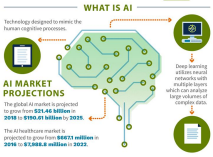
5 EMERGING TECHNOLOGIES AND THEIR IMPACT ON HEALTH INFORMATICS

Health informatics represents the intersection of information technology and the design and delivery of health care services. As new health care technologies emerge, a wealth of data is available to help professionals provide quality care to patients. It is important for health informatics professionals to understand how to leverage data, build effective information technology systems, and share insightful discoveries and information across across organizations.

CHAPTER 1: ARTIFICIAL INTELLIGENCE (AI)

WHAT IS AI

Technology designed to mimic the human cognitive processes.



Deep learning utilizes neural networks with multiple layers which can analyze large volumes of complex data.

AI MARKET PROJECTIONS

The global AI market is projected to grow from **$21.46 billion** in **2018** to **$190.61 billion** by **2025**.

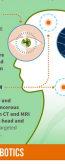
The AI healthcare market is projected to grow from **$600.71 million** in **2016** to **$7,988.8 million** in **2022**.

HOW IS IT USED IN HEALTH CARE

Google DeepMind Health builds AI and mobile tools that mine medical data to improve how hospitals and health care professionals deliver care to patients.

With **Moorfields Eye Hospital** in London, DeepMind is researching how an **AI algorithm** trained with thousands of retinal scans can **analyze eye scans more quickly, accurately and efficiently than human specialists.**

DeepMind and UCLH are researching how AI technology can **rapidly and accurately identify cancerous and healthy tissues on CT and MRI scans of patients with head and neck cancer** for more targeted radiotherapy treatment.



Atomwise utilizes deep learning neural networks to **identify effective pre-clinical drug candidates** for chemists to discover and develop drugs more precisely and accurately.

The Atomwise AI technology analyzes billions of chemical compounds to optimize the discovery of effective **compounds, greatly reducing research and discovery time.**

CHAPTER 2: ROBOTICS

WHAT IS ROBOTICS

The design, engineering and use of robotic machines to perform partially or fully automated physical and cognitive functions.

ROBOTICS MARKET PROJECTIONS

The global robotics market is projected to grow from **$71 billion** in **2019** to **$135.4 billion** in **2019**, growing at an annual rate of **17%**.

The market revenue for robots in health care is projected to grow from **$1.7 billion** in **2016** to **$2.8 billion** in **2021**.

HOW IS IT USED IN HEALTH CARE?

The da Vinci is a robot-assisted surgical system controlled by a surgeon that uses minimally invasive surgical instruments and 3D high definition visuals to enhance accuracy and control.

Wearable robots are devices used to rehabilitate or enhance a patient's physical capabilities.

Robot prostheses replace a missing limb and function in coordination with a residual limb.

Robot exoskeletons provide assistance to people with existing limbs suffering from paralysis, movement disorders or muscle weakness.

Robotics & Health Informatics

Robots collect a vast, precise collection of data, providing accurate and continual data for health informatics professionals across many areas of health care, such as surgery, drug delivery, physical and cognitive rehabilitation and patient management.

CHAPTER 3: 3D BIOPRINTING

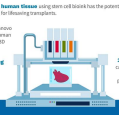
WHAT IS 3D BIOPRINTING

Printing solid, three-dimensional objects from a digital file with an additive process using different materials such as liquid metals, polymers, ceramics, epoxy resin or living cells.

HOW IS IT USED IN HEALTH CARE

Bioprinting **living human tissue** using stem cell biolink has the potential to reduce the shortage of organs for lifesaving transplants.

The company Organovo manufactured a human liver model out of 3D bioprinted liver tissues which are being used for **drug testing and development**.



3D printed drugs can be tailored to the specific needs of patients, such as the FDA-approved Spritam.

3D PRINTING MARKET PROJECTION

The global 3D bioprinting market is projected to reach $4.8 billion by 2027.

3D BIOPRINTING HEALTH INFORMATICS

3D bioprinting furthers the study and research of the molecular basis of diseases through testing models manufactured with 3D printed human tissue cells.

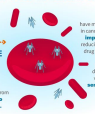
CHAPTER 4: NANOMEDICINE

WHAT IS NANOMEDICINE

Nanomedicine utilizes nanotechnology, or the study of molecular structure for developing precise devices to advance biomedical research and clinical practice.

HOW IS IT USED IN HEALTH CARE

Nanorobots injected into a patient's bloodstream can be used for drug delivery and disease monitoring.



Therapeutic nanoparticles have multiple applications in cancer patients, such as **improving** circulation, reducing toxicity, targeted drug delivery, enhancing pharmaceutical properties of drugs, developing synthetic vaccines, and **more sensitive diagnosis and imaging.**

NANOMEDICINE MARKET PROJECTION

The global nanomedicine market is projected to grow from **$111,912 billion in 2016 to $301,002 billion by 2025.**

NANOMEDICINE HEALTH INFORMATICS

Nanomedicine informatics is necessary for integrating large, complex data sets at the nano level, implementing nanoparticles in living organisms for laboratory research and intelligently delivering drugs throughout the body.

The National Cancer Institute's Biomedical Informatics Grid (caBIG) project established a collaborative research network for sharing cancer research data.

CHAPTER 5: CLOUD COMPUTING

WHAT IS CLOUD COMPUTING

Cloud computing enables the delivery and access to computing resources and services over the internet.

The virtual resources include development platforms, servers, storage, networking, databases and analytics.

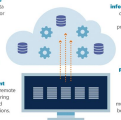
CLOUD COMPUTING MARKET PROJECTIONS

The global market revenue for public cloud services is projected to grow from **$278.6 billion in 2016 to $411.4 billion in 2020.**

The global market for cloud computing in health care is projected to grow from **$23.2 billion in 2017 to $35 billion in 2022.**

HOW IS IT USED IN HEALTH CARE

High-volume storage of data at lower costs for health care organizations.



Real-time information sharing for doctors, administrators and other health care professionals, especially in times of disaster.

Better patient care through remote patient monitoring and patient and doctor interactions.

Faster data sharing for improved medical research, helping data analysts gather data from multiple outside fields to better perform research.

CLOUD COMPUTING HEALTH INFORMATICS

Health informatics relies on access to vast amounts of medical data and patient electronic health records (EHRs). Cloud computing enables the safe and affordable storage of data with portable access to health informatics professionals.

There is greater access to large amounts of patient health and medical research data than ever before. Health informatics is a necessary field for managing this data and making it available and useful for health care professionals.

UIC **healthinformatics.uic.edu**

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