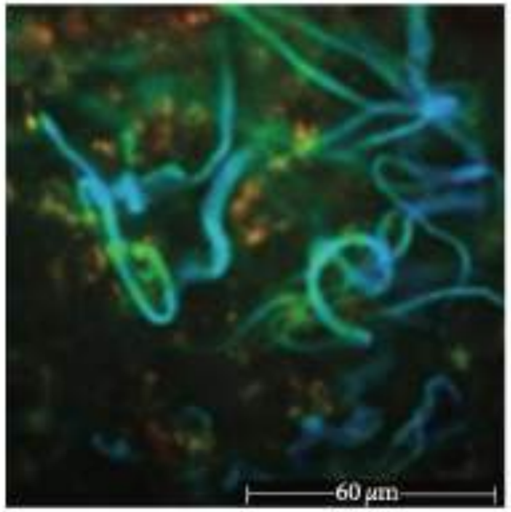


Linming F, Wei H, Anqi L, Yuanyu C, Heng X, Sushmita P, Yiming L, Li L. Comparison of two skin imaging analysis instruments: The VISIA® from Canfield vs the ANTERA 3D® CS from Miravex. Skin Res Technol. 2018 Feb;24(1):3-8.

Measurement of photoageing: Fluorescence lifetime imaging microscopy (FLIM)

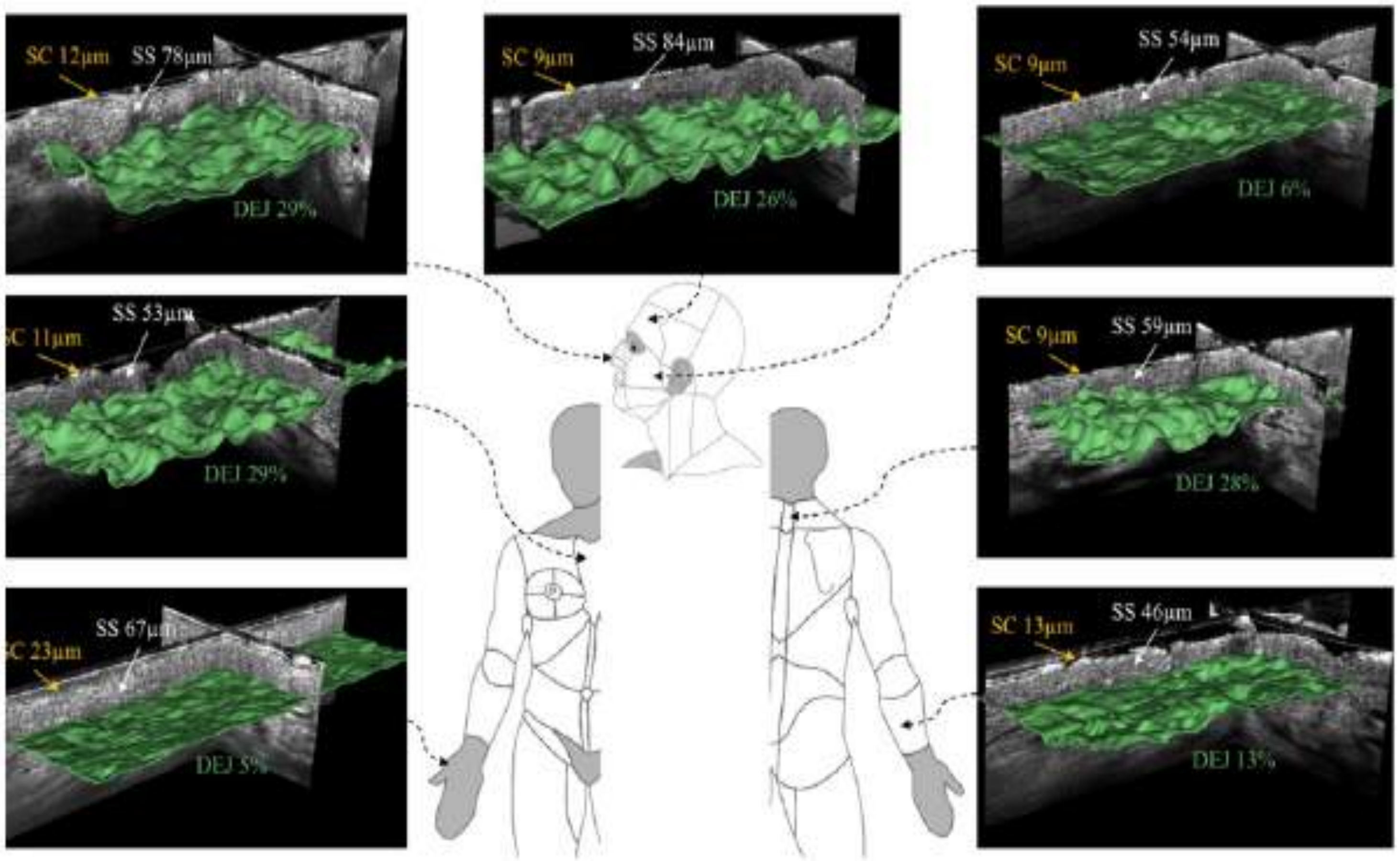






Seidenari S, Arginelli F, Bassoli S, Cautela J, French PM, Guanti M, Guardoli D, König K, Talbot C, Dunsby C. Multiphoton laser microscopy and fluorescence lifetime imaging for the evaluation of the skin. Dermatol Res Pract. 2012;2012:810749. doi: 10.1155/2012/810749. Epub 2011 Nov 28. PMID: 22203841; PMCID: PMC3235701.

Measurement of photoageing: lineal confocal-OCT (LC-OCT)



3D LC-OCT quantification of epidermal characteristics in seven body sites on the same subject (27-year-old female, phototype II). The thickness of stratum corneum (SC) and stratum spinosum (SS) are reported in µm, whereas the undulation of the dermal- epidermal junction (DEJ, green layer) is expressed in percentage (Chauvel-Picard J et al)

Chauvel-Picard J, Bérot V, Tognetti L, Orte Cano C, Fontaine M, Lenoir C, Pérez-Anker J, Puig S, Dubois A, Forestier S, Monnier J, Jdid R, Cazorla G, Pedrazzani M, Sanchez A, Fischman S, Rubegni P, Del Marmol V, Malvehy J, Cinotti E, Perrot JL, Suppa M. Line-field confocal optical coherence tomography as a tool for three-dimensional in vivo quantification of healthy epidermis: A pilot study. J Biophotonics. 2022 Feb;15(2):e202100236. doi: 10.1002/jbio.202100236. Epub 2021 Oct 21. PMID: 34608756.

www.nature.com/scientificreports

scientific reports

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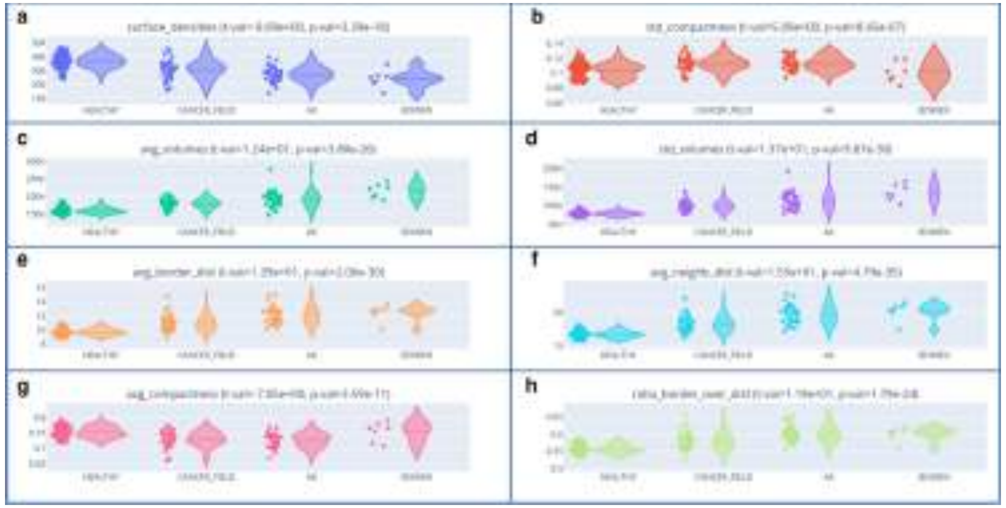
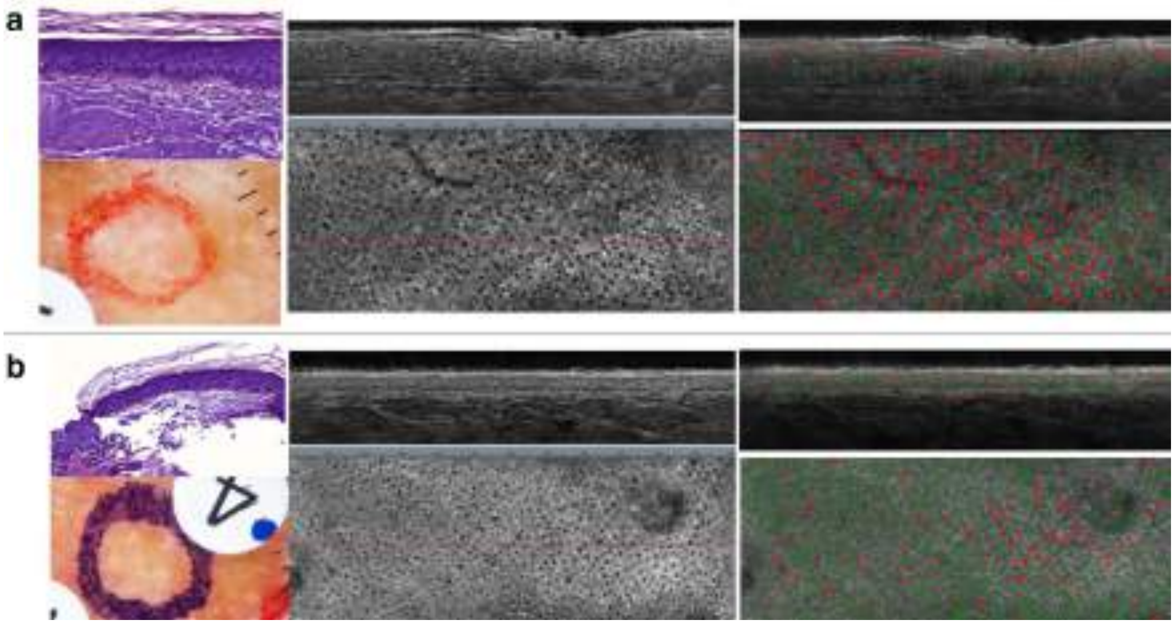
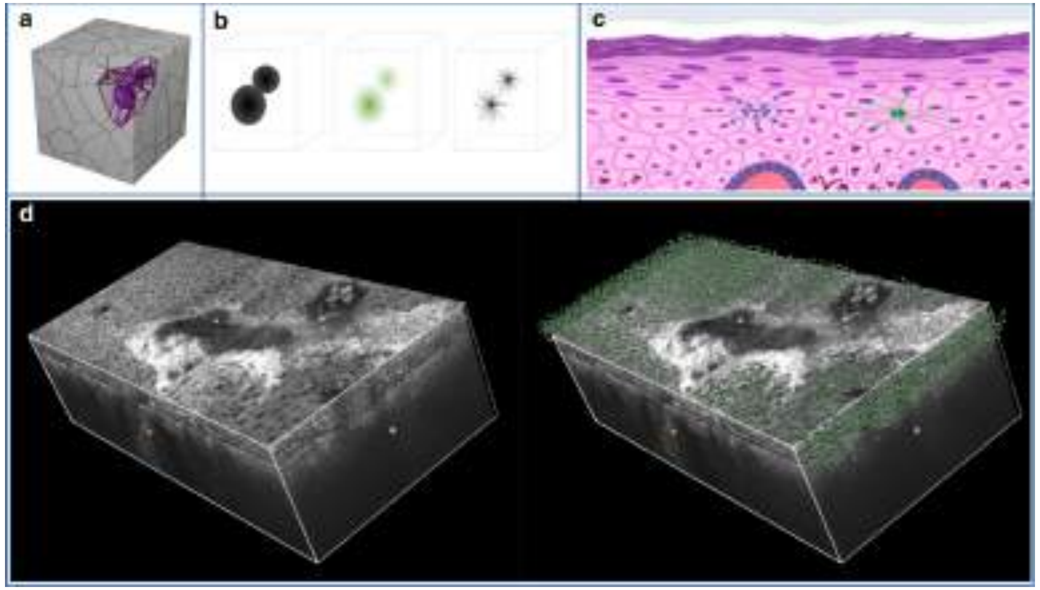
OPEN

Non-invasive scoring of cellular atypia in keratinocyte cancers in 3D LC-OCT images using Deep Learning

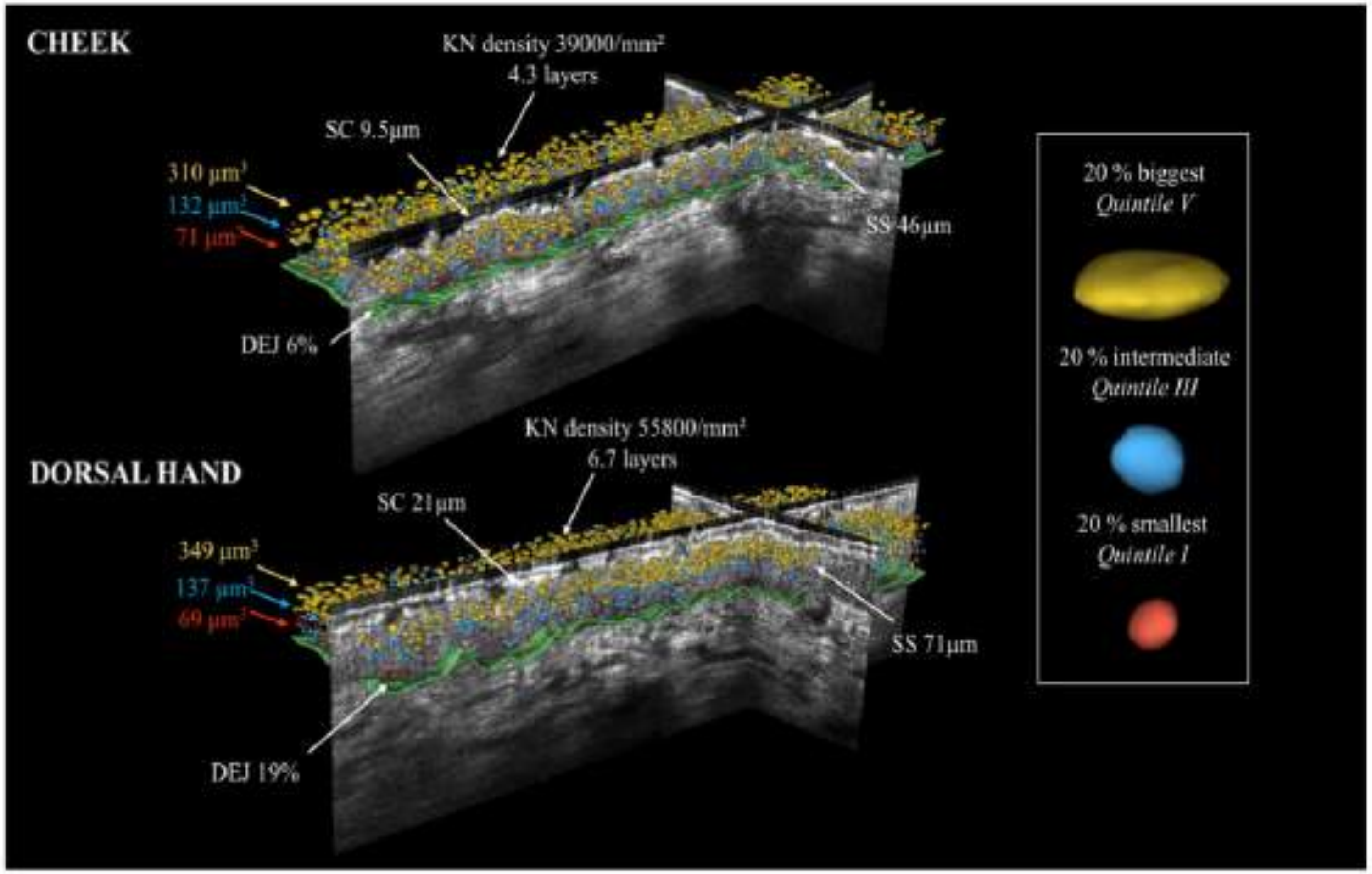
Sébastien Fischman[1]✉, Javiera Pérez-Anker[2,3], Linda Tognetti[4], Angelo Di Naro[4], Mariano Suppa[5,6,7], Elisa Cinotti[4,6], Théo Viel[1], Jilliana Monnier[6,8], Pietro Rubegni[4], Véronique del Marmol[5], Josep Malvehy[2,3], Susana Puig[2,3], Arnaud Dubois[9] & Jean-Luc Perrot[10]





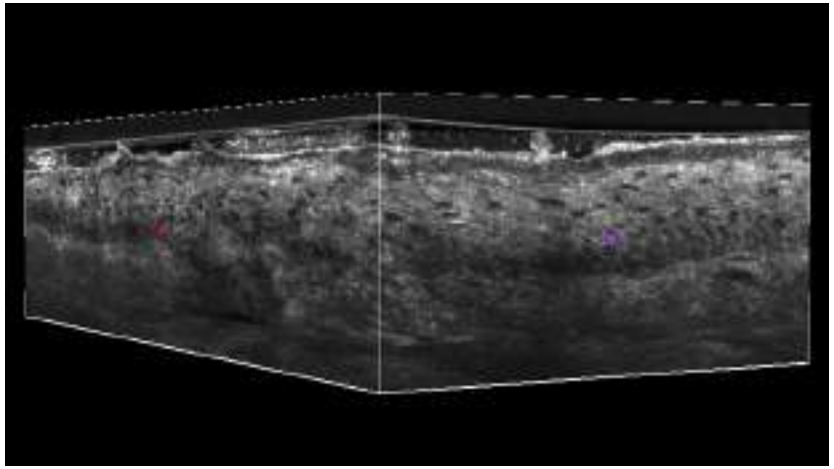


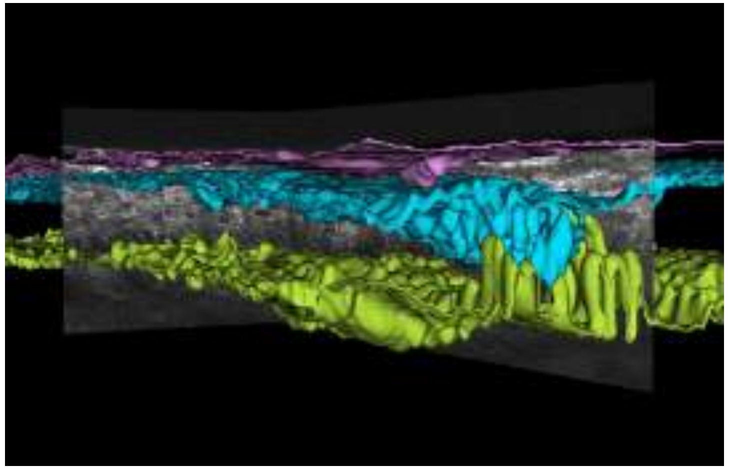
Measurement of photoageing: lineal confocal-OCT (LC-OCT)



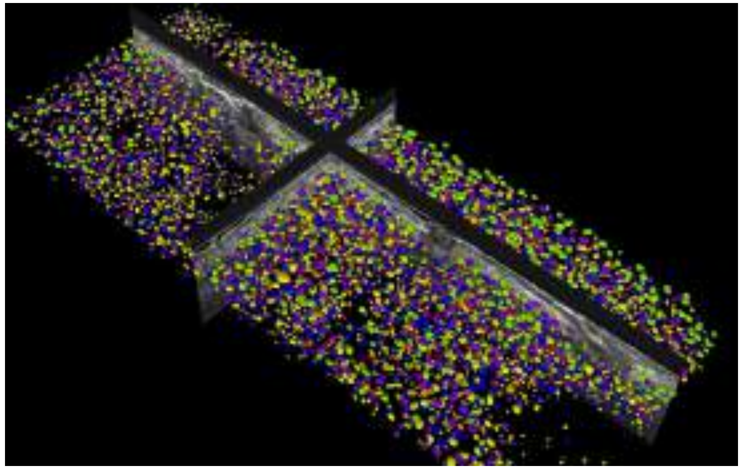
Keratinocyte nuclei distribution according to their volume (level of keratinocyte maturation) on the cheek and dorsal hand of the same study participant (21-year-old female, phototype II). Keratinocytes are illustrated in 3D and colored according to nuclei volume (red, quintile I including the smallest; blue, quintile III including the intermediate; yellow, quintile V including the biggest). The dermal- epidermal junction is depicted as a green layer (undulation index expressed in percentage). Three distinct layers are visible: a lower, red layer (just above the DEJ) containing small, immature basal keratinocytes; an intermediate, blue layer containing maturing keratinocytes; and an upper, yellow layer containing large, mature keratinocytes. DEJ, dermal epidermal junction; KN, keratinocytes; SC, stratum corneum; SS, stratum spinosum. Thicknesses (µm); nuclei volume (µm3); keratinocyte density (mm2)
(Chauvel-Picard J et al)

Chauvel-Picard J, Bérot V, Tognetti L, Orte Cano C, Fontaine M, Lenoir C, Pérez-Anker J, Puig S, Dubois A, Forestier S, Monnier J, Jdid R, Cazorla G, Pedrazzani M, Sanchez A, Fischman S, Rubegni P, Del Marmol V, Malvehy J, Cinotti E, Perrot JL, Suppa M. Line-field confocal optical coherence tomography as a tool for three-dimensional in vivo quantification of healthy epidermis: A pilot study. J Biophotonics. 2022 Feb;15(2):e202100236. doi: 10.1002/jbio.202100236. Epub 2021 Oct 21. PMID: 34608756.

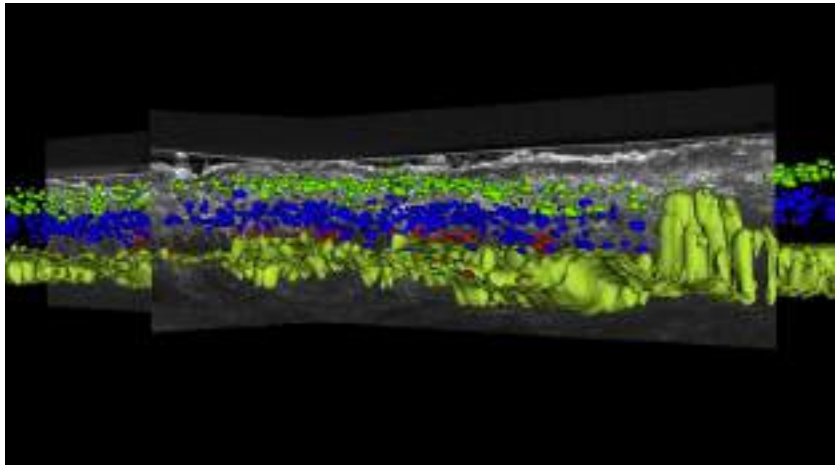




Skin layers segmentation



Nuclei per layers (3D)
Green: 1st top layer / Blue: middle layer /
Red: bottom layer



Nuclei per layers (3D)
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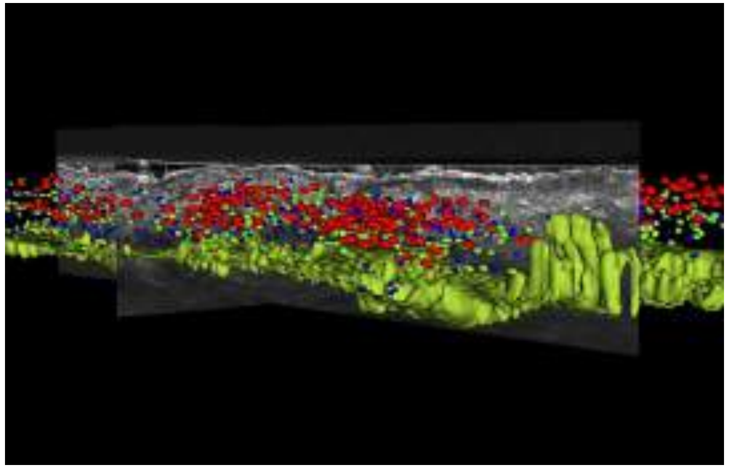
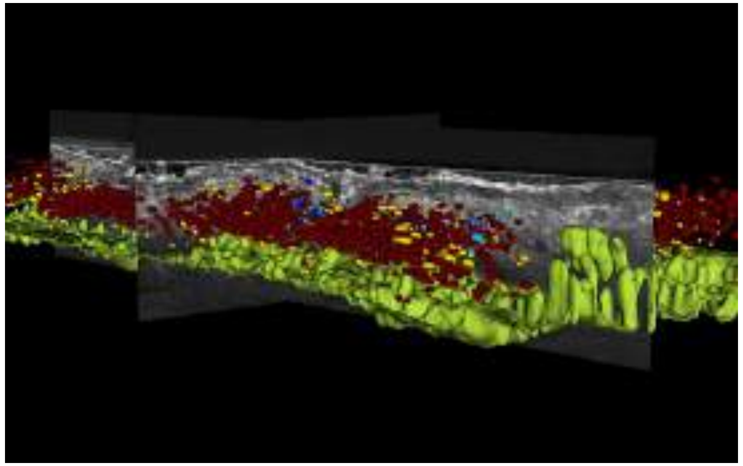
Blue: middle layer
Red: bottom layer

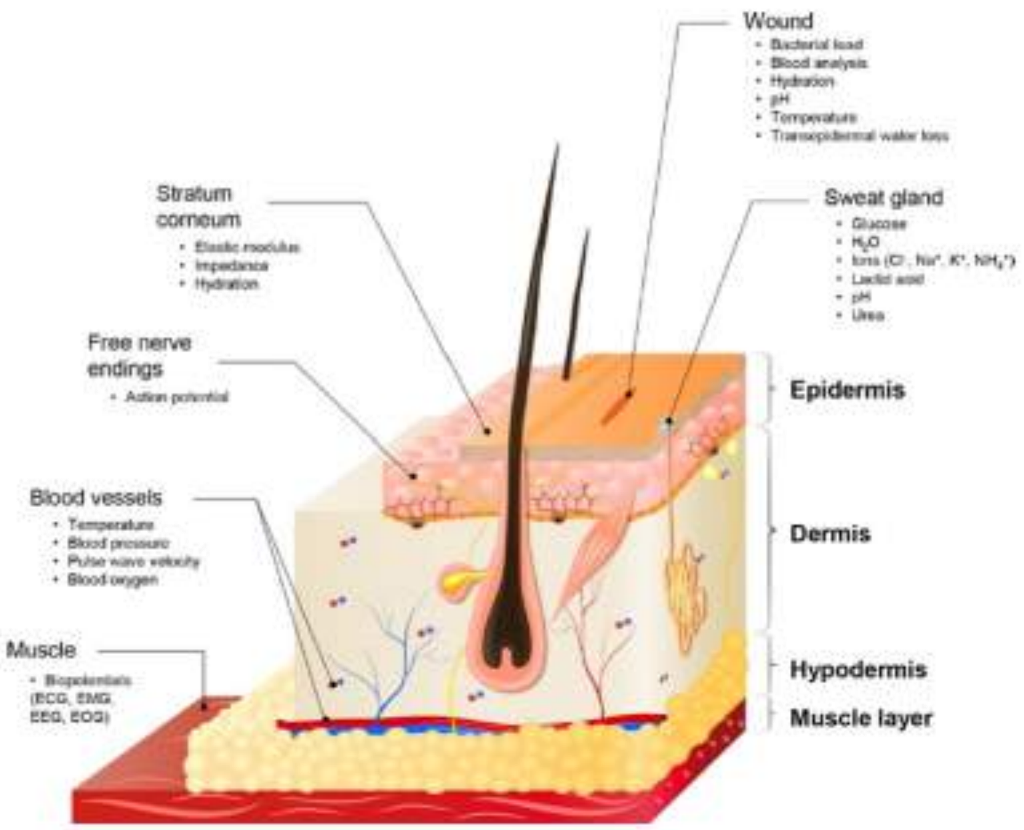


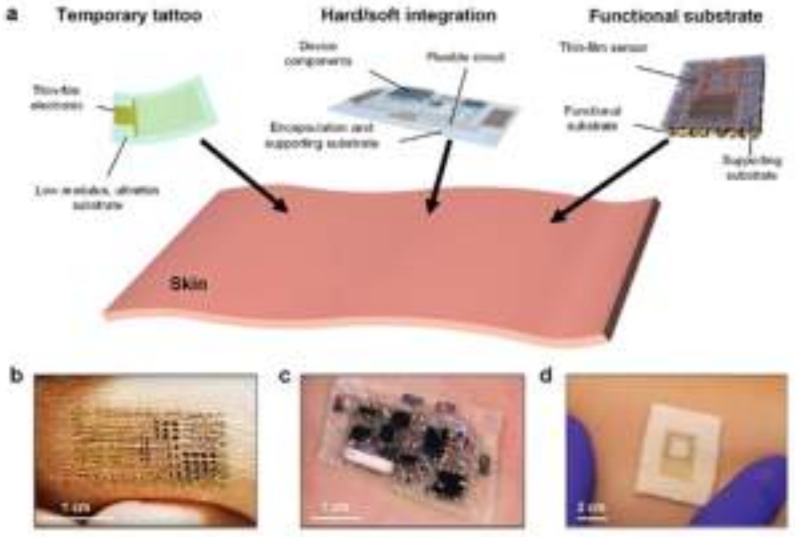
Nuclei per size (volume)
red: largest nuclei
Green: intermediate
blue: smallest



Nuclei per atypia (AI score)
red: highest atypia
Green/yellow: intermediate
blue: smallest atypia

Wearable Health Monitoring





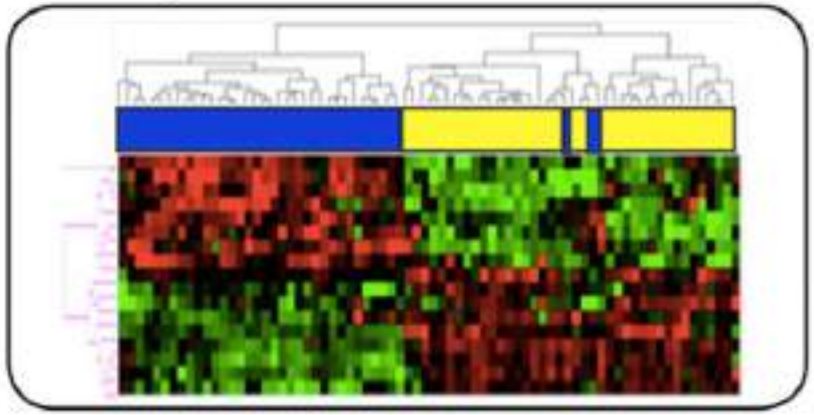
Genetic markers, diet, and microbiota, both on the skin and in the gut

Liu Y, Pharr M, Salvatore GA. Lab-on-Skin: A Review of Flexible and Stretchable Electronics for Wearable Health Monitoring. ACS Nano. 2017 Oct 24;11(10):9614-9635.

Medical devices using molecular analyses (non-invasive)

Adhesive Patch Biopsy

Objective Gene Expression Assessment



Not skin cancer   Skin cancer

Analyses of RNA in stratum corneum. Epidermal Genomic Information Retrieval (EGIR™)

Based on expression profiles of the long intergenic non–protein coding RNA 518 gene (*LINC00518* [HGNC 28626]) and the preferentially expressed antigen in melanoma gene (*PRAME* [HGNC 9336]) in skin tissue samples obtained via adhesive patch biopsies, can accurately classify pigmented skin lesions with a sensitivity of 92% and a specificity of 69%.

Ferris LK, Jansen B, Ho J, Busam KJ, Gross K, et al. Utility of a Noninvasive 2-Gene Molecular Assay for Cutaneous Melanoma and Effect on the Decision to Biopsy. JAMA Dermatol. 2017 Jul 1;153(7):675-680

- Natural language Processing
- Avatars an Deep imaging
- Sensors, biometrics
- ML for complex analytics
- Generative AI
- Robotics for surgery, laser,
- Drug delivery by nanotech
- AI for monitoring of patients
- AI for support for patients

These doctors think electronic health records are hurting their relationships with patients

For every hour physicians provide direct clinical face time to patients, nearly 2 additional hours is spent on EHR and desk work within the clinic day. Outside office hours, physicians spend another 1 to 2 hours of personal time each night doing additional computer and other clerical work.

"There is nothing more frustrating to a patient than talking to their doctor, wanting advice, and that provider is typing away and looking at a computer screen instead of the patient."

"Only 27 percent of a doctor's time is spent with patients — and nearly half is spent on EHR and desk work?

Sinsky C, et al. Allocation of Physician Time in Ambulatory Practice: A Time and Motion Study in 4 Specialties. Ann Intern Med. 2016 Dec 6;165(11):753-760.

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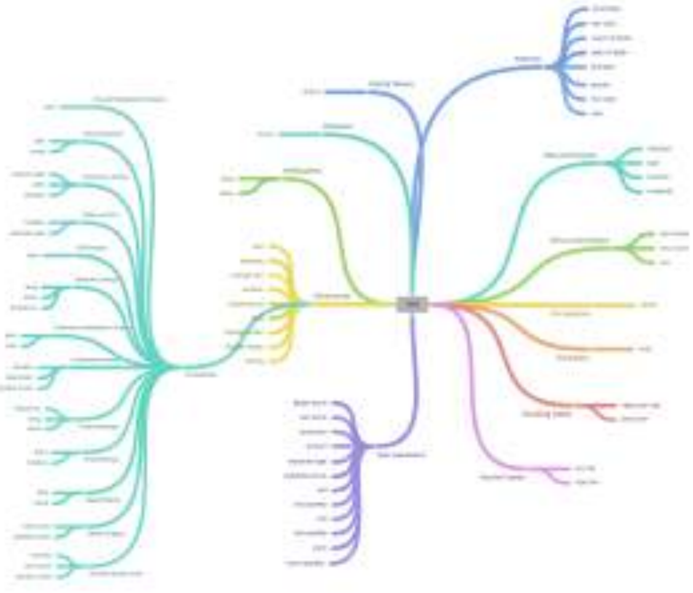


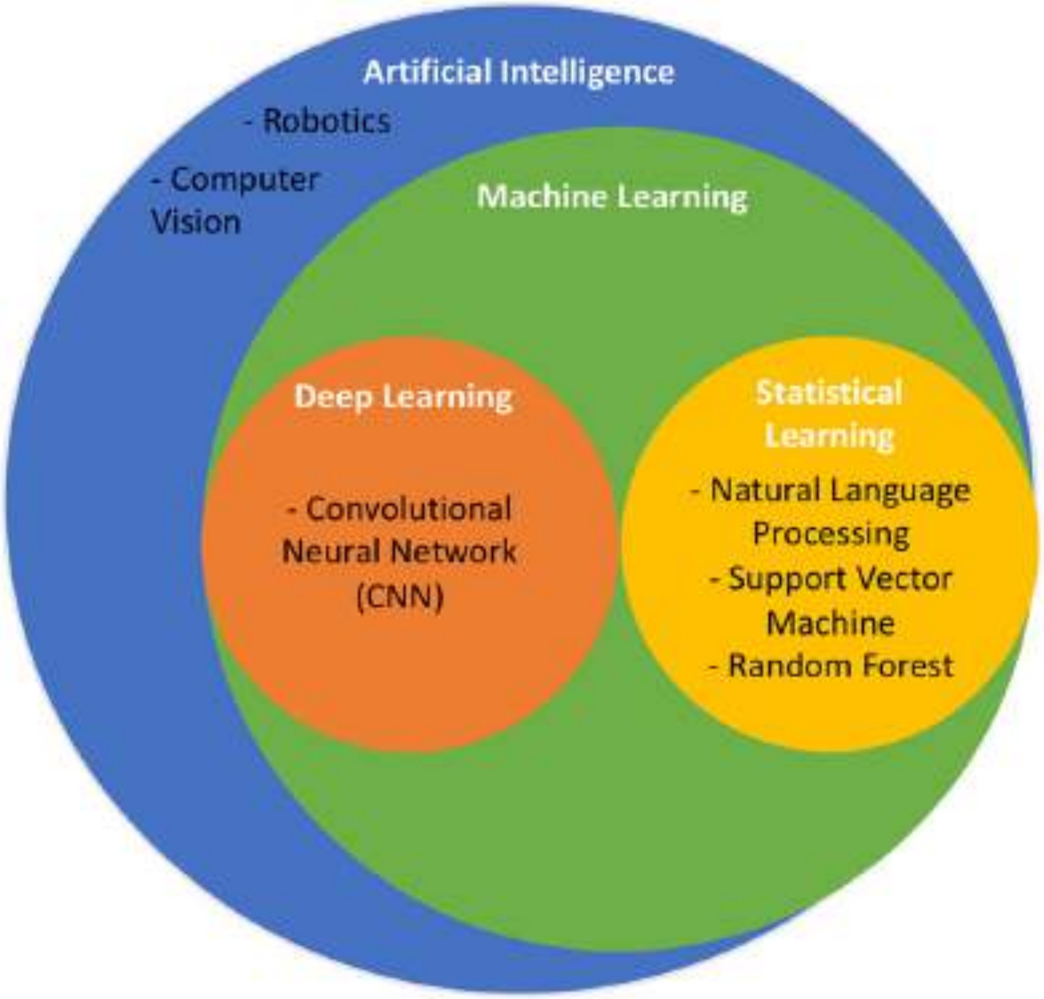
Natural language processing

Clínic Barcelona

ARTIFICIAL INTELLIGENCE AND DERMATOLOGY

Five current areas of applications for ML in DERMATOLOGY

1. Disease classification using clinical/ dermoscopy images
2. Disease classification using dermatopathology images
3. Assessment of diseases using mobile applications and personal monitoring devices
4. Facilitating large-scale epidemiology research
5. Precision medicine



Chan S, Reddy V, Myers B, et al. Machine Learning in Dermatology: Current Applications, Opportunities, and Limitations. Dermatol Ther (Heidelb). 2020 Jun;10(3):365-386.

ARTIFICIAL INTELLIGENCE AND DERMATOLOGY

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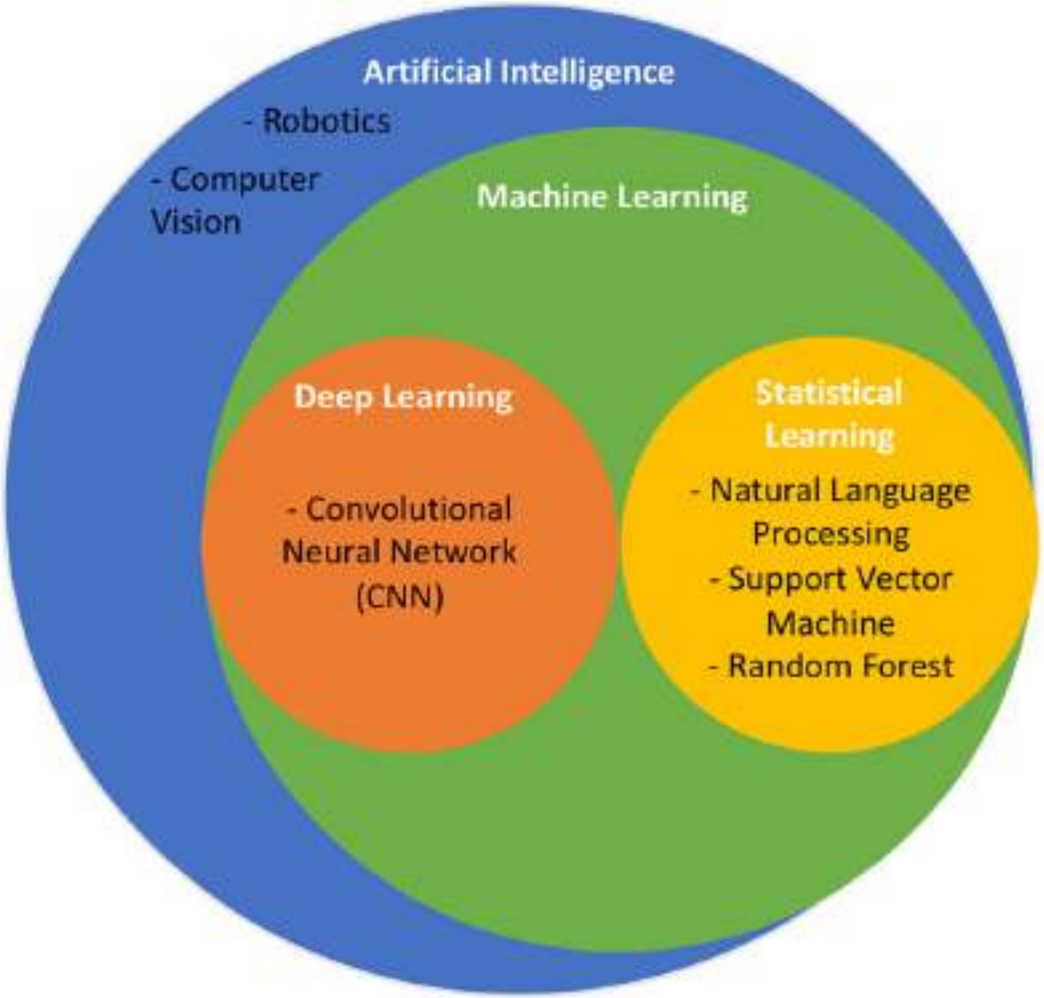
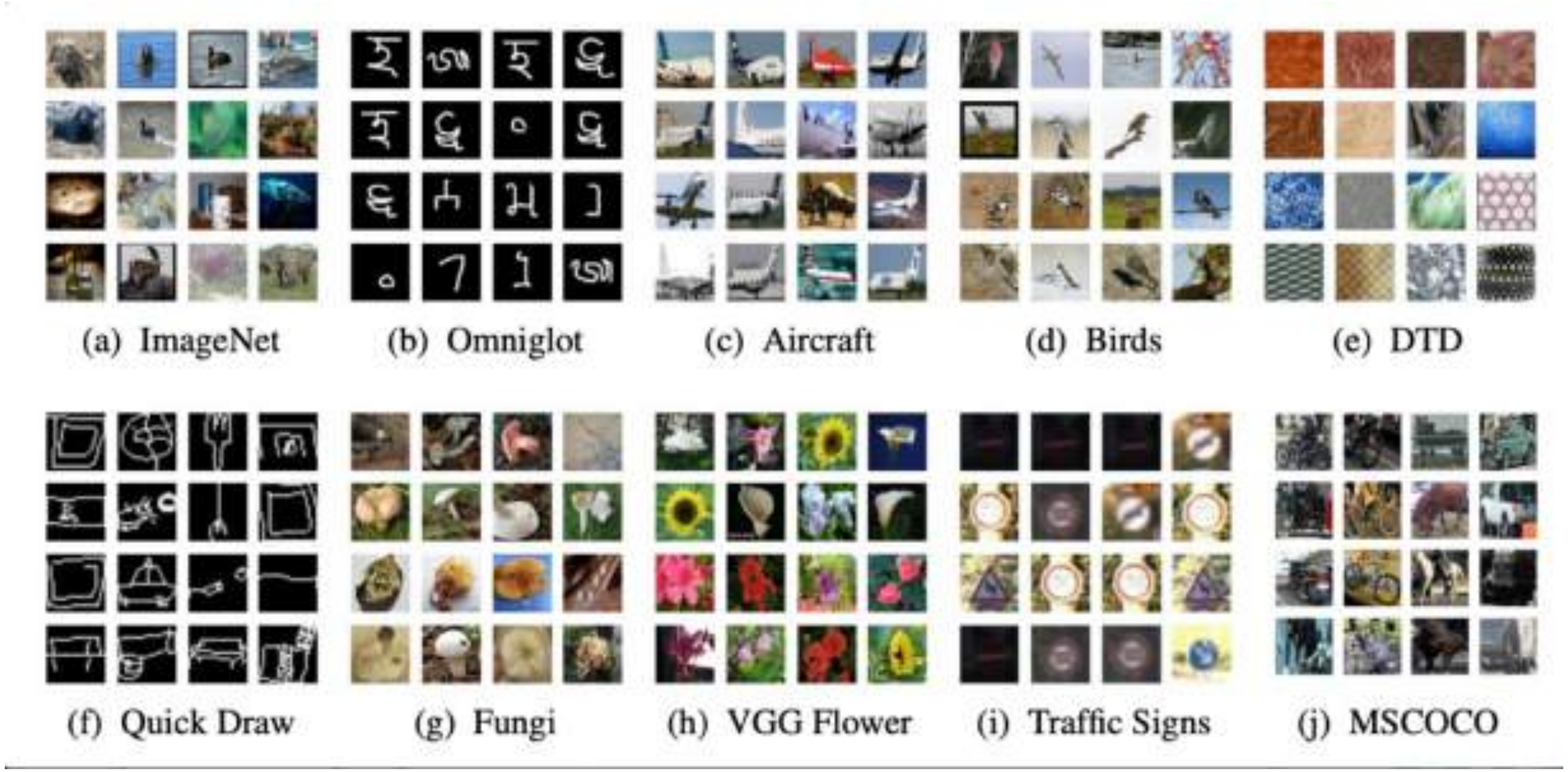


Chan S, Reddy V, Myers B, et al. Machine Learning in Dermatology: Current Applications, Opportunities, and Limitations. Dermatol Ther (Heidelb). 2020 Jun;10(3):365-386.

ImageNet Large Scale Visual Recognition Challenges



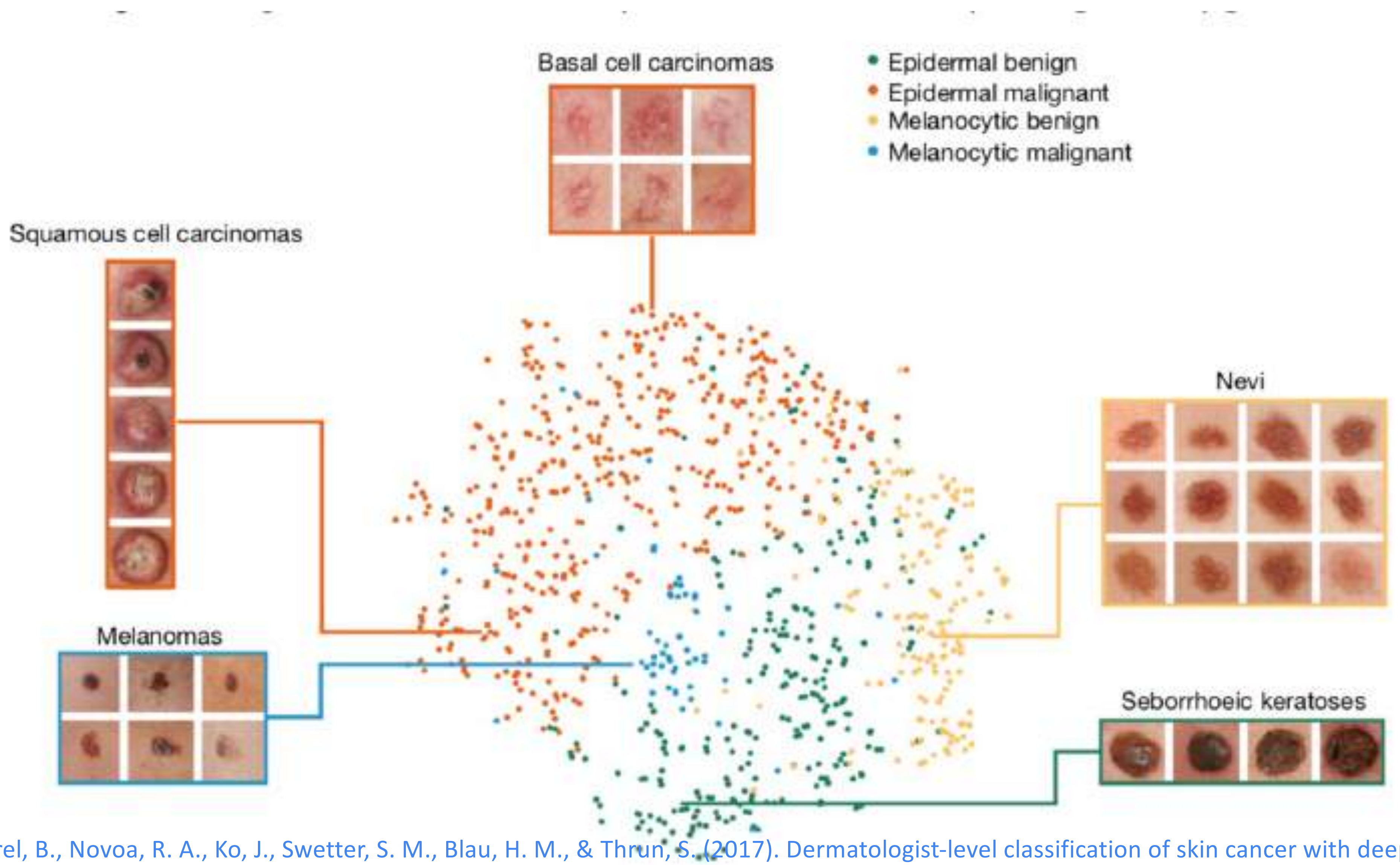
2012 "ImageNet Challenge" = Deep learning

“We should stop training radiologists now”

Geoff Hinton, 2016

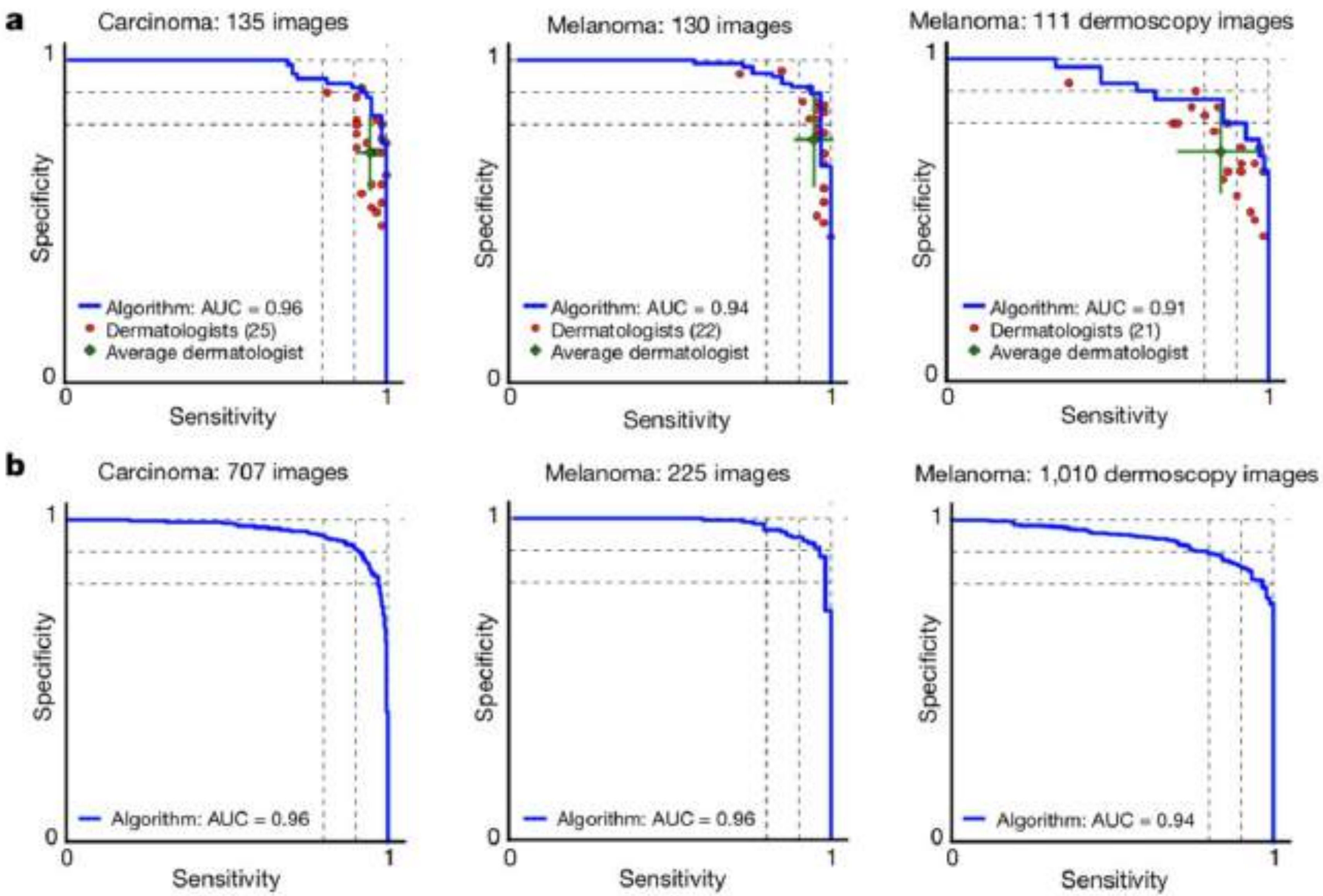
https://www.youtube.com/watch?v=2HMPRXstSvQ
https://medium.com/unauthorized-storytelling/the-radiologist-is-here-to-stay-24da650621b5

Man againts Machine



Esteva, A., Kuprel, B., Novoa, R. A., Ko, J., Swetter, S. M., Blau, H. M., & Thrun, S. (2017). Dermatologist-level classification of skin cancer with deep neural networks. *Nature*, *542*(7639), 115–118.

Nature 2017



Esteva, A. et al. *Nature* (2017). *542*(7639), 115–118.

Man againts Machine

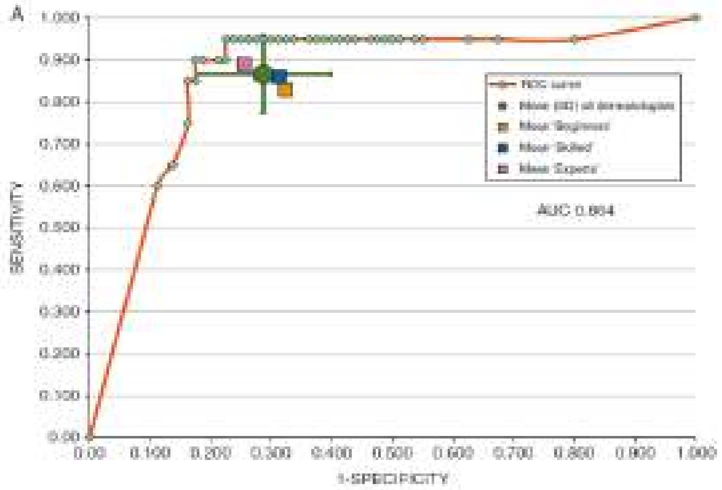
GOOD SCIENCE
BETTER MEDICINE
BEST PRACTICE

Annals of Oncology 29: 1836–1842, 2018
doi:10.1093/annonc/mdy166
Published online 28 May 2018

ORIGINAL ARTICLE

Man against machine: diagnostic performance of a deep learning convolutional neural network for dermoscopic melanoma recognition in comparison to 58 dermatologists

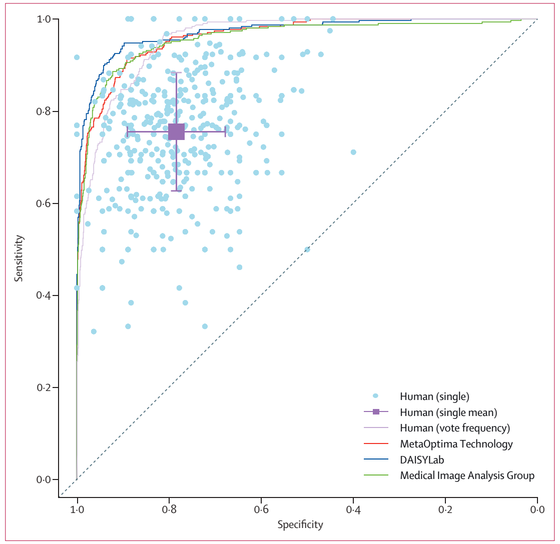
H. A. Haenssle[1*,†], C. Fink[1†], R. Schneiderbauer[1], F. Toberer[1], T. Buhl[2], A. Blum[3], A. Kalloo[4], A. Ben Hadj Hassen[5], L. Thomas[6], A. Enk[1] & L. Uhlmann[7]



CrossMark

Comparison of the accuracy of human readers versus machine-learning algorithms for pigmented skin lesion classification: an open, web-based, international, diagnostic study

Philipp Tschandl, Noel Codella, Bengü Nisa Akay, Giuseppe Argenziano, Ralph P Braun, Horacio Cabo, David Gutman, Allan Halpern, Brian Helba, Rainer Hofmann-Wellenhof, Aimilios Lallas, Jan Lapins, Caterina Longo, Josep Malvehy, Michael A Marchetti, Ashfaq Marghoob, Scott Menzies, Amanda Oakley, John Paoli, Susana Puig, Christoph Rinner, Cliff Rosendahl, Alon Scope, Christoph Sinz, H Peter Soyer, Luc Thomas, Iris Zalaudek, Harald Kittler



2017: AI “better than dermatologist” at detecting skin cancer

BBC

Health

Artificial intelligence 'as good as cancer doctors'

26 January 2017

By James Gallagher

'Automated dermatologist' detects skin cancer with expert accuracy

By Susan Scutti, CNN

Updated 6:37 PM ET, Thu January 26, 2017

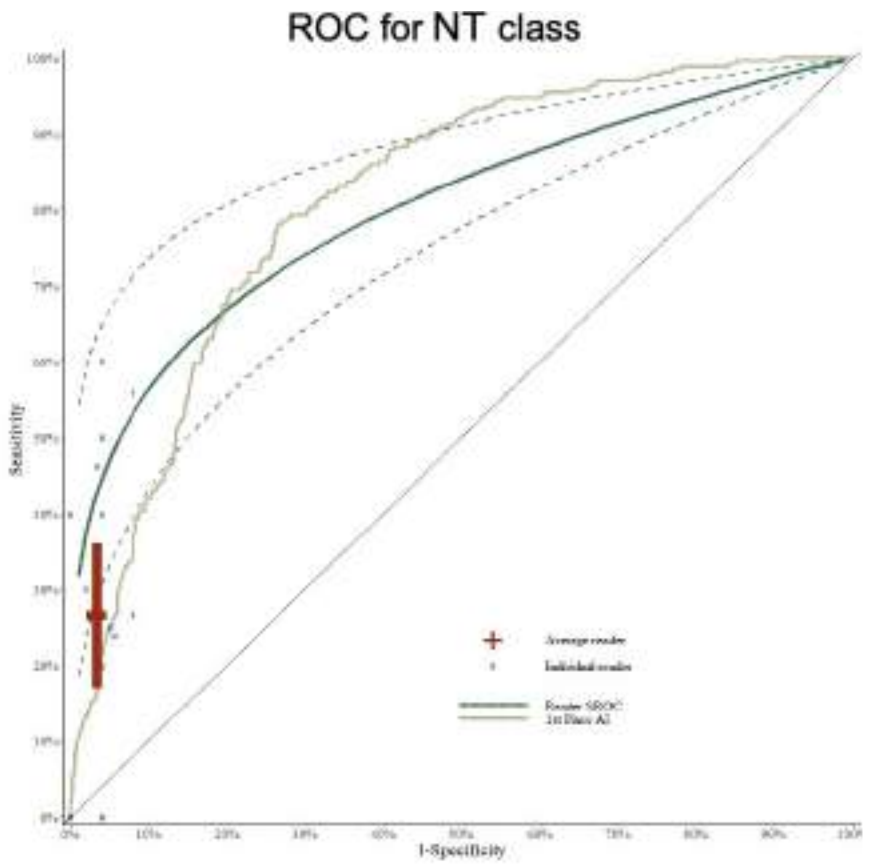
Current Deficiencies of AI for Skin Cancer Diagnosis: Validation of prediction models for skin cancer detection on dermoscopy images in the 2019 International Skin Imaging Collaboration (ISIC) Grand Challenge. Digital Lancet Oncology 2022

Marc Combalia MS, Noel Codella PhD, Veronica Rotemberg MD, Cristina Carrera MD, Stephen Dusza PhD, David Gutman MD, Brian Helba, Harald Kittler MD, Nicholas R. Kurtansky BS, Konstantinos Liopyris MD, Michael A. Marchetti MD, Sebastian Podlipnik MD, Susana Puig MD, Christoph Rinner PhD, Philipp Tschandl MD, Jochen Weber, Allan Halpern MD, and Josep Malvehy MD

Methods: A large dermoscopic image classification challenge was designed to quantify impacts to diagnostic accuracy from shifts in statistical distributions of data, disease categories not represented in training datasets, and imaging or lesion artifacts.

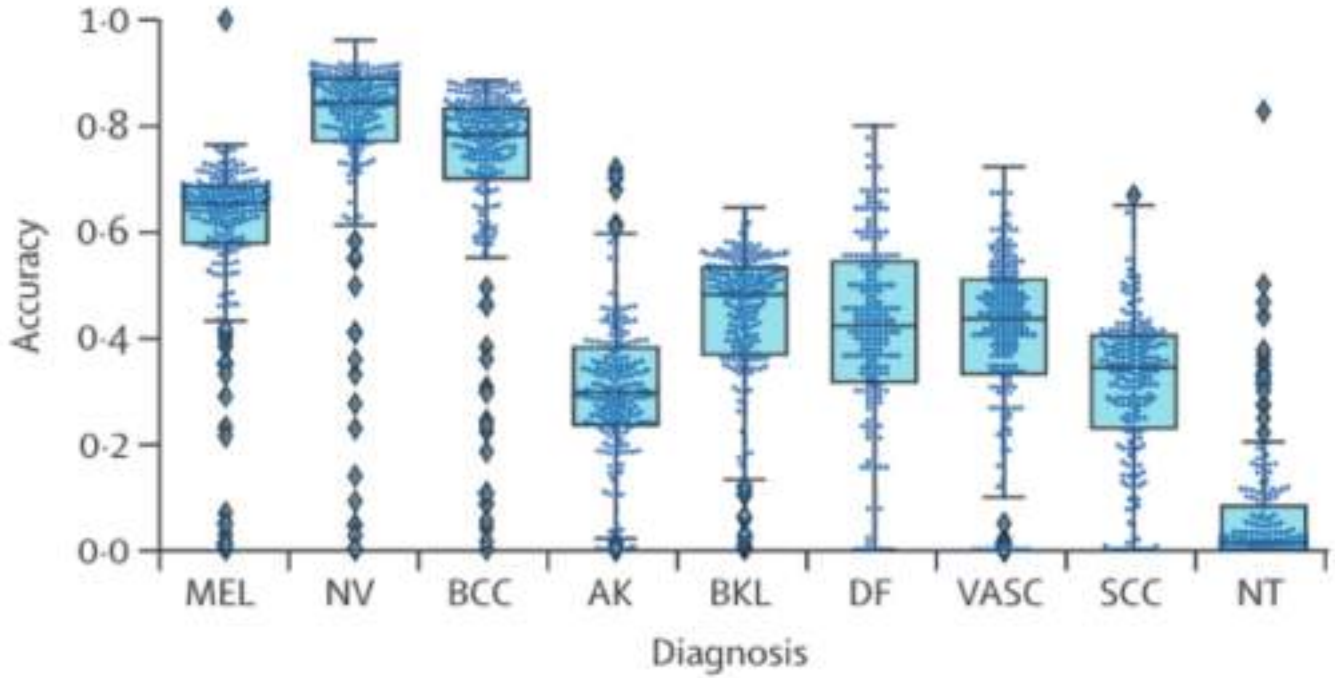
Factors that may be beneficial to performance, such as clinical metadata and external training data, were also evaluated. 25,331 training images across 8 diseases were provided to challenge participants.

Conclusions: We have identified specific deficiencies and safety issues in AI dermatologic diagnostic systems which should be addressed in future diagnostic evaluation protocols to improve safety and reliability in clinical practice.



Current Deficiencies of AI for Skin Cancer Diagnosis: Validation of prediction models for skin cancer detection on dermoscopy images in the 2019 International Skin Imaging Collaboration (ISIC) Grand Challenge. Digital Lancet Oncology 2022 (in press)

Marc Combalia MS, Noel Codella PhD, Veronica Rotemberg MD, Cristina Carrera MD, Stephen Dusza PhD, David Gutman MD, Brian Helba, Harald Kittler MD, Nicholas R. Kurtansky BS, Konstantinos Liopyris MD, Michael A. Marchetti MD, Sebastian Podlipnik MD, Susana Puig MD, Christoph Rinner PhD, Philipp Tschandl MD, Jochen Weber, Allan Halpern MD, and Josep Malvehy MD



	NV	BKL	MEL	SCC	AK	BCC	VASC	DF	NT
Inflammatory disease	0·055	0·072	0·025	0·095	0·19	0·36	0·02	0·081	0·10
Benign neoplasm	0·096	0·12	0·059	0·053	0·13	0·28	0·072	0·073	0·11
Normal variant	0·13	0·089	0·31	0·086	0·07	0·13	0·049	0·015	0·12
Scar	0·029	0·055	0·082	0·048	0·19	0·44	0·019	0·033	0·10
Infectious disease	0·16	0·18	0·074	0·11	0·065	0·12	0·081	0·072	0·14

Task Force of Artifical Intelligence of the European Academy of Dermatology and Venereology (EADV)

European Academy of Dermatology and Venereology

"The mission of the AI Task Force is to influence, promote and develop this field within Dermatology and Venereology, to provide i) a mechanism for greater engagement of EADV members in AI and ii) links to existing subspecialty and other scientific and professional societies including the area of Health, Digital Health and other specialties".

Creation of communication tools for the management of the Task Force, projects and dissemination

Education in AI for dermatologists, students, residents, patients, general public, computer scientists

Radar of AI groups/projects in Dermatology in Europe (and worldwide)

Collaborative research and innovation in AI in Dermatology and Venereology

POSITION PAPERS on AI and Dermatology

Analyses of the regulatory policies of software using AI (European Directives set forth by the European Commission)

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Members of the four European regions: Spain, Portugal, Italy, Greece, Austria, Germany, UK and Poland.

5 Members from the USA, Chile and Australia

EADV European Academy of Dermatology and Venereology

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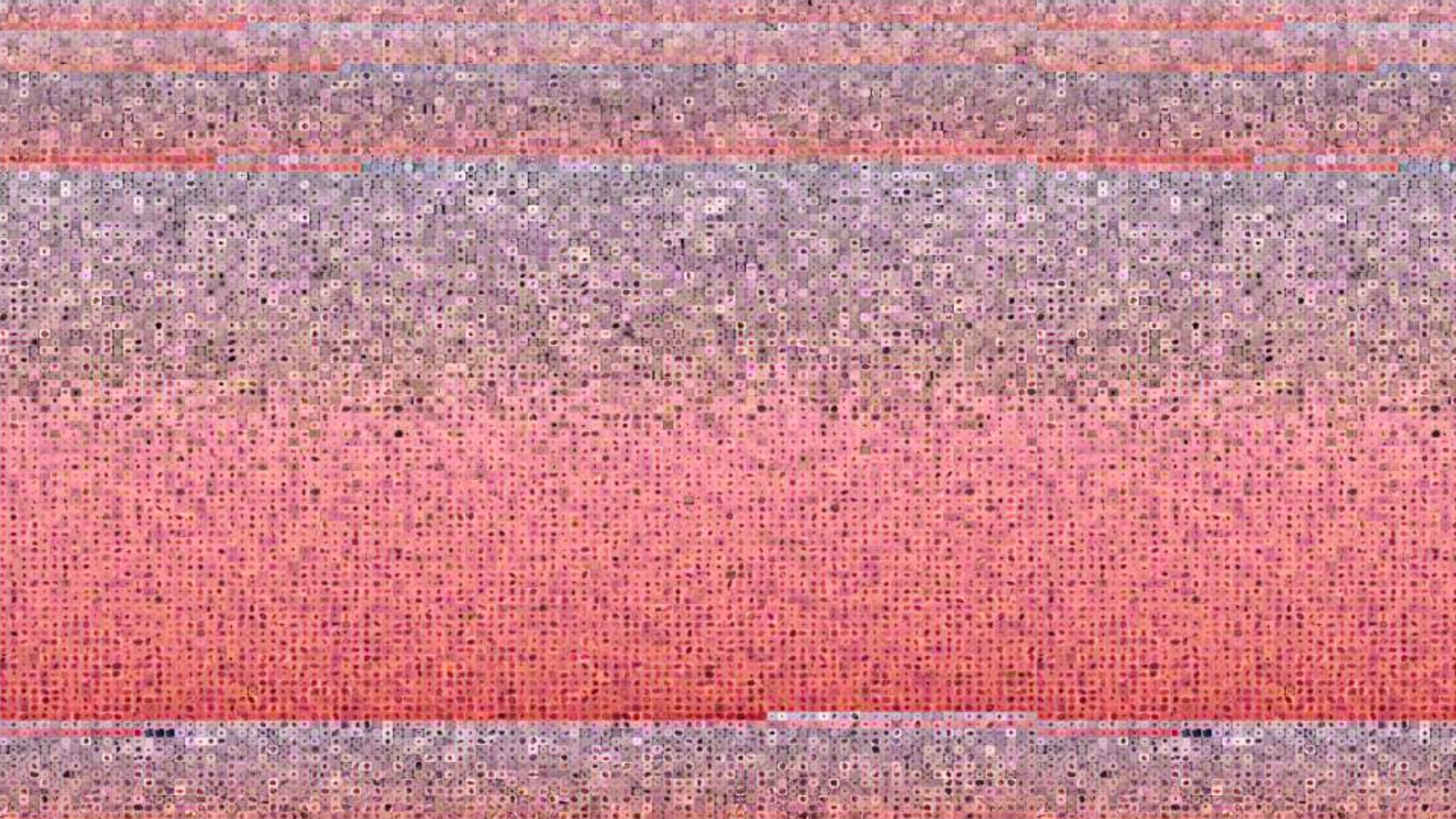

Clinical Review & Education

JAMA Dermatology | Consensus Statement

Checklist for Evaluation of Image-Based Artificial Intelligence Reports in Dermatology

CLEAR Derm Consensus Guidelines From the International Skin Imaging Collaboration Artificial Intelligence Working Group

Roxana Daneshjou, MD, PhD; Catarina Barata, PhD; Brigid Betz-Stablein, PhD; M. Emre Celebi, PhD; Noel Codella, PhD; Marc Combalia, MSc; Pascale Guitera, MD, PhD; David Gutman, MD, PhD; Allan Halpern, MD; Brian Helba, BS; Harald Kittler, MD; Kivanc Kose, PhD; Konstantinos Liopyris, MD, PhD; Josep Malvehy, MD; Han Seung Seog, MD, PhD; H. Peter Soyer, MD; Eric R. Tkaczyk, MD, PhD; Philipp Tschandl, MD, PhD; Veronica Rotemberg, MD, PhD

IMPORTANCE The use of artificial intelligence (AI) is accelerating in all aspects of medicine and has the potential to transform clinical care and dermatology workflows. However, to develop image-based algorithms for dermatology applications, comprehensive criteria establishing development and performance evaluation standards are required to ensure product fairness, reliability, and safety.

OBJECTIVE To consolidate limited existing literature with expert opinion to guide developers and reviewers of dermatology AI.

EVIDENCE REVIEW In this consensus statement, the 19 members of the International Skin Imaging Collaboration AI working group volunteered to provide a consensus statement. A systematic PubMed search was performed of English-language articles published between December 1, 2008, and August 24, 2021, for "artificial intelligence" and "reporting guidelines," as well as other pertinent studies identified by the expert panel. Factors that were viewed as critical to AI development and performance evaluation were included and underwent 2 rounds of electronic discussion to achieve consensus.

FINDINGS A checklist of items was developed that outlines best practices of image-based AI development and assessment in dermatology.

CONCLUSIONS AND RELEVANCE Clinically effective AI needs to be fair, reliable, and safe; this checklist of best practices will help both developers and reviewers achieve this goal.

JAMA Dermatol. 2022;158(1):90-96. doi:10.1001/jamadermatol.2021.4915
Published online December 1, 2021.

Author Affiliations: Author affiliations are listed at the end of this article.

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Table. Checklist for Evaluation of Image-Based Artificial Intelligence (AI) Algorithm Reports in Dermatology (CLEAR Derm)

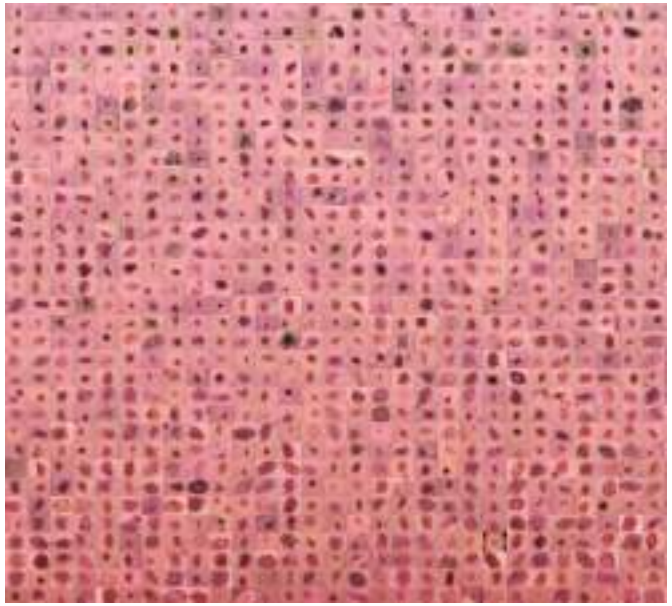
Checklist for image-based AI algorithm development in dermatology		Description is present/absent
Data		
1	Image types	
2	Image artifacts (eg, image quality, pen markings, anatomic site for photography)	
3	Technical acquisition details	
4	Preprocessing procedures	
5	Synthetic images made public if used	
6	Public images adequately referenced	
7	Patient-level metadata: geographic location of patients, sex and gender distribution, ethnicity and/or race, and how it was extracted	
8	Skin tone information and procedure by which skin tone was assessed	
9	Potential biases that may arise from use of patient information and metadata	
10	Data set partitions	
11	Sample sizes of training, validation, and test sets	
12	External test set	
13	Multivendor images	
14	Class distribution and balance	
15	Out-of-distribution images	
Technique		
16	Labeling method	
17	References to common/accepted diagnostic labels	
18	Histopathologic review for malignant neoplasms	
19	Detailed description of algorithm development	
Technical assessment		
20	How to publicly evaluate algorithm	
21	Performance measures	
22	Benchmarking, technical comparison, and novelty	
23	Bias assessment	
Application		
24	Use cases and target conditions (inside distribution)	
25	Potential impacts on the health care team and patients	

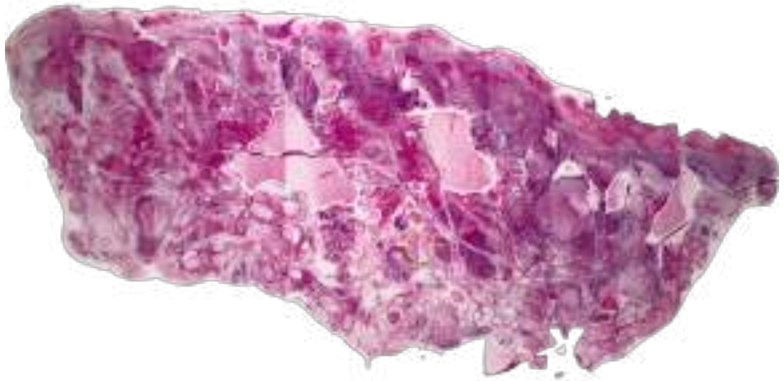
Daneshjou R, Barata C, Betz-Stablein B, Celebi ME, Codella N, Combalia M, Guitera P, Gutman D, Halpern A, Helba B, Kittler H, Kose K, Liopyris K, Malvehy J, Seog HS, Soyer HP, Tkaczyk ER, Tschandl P, Rotemberg V. Checklist for Evaluation of Image-Based Artificial Intelligence Reports in Dermatology: CLEAR Derm Consensus Guidelines From the International Skin Imaging Collaboration Artificial Intelligence Working Group. JAMA Dermatol. 2022 Jan 1;158(1):90-96.

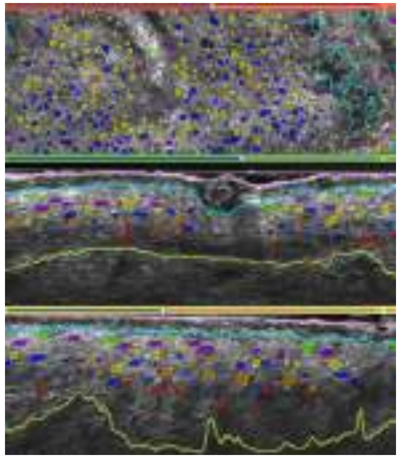
Checklist for image-based AI algorithm development in Dermatology

Data

1. Describe imaging modalities, confounding artifacts, and pre/post data processing
2. Describe the metadata on images used for AI development. Comment on potential biases
3. Carefully define image datasets (independent training, validation, test) used for AI algorithm development
4. Clearly describe how the test dataset relates to the proposed clinical setting, with special attention to statistical distributions, especially out-of-distribution (OOD) images and data







Checklist for image-based AI algorithm development in Dermatology

Technique

5. Develop the AI algorithm using a standard of reference for image labels that is widely accepted in our field
6. Describe algorithm development
7. The AI algorithm or algorithm output should be publicly evaluable

Technical Assessment

8. Performance measures should be consistent with proposed clinical translation
9. Benchmarking, technical comparison, and novelty

Checklist for image-based AI algorithm development in Dermatology

Application

10. Describe intended use cases and target conditions (inside distribution)
11. Discuss potential impacts on the healthcare team and patients

User
Lay-person self exam
Patient
Nurse
GP
General Dermatol
Expert dermatol

Intended use
Education, diagnostics, monitoring,
……

Apps + IA

TeleSkin

home | melanoma | skinScan | TeleSkin system | about

Pin it

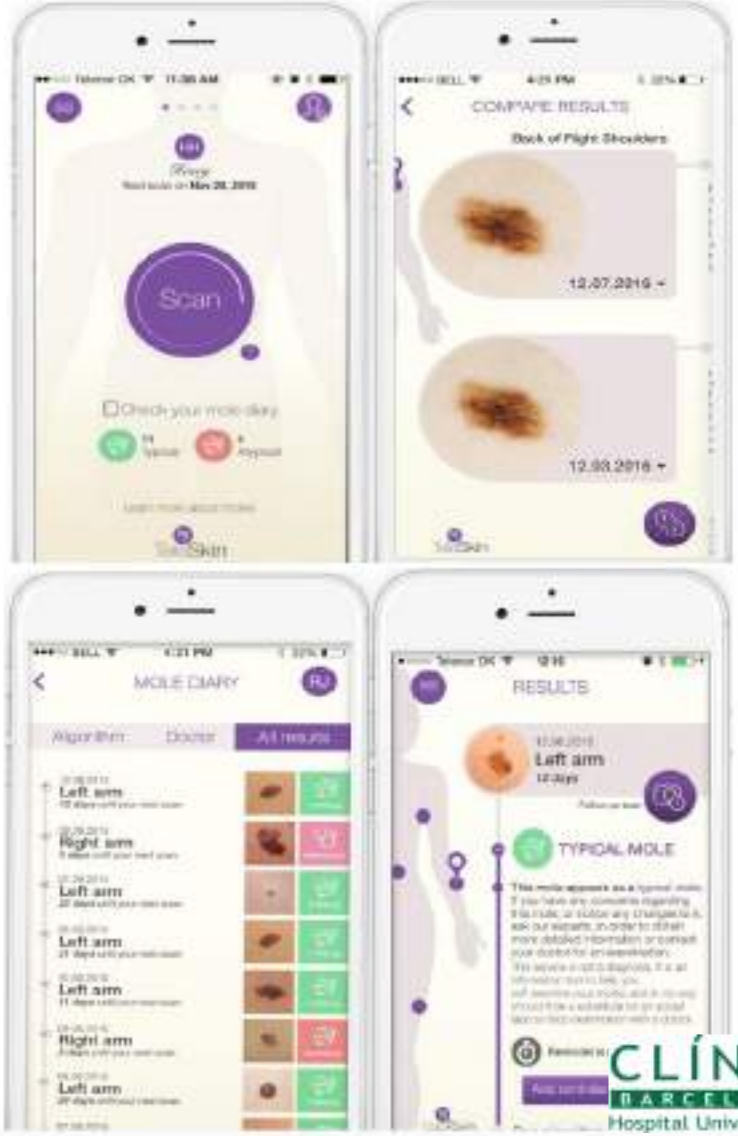
What is skinScan?

skinScan is class 1 medical device (CE mark) for providing assisting information about Pigmented Skin Lesions and Skin Self-Examination.

CLÍNIC BARCELONA Hospital Universitari

TeleSkin ApS aims to help people self-examine and track their moles

- Focused on leveraging mobile technology to help users assess and track moles
- Proprietary algorithm helps users to identify atypical moles
- Algorithm shows 90% sensitivity
- Available in Scandinavia for >1 year, and recently launched in Australia and New Zealand
- >110k people downloaded app in Denmark and Norway
- Feedback from multiple users that the app helped them identify atypical moles which were problematic and further assessed by doctors as melanomas



TeleSkin

CLÍNIC BARCELONA Hospital Universitari

Accuracy of commercially available smartphone applications for the detection of melanoma.

British Journal of Dermatology (2022) 186, pp721–750
M.D. Sun, J.Kentley, P. Mehta, S.Dusza, A.C. Halpern, V. Rotemberg

15 consecutive histologically proven invasive melanoma cases (pT1a–pT2b) and 15 histologically proven benign naevi, all in patients with lighter skin phototypes. Median age was 56 years (range 23–87), and 21 patients (60%) were female. Images were cropped to the lesion and are available at the International Skin Imaging Collaboration Archive (https://doi.org/10. 34970/401946). Local institutional review board approval was obtained.
Of 43 apps identified, 25 claimed to identify melanoma and were functional.

Fifteen of 25 apps returned diagnoses, 12 of 25 risk categories and two of 25 risk scores (Figure 1). Three apps gave >1 output type. Mean accuracy was 0,56, 0,60 and 0,64

Apps in Dermatology using AI: Position statement of the EADV Artificial Intelligence Task Force

EADV European Academy of Dermatology and Venereology

Risks

Potential risks due to inaccuracy, limited reliability, especially when analyzing suspicious skin lesions for features of skin cancer.

Education

Lack of education and proper information for users on how to correctly select lesions that are suspicious of skin cancer.

Regulation

Lack of proper regulation is another significant concern related to dermatology smartphone apps.

Opportunity

Have the potential to become reliable screening tools. . These apps may provide increased access to dermatological care.

Clinic Barcelona

AI in medicine: liability and responsibility

When the use of AI will become widely accepted in practice

- Doctors could potentially be held **liable for failing to use available software as an aid to diagnosis**
- Decisions of liability may become complex in **situations where the clinician and software come to contradictory conclusions**

Expert consensus on the competency items in the Delphi study

1. Understanding the value, limitations and use of AI solutions
2. Knows basic concepts of data science (data collection, analysis, evaluation, safety,…)
3. Chosing the best AI tool in every indication
4. Integration in the workflow of patients
5. Legal and ethical norms
6. Communication to patients

Çalışkan SA, Demir K, Karaca O. Artificial intelligence in medical education curriculum: An e-Delphi study for competencies. PLoS One. 2022 Jul 21;17(7):e0271872.

"The question is not "whether" artificial intelligence will take a place in the early detection of skin cancer, but "when" and in what form."

PROF. DR. MED. HOLGER HAENSSLE
Managing Senior Physician (Department of Dermatology)
University of Heidelberg, Germany

Moleanalyzer pro

The Intelligent AI Assistant

Anyone working with the Moleanalyzer pro AI Assistant will experience a new dimension in skin checks. Thanks to the significant help in the pre-assessment of melanocytic and non-melanocytic skin lesions, the expert system with its AI Scoring generates enthusiasm among physicians and patients. The specificity and sensitivity are impressive, as proven by numerous studies.

Together with the Bodyscan master software feature, the Moleanalyzer pro unleashes the full potential of FotoFinder Artificial Intelligence. The Total Body Dermoscopy workflow reduces the examination time for patients with multiple lesions to a minimum.

Powerful Performance

Clinically proven in multiple trials

FotoFinder AI inspires users in multiple ways and combines artificial intelligence and human experience to form an unbeatable duo. For the pre-assessment of skin lesions, physicians have access to extensive analysis and comparison functions as well as probably the most powerful deep-learning algorithm that has been evaluated and validated in clinical studies to date ("Man against machine", "Man against machine reloaded" and others, University of Heidelberg). In addition, users have access to the FotoFinder Second Opinion Service.

Analysis & Segmentation

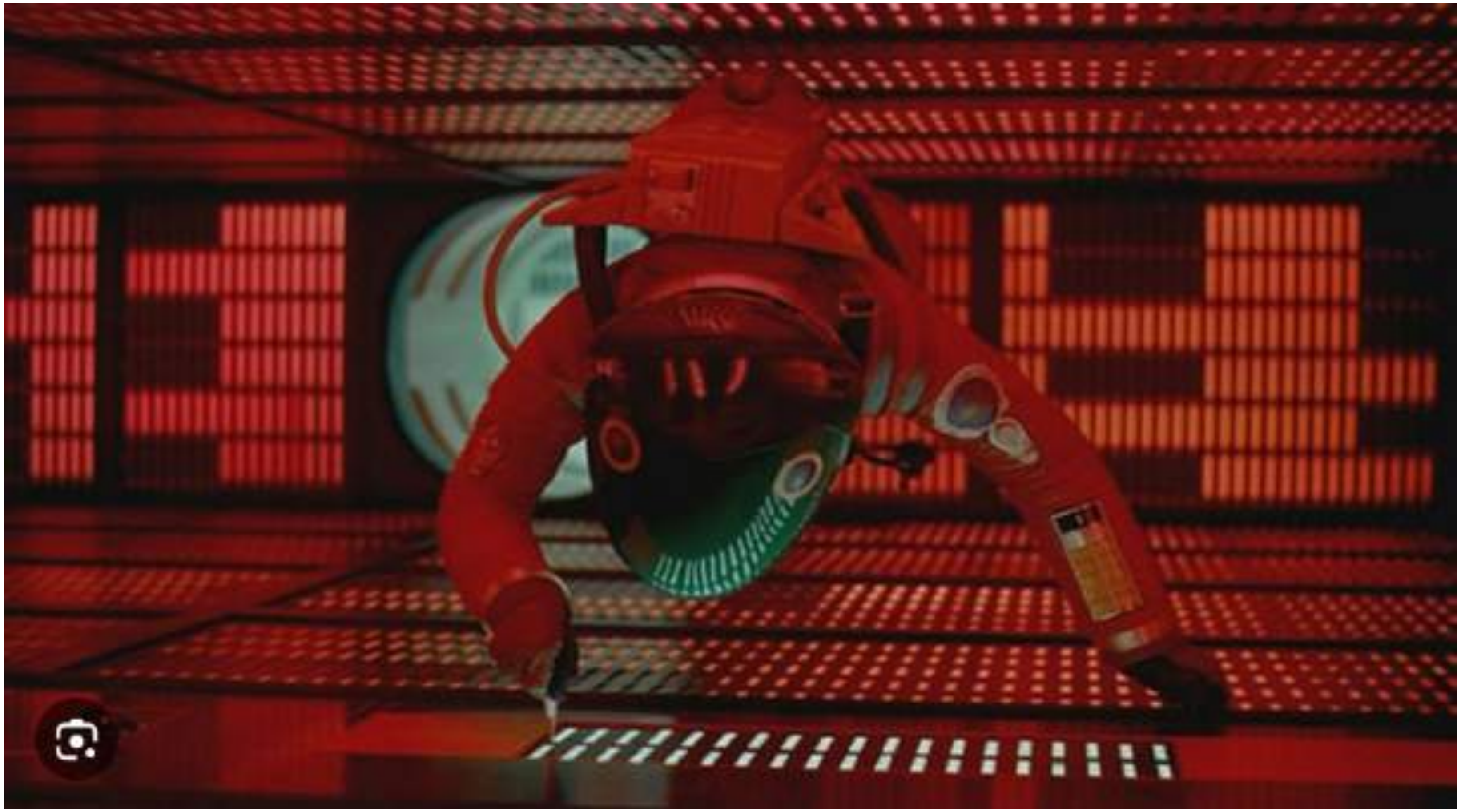
Moleanalyzer pro impressively visualizes colors, borders, symmetry axes, structure and network of a lesion.

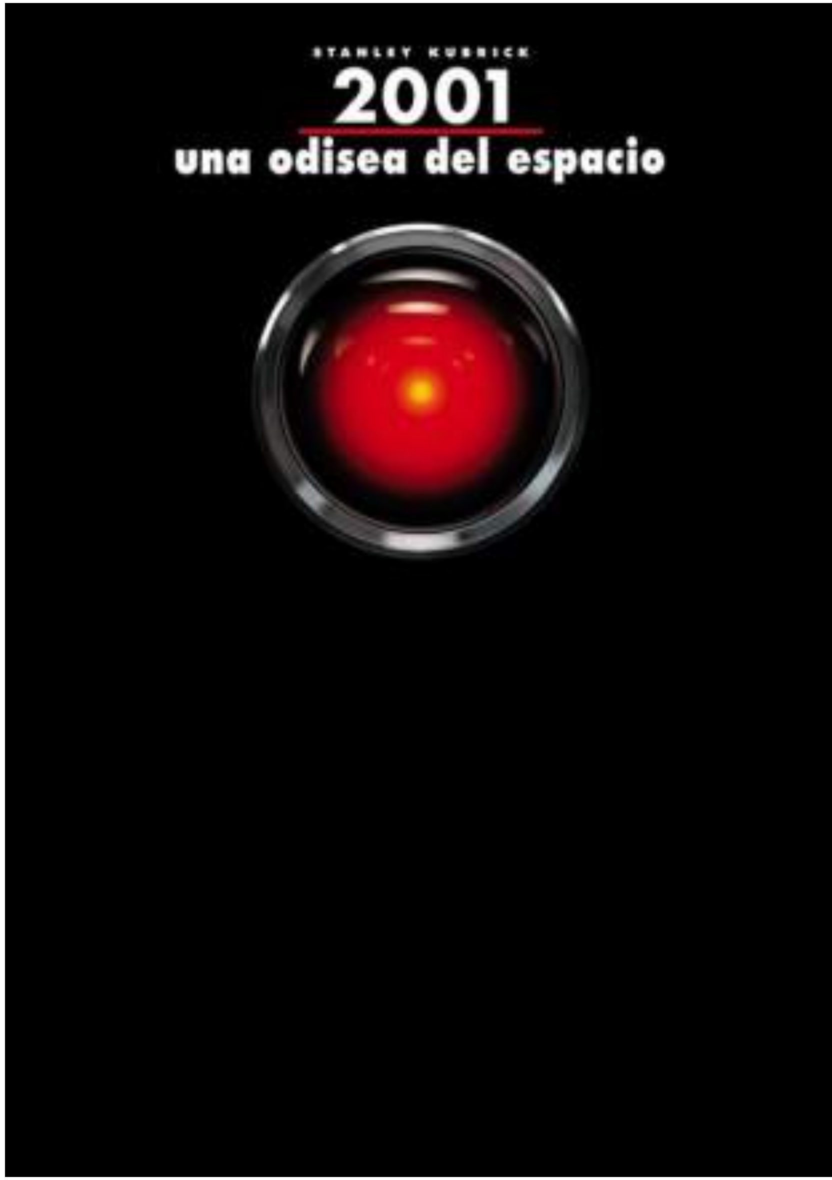
You can also view the images in gray-scale mode. Additionally, the software provides detailed information on all parameters and indicates size, perimeter and diameter of a lesion. The automated segmentation provides hints for all criteria.

Image Comparison

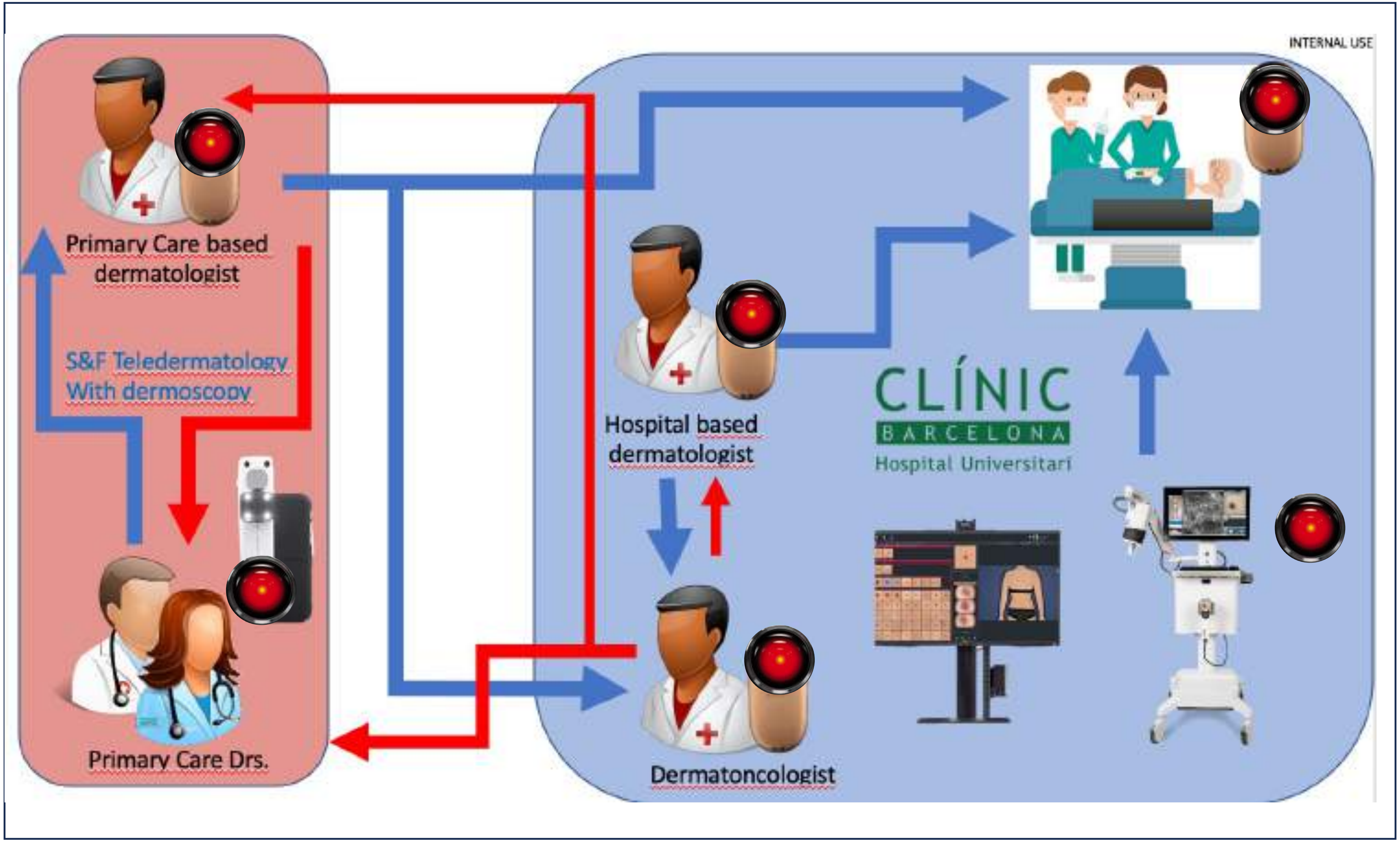
Lesion Evaluation

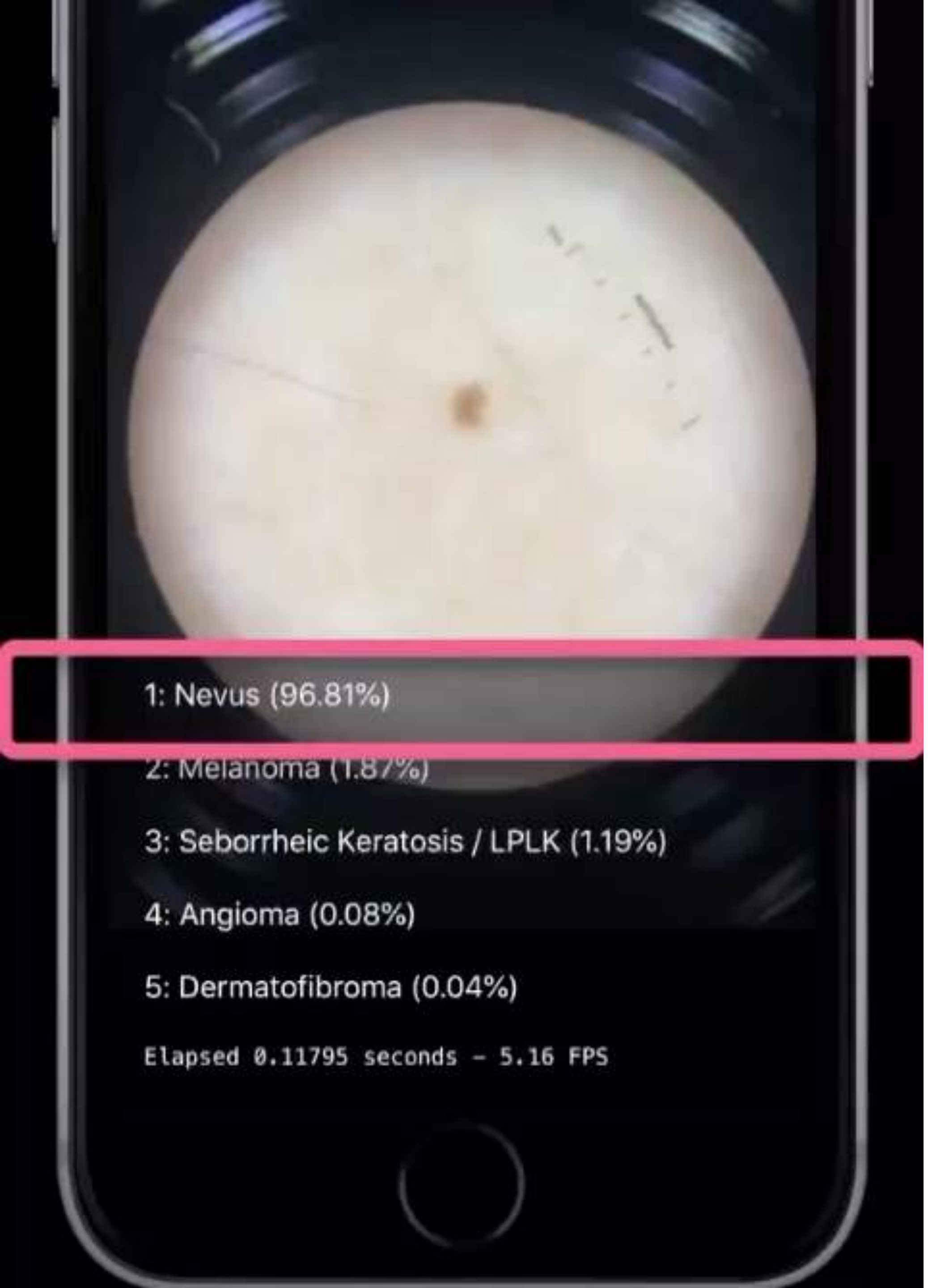
AI Scoring with Heatmap




STANLEY KUBRICK
2001
una odisea del espacio

AI in Dermatology

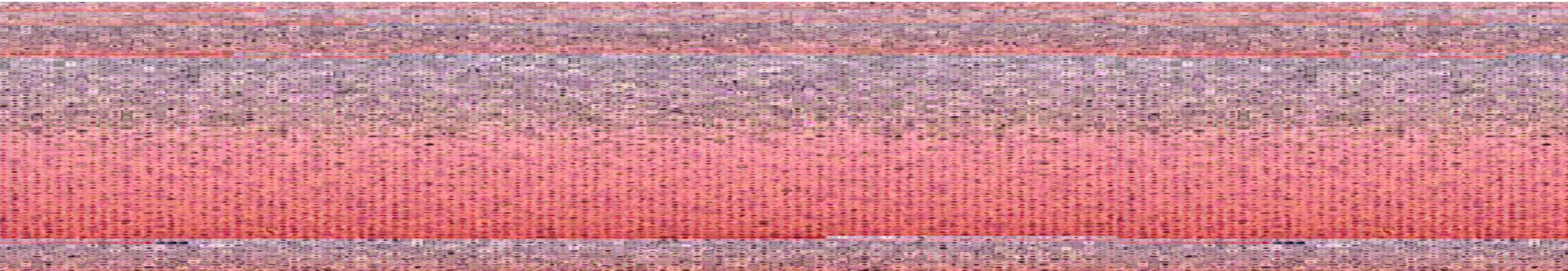




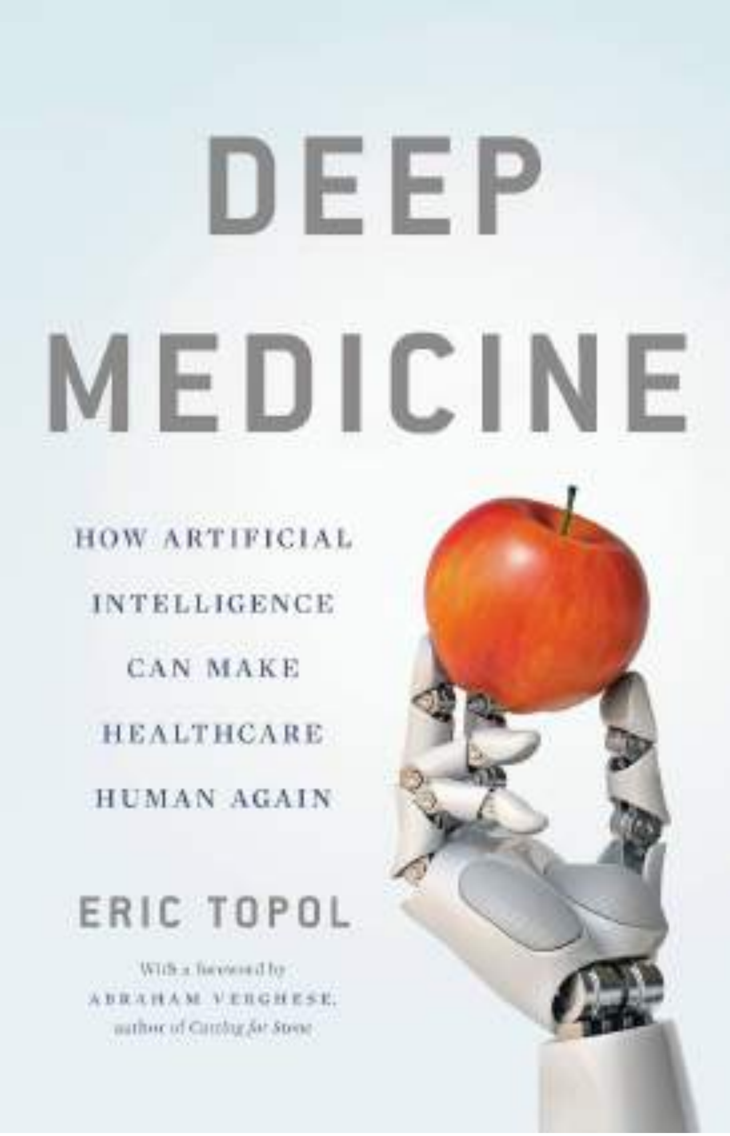
Courtesy of P.Tschanldt

CONCLUSIONS

1. Deep phenotyping = clinical, genetic and deep imaging
2. Augmented intelligence
3. Transparency, education, clinical validation, legal aspects



- Natural language Processing
- Avatars an Deep imaging
- Sensors, biometrics
- ML for complex analytics
- Generative AI
- Robotics for surgery, laser,
- Drug delivery by nanotech
- AI for monitoring of patients
- AI for support for patients



"….Doctors should spend less time collecting information and classifying it….

……. and dedicate more time to listening, attending and caring for their patients"

IA en dermatología: el futuro en 5 años

1. ¿Piensa que la IA puede mejorar su práctica profesional?

a. Sí puede mejorarla
b. No la cambiará de forma significativa
c. La empeorará
d. No tengo ni idea

2. ¿Piensa que la IA cambiará su relación con el paciente?

a. sí puede mejorarla
b. no la cambiará de forma significativa
c. la puede empeorar
d. no tengo ni idea

IA en dermatología

3. ¿Piensa que la IA debe incorporarse en la formación continuada del dermatólogo?

a. Sí
b. No
c. Sólo para los más jóvenes (a mi ya no me pilla...)
d. La IA me importa un comino