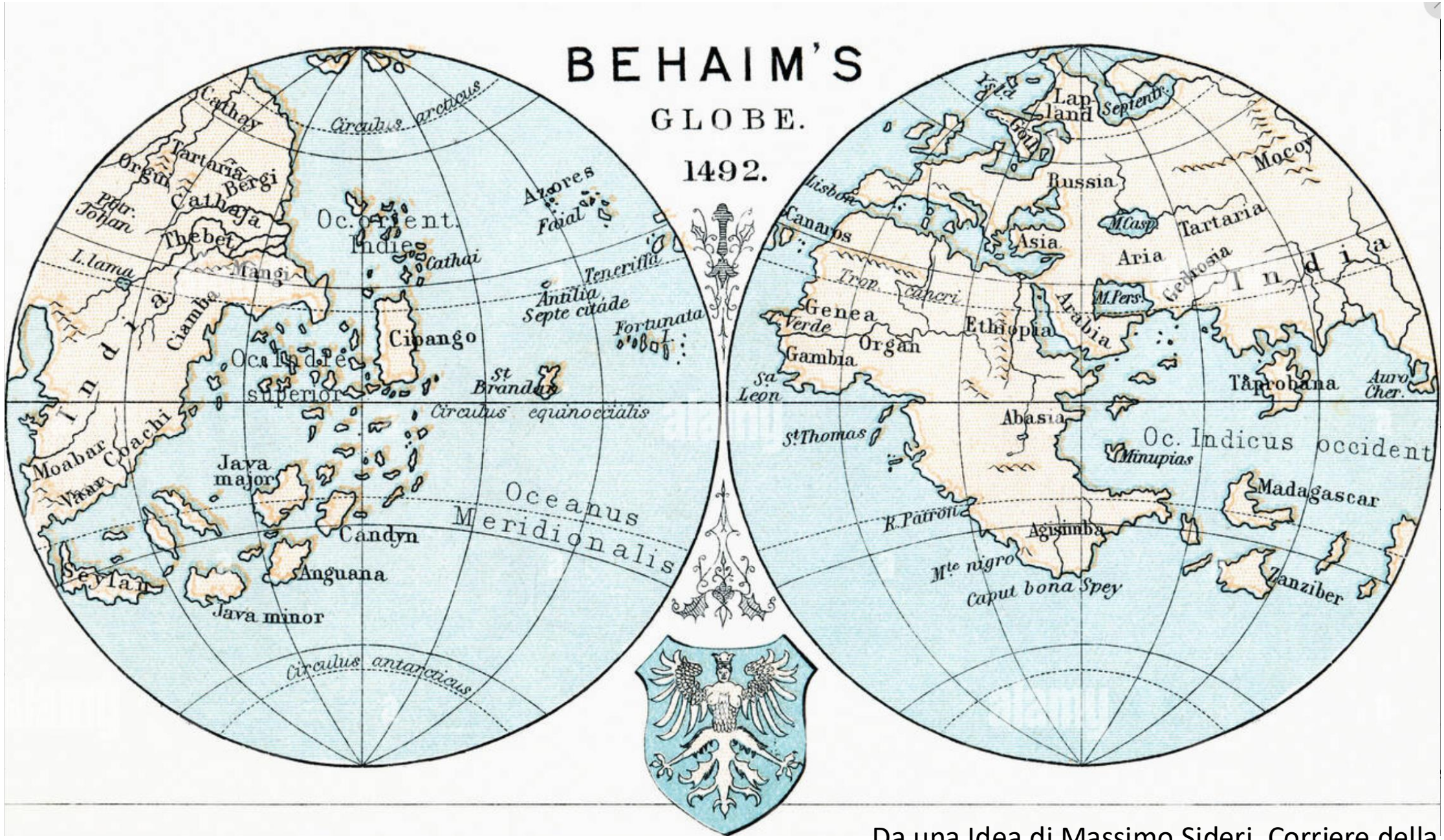
Meeting Nazionale ITACARE-P 2025

La Cardiologia Riabilitativa e Preventiva come snodo fondamentale della cura della persona con cardiopatia

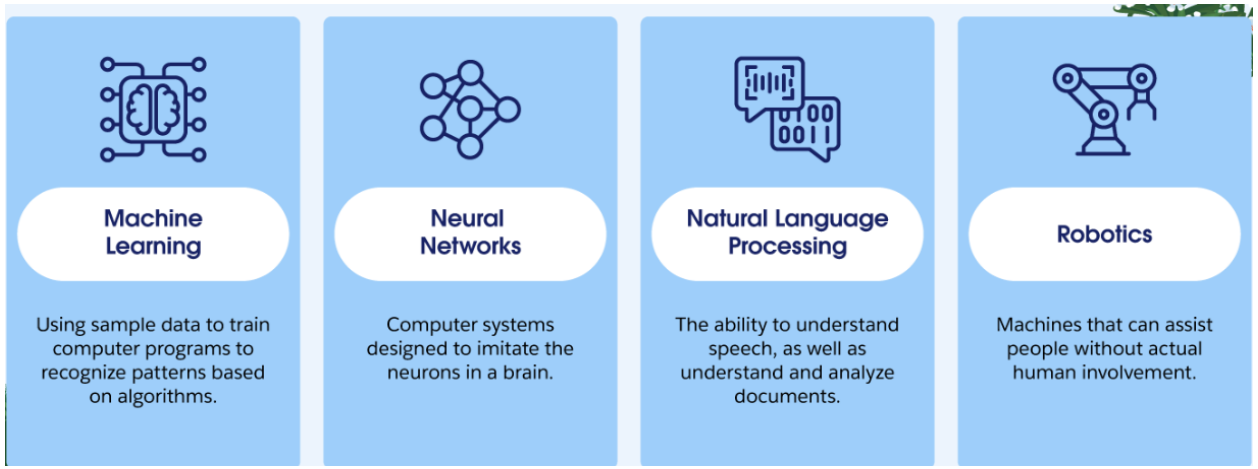
AI in cardio-riabilitazione: i nostri bisogni e i nostri desiderata

CENTRO CONGRESSI FRENTANI
Roma, 21-22 novembre 2025

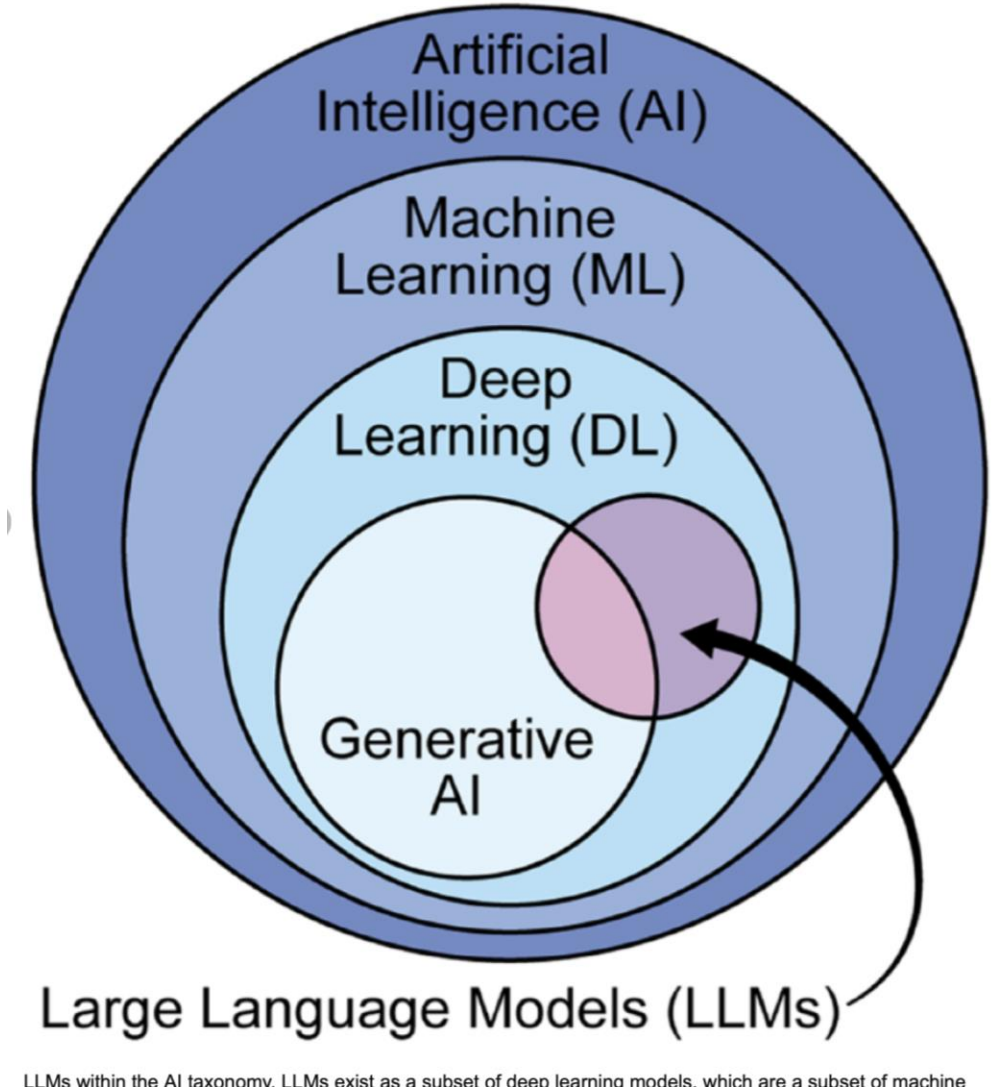
Egidio Traversi



Da una Idea di Massimo Sideri, Corriere della Sera



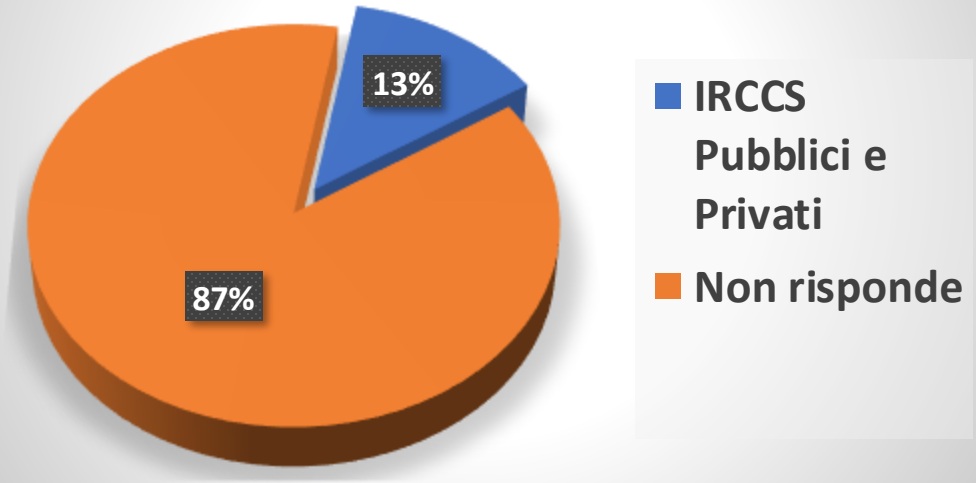
NLP: Natural language processing
Gpt: Generative pre-trained transformer: Un tipo di LLM
LLM: Large Languages models: strumenti di AI specificatamente addestrati per elaborare e generare testo.
Computer vision: analisi di immagini medicali
Robotics



LLMs within the AI taxonomy. LLMs exist as a subset of deep learning models, which are a subset of machine

Progetto PNRR MUSA. Università Bocconi e Osservatorio Sanità Digitale del Politecnico di Milano

INTERNALIZZAZIONE E SVILUPPO

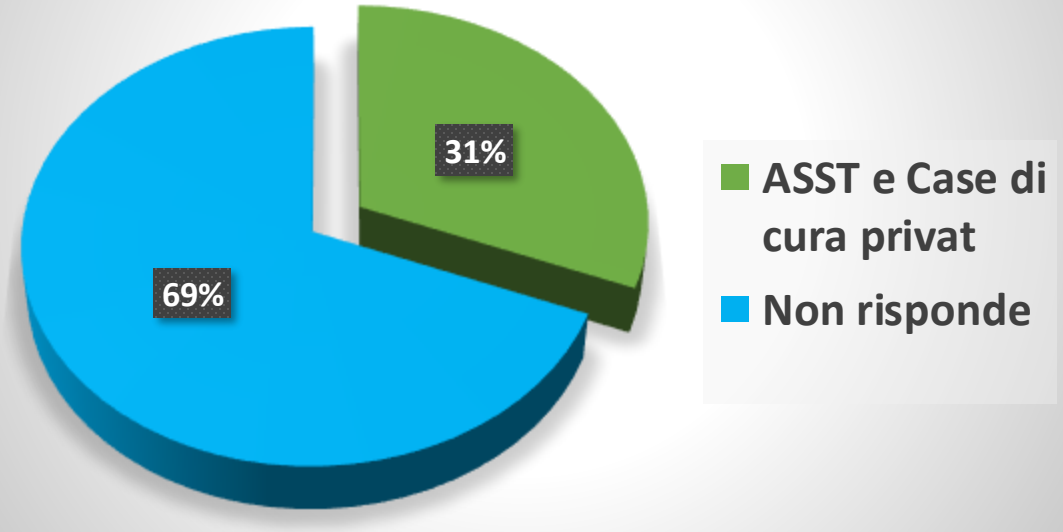


63% da fondi di ricerca
29% da budget aziendali

Settori:
- **Medicina Fisica**
- **Neurologia**
- **Oncologia**
- **Diabetologia**

Difficoltà riportate:
- **Riservatezza dati**
- **Rimborso**
- **interoperabilità**

ACQUISTO DI APPLICAZIONI AI SUL MERCATO



76% da budget aziendali

integrate in dispositivi medici (es. sistemi di radiologia)

Difficoltà riportate:
- **Cultura aziendale**
- **Responsabilità medica**

BISOGNO: La gestione dei electronic medical records, EMR

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The American Journal of Emergency Medicine
Volume 31, Issue 11, November 2013, Pages 1591-1594

Brief Report

4000 Clicks: a productivity analysis of electronic medical records in a community hospital ED

Robert G. Hill Jr. MD, Lynn Marie Sears MBA, Scott W. Melanson MD

The redundancy of the notes, the burden of alerts, and the overflowing inbox has led to the "4000 keystroke a day" problem and has contributed to, and perhaps even accelerated, physician reports of symptoms of burnout

***burnout* da parte dei medici**. Anche se l'EMR può fungere da efficiente strumento amministrativo e di rendicontazione e costituisca un potente magazzino di ricerca per dati clinici, **la maggior parte degli EMR alla fine complica e non aiuta chi si trova in prima linea.** Le conseguenze impreviste poi includono **la perdita di importanti rituali sociali "cartella clinica alla mano"** (tra medici, tra medici e infermieri e altri operatori sanitari, i nei rapporti con il paziente) e, soprattutto, la **mancanza di tempo dedicato alla cura (e alla empatia) del malato.**

BISOGNO: Ausilio in diagnostica terapia e ricerca

+ + + +


NEJM AI

CURRENT ISSUE | RECENTLY PUBLISHED | PODCAST | EVENTS | AUTHOR CENTER | ABOUT | PUBLICATIONS

PERSPECTIVE

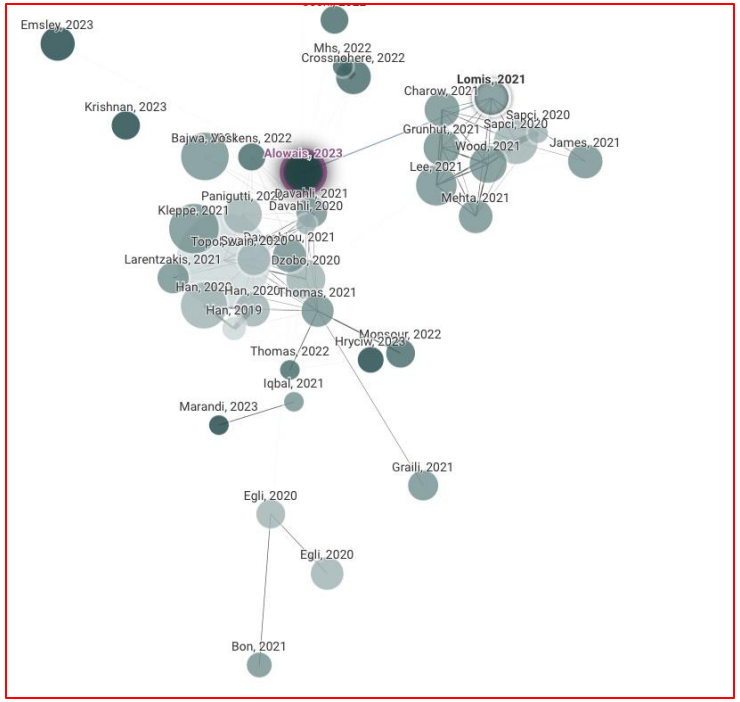
Use of GPT-4 to Diagnose Complex Clinical Cases

Authors: Alexander V. Eriksen, M.D., Sören Möller, M.Sc., Ph.D., and Jesper Ryg, M.D., Ph.D. Author Info & Affiliations

Published November 9, 2023 | NEJM AI 2023;1(1) | DOI: 10.1056/AIp2300031 | VOL. 1 NO. 1

https://www.**elicit**.com

Produce sommari di bibliografia



Dall' 8 ottobre 2025

ESC European Society of Cardiology

ESC CHAT

Your Guidelines Companion

www.**paperpal**.com

Analisi di parti di testo plagiato

https://www.**unriddle**.ai

Produce l'abstract di una pubblicazione

www.**connectedpapers**.com

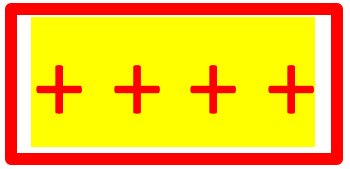
https://reference.**medscape**.com

Per le interazioni farmacologiche

Tabella 1. Applicazioni dell'intelligenza artificiale (IA) in cardiologia.

1. Diagnosi e interpretazione di immagini
• Automatizzazione di ecocardiogrammi per valutare la funzione cardiaca
• Interpretazione di ECG per rilevare aritmie e altre anomalie
• Analisi delle immagini di risonanza magnetica cardiaca e tomografia computerizzata coronarica
• Rilevamento precoce di patologie cardiache attraverso "pattern recognition"
2. Predizione e prevenzione
• Quelli predittivi per identificare pazienti ad alto rischio di eventi cardiovascolari
• Analisi dei fattori di rischio e previsione di potenziali complicanze
• Sistemi di allerta precoce per prevenire eventi cardiaci acuti
• Ottimizzazione delle strategie di prevenzione e personalizzate
3. Gestione del paziente
• Monitoraggio remoto dei pazienti attraverso dispositivi indossabili
• Sistemi di supporto alle decisioni cliniche per i medici
• Personalizzazione delle terapie basate su dati individuali
• Ottimizzazione della gestione dei farmaci e del dosaggio
4. Ricerca e sviluppo
• Analisi di grandi dataset per scoprire nuovi biomarcatori
• Sviluppo di nuovi farmaci attraverso simulazioni molecolari
• Identificazione di sottogruppi di pazienti per trial clinici
• Studio delle interazioni genetiche nelle malattie cardiache
5. Interventi e chirurgia
• Pianificazione preoperatoria assistita da IA
• Sistemi di guida durante procedure interventistiche
• Robotica assistita per procedure mini-invasive
• Simulazioni virtuali per l'addestramento dei chirurghi
6. Follow-up e riabilitazione
• Programmi personalizzati di riabilitazione cardiaca
• Monitoraggio continuo del recupero post-intervento
• Valutazione dell'aderenza alla terapia
• Supporto psicologico attraverso chatbot specializzati
7. Amministrazione e gestione
• Ottimizzazione dei percorsi di cura
• Gestione efficiente delle risorse ospedaliere
• Riduzione dei tempi di attesa e miglioramento dell'efficienza
• Analisi dei costi e benefici dei trattamenti
8. Educazione e prevenzione pubblica
• Programmi educativi personalizzati per i pazienti
• Campagne di sensibilizzazione mirate
• Strumenti di valutazione del rischio per il pubblico
• Diffusione di informazioni sulla salute cardiaca
9. Telemedicina
• Consulti remoti supportati da IA
• Monitoraggio domiciliare avanzato
• Gestione delle emergenze a distanza
• Integrazione con dispositivi smart domestici
10. Ricerca traslazionale
• Integrazione di dati clinici e molecolari
• Identificazione di nuovi target terapeutici
• Sviluppo di terapie personalizzate
• Valutazione dell'efficacia dei trattamenti in tempo reale

L'intelligenza artificiale in cardiologia e non solo



Roberto Ferrari[1], Luigi Tavazzi[2]

[1]*Centro per la Prevenzione Cardiovascolare, Università degli Studi, Ferrara*
[2]*Maria Cecilia Hospital, GVM Care & Research, Cotignola (RA)*

G Ital Cardiol 2025;26(5):309-315

2. Predizione e prevenzione

- Quelli predittivi per identificare pazienti ad alto rischio di eventi cardiovascolari
- Analisi dei fattori di rischio e previsione di potenziali complicanze
- Sistemi di allerta precoce per prevenire eventi cardiaci acuti
- Ottimizzazione delle strategie di prevenzione e personalizzate

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- Supporto psicologico attraverso chatbot specializzati

BISOGNO: Tools per la Cardiologia Riabilitativa

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ESC European Society of Cardiology
European Journal of Preventive Cardiology (2024) 31, 448–457
https://doi.org/10.1093/eurjpc/zwad375
FULL RESEARCH PAPER
Machine learning & artificial intelligence

Development of deep-learning models for real-time anaerobic threshold and peak VO_2 prediction during cardiopulmonary exercise testing

Tatsuya Watanabe[1,2], Takeshi Tohyama [3]*, Masataka Ikeda[1,2], Takeo Fujino[1,2], Toru Hashimoto[1,2], Shouji Matsushima[1,2], Junji Kishimoto[4], Koji Todaka[3,4], Shintaro Kinugawa[1,2], Hiroyuki Tsutsui[1,2,5], and Tomomi Ide [1,2]*

Deep-learning models for **real-time CPET analysis** can accurately identify AT and predict peak VO2. The developed models can be a competent assistant system to assess a patient's condition in real time, expanding CPET utility.

ESC European Society of Cardiology
European Journal of Preventive Cardiology (2024) 31, 252–262
https://doi.org/10.1093/eurjpc/zwad321
FULL RESEARCH PAPER
Risk prediction/assessment & stratification

Deep learned representations of the resting 12-lead electrocardiogram to predict $\dot{V}O_2$ at peak exercise

Shaan Khurshid [1,2,3†], Timothy W. Churchill [1,4†], Nathaniel Diamant[5†], Paolo Di Achille[5], Christopher Reeder[5], Pulkit Singh[5], Samuel F. Friedman[5], Meagan M. Wasfy[1,4], George A. Alba[6], Bradley A. Maron[7,8,9], David M. Systrom[10], Bradley M. Wertheim[10], Patrick T. Ellinor [1,2,3], Jennifer E. Ho[11], Aaron L. Baggish[1,4,12], Puneet Batra[5], Steven A. Lubitz[1,2,3*‡], and J. Sawalla Guseh[1,4*‡]

We demonstrate that automated estimation of $\dot{V}O_2$ peak from the resting 12-lead ECG **is feasible.**

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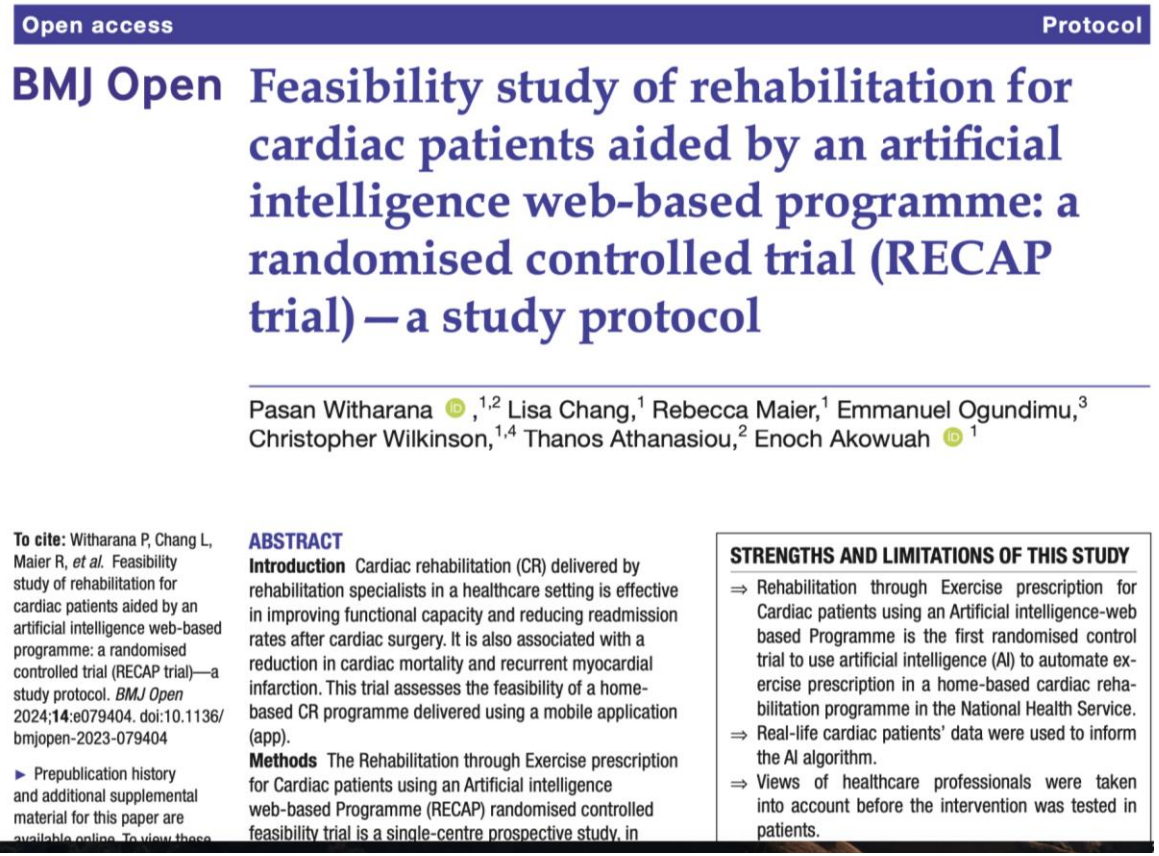


Open access Protocol

BMJ Open

Feasibility study of rehabilitation for cardiac patients aided by an artificial intelligence web-based programme: a randomised controlled trial (RECAP trial)—a study protocol

Pasan Witharana ,[1,2] Lisa Chang,[1] Rebecca Maier,[1] Emmanuel Ogundimu,[3] Christopher Wilkinson,[1,4] Thanos Athanasiou,[2] Enoch Akowuah [1]

To cite: Witharana P, Chang L, Maier R, *et al*. Feasibility study of rehabilitation for cardiac patients aided by an artificial intelligence web-based programme: a randomised controlled trial (RECAP trial)—a study protocol. *BMJ Open* 2024;**14**:e079404. doi:10.1136/bmjopen-2023-079404

► Prepublication history and additional supplemental material for this paper are available online. To view these

ABSTRACT

Introduction Cardiac rehabilitation (CR) delivered by rehabilitation specialists in a healthcare setting is effective in improving functional capacity and reducing readmission rates after cardiac surgery. It is also associated with a reduction in cardiac mortality and recurrent myocardial infarction. This trial assesses the feasibility of a home-based CR programme delivered using a mobile application (app).

Methods The Rehabilitation through Exercise prescription for Cardiac patients using an Artificial intelligence web-based Programme (RECAP) randomised controlled feasibility trial is a single-centre prospective study, in

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Rehabilitation through Exercise prescription for Cardiac patients using an Artificial intelligence-web based Programme is the first randomised control trial to use artificial intelligence (AI) to automate exercise prescription in a home-based cardiac rehabilitation programme in the National Health Service.

⇒ Real-life cardiac patients' data were used to inform the AI algorithm.

⇒ Views of healthcare professionals were taken into account before the intervention was tested in patients.

medicina

MDPI

Systematic Review

The Application of Robotics in Cardiac Rehabilitation: A Systematic Review

Aseel Aburub [1], Mohammad Z. Darabseh [2,*], Rahaf Badran [3,*], Ala'a M. Shurrab [4], Anwaar Amro [1] and Hans Degens [5,6]

The trials used different robotic systems: **Lokomat® system**, **Motomed Letto/Thera Trainer** tigo, **BEAR**, and **Myosuit.**

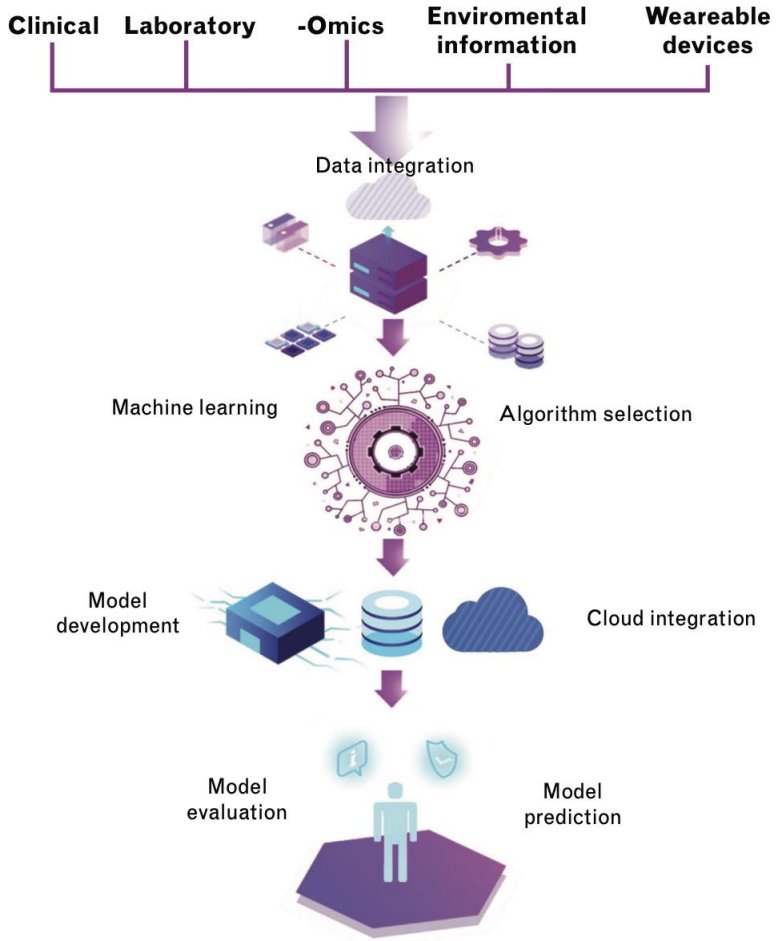
It was found that interventions that included the use of robotic assistance technologies **improved** the **exercise capacity**, **VO_2** max/peak, left ventricular **ejection fraction**, **QOL**, and physical **functioning** in people with cardiac diseases

Supplement submission

I.F.C. Italian Federation of Cardiology

Artificial intelligence in cardiovascular prevention: new ways will open new doors

Michele Ciccarelli[a], Francesco Giallauria[b], Albino Carrizzo[a,c], Valeria Visco[a], Angelo Silverio[a], Arturo Cesaro[d], Paolo Calabrò[d], Nicola De Luca[e], Costantino Mancusi[e], Daniele Masarone[f], Giuseppe Pacileo[f], Nidal Tourkmani[g,h], Carlo Vigorito[b] and Carmine Vecchione[a,c]



The typical machine learning workflow in healthcare research.

ESC European Society of Cardiology

European Journal of Preventive Cardiology (2022) **29**, 1940–1942
https://doi.org/10.1093/eurjpc/zwab218

COMMENTARY

The future of cardiovascular prevention: between fiction and reality

Gabriele Guardigli[1], Paolo Cimaglia [2], Claudio Rapezzi[1,2], Luigi Tavazzi[2], and Roberto Ferrari [1,2]*

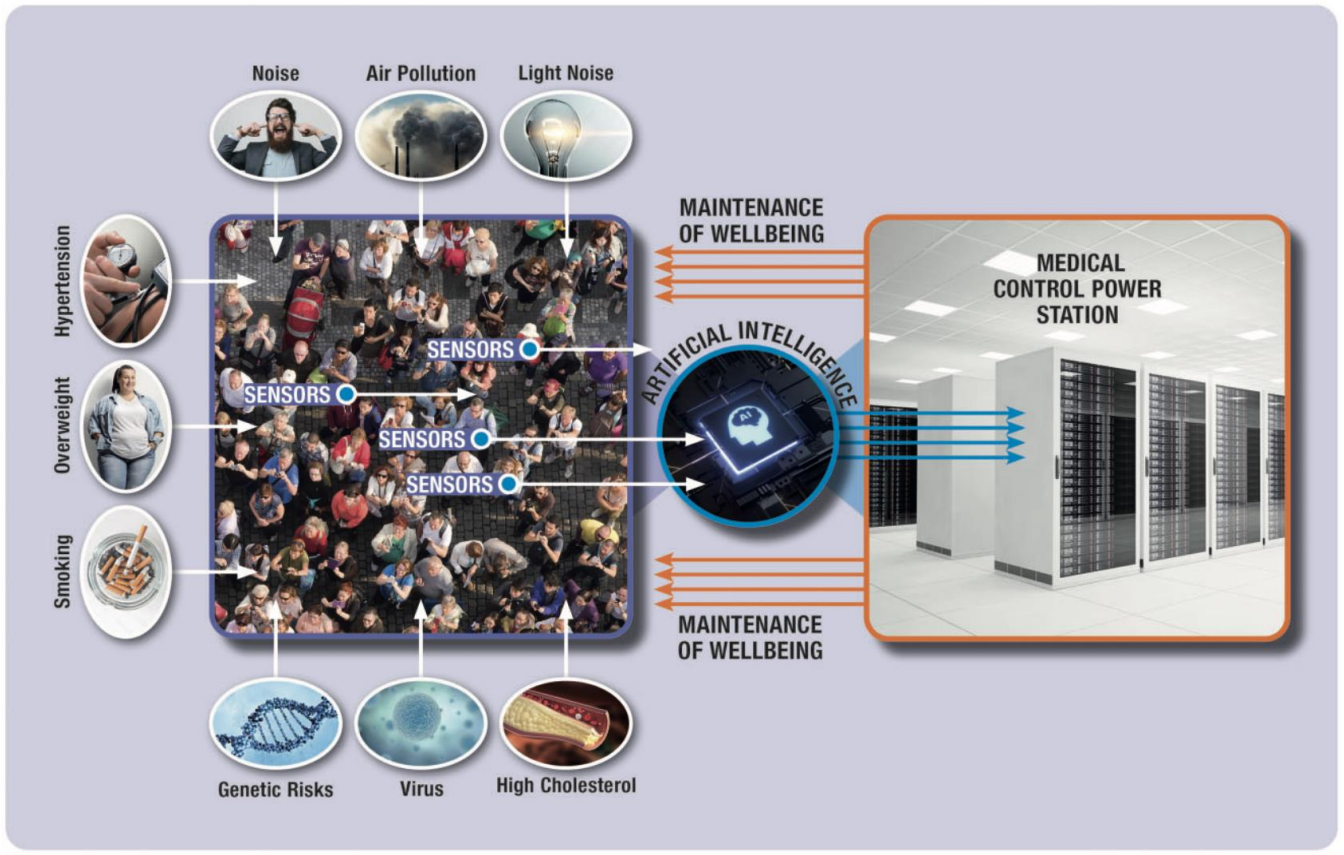


Figure 1 Future vision of how prevention could develop Sensors will help population to continuously collect data related to classic risk factors but also to the new ones, such as those from the exposome, pollution, genetics, etc. The data will be transformed into deep learning's and artificial intelligence's regulated algorithms and stored in a medical control power station. This last, is in continuous contact with the individuals' general practici-

Article

Learning the natural history of human disease with generative transformers

https://doi.org/10.1038/s41586-025-09529-3

Received: 18 May 2024

Accepted: 13 August 2025

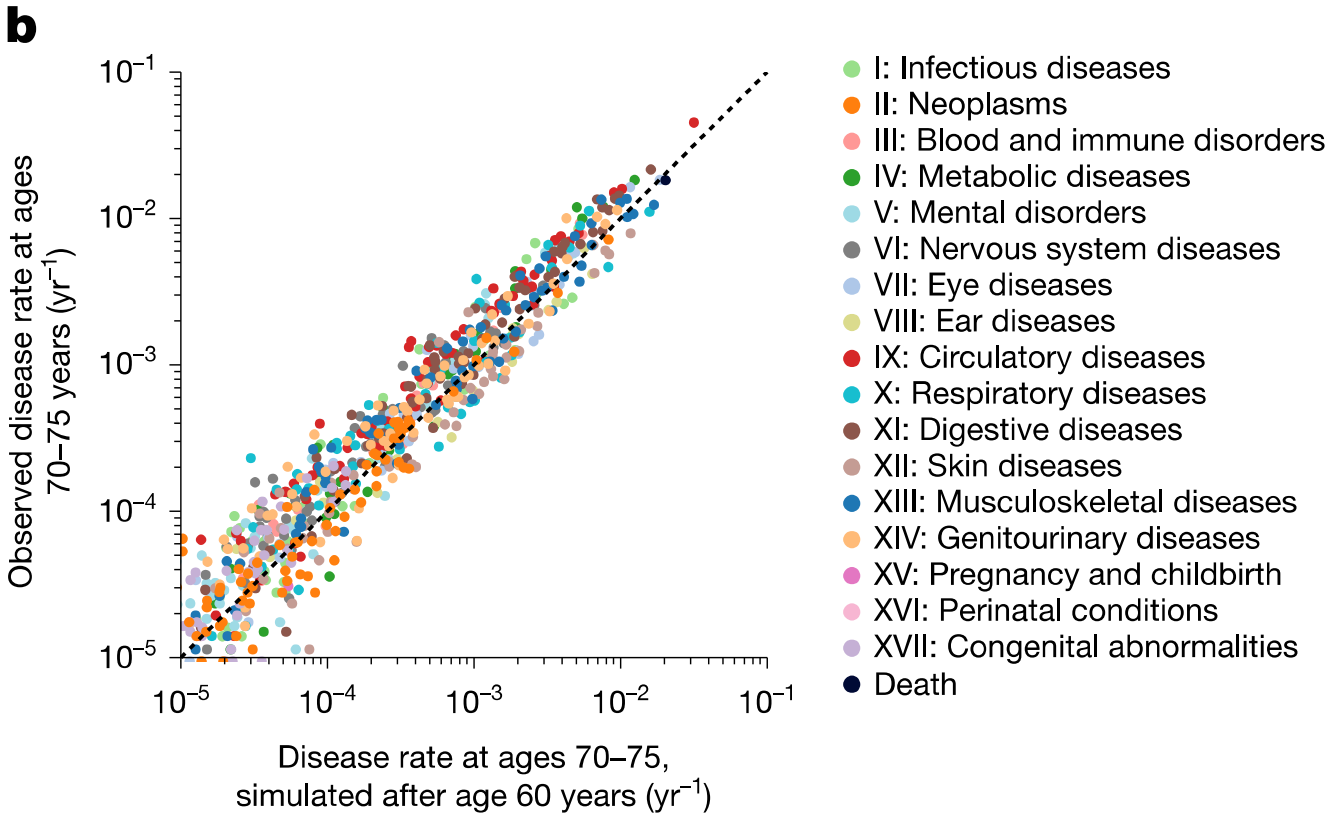
Published online: 17 September 2025

Artem Shmatko[1,2,3,13], Alexander Wolfgang Jung[2,4,5,6,13], Kumar Gaurav[2,13], Søren Brunak[4,7], Laust Hvas Mortensen[5,7,8], Ewan Birney[2]✉, Tom Fitzgerald[2]✉ & Moritz Gerstung[1,2,9,10,11,12]✉

Decision-making in healthcare relies on understanding patients' past and current health states to predict and, ultimately, change their future course[1–3]. Artificial

We train this model, Delphi-2M, on data from **0.4 million UK Biobank par**ticipants and validate it using external data from **1.9 million Danish** individuals with no change in parameters

transformer-based models appear to be well suited for predictive and generative health-related tasks, are applicable to population-scale datasets and provide insights into temporal dependencies between disease events, potentially improving the understanding of personalized health risks and informing precision medicine approaches.



BISOGNO: Problemi personali /e Regole e Normative di riferimento

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ARTIFICIAL INTELLIGENCE AND THE HEALTH WORKFORCE

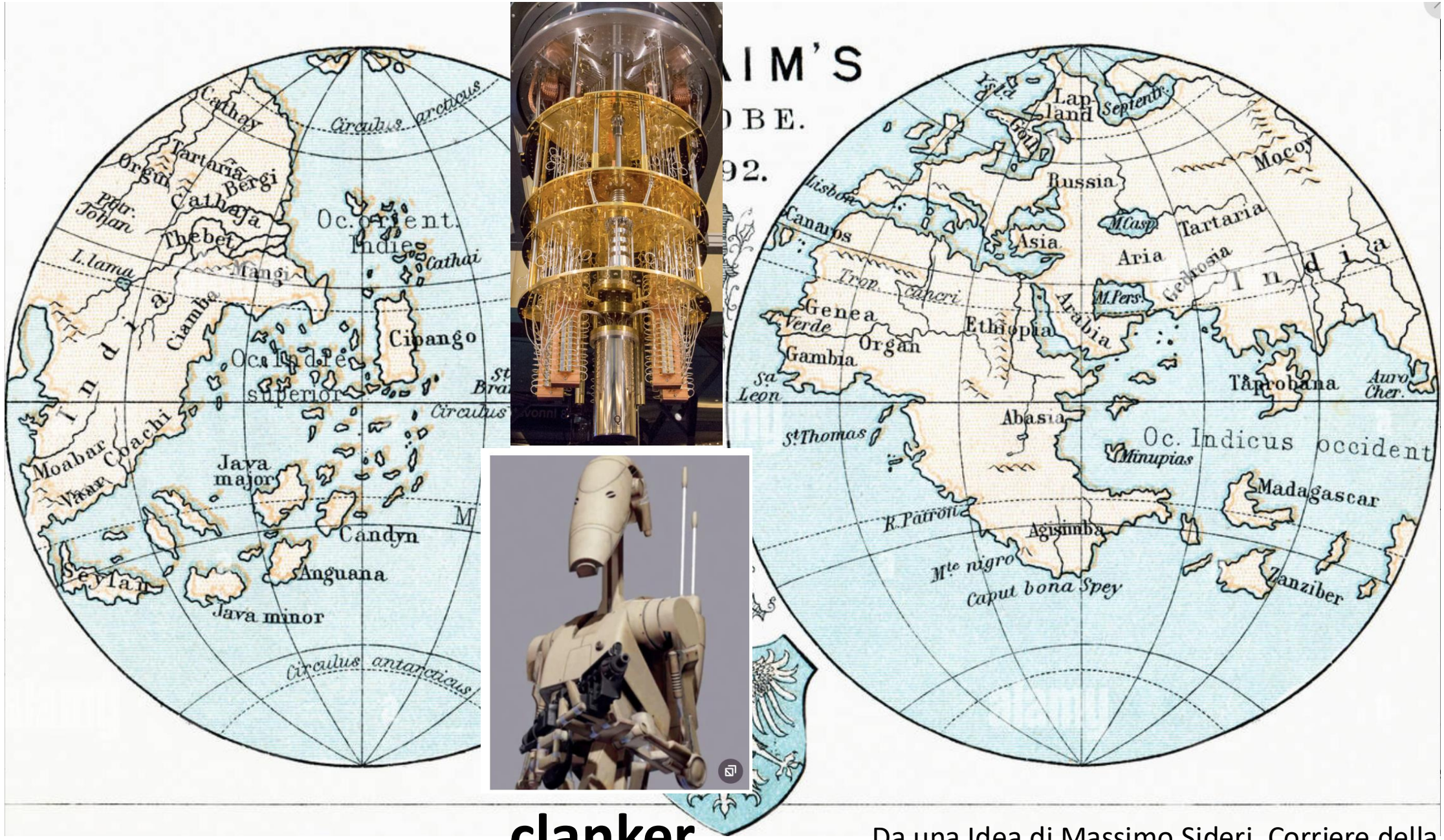
PERSPECTIVES FROM MEDICAL ASSOCIATIONS ON AI IN HEALTH

OECD ARTIFICIAL INTELLIGENCE PAPERS

November 2024 **No. 28**

- **«Deskilling» (da Medico a tecnico)**
- **Perdita del posto di lavoro**
- **Minori guadagni**
- **Una medicina disumanizzata**
- **Problemi etici e di denunce legali**
- **Aumento del burden di lavoro**

Regolamento (UE) 2024/1689, noto come AI Act
Recepito in Italia con la legge 132/2025



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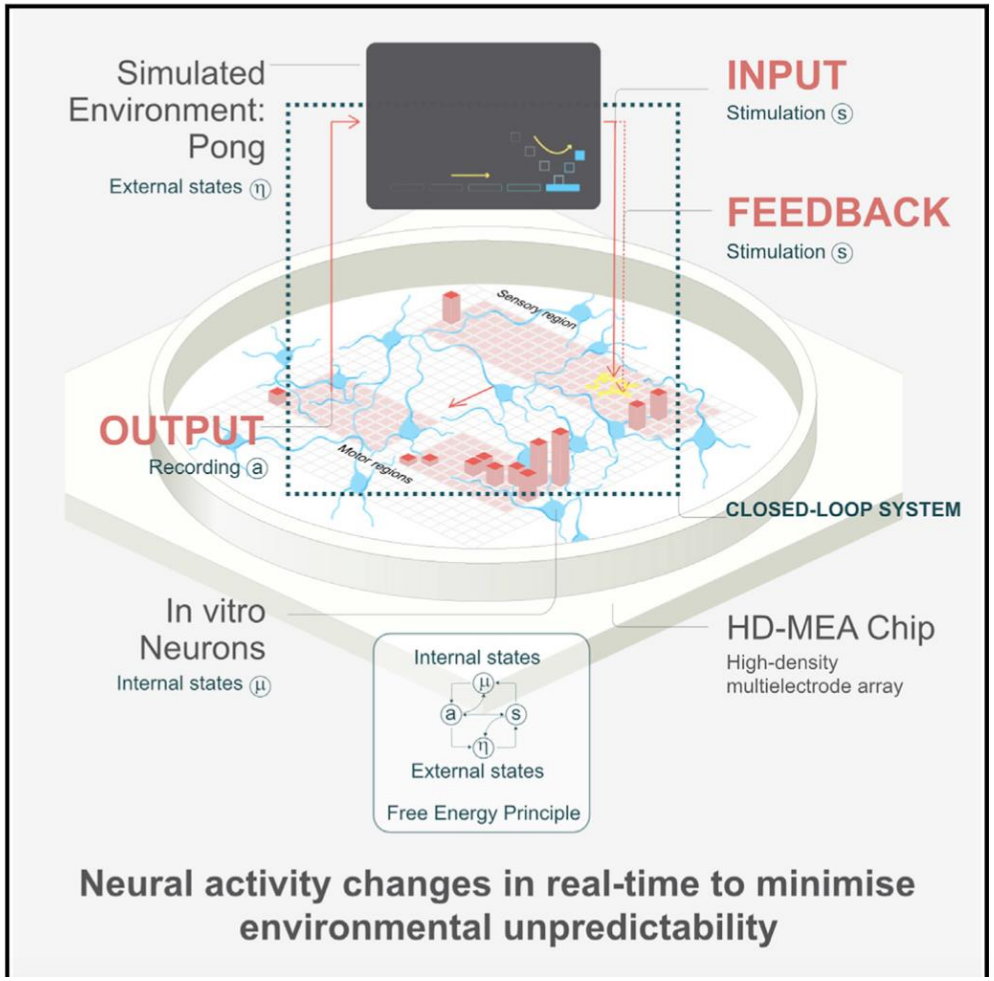
Da una Idea di Massimo Sideri, Corriere della Sera

Neuron

In vitro neurons learn and exhibit sentience when embodied in a simulated game-world

Graphical abstract



Authors

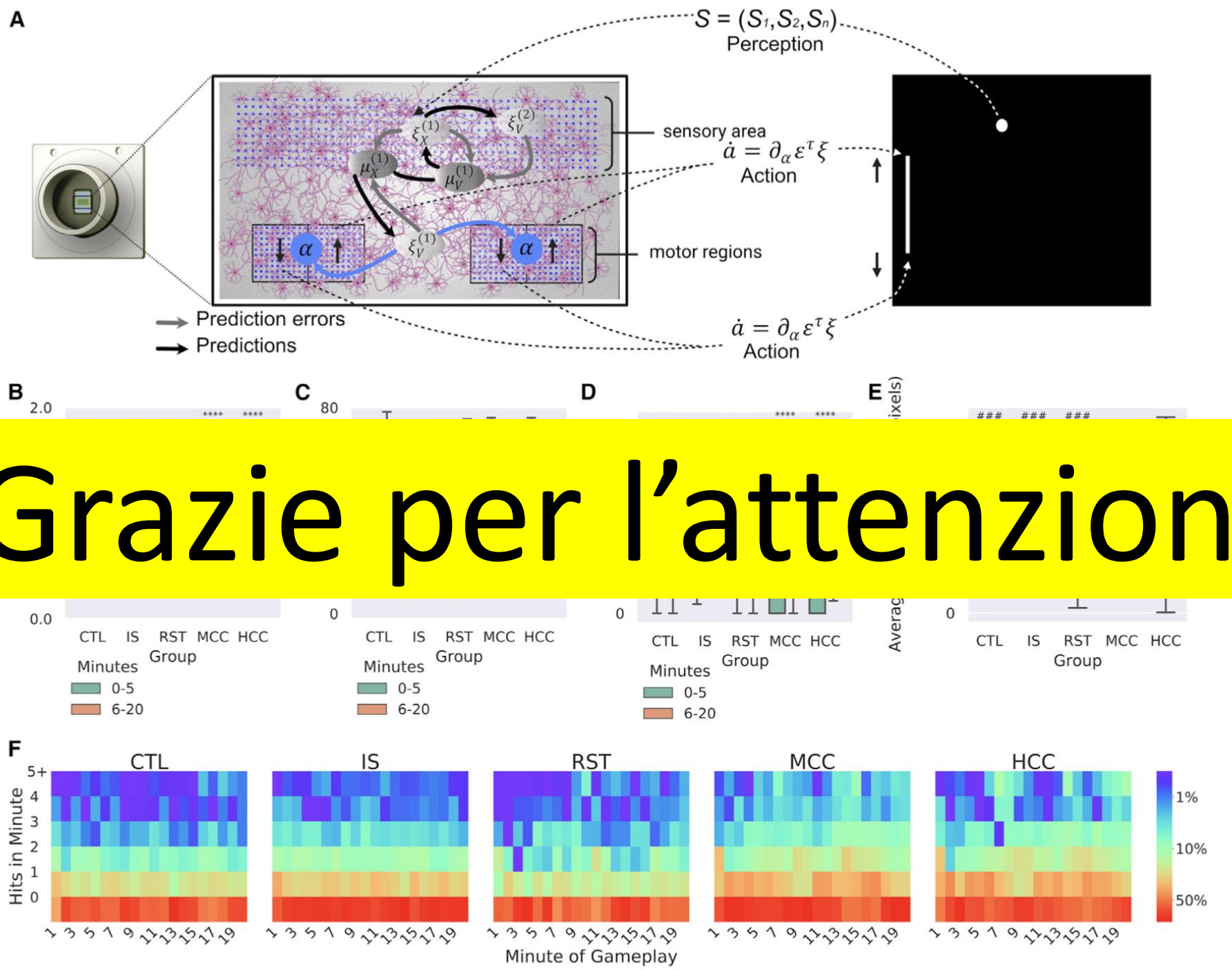
Brett J. Kagan, Andy C. Kitchen, Nhi T. Tran, ..., Ben Rollo, Adeel Razi, Karl J. Friston

Correspondence

brett@corticallabs.com

In brief

The *DishBrain* system is the first real-time synthetic biological intelligence platform that demonstrates that biological neurons can adjust firing activity in a way that suggests the ability to learn to perform goal-oriented tasks when provided with simple electrophysiological sensory input and feedback while embodied in a game-world.



Grazie per l'attenzione