



Nursing Informatics: Navigating the Future of Patient-Centered Care



“IT as Opportunity for Strengthening Nursing Research”



Types of Health Informatics

- **Bioinformatics:** The application of computer technology and three-dimensional modeling to large sets of biological data.
- **Biomedical Informatics:** The statistical analysis of healthcare information to identify trends and improve healthcare problems and decision-making.
- **Medical Informatics:** The collection and evaluation of medical knowledge and patient data to facilitate and improve patient care.
- **Clinical Informatics:** The collection, evaluation, and application of information technology to deliver healthcare services and improve care provided by healthcare organizations.
- **Nursing Informatics:** The combination of nursing information, information management, and communication technologies to promote patient-centered care.
- **Pharmacy Informatics:** The collection, evaluation, and application of medication-related data.
- **Public Health Informatics:** The use of technology within the public health field, including to promote surveillance of population health, education, prevention, outbreak management, and electronic reporting.

Emergence of Technology in Healthcare

Evolution of technology supporting health care and professional nursing practice

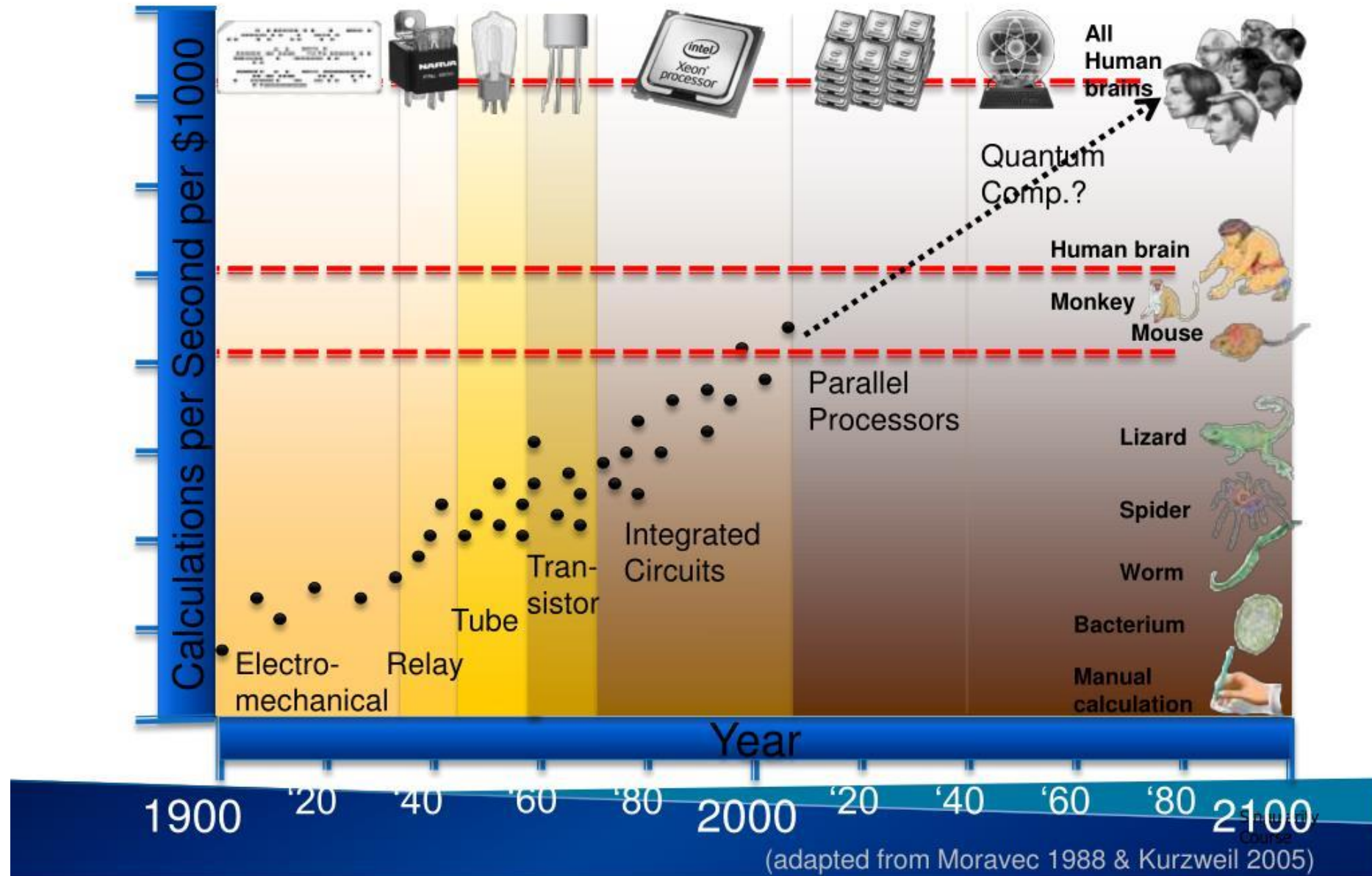




Kathryn J Hannah, C.M., Ph.D., D.Sc. (h.c.)

1985 – Kathryn Hannah :..is the use of information technologies in relation to any nursing functions.

Moore's Law

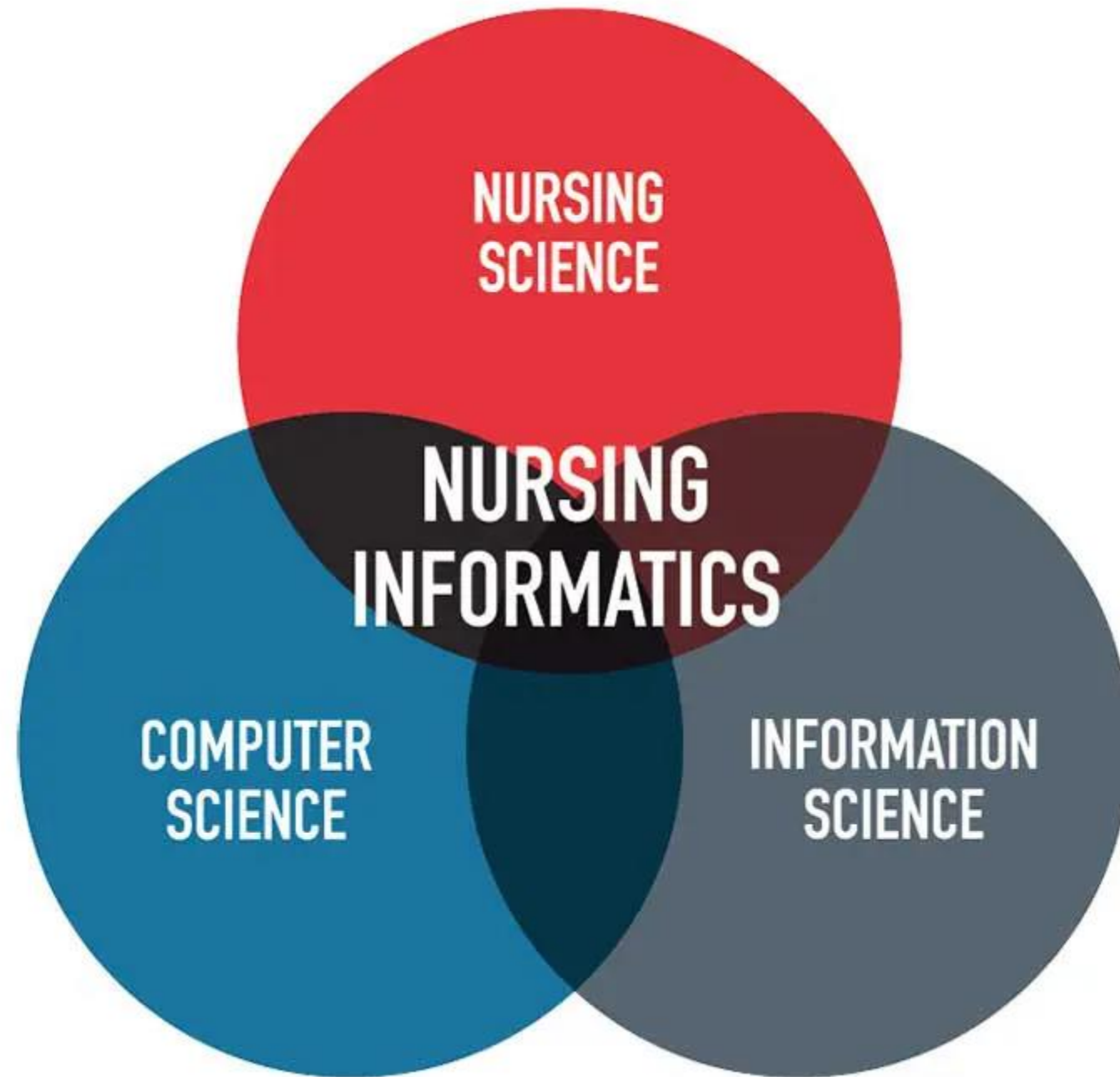




What is nursing informatics?

Nursing informatics (NI) is a nursing specialty that integrates nursing science, patient care, computer science, and information technology (IT). The American Nurses Association (ANA) defines nursing informatics as the nursing niche that identifies, defines, manages, and communicates data to bring “data, information, and knowledge” into actual nursing practice. The need for nursing informatics is becoming more recognized, with a 21% employment growth predicted for computer and information research scientists in general up until 2031.





Nursing Informatics Combines Diverse Fields



Nursing



IT Communications



Computer science



Information science



Information Technology

**Information
Technology**

Hardware

Software

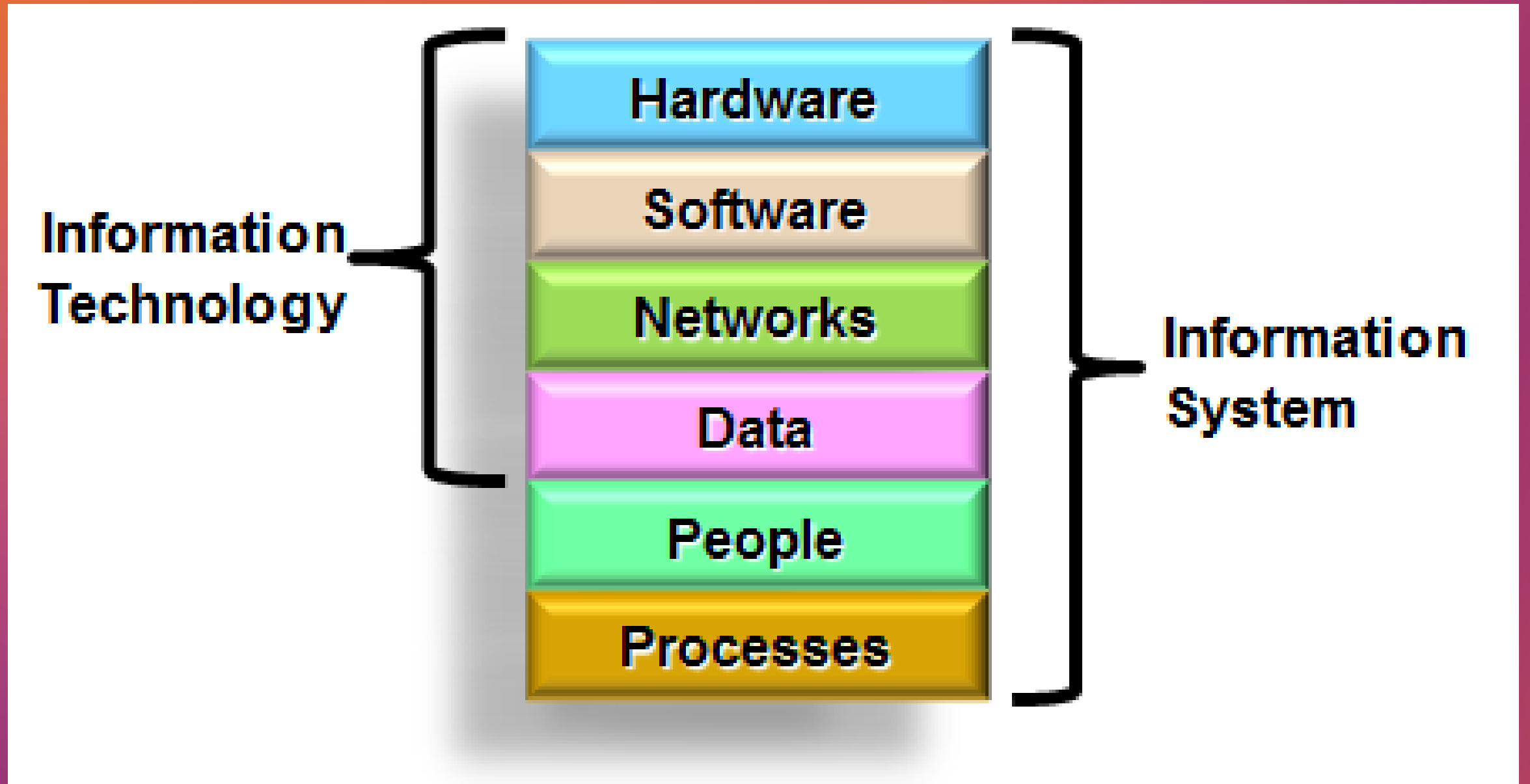
Networks

Data

People

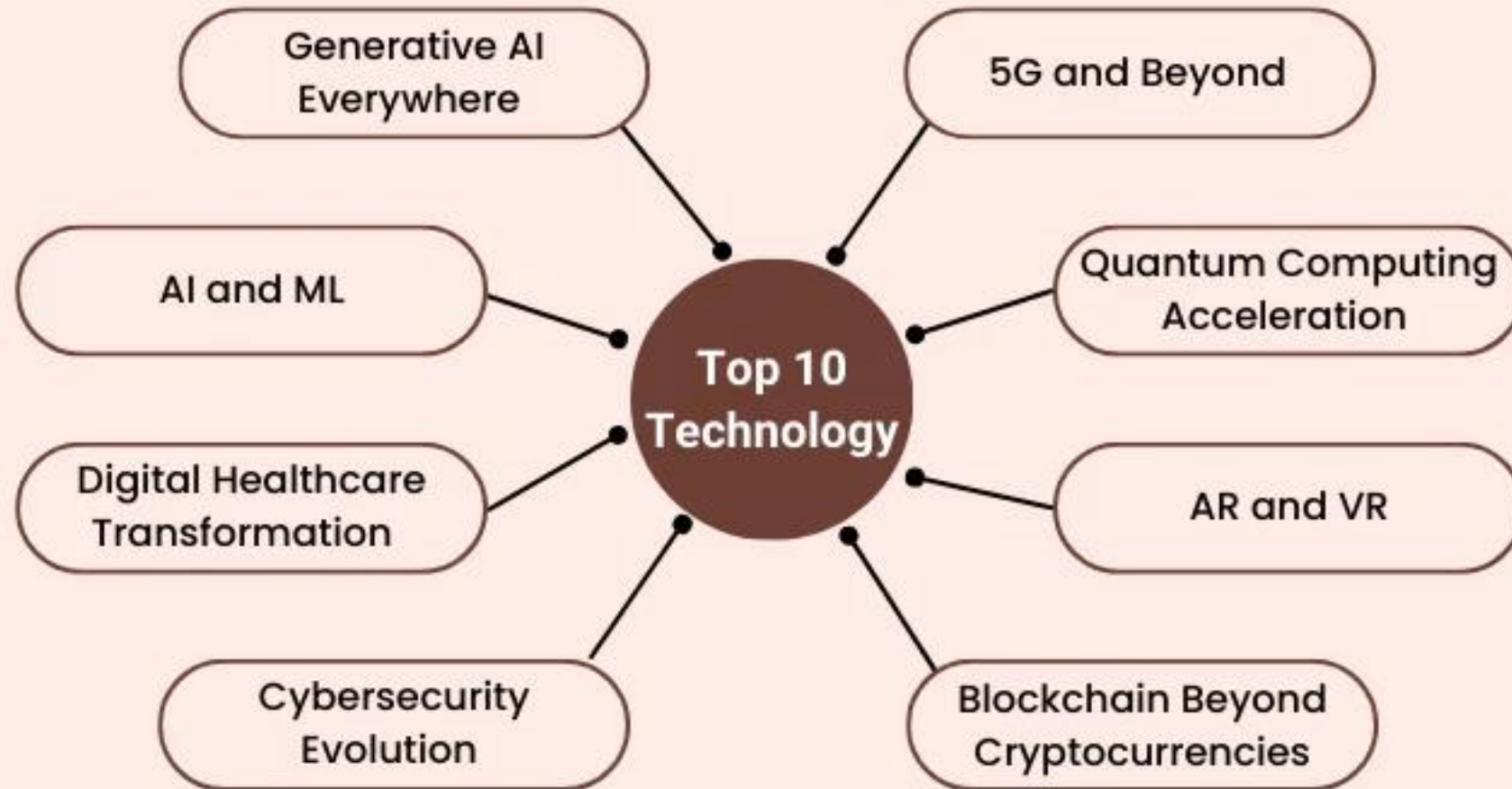
Processes

**Information
System**





Top 10 Technology Trends to Watch in 2024



The Importance of Health Informatics (Nursing Informatics)

<https://www.publichealthdegrees.org/careers/health-informatics-vs-bioinformatics/>



Information technology



Nursing informatics and analytics

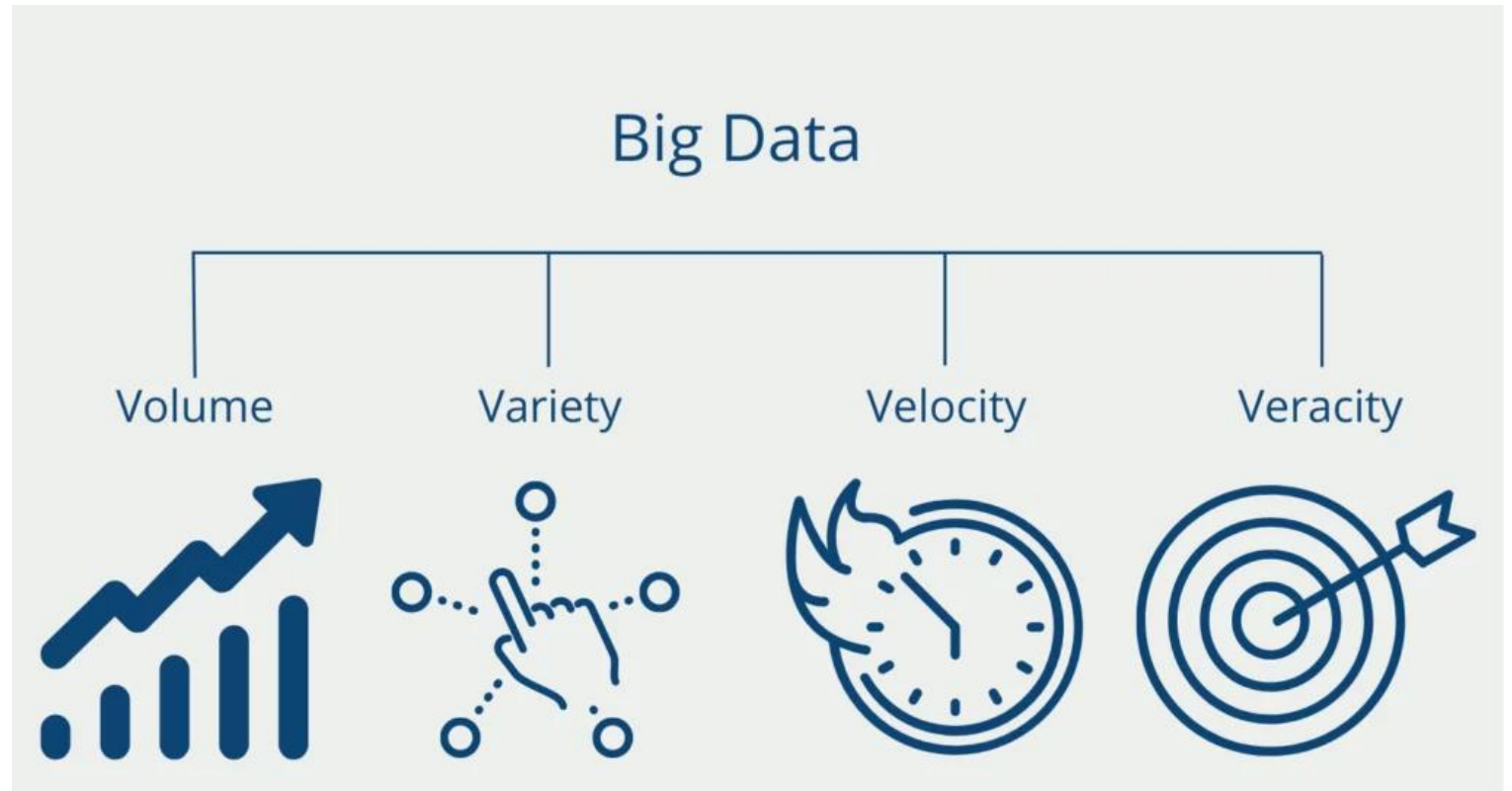


Legal issues and ethics

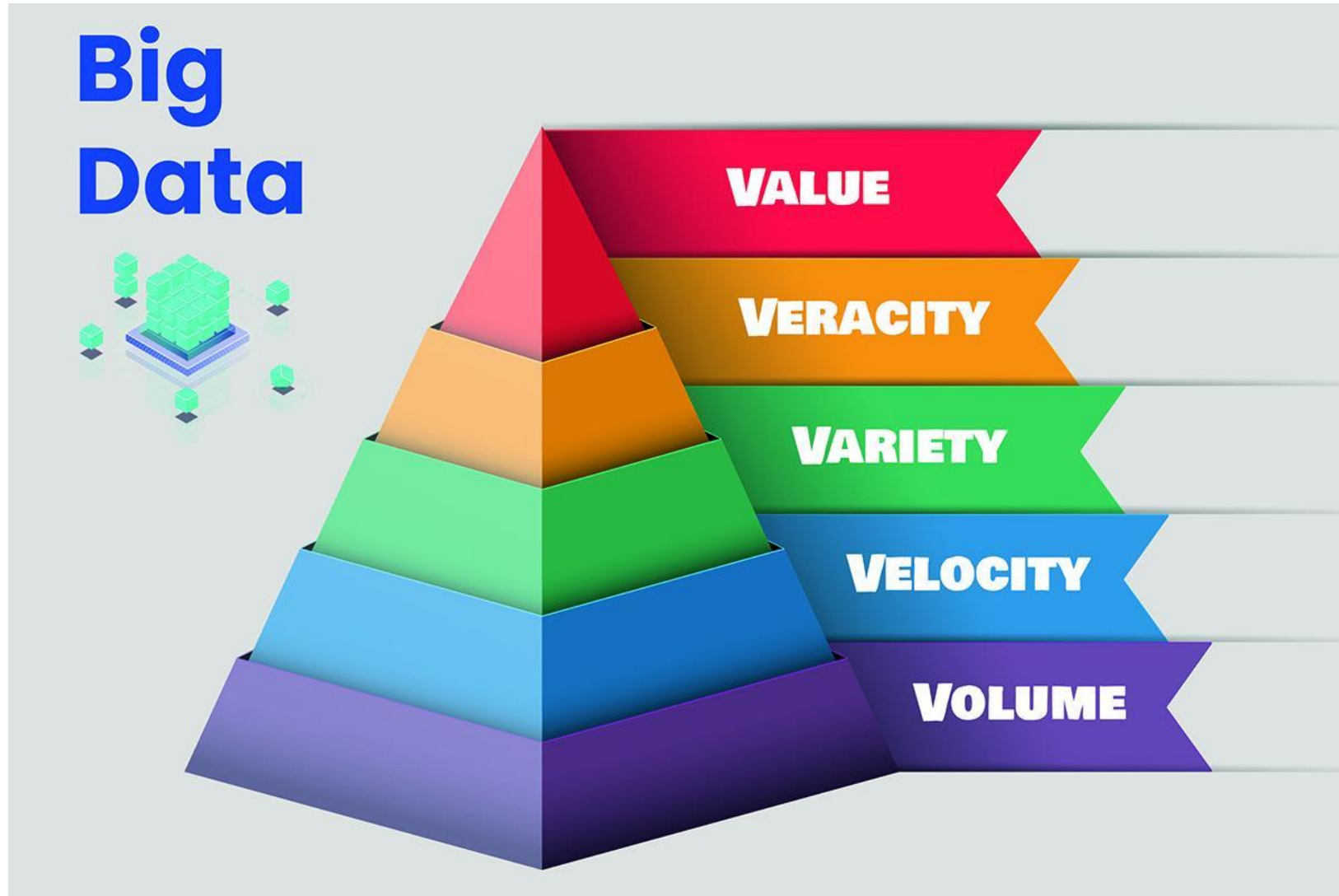


Database design

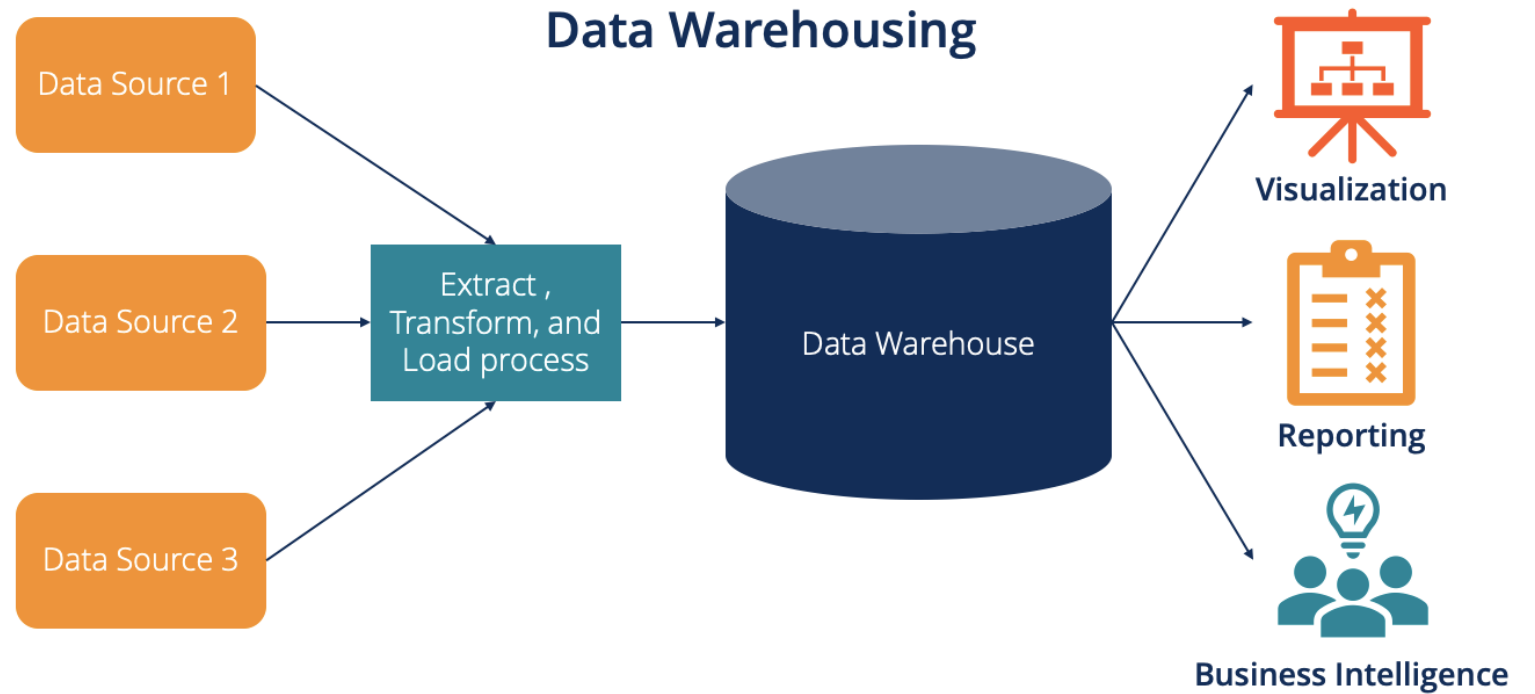
4 V's of Big Data



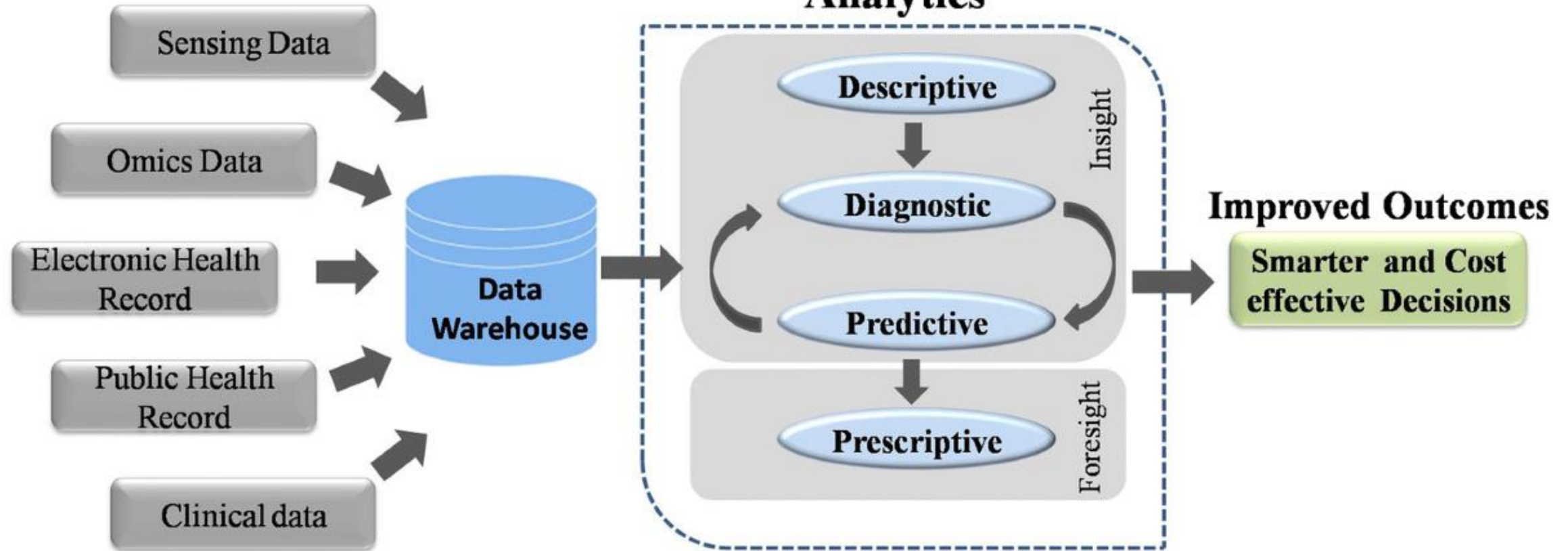
Big Data
+
Data Analytics
= Value



Data Warehouse



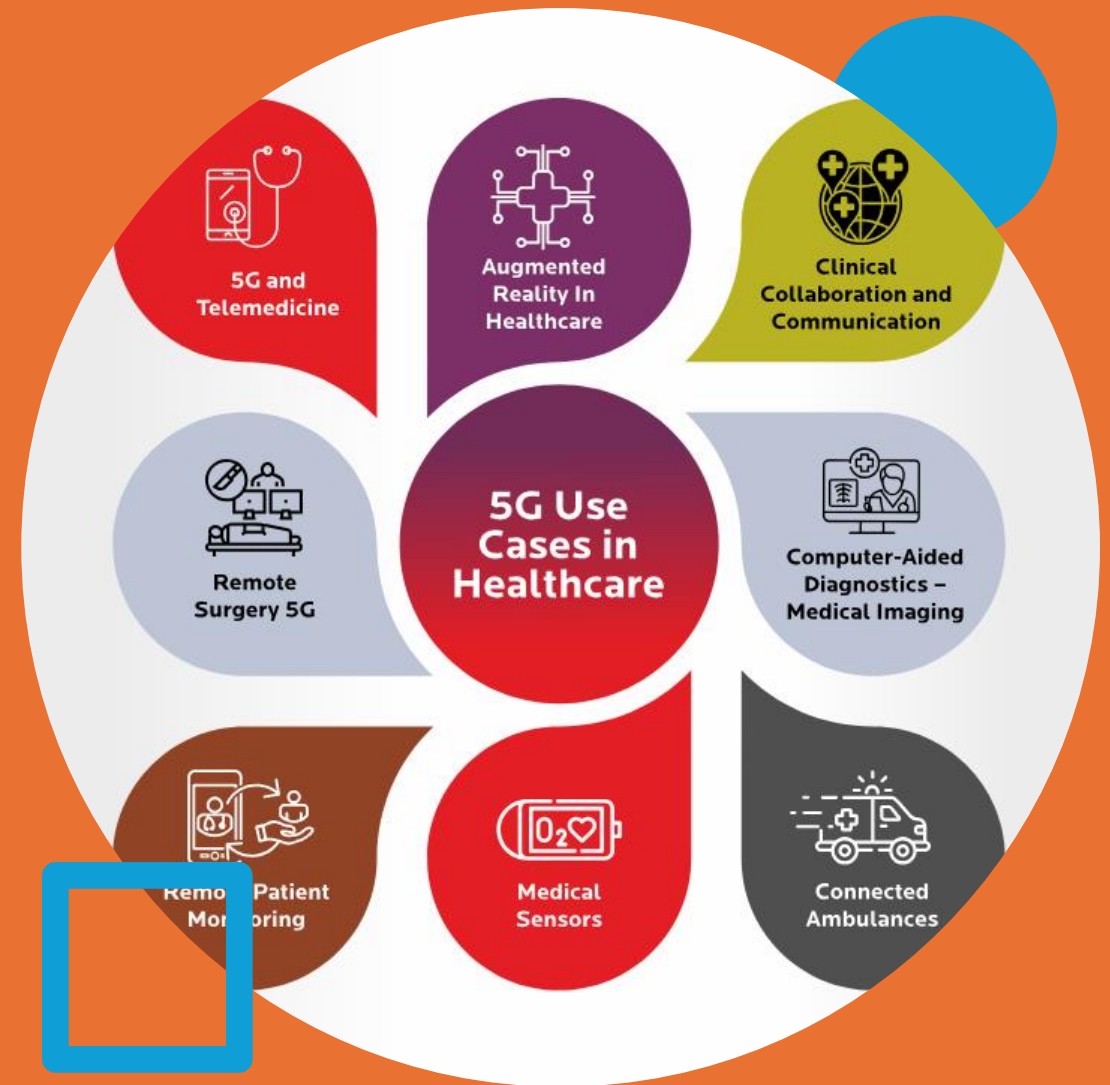
Analytics

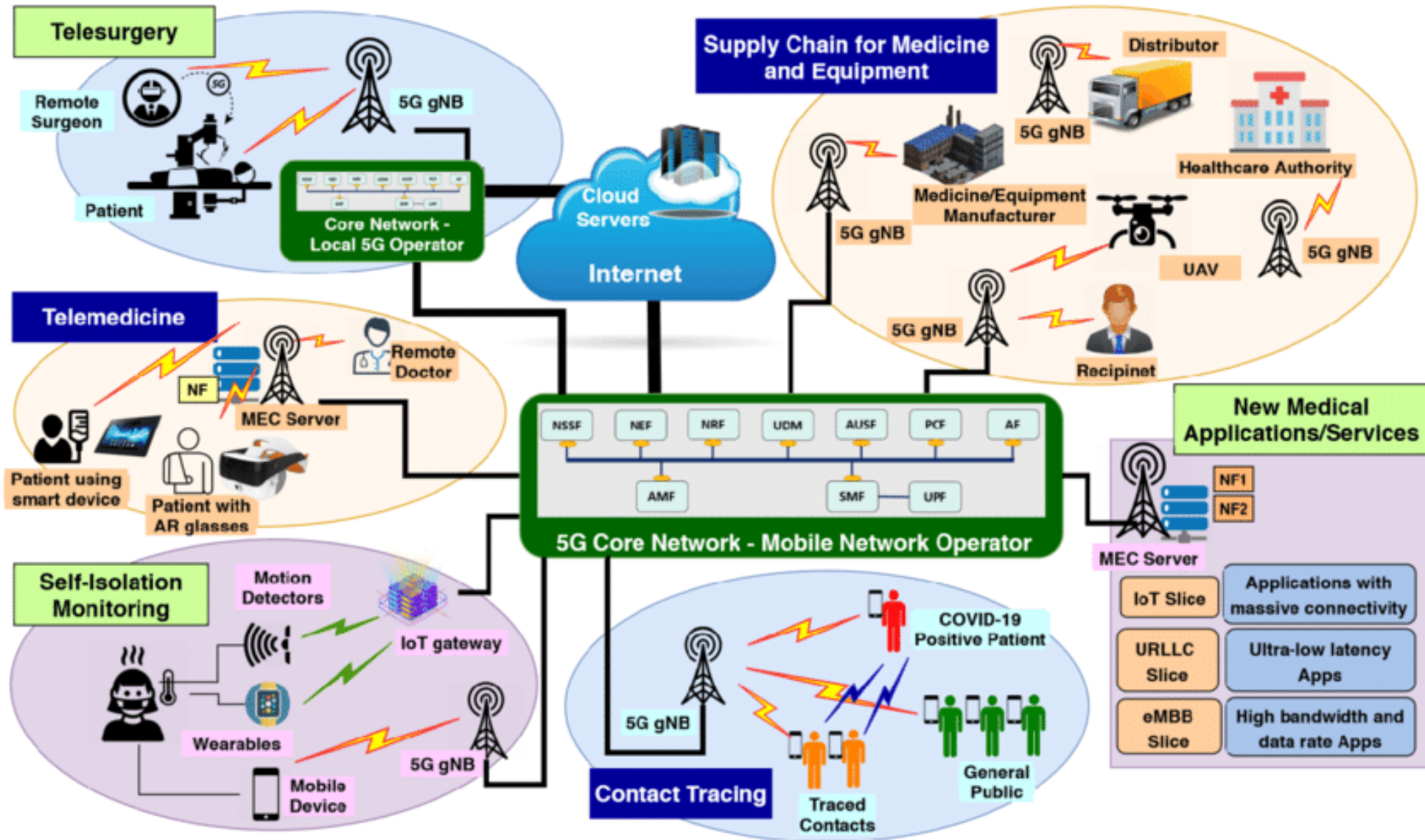




The world's most valuable resource is no longer oil, but data

5G and Beyond

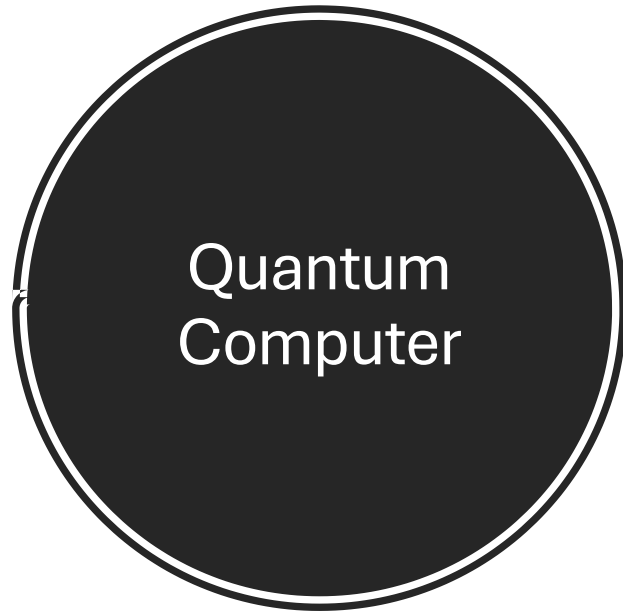




Taiwan leverages AI supercomputers for medical and life science breakthroughs

Supercomputer
for healthcare



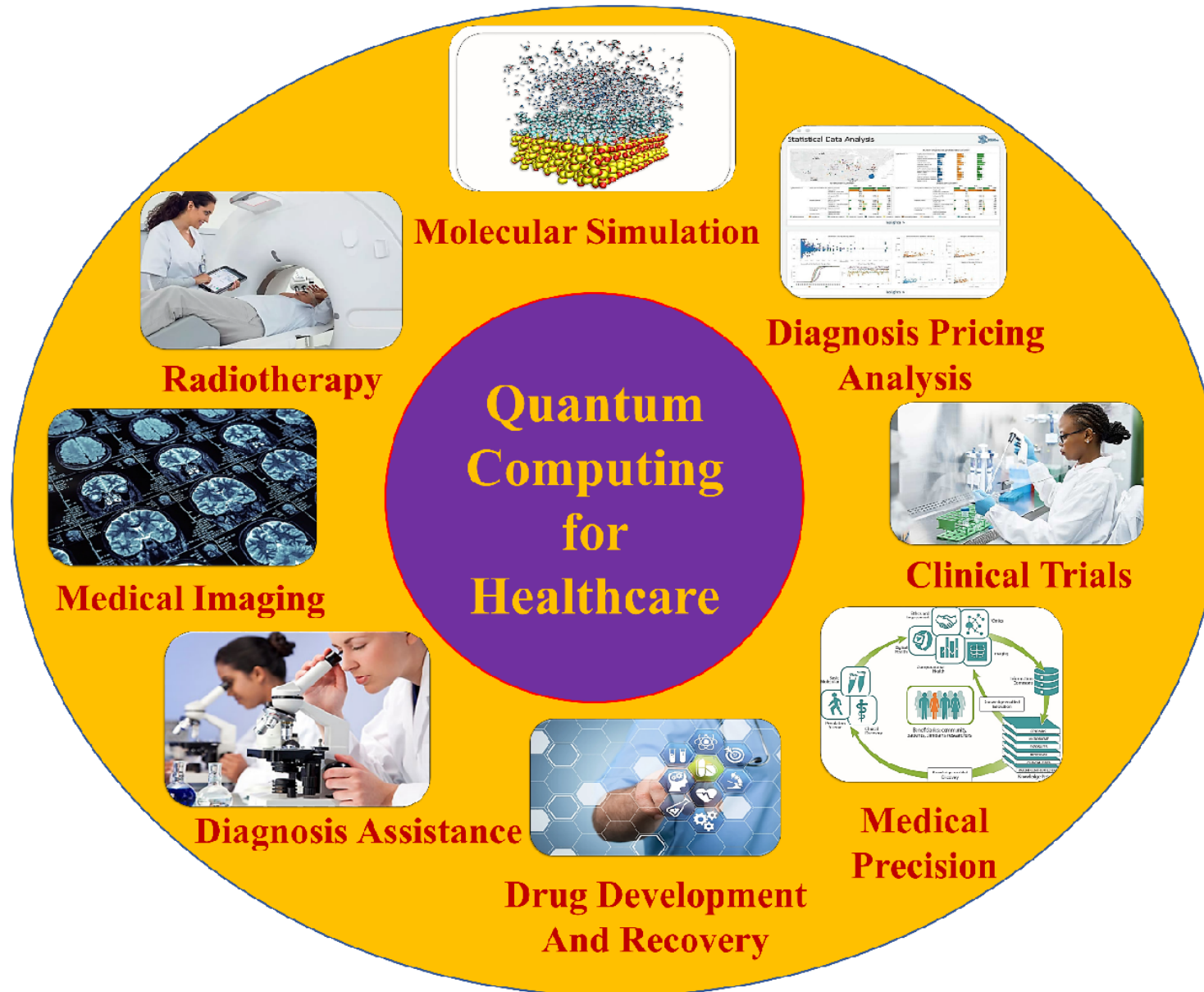


Cleveland Clinic and IBM Unveil First Quantum Computer Dedicated to Healthcare Research

IBM Quantum System One deployed at Cleveland Clinic as part of landmark 10-year partnership

Mar 20, 2023





Top 6 Tech Trends Reshaping Healthcare in 2024



Telehealth &
Telemedicine



Internet of
Medical
Things (IoMT)



Cloud
Computing



Artificial
Intelligence (AI)

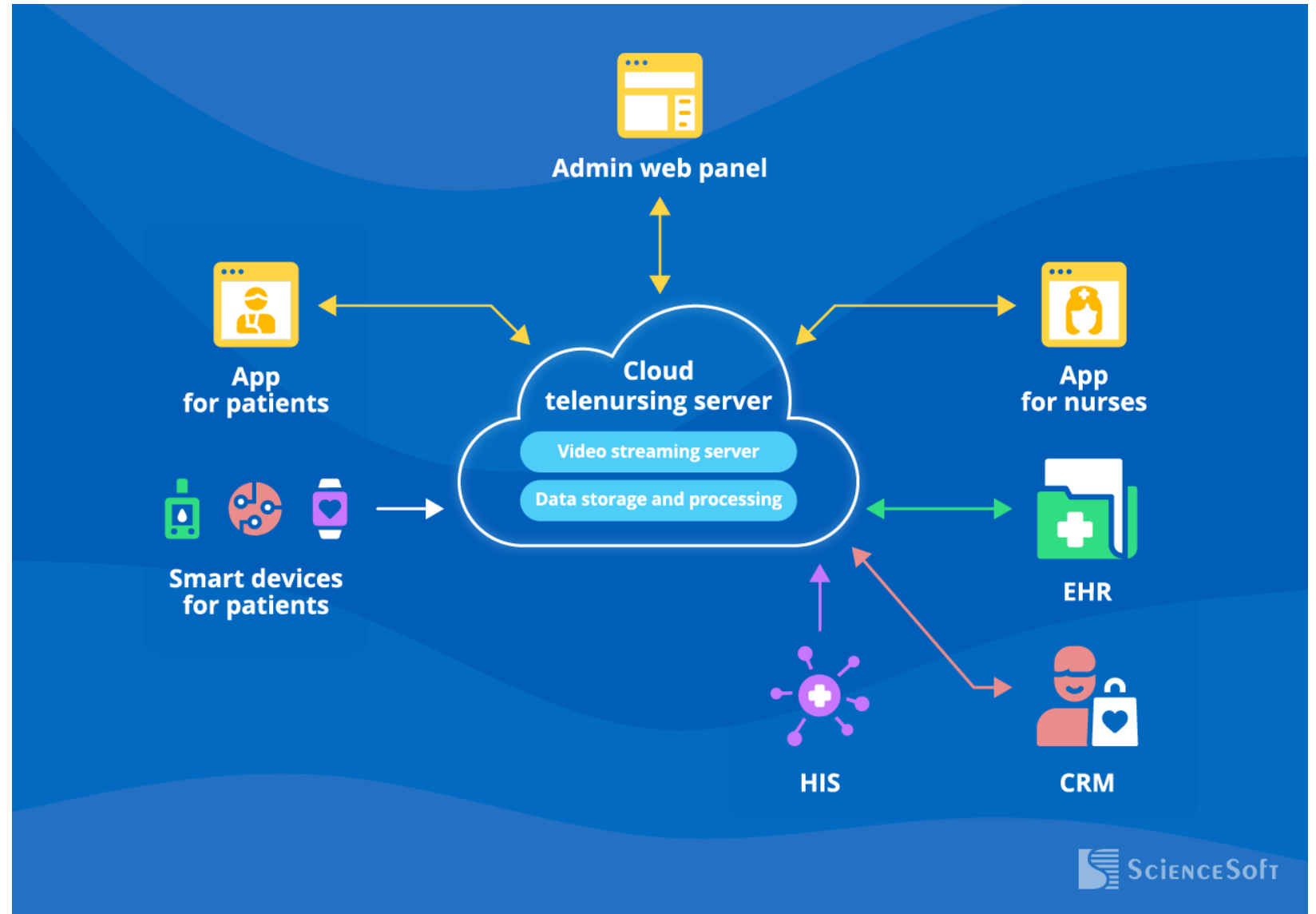


Big Data
& Analytics



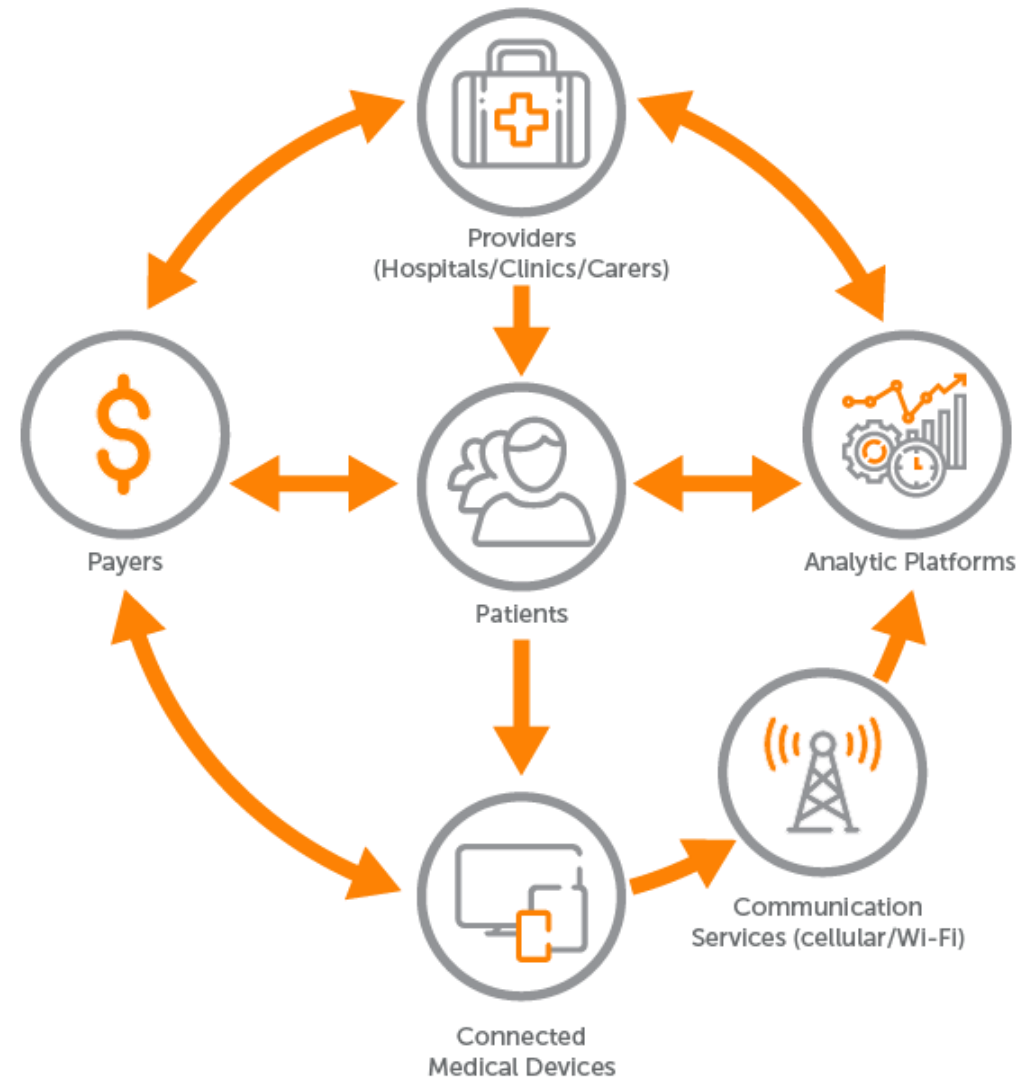
Augmented Reality
(AR) & Virtual Reality (VR)

Telehealth and Telemedicine (Telenursing)



IoMT

The IoMT Ecosystem of Dynamic Collaborations



Note. Arrows indicate points at which data from connected devices can be transferred
Source: Deloitte LLP, 2018



Augmented Reality (AR) and Virtual Reality (VR)

Differences between AR and VR

AR

Description

- A real world with digital elements added

Capabilities

- Integrating computer-generated images/motion elements into a physical world

Engagement level

- Users distinguish between real and virtual world while interacting with the both

Equipment

- Smartphone or any AR-compatible device

Scalability

- Easy to scale & access from multiple devices

VR

Description

- An entire virtual world

Capabilities

- Immersing users into a fully digital environment

Engagement level

- Full immersion in the digital environment with no elements from the real world

Equipment

- VR headset is required

Scalability

- Hard to scale due to the need for extra equipment

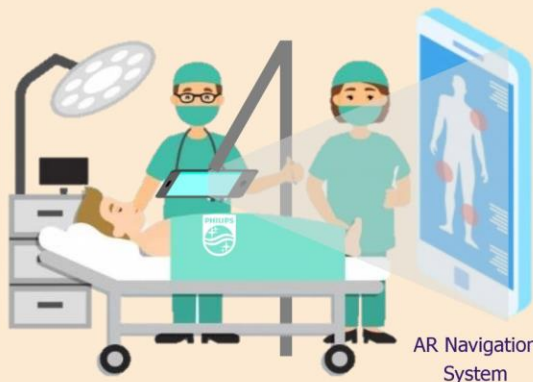
Key Cost Saving Applications of AR and VR in Healthcare



HOSPITAL



Operating Room



AR Navigation System

If all the hospitals in the USA increased the number of **minimally-invasive procedures by 50%**, **144,863** days hospital stay could be cut annually

AR navigation system for a minimally-invasive surgical procedure can help **achieve 85% accuracy** (64% in conventional techniques?)

Annual Cost Savings (USA)
US\$288 million

International Collaboration

Experts from remote locations can virtually join a surgical procedure using AR platform

In 2016, **Virtual Interactive Presence and Augmented Reality (VIPAR)** system was set up at children's hospital in the USA and its counterpart in Vietnam to provide **intraoperative assistance**

The cost of setting up VIPAR was **US\$2,500**, about **20%** of cost of three American experts' travel and stay in Vietnam for 14 days



Pain Management Clinic

Rising use of opioids for pain relief is a concern; the economic cost of the opioid crisis in the USA reached **US\$504 billion** in 2015

VR therapy, which is proven to **reduce pain by 52%**, is a non-addictive, less harmful alternative pain management technique



Training Room



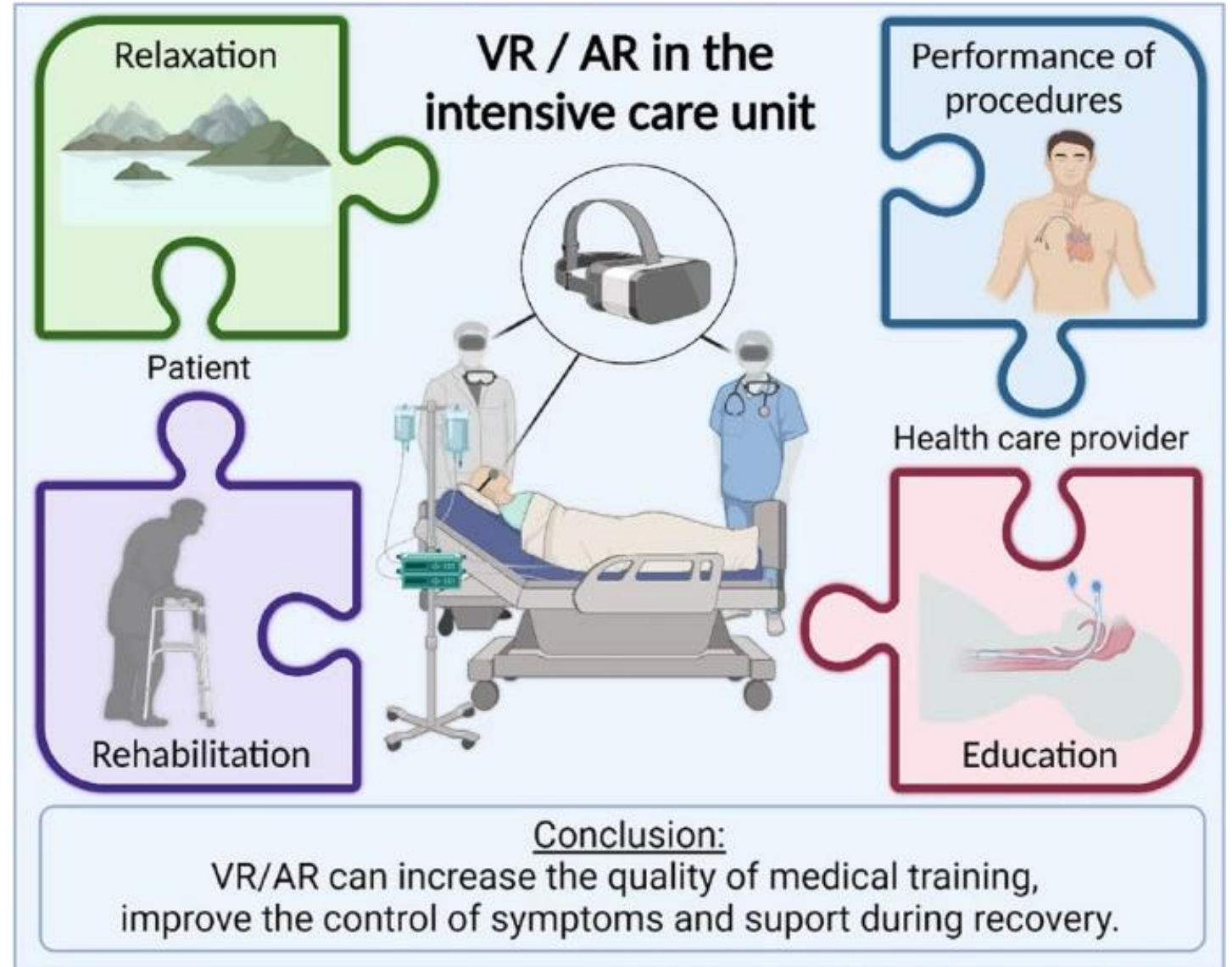
Students can retain hardly **20%** of the information through traditional teaching methods, but VR-based training tools can help increase **retention level to 80%**

Elderly care facilities in the USA spend on average **US\$3,000 per employee** to teach tracheal insertion through traditional methods

However, VR-based training tools could **bring down this cost to US\$40**



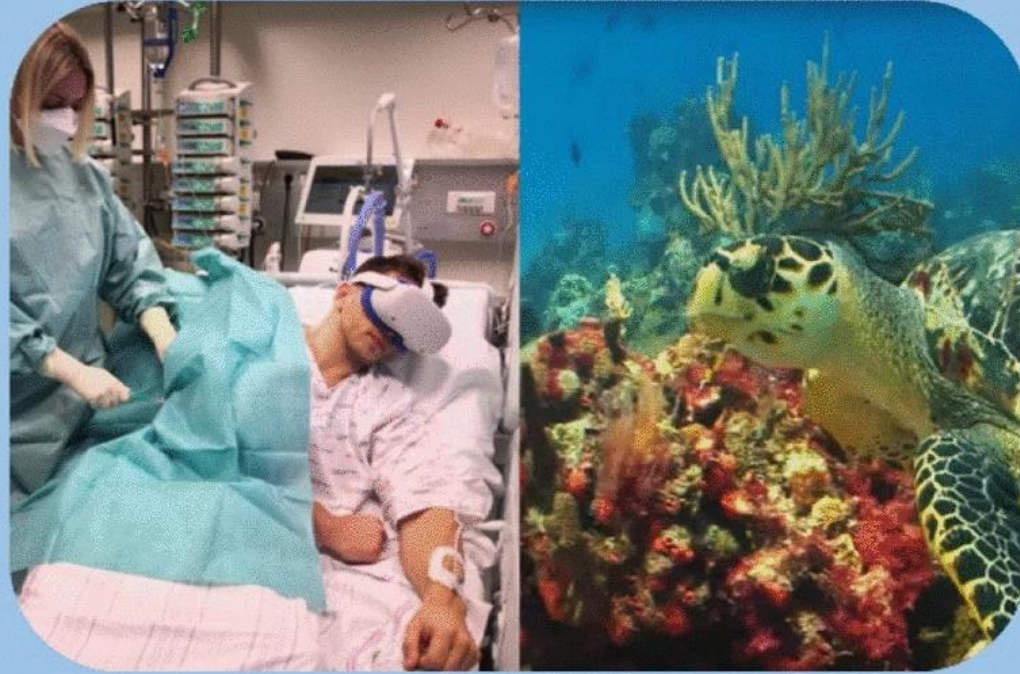
Virtual and augmented reality in intensive care medicine: a systematic review



A



B




C



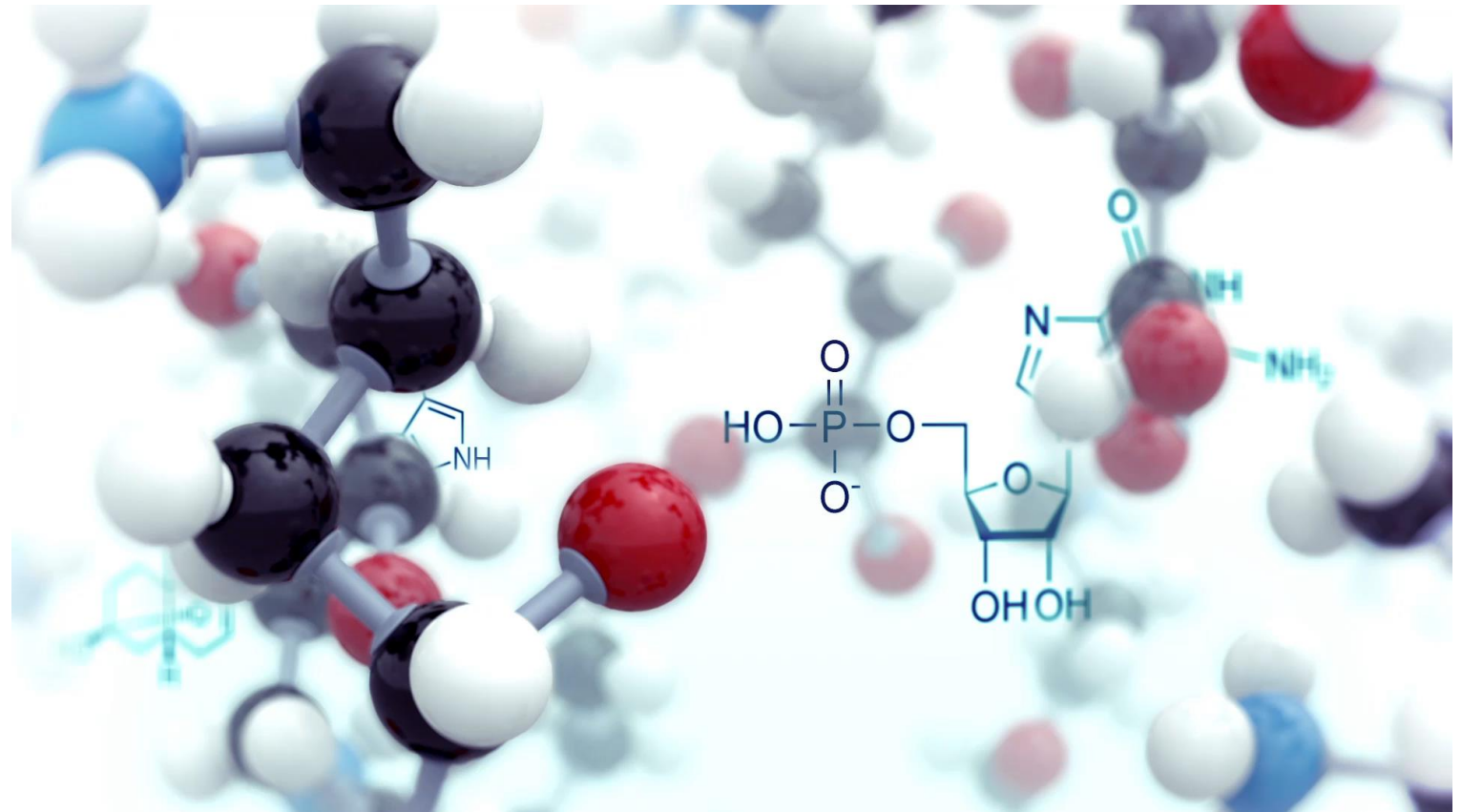
D



A group of senior citizens are seated in a room, each wearing a VR headset. The person in the foreground is looking upwards, while others in the background are looking forward. They are all wearing casual clothing. A white circular text box is overlaid on the left side of the image.

V.R. 'Reminiscence
Therapy' Lets
Seniors Relive the
Past

**AI and ML
for nursing
research**



WHAT IS ARTIFICIAL INTELLIGENCE?

Machine Learning

Using sample data to train computer programs to recognize patterns based on algorithms.



Neural Networks

Computer systems designed to imitate the neurons in a brain.



Natural Language Processing

The ability to understand speech, as well as understand and analyze documents.



Robotics

Machines that can assist people without actual human involvement.



Artificial Intelligence



Mimic



Vision Intelligence



Mimic



Natural Language Processing



Mimic



Robotics



Mimic



Major Tasks / Challenges

1

Image Recognition

1

Automatic speech recognition (ASR)

1

Better Power Source

2

Motion analysis

2

Natural Language Understanding (NLU)

2

Robotic Sensing

3

Scene reconstruction

3

Natural Language Generation (NLG)

3

Human-robot interaction

4

Image restoration

4

Text To Speech (TTS)

4

Robot locomotion



Electronic Health Record (EHR)

Machine learning process



Define the task.

- What do you want the model to do?

Select the model.

- What do you want the model to do?

Collect the data.

- Clean the data
- Split into validation set (if necessary)

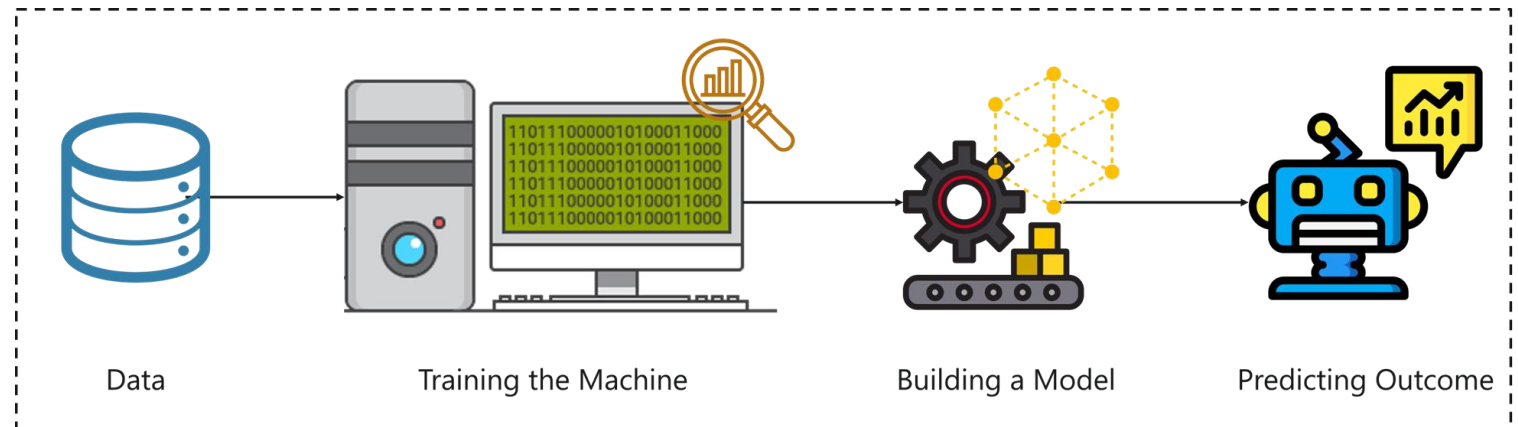
Train the model.

- Choose model type
- Set some parameters

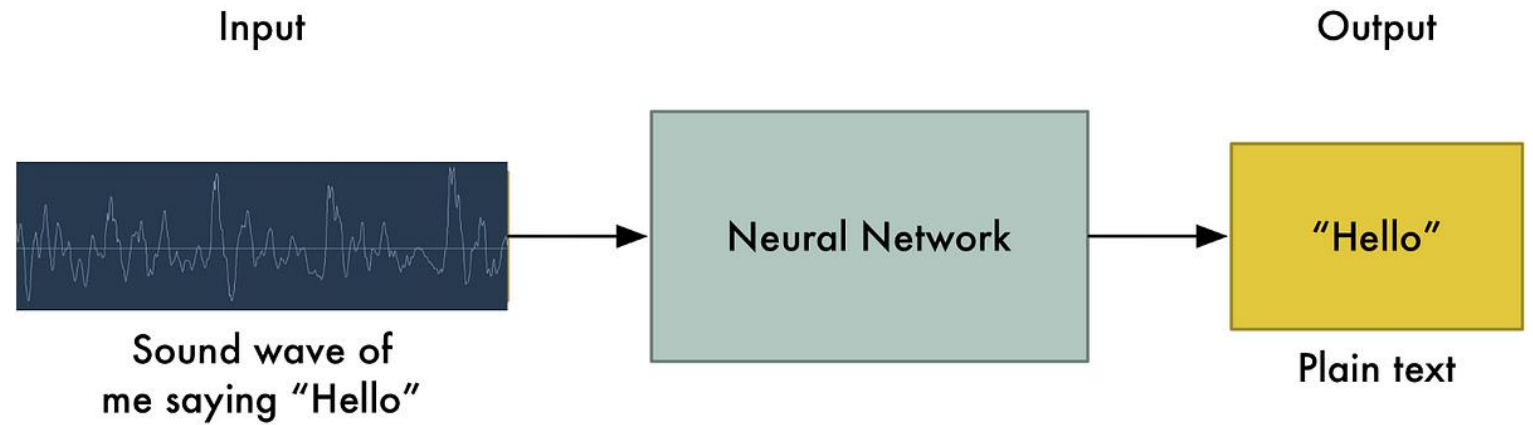
Evaluate the model.

- Choose evaluation metrics
- Assess performance on validation set (if necessary)

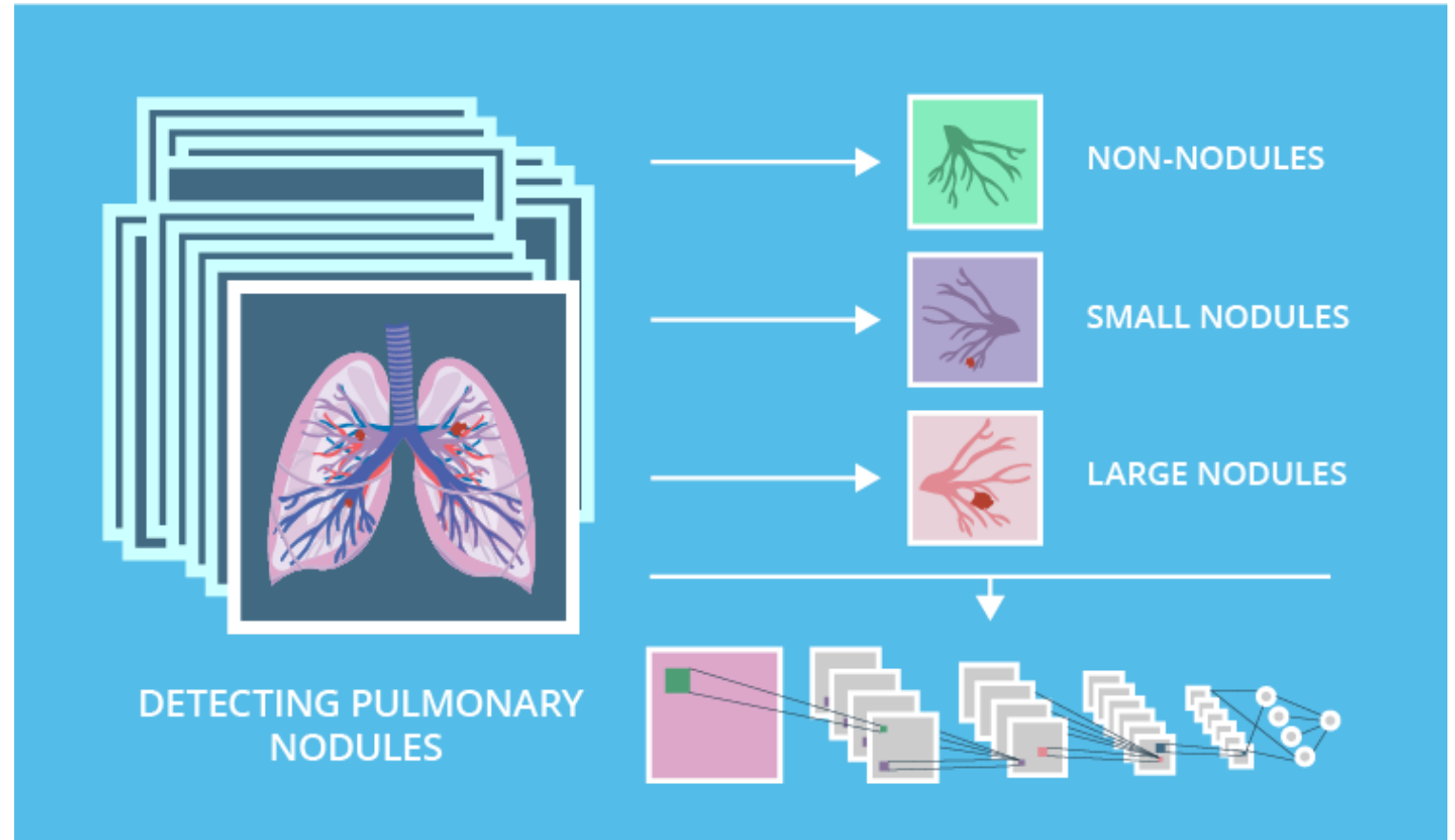
Machine Learning



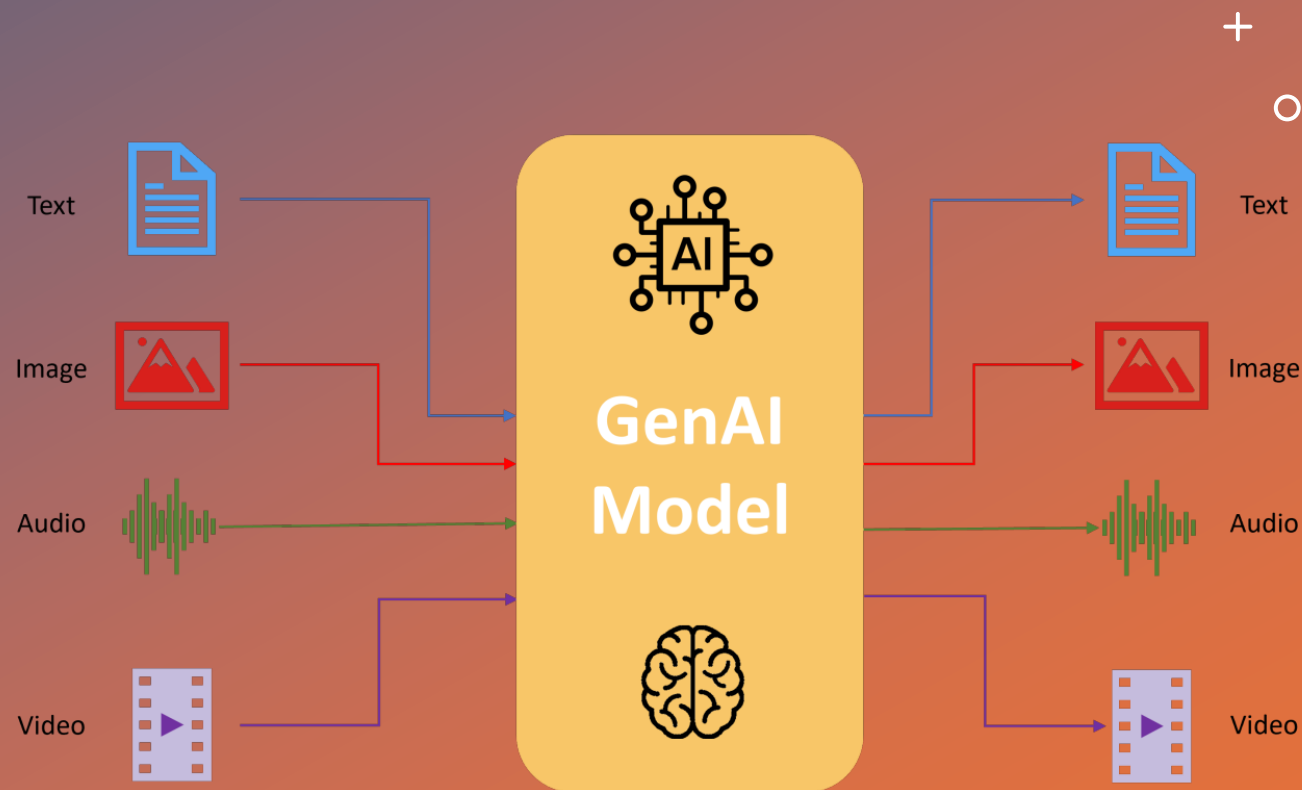
Natural Language Processing (NLP)



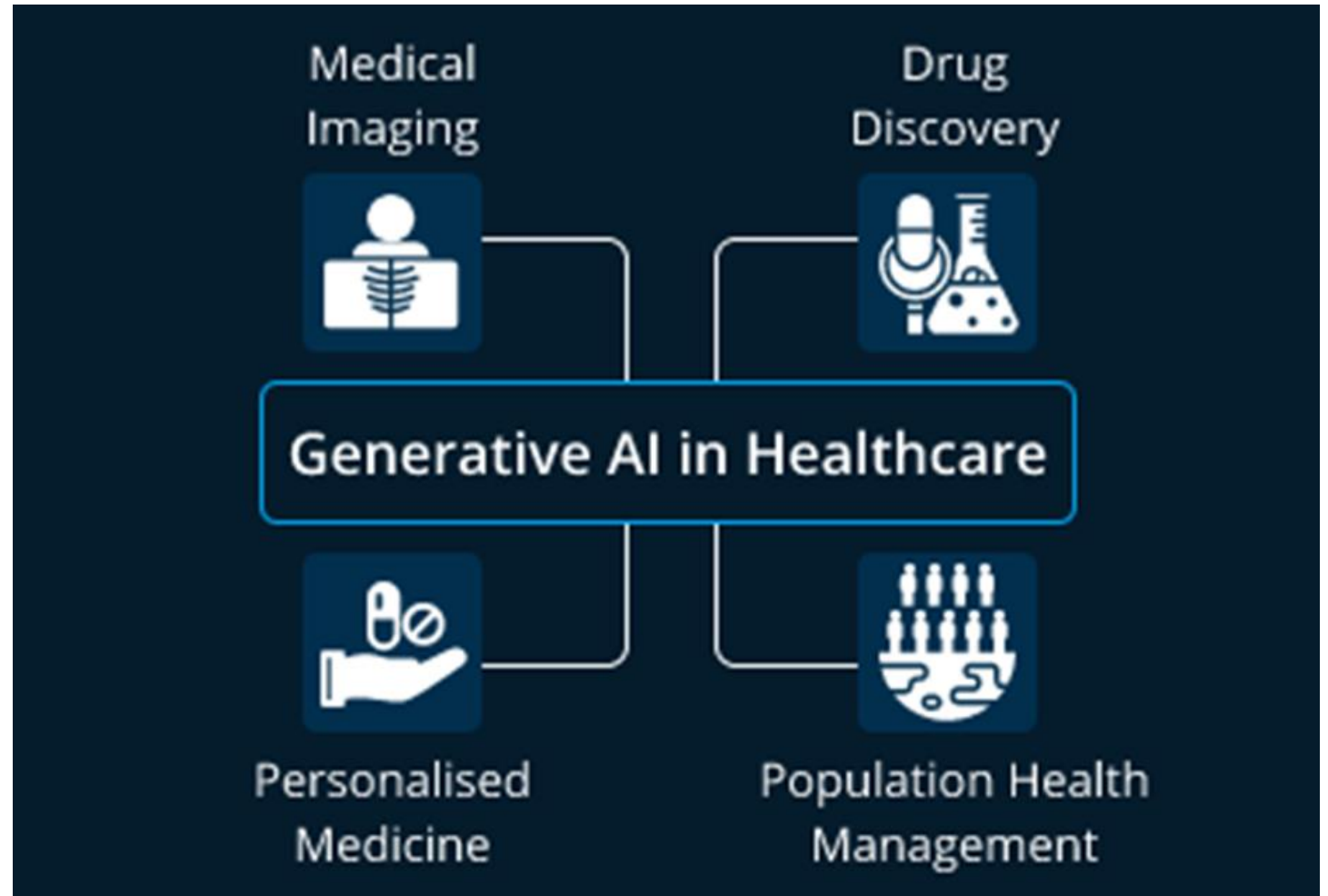
CNNs in medical image analysis



Generative AI



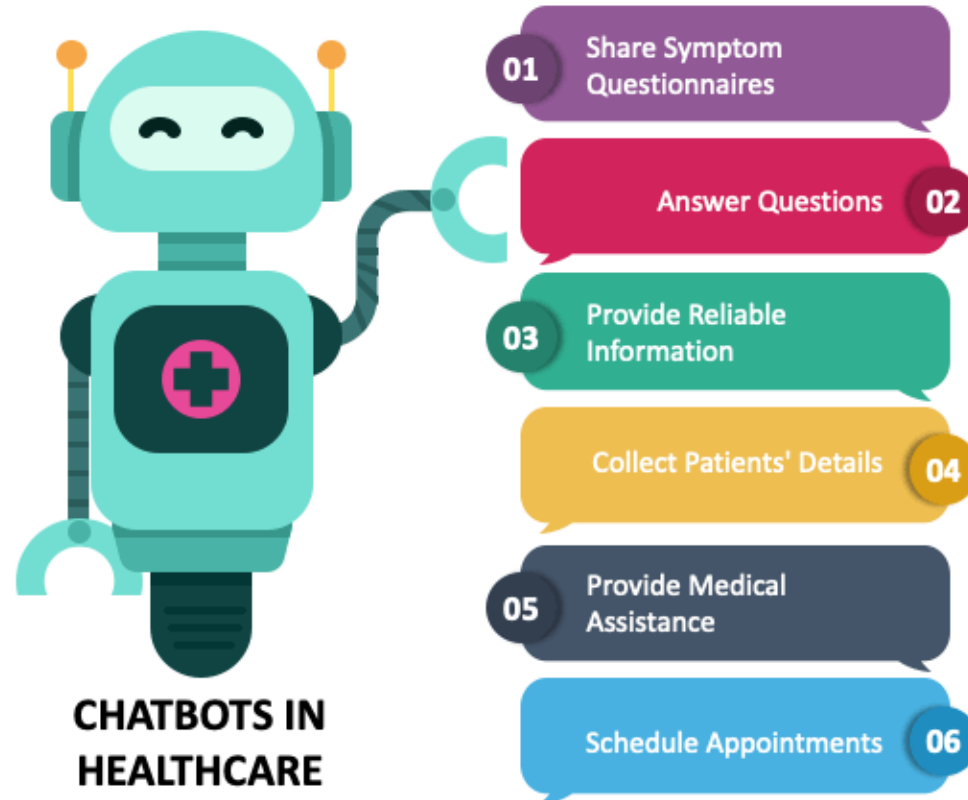
Generative AI in Healthcare



AI Chatbot

CHATBOTS IN HEALTHCARE

Create Better Patient Experiences with AI-Powered Chatbots



Viewpoint

Perspectives on Artificial Intelligence in Nursing in Asia

Nada Lukkahatai¹, RN, MSN, PhD, FAAN; Gyumin Han^{1,2}, PhD

¹School of Nursing, Johns Hopkins University, Baltimore, MD, United States

²College of Nursing, Research Institute of Nursing Science, Pusan National University, Busan, Republic of Korea

Corresponding Author:

Nada Lukkahatai, RN, MSN, PhD, FAAN

School of Nursing

Johns Hopkins University

525 N Wolfe Street

Baltimore, MD, 21205

United States

Phone: 1 4106145297

Email: nada.lukkahatai@jhu.edu

Table 1. Examples of artificial intelligence (AI) in nursing practice and research across Asia.

Authors, year, and country	Study type	AI features	AI feature description	Application in nursing	Key findings
Aydın and Özyazıcıoğlu [26], 2023, Turkey	Primary research; observation study	ML ^a (CNNs ^b)	Deep-learning models for visual data analysis, using layers to automatically learn and extract features from images	Postoperative pain assessment in children	ML closely matched children's self-reported pain scores, demonstrating potential for clinical application
Back et al [16], 2016, South Korea	Primary research	AI-powered sepsis risk assessment system (Auto-SepRAS)	AI is used to analyze patient data and predict the likelihood of sepsis	Sepsis risk assessment	Auto-SepRAS demonstrated moderate predictive power for early sepsis identification in hospitalized patients
Hu et al [15], 2020, Taiwan	Primary research	ML (decision tree, logistic regression, random forest)	ML algorithms to make predictions and classifications based on data	Inpatient pressure injury prediction	The random forest model was the most accurate with key identified risk factors, including skin integrity and systolic blood pressure
Jeon et al [17], 2020, South Korea	Primary research	Temporal-difference method in reinforcement learning	Combining aspects of Monte Carlo methods and dynamic programming	ADRs ^c	Employing temporal-difference learning for analyzing ADRs from nursing notes offers promise for drug safety surveillance

Kawashima et al [21], 2024, Japan	Primary research	ML (XG-Boost ^d)	ML algorithm based on gradient boosting used for classification and regression tasks	Specialist palliative care needs prediction	The predictive model showed potential to replace traditional screening tools, with high accuracy in identifying palliative care needs
Kim et al [18], 2023, South Korea	Primary research	CNN	Deep-learning models for visual data analysis	Pressure injury staging	The CNN model improved the accuracy of pressure injury staging decisions among health professionals
Khan et al [24], 2019, Bangladesh	Perspective	DHIS2 ^e , EHR ^f , big data, AI, ML	The use of AI and ML in medical health record software	Health data warehouse, EHRs, workforce strategy	Bangladesh integrated fragmented health systems into a unified digital health platform, advancing national health care delivery and planning
Lei et al [22], 2023, China	Primary research	ML (XG-Boost, logistic regression, random forest)	ML algorithms based on gradient boosting	Delirium prediction in pediatric intensive care	The XGBoost model was the best performer for early prediction of delirium in critically ill children
Nakatani et al [20], 2020, Japan	Primary research	NLP ^g and ML	NLP focuses on the interaction between computers and human language; ML involves prediction algorithms	Predicting inpatient falls	High accuracy in predicting inpatient falls using nursing records with NLP and ML techniques

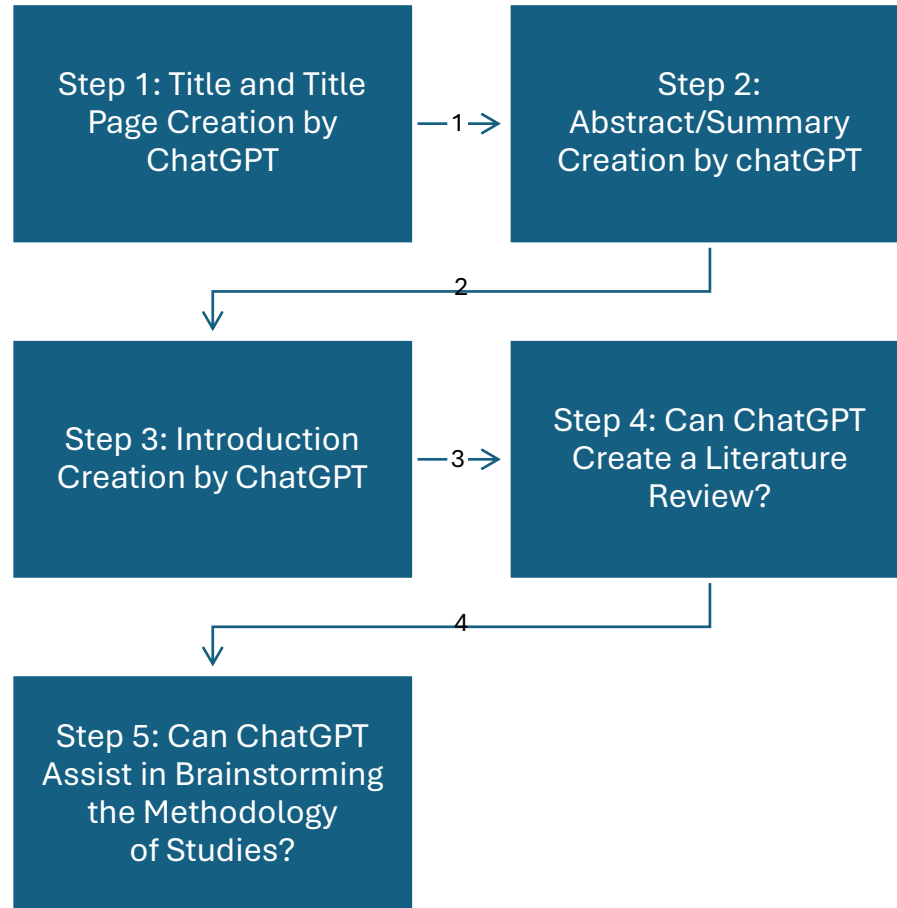
Table 2. Examples of artificial intelligence (AI) in nursing education and patient support across Asia.

Authors, year, and country	Study type	AI features	AI feature description	Application in nursing	Key findings
Nurse education and provider training					
Chen et al [31], 2022, China	Primary research	Chatbot	AI program designed to simulate conversation with human users	History-taking instruction program	Identified a need for chatbot-based history-taking instruction to provide more practice and feedback opportunities
Liao et al [8], 2015, Taiwan	Primary research; case study	BPN ^a , ANFIS ^b	BPN is a machine-learning model that learns by adjusting its connections based on errors. ANFIS combines neural networks and fuzzy logic to learn and make decisions from data.	Support decision-making in nursing; generate nursing diagnoses	AI can assist in accurately generating nursing diagnoses with an agreement rate of up to 87% between system suggestions and nurse-made diagnoses.
Liaw et al [37], 2023, Singapore	Primary research; RCT ^c	AI in virtual reality simulation	Using AI to create realistic and interactive virtual environments, enhancing the user's experience	Sepsis care and interprofessional communication training	Virtual reality simulations with AI-powered doctors were effective for sepsis team training without inferior outcomes
Castonguay and Lovis [30], 2023, Canada	Reflection article	ChatGPT	A language model developed by OpenAI designed to understand and	Nursing education, research, and practice	ChatGPT could revolutionize nursing education by supporting students' learn-

Patient education and support

Cheng et al [32], 2023, Taiwan	Primary research; interventional study	AI chatbot	AI program designed to simulate conversation with human users	Peritoneal dialysis care	The AI chatbot significantly improved patient satisfaction and reduced infection rates
Castonguay et al [29], 2023, global (including Asia)	Comparative study	AI	A technology that enables machines to mimic human intelligence, allowing them to learn, reason, and make decisions	AI maturity in health care systems	Most OECD ^d countries are at the emerging level of AI maturity in health care. Only the United States and the United Kingdom have achieved the integrated ecosystem level, indicating mature, collaborative AI use in health care. The study underscores the need for adaptable, context-specific AI strategies for health care across different countries.

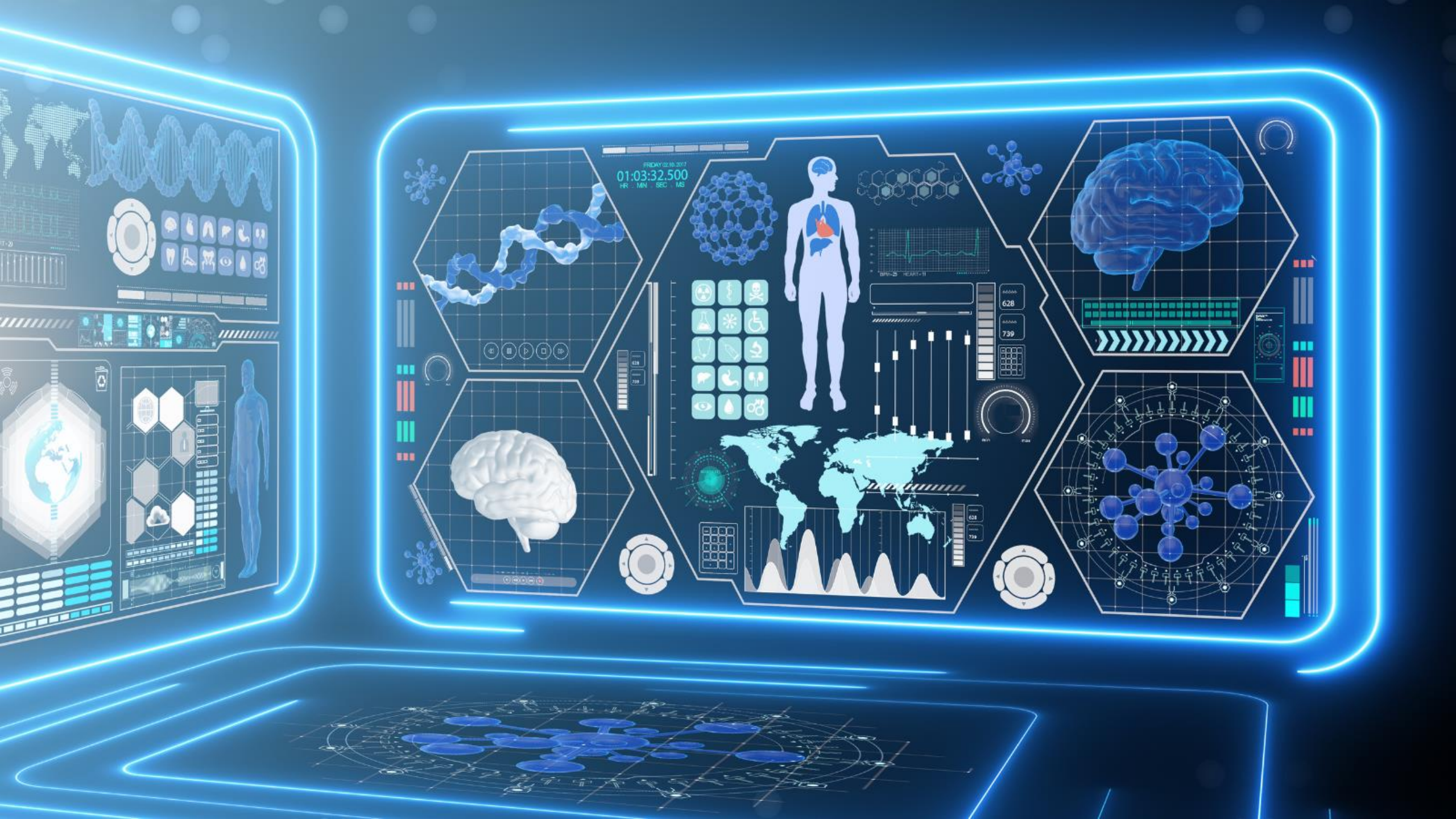
ChatGPT for Research and Publication: A Step-by-Step Guide



Key Recommendations









ALIGN Model (O'Connor et al., 2023)

+
○

Thank you for you attention

