

DSHC, Ass - 1

Q1. What is the role of DS in improving patient outcomes?

① Predictive Analytics:

DS leverages patient data, including electronic health records (EHR) & wearables, to build predictive models. This model helps to identify patients at risk for specific diseases, enabling early interventions & personalized treatment plans.

② Disease Detection & Diagnosis:

DS also analyzes medical images, lab results, & patient histories to assist healthcare professionals in accurate disease detection & diagnosis.

③ Treatment Personalization:

By analyzing patient genetic data & medical histories, data science enables the development of personalized treatment plans. Tailored treatments lead to better outcomes & fewer side effects.

④ Patient Monitoring:

Real-time data from IoT devices & wearable sensors are analyzed to monitor patient health continuously.

⑤ Drug Discovery:

DS accelerates drug discovery by analyzing vast datasets, predicting drug candidates & optimizing clinical trials.

Q2) How does DS contribute to Biomedical Image Analysis?

- ① Image Preprocessing:
DS techniques are used to enhance & normalize medical images, making them suitable for analysis.
- ② Feature Extraction:
DS algo. identify & extract relevant features from images such as tumor boundaries or tissue structure.
- ③ Segmentation:
Image segmentation is performed to separate regions of interest (e.g. tumors) from the surrounding tissue.
- ④ Classification:
ML models classify biomedical images to detect diseases, such as identifying cancerous cells in histopathology images.
- ⑤ Quantitative Analysis:
DS helps quantify characteristics within images providing precise measurements for clinical decision-making.

Q3) Design EHR sys using various components of it.

Designing of EHR sys.

① UI (User Interface):

The user interface is the front-end of the EHR sys, enabling healthcare professionals to access & i/p patient data. It should be user friendly, customizable, & support touch or stylus i/p for mobile devices.

② Patient Portal:

A patient portal component allows patients to access their health records, view test results, schedule appointments & communicate with healthcare providers.

③ Health Info. Exchange (HIE):

The HIE component facilitates the sharing of patient data among different healthcare organizations, ensuring interoperability.

④ Clinical Decision Support (CDS):

CDS sys. provide real-time clinical guidance to healthcare providers based on patient data, reducing errors & improving outcome.

Q4) List & explain any 2 Biomedical Imaging modalities that you came across during any health-related visits.

A) MRI (Magnetic Resonance Imaging)
MRI is a non-invasive imaging modality that uses strong magnetic fields & radio waves to generate detailed images of internal structures like the brain, joints & organs. It is commonly used for diagnosing neurological disorders, orthopedic conditions & abdominal issues. MRI offers excellent soft tissue contrast, making it suitable for identifying tumors, abnormalities & vascular diseases.

B) PET (Positron Emission Tomography):
PET is a nuclear medicine imaging technique that uses a small amount of radioactive material (radioisotopes) to visualize the metabolic & functional activity of tissues & organs. It is often used in oncology to detect & stage cancer, as cancerous cells typically have increased metabolic activity.

Q5) Why Object detection, Image segmentation, Image Registration & Feature Extraction is required in Biomedical Image analysis & explain how it can be applied for data such as...

① Object Detection:

Object detection identifies & locates specific objects within an image, such as tumors, cells or anatomical structures. This is crucial for diagnosis, treatment planning, & monitoring disease progression.

Appl: Object detection can automate the process of detecting & quantifying specific biomarkers or structures in biomedical images enabling large-scale analysis & predictive modelling for disease outcomes.

② Image Segmentation:

Image segmentation divides an image into regions or objects of interest, providing a foundation for further analysis. It's essential for isolating specific tissues or structures within medical images.

Appl: Segmentation helps in quantifying the size, shape, & volume of anatomical structures or lesions. This data can be used for statistical analysis & predictive modeling in healthcare research.

Q6) Summarize Genomic Data Analysis for Personalized Medicine with example or case study.

① Importance:

Genomic data analysis involves sequencing & interpreting an individual's DNA to identify genetic variations & mutations. It enables the customization of medical treatments.

② Example:

In the case of cancer, genomic data analysis can identify specific genetic mutations driving a patient's tumor. This info. allows oncologists to prescribe targeted therapies that are more effective & have fewer side effects than standard treatments.

③ Appln:

DS techniques, such as ML & bioinformatics, are used to process & analyze large-scale genomic datasets.

④ Impact:

Genomic Data Analysis enables more precise diagnosis & treatment reducing adverse reaction & increasing treatment effectiveness.