

Data Science for Healthcare:

Healthcare Data Sources and Data Analytics for Healthcare,

→ The healthcare industry generates a tremendous amount of data but struggles to convert that data into insights that improve patient outcomes and operational efficiencies. Data analytics in healthcare is intended to help providers overcome obstacles to the widespread application of data-derived intelligence:

- Making healthcare data easier to share among colleagues and external partners, and easier to visualize for public consumption
- Providing accurate data-driven forecasts in real time to allow healthcare providers to respond more quickly to changing healthcare markets and environments
- Enhancing data collaboration and innovation among healthcare organizations to convert analytics-ready data into business-ready information by automating low-impact data management tasks

The typical roles of a healthcare analyst are as follows:

- Organizing and maintaining databases
- Transforming data into easily understood insights
- Collecting data through sources such as electronic health records, cost reports, etc
- Providing recommendations and supporting decision-making to improve facility operations
- Finding trends and pattern through data analysis
- Sharing key findings with stakeholders
- Implementing healthcare database security protocols

Applications,

HEALTHCARE BIG DATA ANALYTICS APPLICATIONS



DIAGNOSTICS

Identification of disease causes



TELEMEDICINE

Patient health monitoring



PATIENTS TREATMENT

Selecting treatment options



HEALTH POPULATION SUPPORT

Big Data monitoring to capture disease trends, outbreaks, etc.



PRECISION MEDICINE

Treatment adjusted to a specific patient – personalized medicine



MEDICAL RESEARCH

Data-driven medical research



PREVENTIVE MEDICINE

Predictive analytics for disease prevention



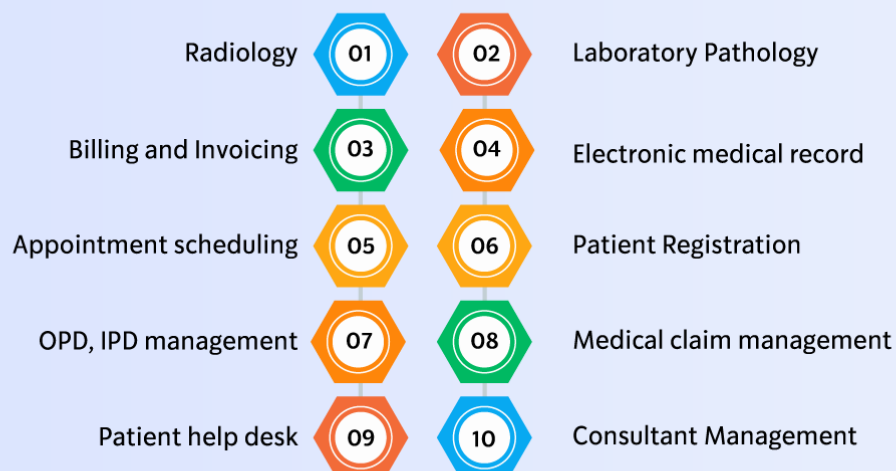
COST REDUCTION

Greater insight into medical data translates into better patient care, resulting in long-term savings

→ Healthcare data analytics helps managers in making predictions regarding resource availability, treatment facilities, checkups, etc.

This has promoted strategic decision-making and also boosted the trust and faith of patients in medical treatments.

Practical Systems for Healthcare.



Electronic Health Records (EHR), Benefits of EHR,



An electronic health record (EHR) is an individual's official health document that is shared among multiple facilities and agencies. The role of EHRs is becoming increasingly influential as more patient information becomes digital and larger numbers of consumers express a desire to have mobile access to their health records.

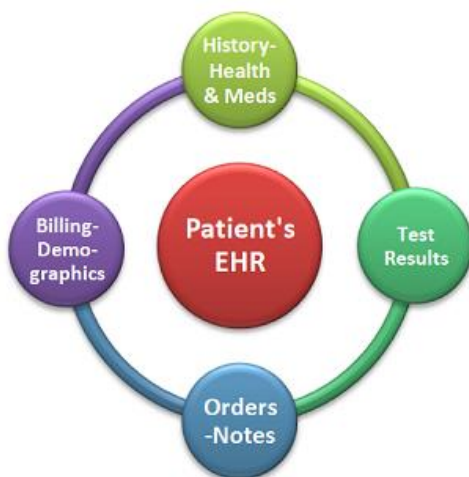
Among other types of data, an EHR typically includes:

- Contact information
- Information about visits to healthcare professionals
- Allergies
- Insurance information
- Family history
- Immunization status
- Information about any conditions or diseases
- A list of medications
- Records of hospitalization
- Information about any surgeries or procedures performed
- It is also becoming more common to see medical images attached to EHRs.

The benefits of EHRs include:

- The ability to automatically share and update information among different offices and organizations
- More efficient storage and retrieval
- The ability to share multimedia information, such as medical imaging results, between locations
- The ability to link records to sources of relevant and current research
- Easier standardization of services and patient care
- The ability to aggregate patient data for population health management and quality of care programs
- Provision of decision support systems for healthcare professionals
- Less redundancy of effort
- Potential long-term lower costs to medical systems

Components EHR



Barriers to Adopting EHR,



Over 60% named lacking the necessary code sets and national information standards as the most significant barrier.

59% named the lack of funding available to allocate to EHR implementation as their most significant barrier.

Just over 50% were most concerned with the physician's ability to transition to EHR.

50% named lacking interoperability as their most significant barrier to EHR implementation.

- #1. Cost constraints
2. Technical limitations
3. Standardization limits
4. Attitudinal constraints and behaviour of individuals
5. Lack of Proper Planning
6. Lack of Communication

Challenges of using EHR data,



What are the challenges of HER: Cost of Use.

Workflow breakup.

Concerns with privacy.

Time-consuming training.

Limitations of technical resources.

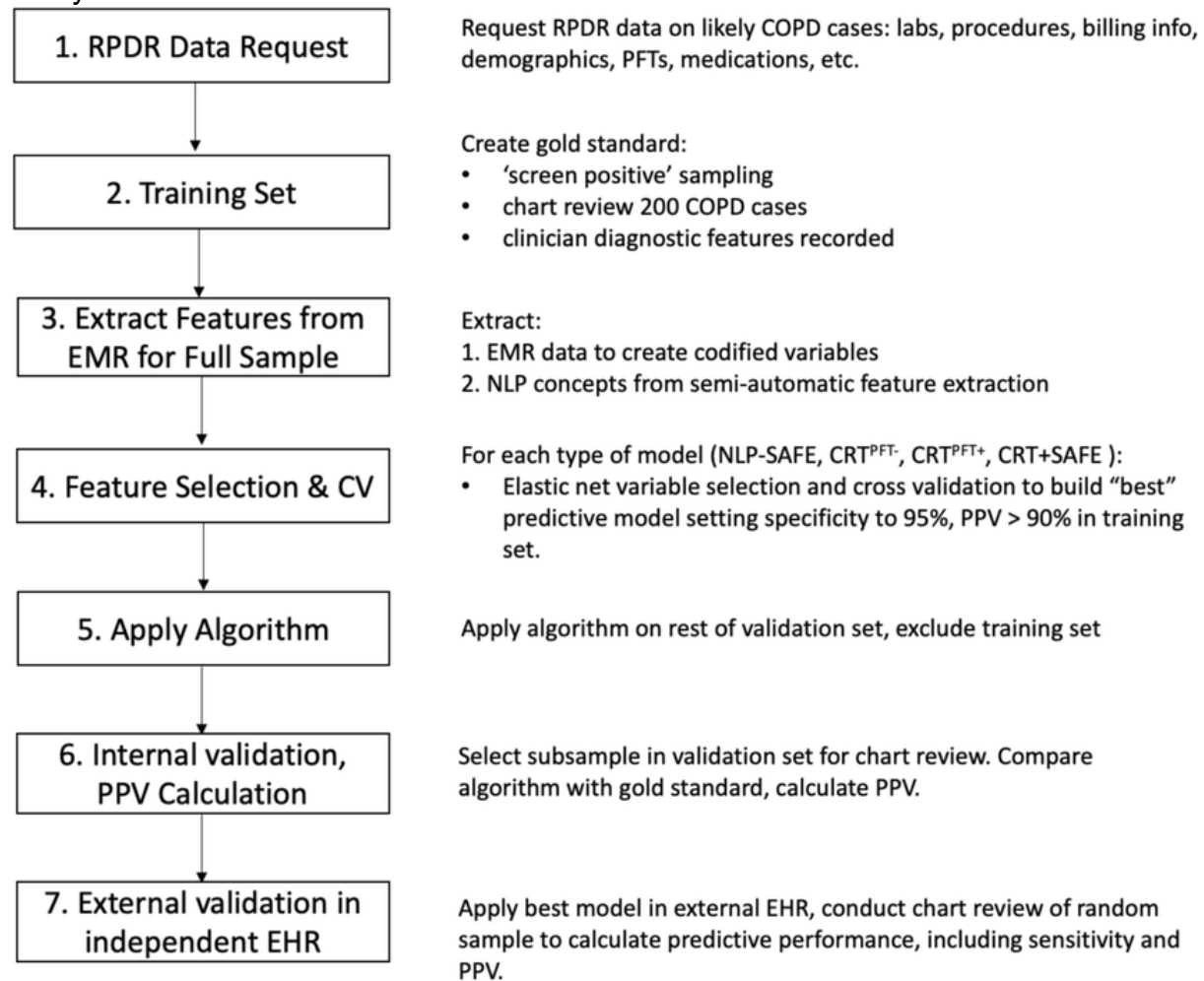
Lack of interoperability.

Phenotyping Algorithms.



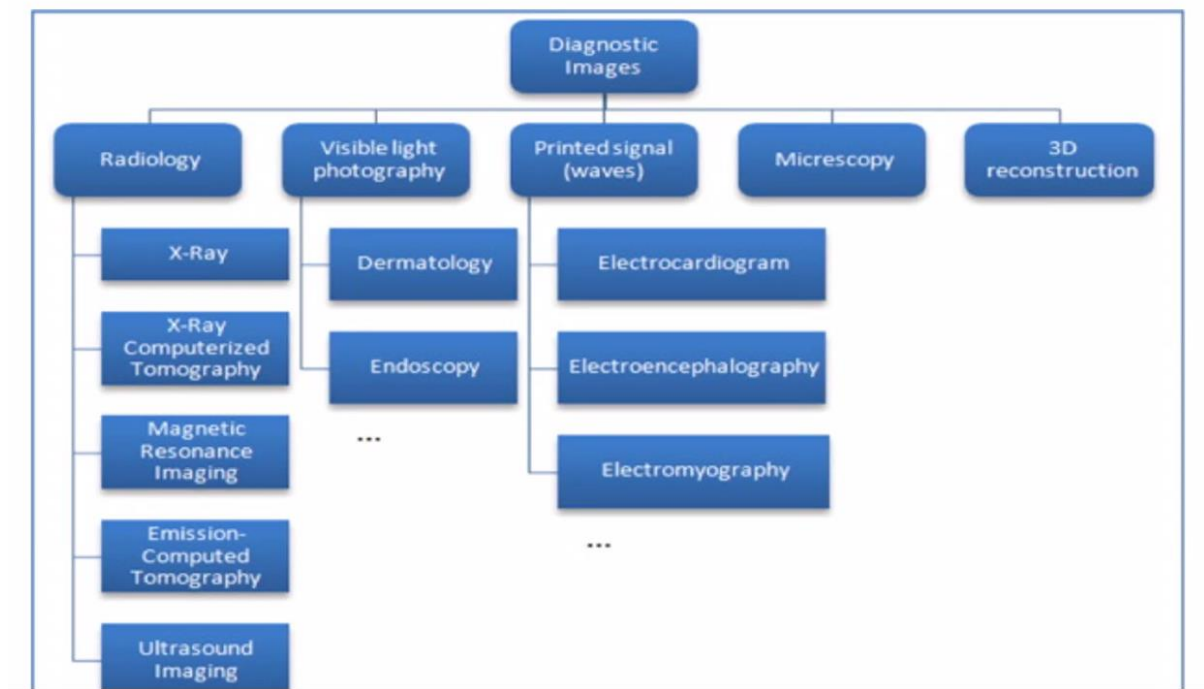
Phenotyping is the practice of developing algorithms designed to identify specific

phenomic traits within an individual. These algorithms are created using multiple variables, thus enabling researchers to accurately identify traits and perform analyses.



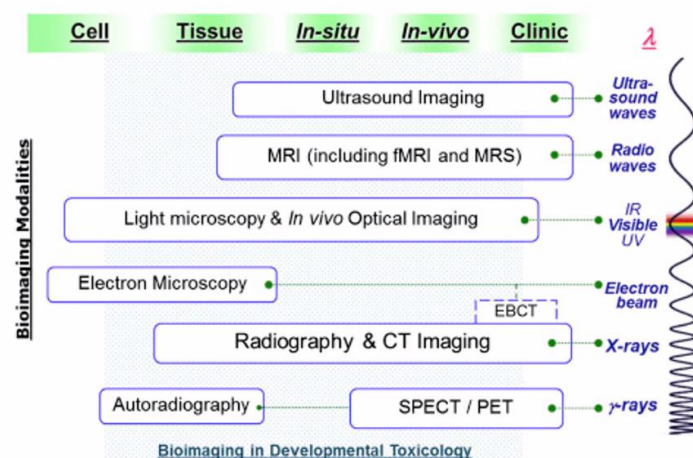
**Biomedical Image Analysis:
Biomedical Imaging Modalities,**

Biomedical Imaging Modalities



What is biomedical imaging modalities?

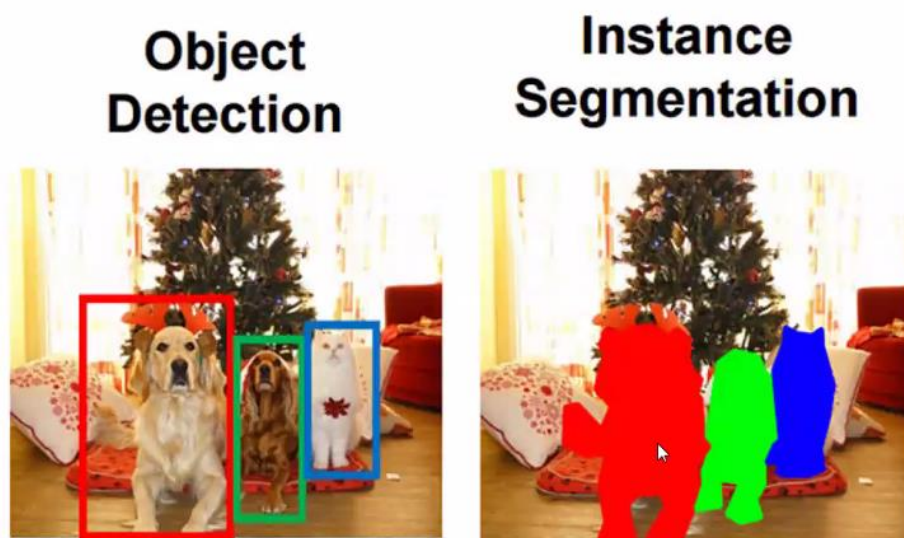
In biomedical imaging, **the application of most digital filters** is generally empirical and aims at enhancing visual perception to improve the detection or characterization of a particular lesion.



What are the 5 medical imaging modalities?

1. Ultrasound.
2. X-Ray Imaging.
3. Computer Tomography (CT)
4. Magnetic Resonance Imaging (MRI)
5. Positron Emission Tomography (PET)

Object detection,



Object detection is a computer vision technique for locating instances of objects in images or videos. Object detection algorithms typically leverage machine learning or deep learning to produce meaningful results.

- **Pixel Based Method**
- **Point Mapping Method**
- **Contour Based Image Registration**
- **Multimodal Image Registration Using Mutual Information**
- **Image Registration in Frequency Domain**

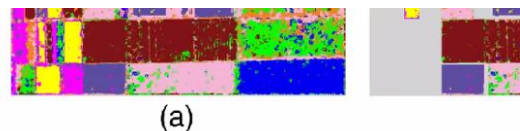


Image segmentation,

→ In digital image processing and computer vision, image segmentation is the process of partitioning a digital image into multiple image segments, also known as image regions or image objects.

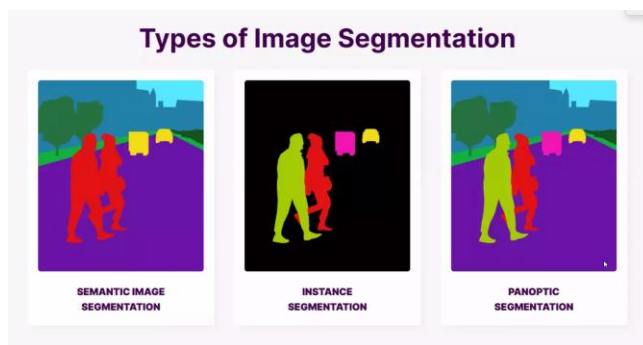
Why is image segmentation needed?

Need for image segmentation. Segmentation is an important stage of the image recognition system, because it extracts the objects of our interest, for further processing such as description or recognition.

What is image segmentation and its classification?

Image Segmentation | Types Of Image Segmentation

There are mainly 4 types of image segmentation: region-based segmentation, edge detection segmentation, clustering-based segmentation, and mask R-CNN.



What are four different types of image processing methods?

Common image processing include image enhancement, restoration, encoding, and compression.

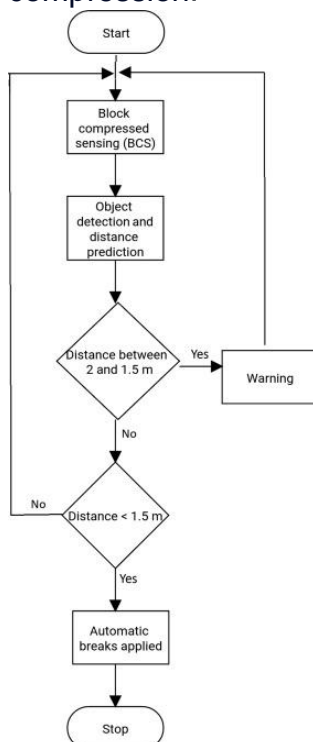


Image Registration, Image Registration

fitting two images as per the image, either automate or manual – match two spots or area – uniform proximity measurement.

uses : image to image registration

image to map registration

Process of establishing correlation between

image registration calculating special transform of observation frame of ref

2 situations become evident

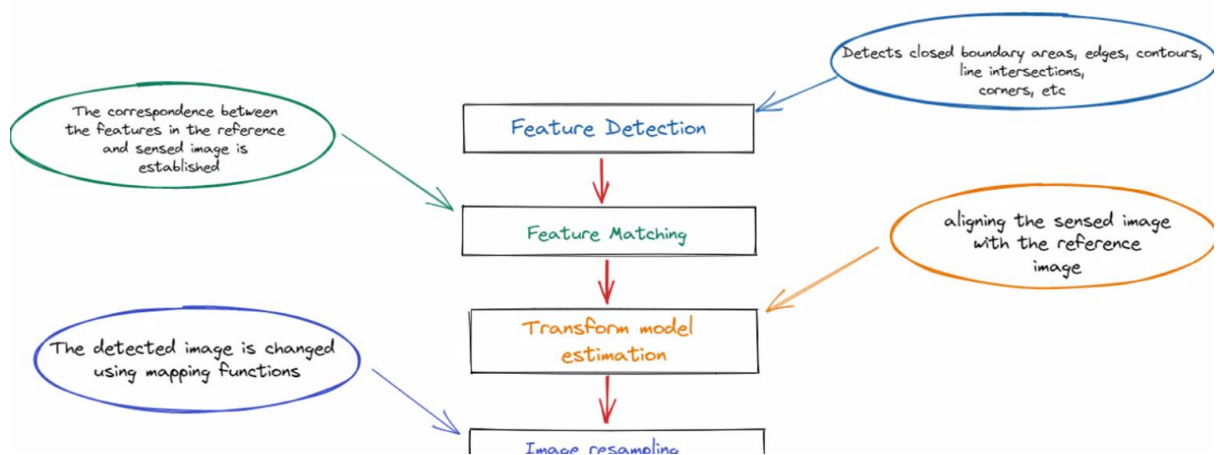
1) matching issues – most time consuming steps

req- transformation in 3D for this hence :

IIR- two or more pictures are used to match

I-MR : mapping base image keeping original without change

uses : digital cam- alignment link single panoramic image



Feature Extraction,

-> on fundamental side – dimensionality reduction process. An initial raw data is divided into groups

imp characteristic – large no of variables are involved

ppl may ask ? what is the feature extraction when image detection is concerned ??(mls) 1 / 2

Ans: object represented by grp of features → extracted → recognised → classified classification is done

at the same time --> pre processing – main signal characteristics must be distinguished .. that what happens, achieved keep in mind interpretal results / raw signal . optimality

-- diff between selection and extraction

selection -keeps the subset of original feature

and extraction is – transforms in to a new overall feature

diff image segmentation & feature extraction ?

feature extraction is a pre requisite for image segmentation

is PCA used for img selection / feature extraction
used for feature extraction

Mining of Sensor data in Healthcare,

→ Other Data Mining Tasks for Wearable Sensors. The main role of data mining in healthcare monitoring systems is retrieving information (i.e., anomaly detection, prediction and diagnosis decision making), and there are several tasks considering wearable sensors that data mining methods are able to carry out

Sensor data is the output of a device that detects and responds to some type of input from the physical environment. The output may be used to provide information to an end user or as input to another system or to guide a process. Sensors can be used to detect just about any physical element.

Challenges in Healthcare Data Analysis.

→ Capturing Accurate Data. In a study at an ophthalmology clinic, EHR data matched patient-reported data in 23.5 percent of records. ...

- Fragmented Patient Care. ...
- Data Privacy & Security. ...
- Data Visualization. ...
- Document Processing and Analysis.
- effectively managing and analyzing unstructured data,

-----extra

Image recognition	Object Recognition
Image recognition predicts the class of an image or video as a whole.	Object recognition identifies multiple objects in an image or video with defined labels.
It bundles image class and descriptive integers together to display key output.	It bundles together, class, location, frequency, and other factors of objects.
Users can scan a quick response (QR) code to anchor digital content on an image.	Users can slide a camera or smartphone to label real-world objects in real-time.
A list class is fed into the training model to identify images.	Powerful machine learning algorithms detect unknown features to identify objects.
The model is trained on the <u>K-nearest neighbor</u> algorithm	Each object is assigned a bounding box that predicts a confidence score.

In the supply chain, it is used to identify certain goods and classify them as defective or not defective.	It helps in performing facial recognition across domains to detect trespassers and alarm the concerned team.
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when this question is asked
physical mechanism that affect anatomical structure combo of visualization and physical
eg : are the example OF TECH

MOST COMMON :
ultrasonic SCAN /PET SCAN
best imaging modality :- MRI Is better a soft tissue hence its it best tha is more powerful than any other modality

cross question is mri imaging modality :
mri doesn't use Xray / any radiation but use image modality and is ore MRI
FMRI – a bigger cost

Safest Imaging Modality :
ultra soun : safest
can be used by any patient : lesser risk

Differences between EMR and EHR

EHR (electronic health record)	EMR (electronic medical records)
A digital record of health information	A digital version of a patient chart
Allows access to tools that providers can use for decision making	Is mainly used by providers for diagnosis and treatment
Allows a patient's medical information to be accessed from different places	Patient record cannot easily be sent outside the practice
Simplified sharing of updated, real-time information	Not designed to be shared outside the individual practice