21 September
University
For Medical & Applied
Sciences

كلية التكنولوجيا الطبية
Faculty of Medical Technology

Bioinformatics in Medical Devices

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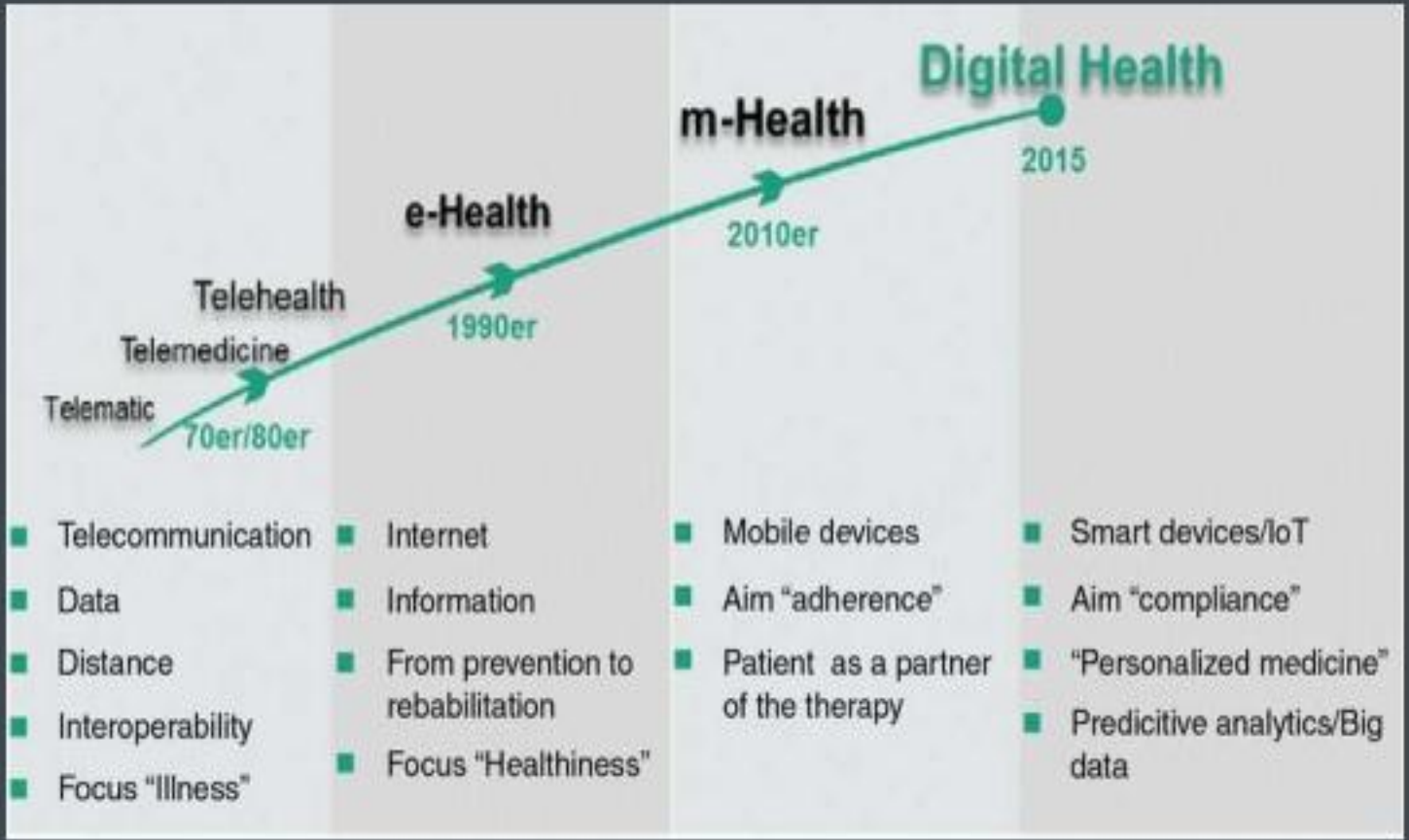
Titles

- **Bioinformatics From telematics to Digital Health – A brief history.**
- **Bioinformatics uses in medical devices.**
- **Bioinformatics in Wearable Devices.**
- **Bioinformatics in Prosthetic Devices.**
- **Bioinformatics in Diagnostic Devices.**
- **Bioinformatics in Therapeutic Devices.**
- **Top 9 AI Applications In Healthcare.**
- **Conclusion.**

Bioinformatics from Telematics to Digital Health – A brief history



Bioinformatics uses in medical devices

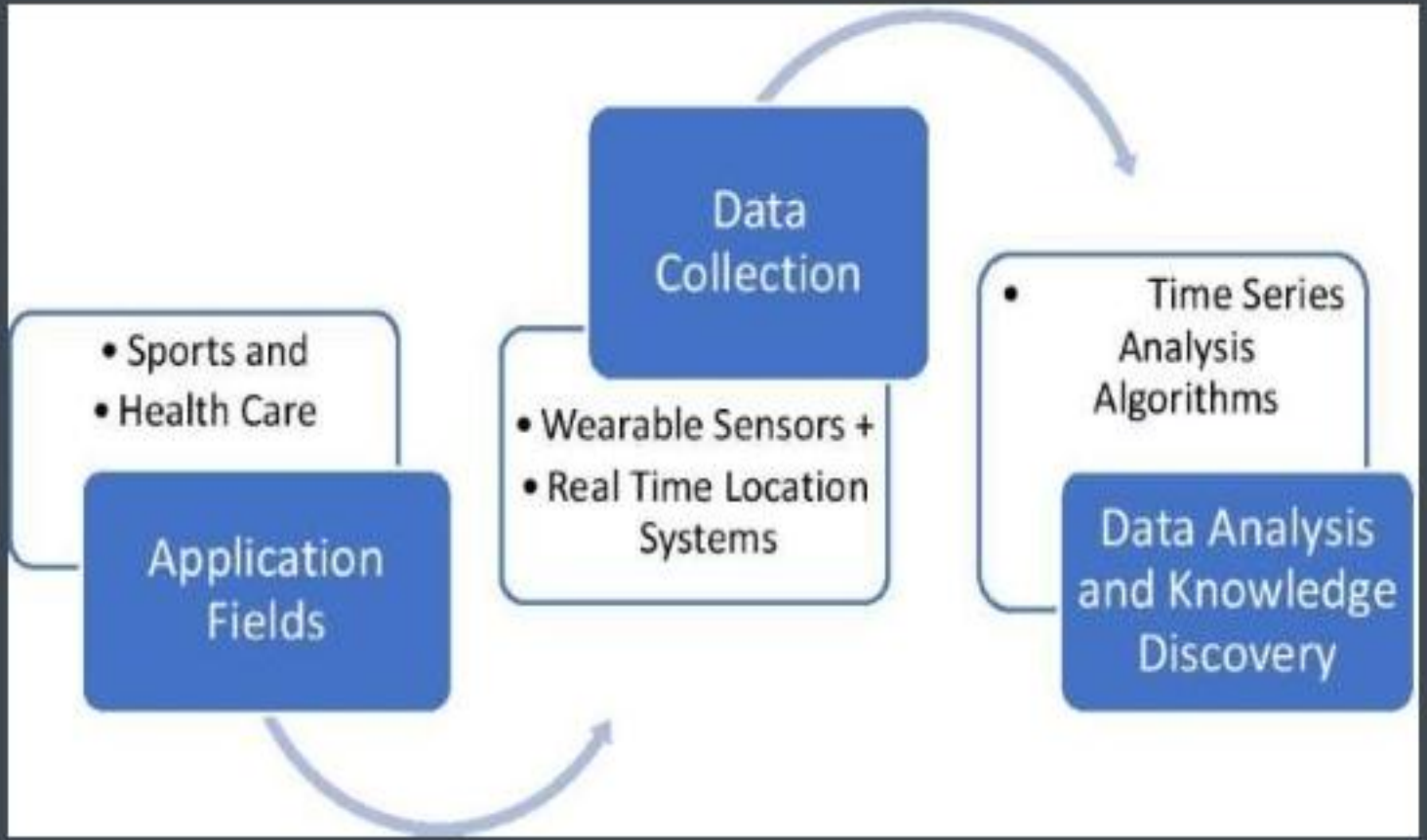
1. **Wearable Devices**
   Bioinformatics can be used to develop new sensors and algorithms that can detect a variety of health parameters, from heart rate to blood sugar levels

2. **Prosthetic Devices**
   Bioinformatics plays a significant role in the development of prosthetic devices by analyzing biological data, creating models, developing algorithms, and contributing to the overall improvement of these devices.

3. **Diagnostic Devices**
   Bioinformatics plays a critical role in the development and use of diagnostic devices, helping to improve diagnosis, treatment, and patient outcomes. It used in: Data analysis, Disease prediction, Personalized medicine, Drug discovery, and Quality control.

4. **Therapeutic Devices**
   Bioinformatics plays a critical role in the development and implementation of treatment devices, improving patient outcomes, and advancing medical technology. It used in: Design and development, Personalized medicine, Monitoring and analysis, and Data sharing and collaboration.

Bioinformatics in Wearable Devices



History of Wearable Technology

1644 — The Abacus Ring

1762 — Marine Chronometer Pocket Watch

1961 — The Gambling Shoe

1977 — HP releases the HP 01 algebraic calculator watch

1987 — The Digital Hearing Aid

1994 — Edgar Matias debuts a "wrist computer"

2000 — Bluetooth Headset

2004 — Microsoft launches SPOT Smartwatch

2008 — Fitbit

2012 — The Oculus Rift

2012 — Nike FuelBand

2012 — Pebble Kickstarter Record

2013 — Samsung Galaxy Wear

2013 — Google Glass

2014

- Specialized Visual Aids
- Medical Grade Monitors (on wrist)
- Smart Safety Glasses
- Augmented Reality

History of Wearable Health Monitoring Devices

1788

Thomas Jefferson introduced the first pedometer to the US

Tomish Meter

1921

1st machine to include sensors to measure galvanic skin response, pulse rate and BP

Galvanic Skin Response

1938

Aurex Corp. developed 1st wearable Hearing Aid

Hearing Aid

2003

Vitatron C series, world's 1st fully digital pacemaker

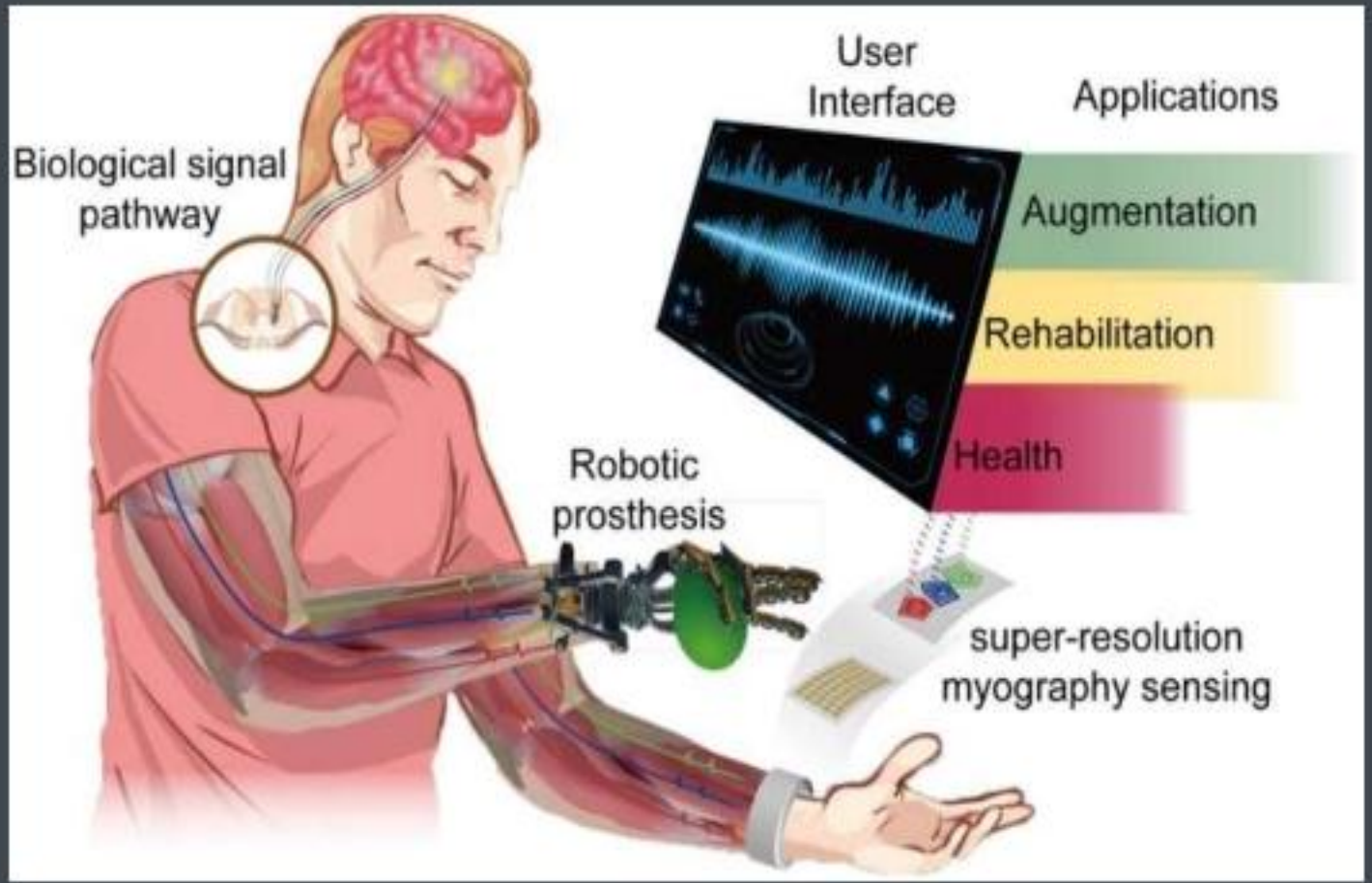
C Series

2008

Activity trackers, wireless-enabled wearable technology devices that measure data such as the number of steps walked, heart rate, quality of sleep, steps climbed, and other personal metrics involved in fitness.

Fit-bit

Bioinformatics in Prosthetic Devices



History of Prosthetic Devices

applications

1500's
Ambroise Paré
Silver nose, ear, and eye

1560's
Tycho Brahe
Metal nose

1830's
"Gunner with the Silver Mask"

1940's
Acrylic resin eyes

1970's
Silicone maxillofacial prosthetics

2010's
3D Printed Silicone prosthetics

1400 1600 1800 1900 2000 Beyond

materials

1500's
Silver
Gold
Iron

1800's
Paper, porcelain, celluloid, leather, wood

Late 1800's
Vulcanite rubber

1930's
Prevulcanised latex

1946
Silicones enter market (not as prosthetic material)

1970's
Silicones become preferred prosthetic material

Bioinformatics in Diagnostic Devices

AI could save lives and improve medical diagnoses

Artificial intelligence in healthcare must combat the hype that inflates the technology's potential. But there are success stories about what AI algorithms could accomplish.

20,000 lives

The U.K. National Health Service plans to use AI to improve early cancer diagnosis. The healthcare system believes early diagnosis may prevent 20,000 cancer-related deaths annually by 2033.

SOURCE: NATIONAL HEALTH SERVICE

50,000 proteins

Machine learning could aid early diagnosis by evaluating blood samples. An author of a study by vendor Aruba Networks predicted that machine learning may one day pull 50,000 different proteins from a blood sample, compared to just 30 today.

SOURCE: ARUBA NETWORKS

70% accuracy

Researchers from Google and Verily Life Sciences found that AI could analyze retinal images to predict heart attack risks with an accuracy of 70%.

SOURCE: NATURE BIOMEDICAL ENGINEERING

1 pixel

Examining data by the pixel, AI can infer from 500 mammographies which images warrant more review by radiologists.

SOURCE: LOGICALIS PRINCIPAL CONSULTANT KIM GARRETT

Image Analysis and Visualization Benefits

- Optimized images analysis
- Reducing medical errors
- Less work for human
- Better diagnosing
- Time saving
- Improved performance
- Case rating by prioritization
- Earlier detection of cancers

EVOLUTION OF DIGITAL RADIOGRAPHY

W. RONTGEN

MRI

DICOM - PACS

Direct Radiography (Flat Panel)

1895 — 1973 — 1980 — 1983 — 1991 — 1992 — 1994

Film...

CT SCANNER

EMI - G. Hounsfield

CR

Phosphorous Plates

Direct Radiography (CCD)

2019

Flat Panel

- Wireless
- Ultra Thin
- 1 Sec. speed
- Plug & Play
- Unbreakable
- Lower cost than CR

HISTORY OF CT SCANNER

EMI- "The Beatles" Company
Inventor: G. Hounsfield

TRANSLATE/ ROTATE
(1 Slice in 5 minutes)
1973

ROTATIONAL
(Rotates 180 degrees, 1 Slice in 3 seconds)
80's

MULTI-SLICE
(Thousands of Slices per second)
2021

1975
First GE CT Scanner installed in Latin America
Place: Bogotá, Colombia
Eng. Rodolfo Gutierrez (EMI)

90's
HELICAL

(Rotates continuously, 1 Slice in 0.25 seconds)

RESULTS:

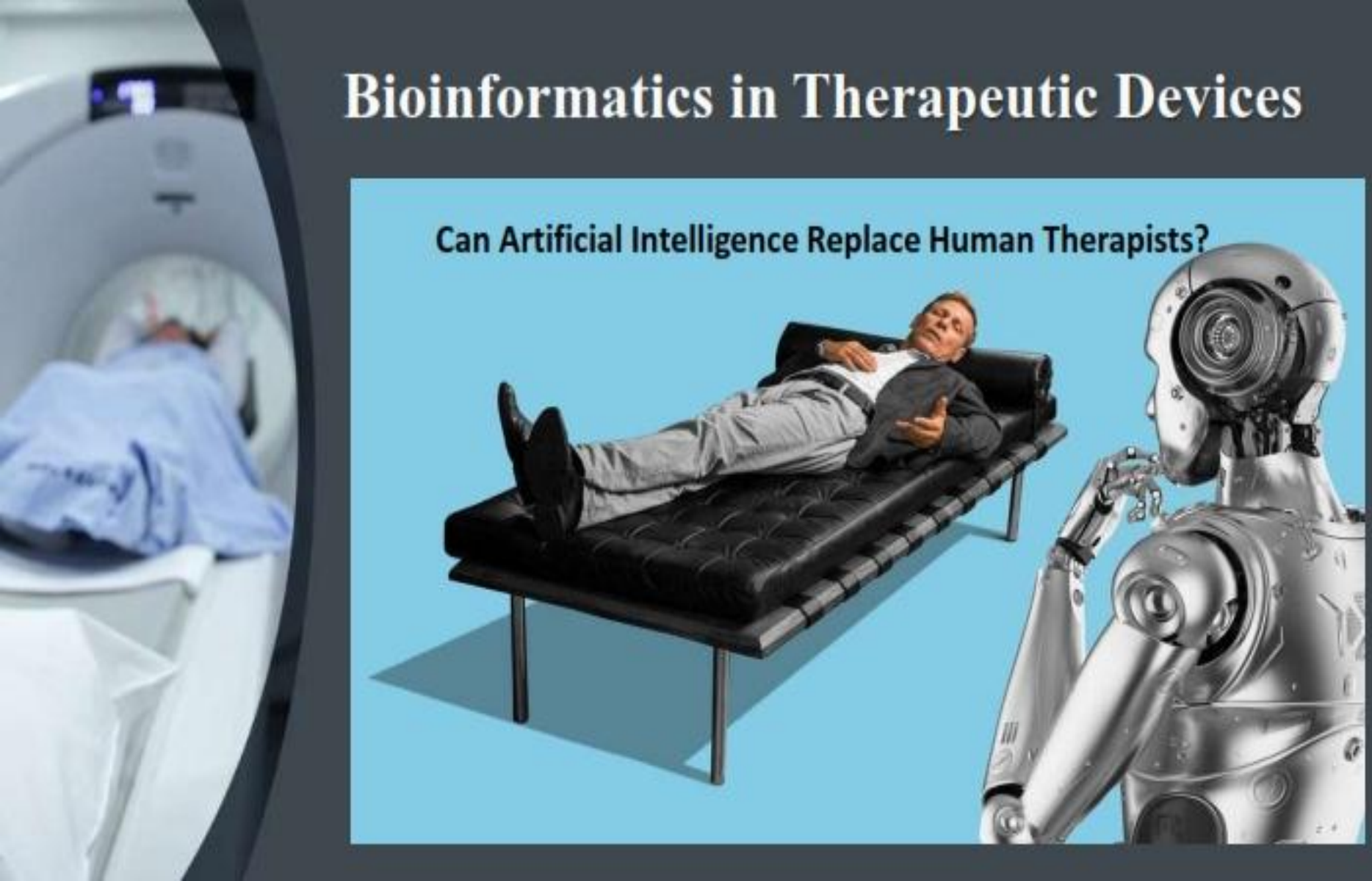
1973
First Head CT

2021
CT - 3D Angiography

APPLICATIONS:

- Trauma
- Cardiology
- Orthopedics
- Vascular
- Oncology
- MR/CT
- PET/CT
- Others

Bioinformatics in Therapeutic Devices

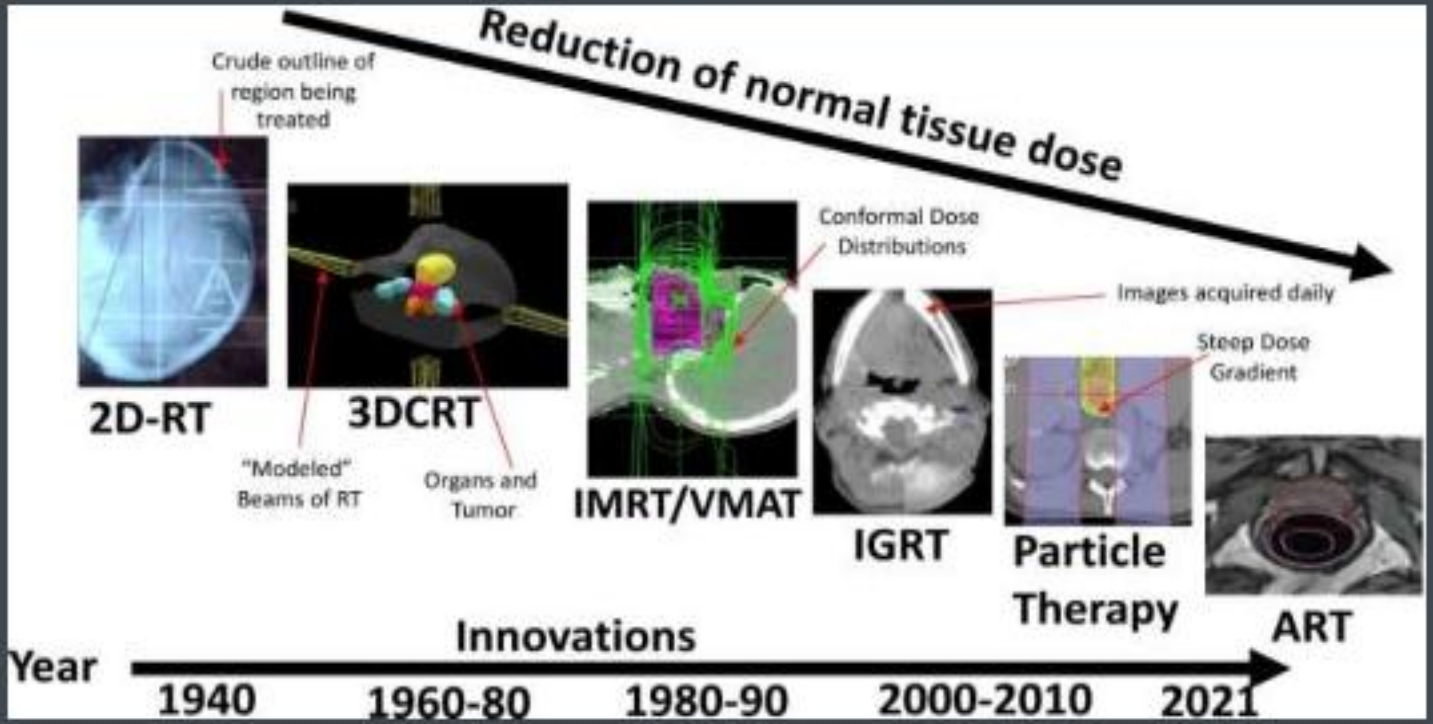


Robotic Surgery: A hi-tech path to the future of healthcare

Benefits:

- Shorter hospital stays
- Reduced pain and discomfort
- Faster recovery time
- Reduced infection risk
- Reduced blood loss and need for transfusions
- Minimal scarring
- Better outcomes for patients

Historic Evolution of Radiation Technology Over the Past 30 Years



2-Dimensional Radiotherapy (2D-RT), 3D-RT, Intensity-Modulated RT/Volumetric Modulated Arc Therapy (IMRT/VMAT), Image-Guidance Radiotherapy (IGRT), Particle Therapy, and Adaptive Therapy (ART).

Top AI Applications In Healthcare

Conclusion

The use of bioinformatics in medical devices is critical for the future of healthcare. It enables the development of personalized treatments, improves the safety and efficacy of medical devices, and leads to faster diagnosis and treatment. While there are challenges to implementing bioinformatics in medical devices, the future looks promising, with integration with EHRs, AI, and wearable devices on the horizon.


Thank
You