PLACE 2026
PLATFORM OF LABORATORIES FOR ADVANCES IN CARDIAC EXPERIENCE

CONGRESSO
ROMA, 25 - 27 Giugno 2026

ARTIFICIAL INTELLIGENCE IN INTERVENTIONAL CARDIOLOGY

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Action is the real measure of intelligence

Napoleon Hill

Disclosure

- I have consulted for Abiomed, Advanced Nanotherapies, Aleph, Amarin, Balmed, Cardionovum, Crannmedical, Endocore Lab, Eukon, Guidotti, Innovheart, Meditrial, Menarini, Microport, Opsens Medical, Terumo, and Translumina.
- This presentation was drafted with the assistance of artificial intelligence tools, including ChatGPT 4 (OpenAI, San Francisco, CA, USA), in keeping with established best practices: Biondi-Zoccai G, editor. ChatGPT for Medical Research. Torino: Edizioni Minerva Medica; 2024.
- The final content, including all conclusions and opinions, has been thoroughly revised, edited, and approved by the author. The author take full responsibility for the integrity and accuracy of the work and retain full credit for all intellectual contributions. Compliance with ethical standards and guidelines for the use of artificial intelligence in research has been ensured.

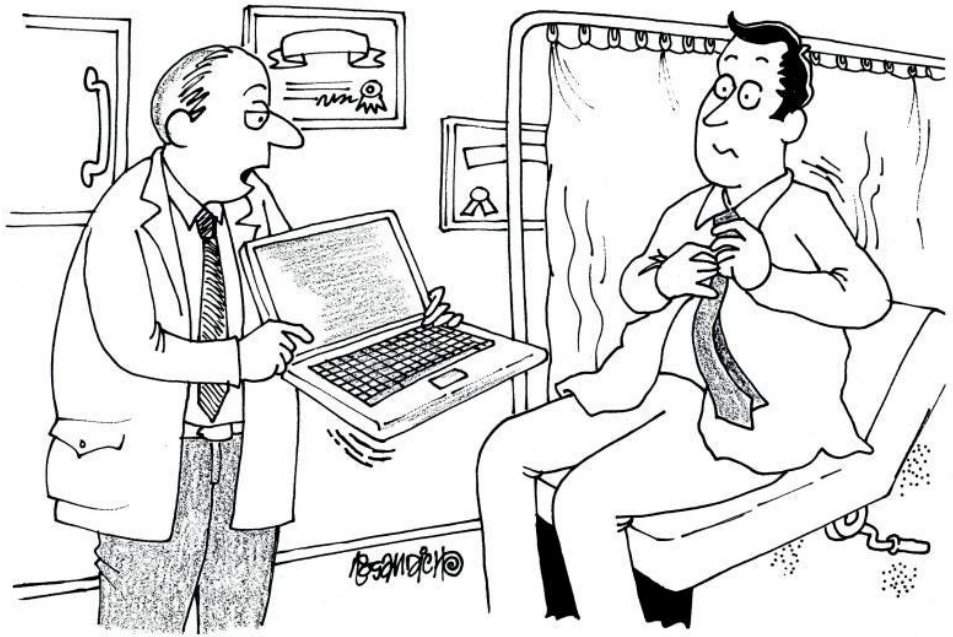
Teasers


Giuseppe BIONDI-ZOCCAI
ChatGPT
for medical research
A user-friendly manual for physicians, medical professionals, basic, translational and clinical researchers, biostatisticians, funders, publishers and anyone interested in leveraging AI
EDIZIONI MINERVA MEDICA


Giuseppe
BIONDI-ZOCCAI
INTELLIGENZA
ARTIFICIALE
Applicazioni in Medicina,
Chirurgia,
e nelle diverse specialità
EDIZIONI
MINERVA
MEDICA

Acronyms

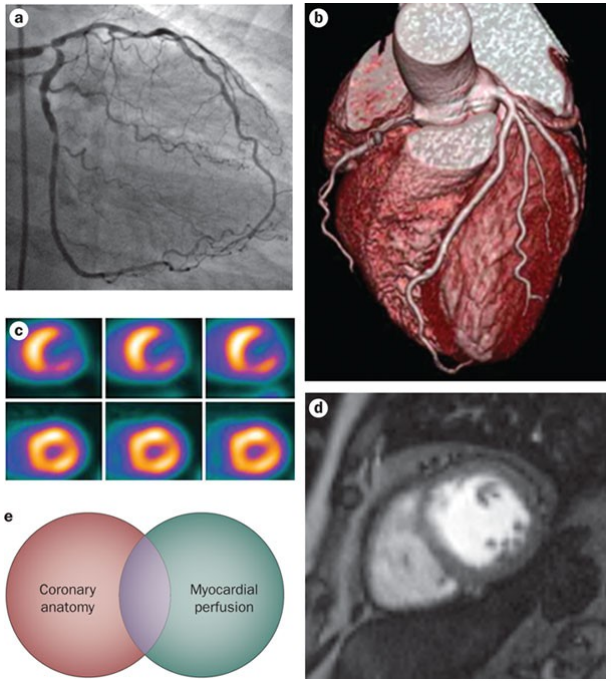
- AI – Artificial Intelligence
- API – Application Programming Interface
- CNN – Convolutional Neural Networks
- CV – Computer Vision
- DL – Deep Learning
- GAN – Generative Adversarial Networks
- LSTM – Long Short-Term Memory
- ML – Machine Learning
- NLP – Natural Language Processing
- NN – Neural Networks
- PCA – Principal Component Analysis
- RL – Reinforcement Learning
- RNN – Recurrent Neural Networks
- SVM – Support Vector Machine
- XAI – Explainable AI



"If you want a second opinion, I'll ask my computer."

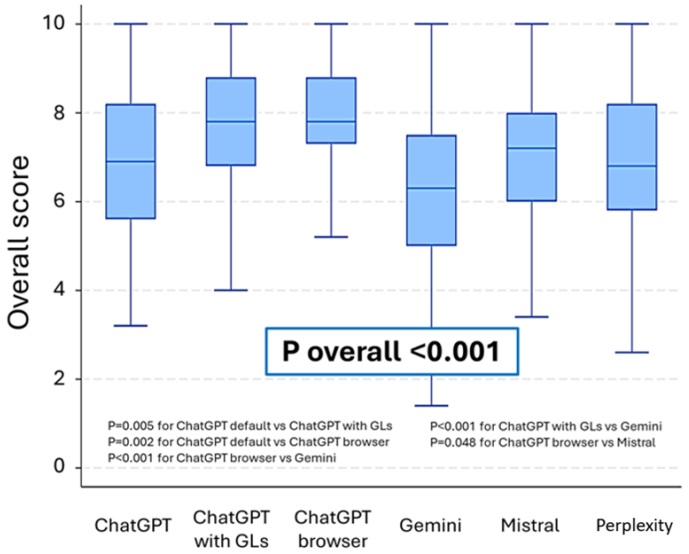
Data for interventional AI

- Imaging/physiology/report data provide complementary views of the same problem.
- Poor annotation quality can make an apparently sophisticated model reproduce human inconsistency rather than procedural truth.
- Data harmonization remains essential because device vendors, imaging protocols, and reporting habits vary substantially across catheterization laboratories.



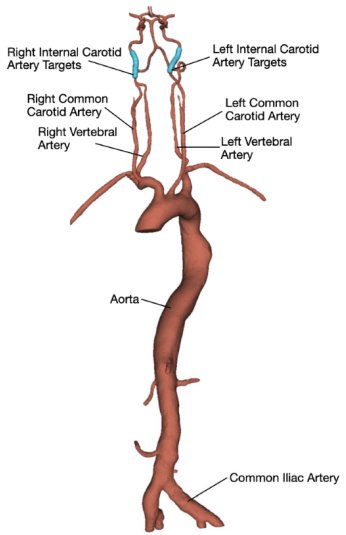
AI-augmented Heart Team

- AI tools can be used to coordinate, supervise and summarize Heart Team discussions.
- Generative AI tools can be leveraged to suggest specific recommendations and provide risk estimates.
- Confidentiality and clinical responsability are paramount, and final decision making should always remain in the hands of the caring physicians.

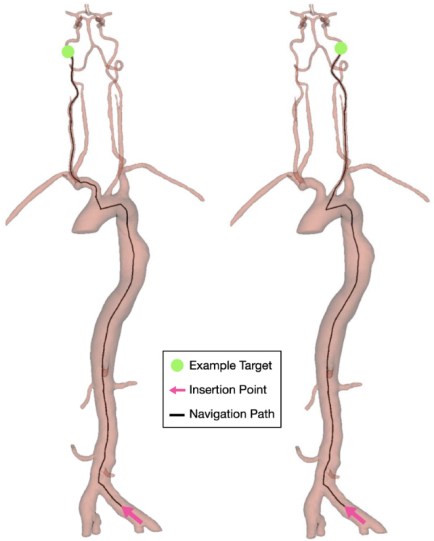


Access and navigation

- ML algorithms may analyze patient-specific anatomical data to guide optimal access points.
- Real-time AI feedback can assist clinicians in navigating complex vascular structures efficiently.
- AI-augmented device navigation may reduce complication rates and increase success rates, leading to safer, more effective, and more efficient interventional procedures.



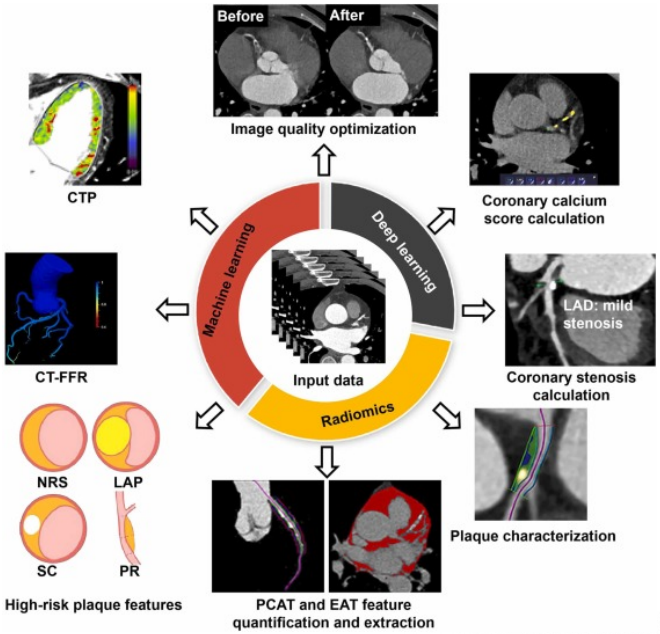
(a) Example targets.



(b) Navigation path.

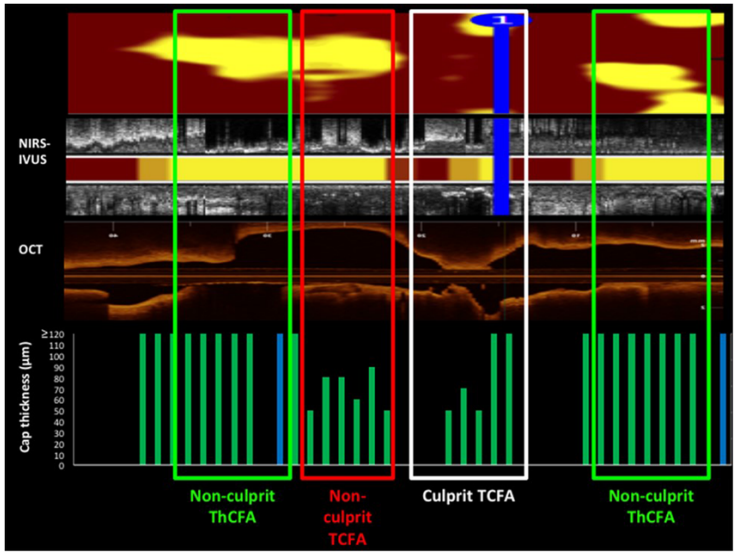
Lesion assessment

- Deep learning tools can be used to analyze imaging data to classify plaque composition and stability.
- Accurate assessment guides decisions on intervention necessity and technique.
- Personalized approaches based on AI assessments lead to better patient outcomes.



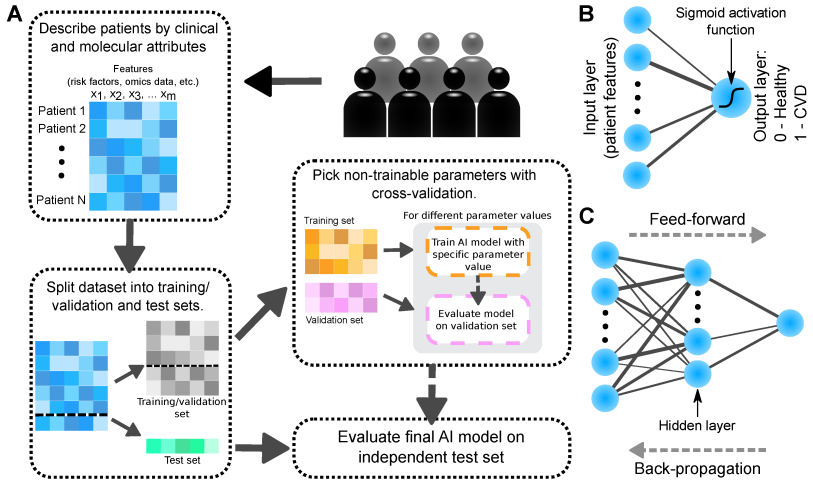
IVUS/NIRS/OCT integration

- AI algorithms can provide real-time analysis of intravascular images, identifying critical features.
- Enhanced imaging interpretation guides precise stent placement and deployment.
- Improved accuracy reduces the risk of procedural complications and improves outcomes.



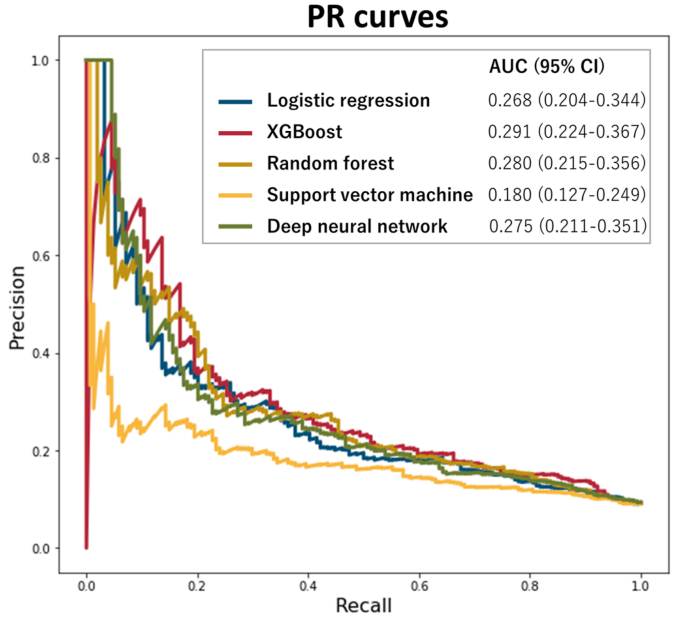
Predictive analytics

- AI models can predict patient-specific risks, allowing for tailored post-procedural care plans.
- Early identification of high-risk patients facilitates timely interventions to prevent complications.
- Predictive insights improve resource allocation and patient monitoring strategies.



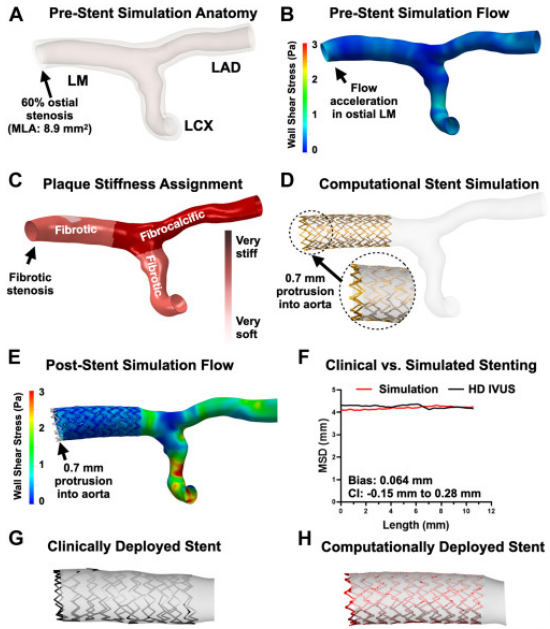
Guidance for CTO PCI

- ML models can predict the likelihood of procedural success based on patient data.
- AI can assist in selecting optimal crossing strategies for complex occlusions.
- Enhanced planning reduces procedure time and improves patient safety.



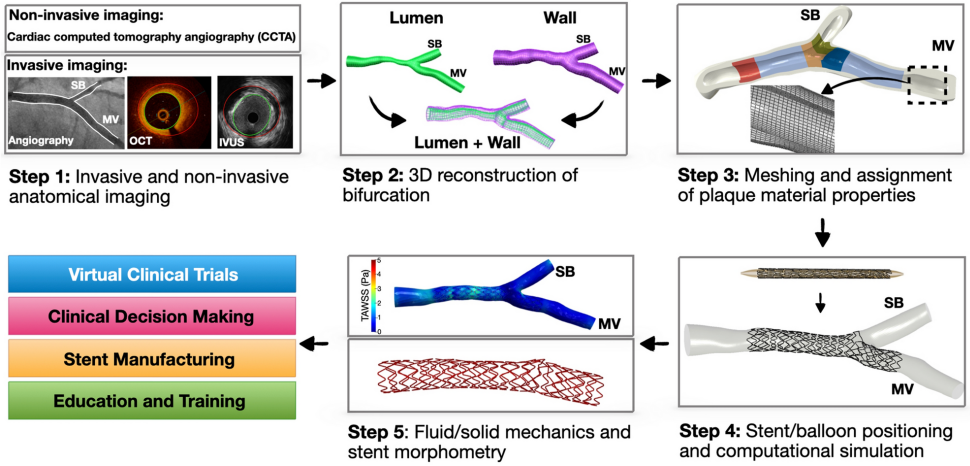
Real-time decision support

- AI can analyze intra-procedural data to suggest optimal PCI techniques.
- Real-time analytics assist in assessing lesion characteristics, guiding intervention decisions (eg bifurcation PCI strategy).
- Decision support systems enhance operator confidence, improving patient outcomes.



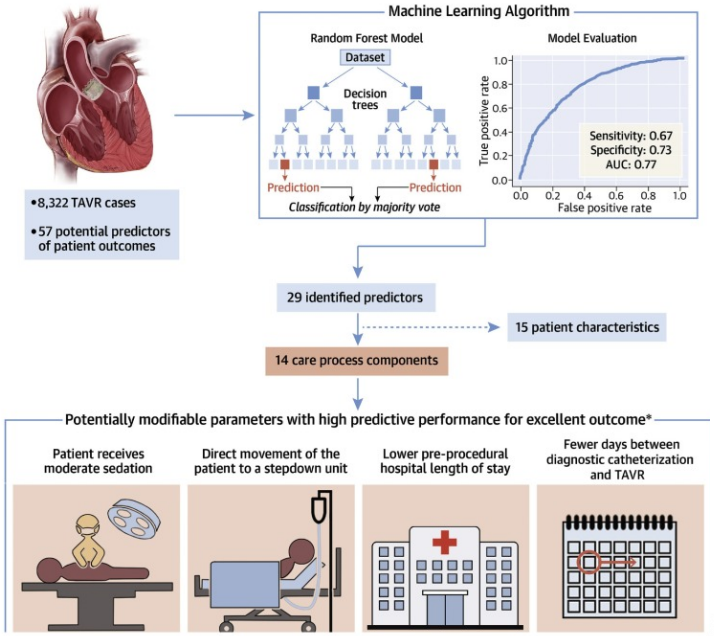
Selecting/placing devices

- AI algorithms can evaluate vessel size and lesion morphology to recommend appropriate stent types.
- AI-guided placement ensures optimal stent expansion and apposition.
- Personalized stent strategies decrease the likelihood of restenosis and thrombosis.



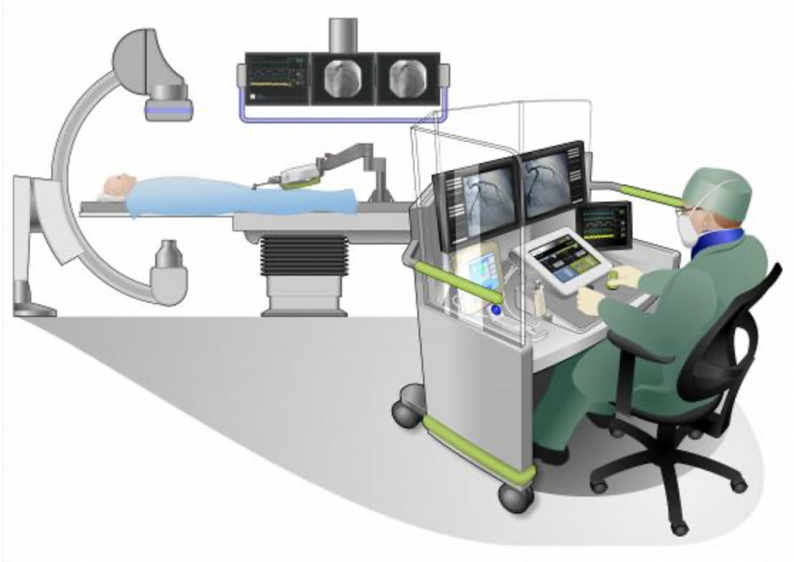
AI for SHD procedures

- Algorithms can assess anatomical suitability, aiding in appropriate patient selection for TAVI.
- AI assists in sizing and positioning of the valve, reducing procedural complications.
- Post-operative monitoring with AI predicts potential complications, ensuring timely interventions.



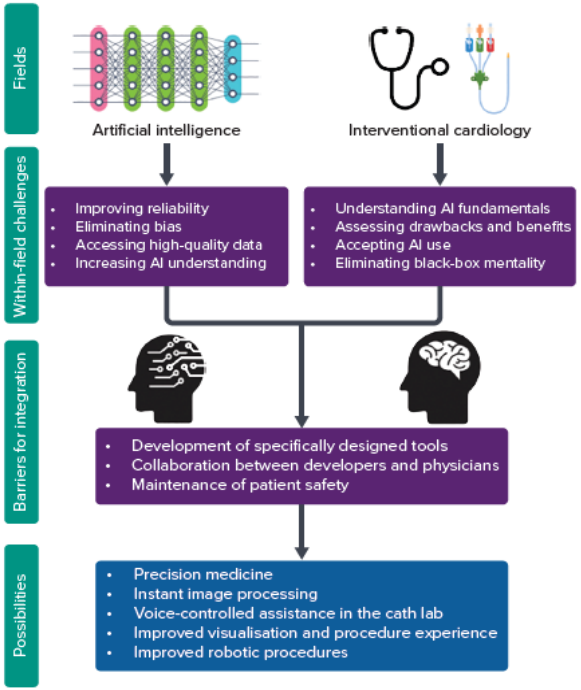
Robotic PCI

- AI algorithms can guide robotic systems for precise device manipulation during procedures.
- Enhanced precision reduces radiation exposure and contrast use.
- Automation of repetitive tasks allows clinicians to focus on complex decision-making.



Autonomous IC procedures

- Research is ongoing into AI systems capable of performing interventions with minimal human input.
- Autonomous procedures could increase access to care in underserved regions.
- Ethical and regulatory considerations are crucial as technology advances toward autonomy.



Kid: this might hurt a little

Doctor: ok

Kid: an AI is going to replace you

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Conclusions

- AI in IC should be judged by its ability to improve outcomes, not by algorithmic sophistication alone.
- Its greatest near-term value lies in coordinating/supervising team care, imaging interpretation, physiology/imaging integration, risk prediction, procedural quality control and documentation.
- Clinical adoption will require external validation, workflow integration, explainability, and evidence that AI improves outcomes without weakening operator accountability nor jeopardizing confidential and unbiased care.

Many thanks for your kind attention!

For any query or requesting a pdf copy of my books:

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