AI and Biomarkers: Advancing Medical Imaging

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Biomarkers, precision medicine and drug development

Infographic Challenge

Introduction

The field of medical imaging is undergoing a transformative revolution driven by artificial intelligence (AI). This integration reveals the great **potential** of imaging biomarkers, quantifiable features extracted from medical images that hold immense value for disease diagnosis and treatment.

However, AI in medical imaging poses **risks** such as privacy breaches, data bias, black box problems, and overreliance, potentially compromising patient confidentiality, exacerbating health disparities, obscuring decision-making rationale, and fostering dependence on imperfect technology.

Machine Learning

Through image **segmentation**, machine learning models separate images into distinct areas, allowing doctors to identify structures or abnormalities. ML techniques help find **patterns** in this data, aiding diagnosis, and treatment. **Feature extraction** captures key details from images, making them easier to analyze and understand for better patient care.

Deep Learning

Deep learning unlocks new possibilities in medical imaging. Unlike traditional methods, convolutional neural networks (**CNNs**) can learn directly from raw images, uncovering **hidden patterns**. Additionally, deep learning excels at **combining** various **data sources** like medical records and genetic profiles with images, creating a more complete view of a patient's health. This multimodal approach helps to reach more accurate disease predictions and personalized treatment plans.

Generative AI

Generative AI creates new data resembling existing data. Generative Adversarial Networks (**GANs**) use two networks, a generator and a discriminator, to produce synthetic images akin to real ones. Variational AutoEncoders (**VAEs**) reconstruct input data, aiding anomaly detection for early disease identification in precision medicine.

Explainable AI

XAI enables human oversight in AI systems. Methods like **SHAP** and LIME unveil "black-box" models, highlighting influential features. In biomarker validation, XAI assesses imaging biomarkers' **clinical validity**, aiding specificity and sensitivity determination. Collaborative efforts with clinicians enhance **transparency**, fostering mutual understanding and clinical integration of AI models in research.

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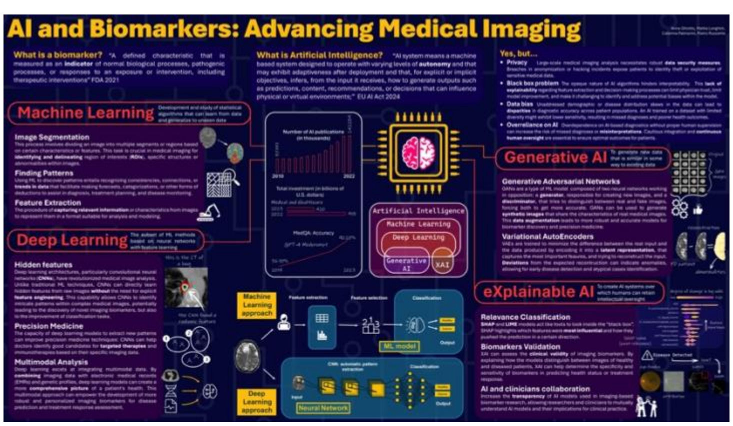

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