

Title: Artificial Intelligence in Healthcare
An integrated approach to healthcare delivery

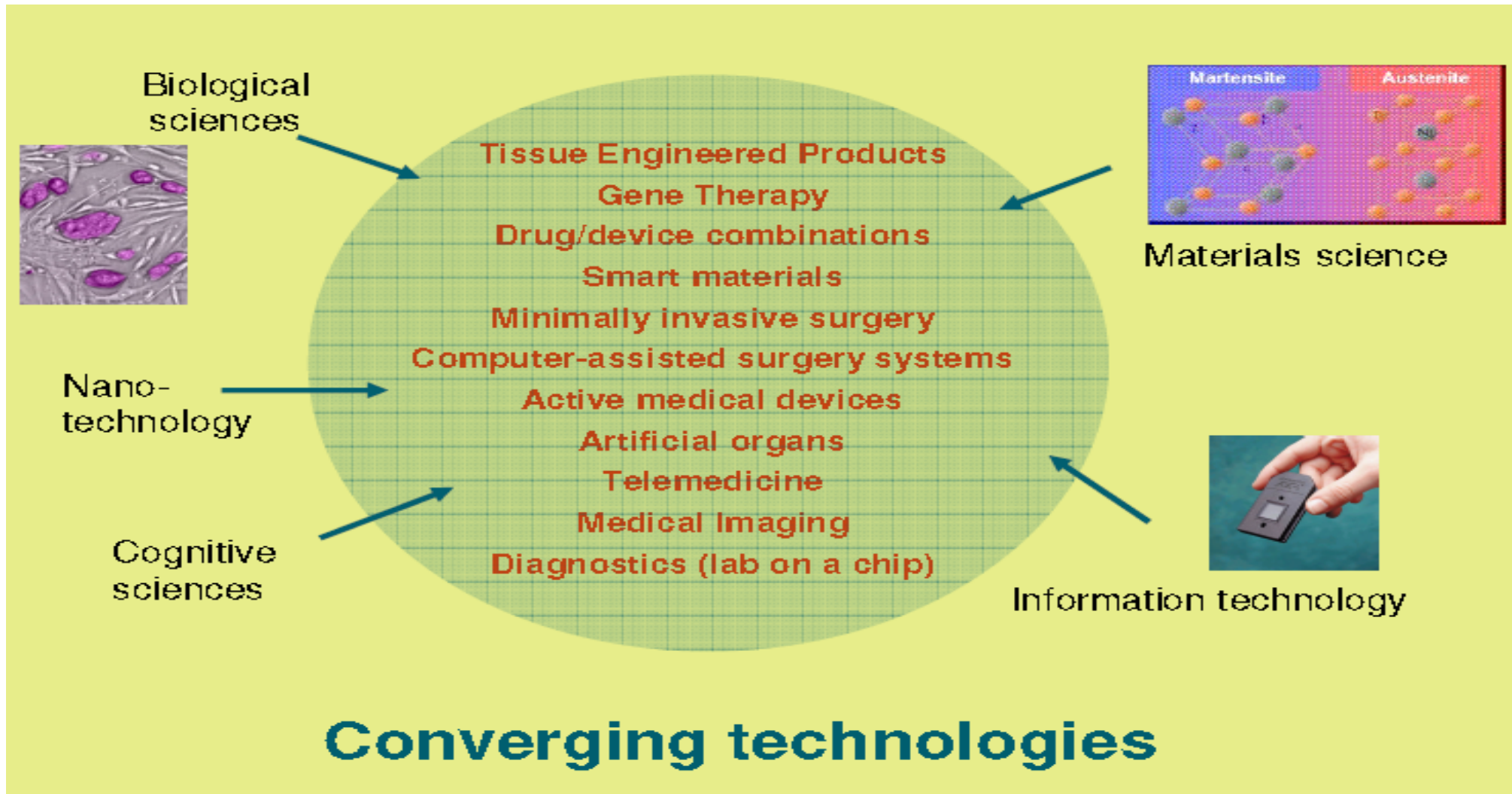
Objectives

- The symptomatology affecting us is hyper-variable. Current practice guidelines, the variability of experience in medicine, the translatability and two-way outcome tracking suffers. This can lead to sub-optimal handling of the disease. Patient outcome is unpredictable.
- In 'Machine Learning', machine is made to learn the various parameters including, symptoms, behavior, biochemical and pathologic variables, among others. With help of a specially-designed software, the computer can develop effective learning.
- AI needs machine-learning, facilitates heightened diagnostic sensitivity, specificity and treatment.
- SahaManthran proposes a knowledge based initiative around medical virtualism to be utilized for co-creating machine-learning derived AI in Medicine.

Innovations in Medical and Biological Engineering

- 1950s and earlier
 - **Artificial Kidney**
 - X ray
 - Electrocardiogram
 - **Cardiac Pacemaker**
 - Cardiopulmonary bypass
 - **Antibiotic** Production technology
 - Defibrillator
- 1970s
 - **Computer assisted tomography**
 - Artificial hip and knee replacements
 - Balloon catheter
 - Endoscopy
 - Biological plant food engineering
- 1960s
 - Heart valve replacement
 - Intraocular lens
 - **Ultrasound**
 - Vascular grafts
 - Blood analysis and processing
- 1980s
 - **Magnetic resonance imaging**
 - **Laser surgery**
 - Vascular grafts
 - Recombinant therapeutics
- Present day
 - Genomic sequencing and microarrays
 - Positron Emission tomography
 - Image guided surgery

New generations of medical technology products are
Combination of different technologies which lead to the crossing of borders between
traditional categories of medical products such as medical devices, pharmaceutical products
or human tissues



What is Artificial Intelligence

- Definition--“Use of a computer to model intelligent behaviour with minimal human intervention”
- Machines & computer programs are capable of **problem solving and learning, like a human brain.**
- Natural Language Processing (“NLP”) and translation,
 - Pattern recognition,
 - Visual perception and
 - Decision making.
- Machine Learning (“ML”), one of the most exciting areas for Development of computational approaches to **automatically make sense of data**
- Advantage of Machine
 - Can retain information
 - **Becomes smarter over time**
 - Machine is **not susceptible to** Sleep deprivation, distractions, information overload and short-term memory loss

The application of **AI in medicine** has two main branches:

A) Virtual branch

B) Physical branch.

- Highly repetitive work
- Empower doctors
 - help them deliver faster and more accurate
- Augment the professionals, offering them expertise and assistance.
- Replace personnel and staffing in medical facilities, particularly in administrative functions,
- Managing wait times & automating scheduling
- “Deep-learning devices will not replace clinicians



Artificial intelligence in medicine : The virtual branch

The virtual component is represented by Machine Learning, (also called Deep Learning)-mathematical algorithms that improve learning through experience.

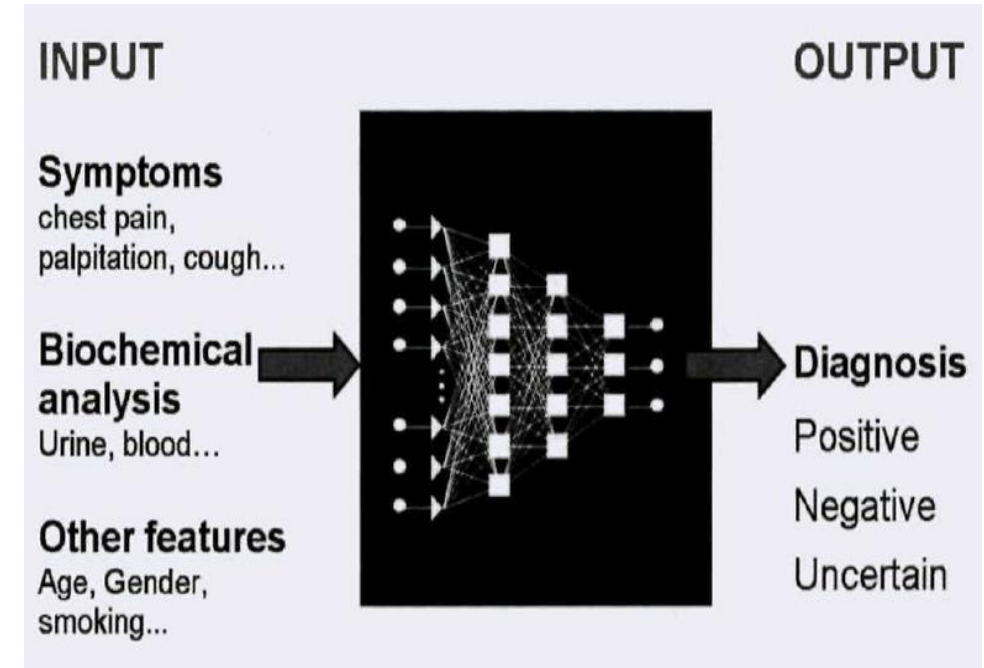
Three types of machine learning algorithms:

1. Unsupervised (ability to find patterns)
2. Supervised (classification and prediction algorithms based on previous examples)
3. Reinforcement learning (use of sequences of rewards and punishments to form a strategy for operation in a specific problem space)



Benefits of Artificial intelligence

- AI can definitely assist physicians
 - Clinical decision making - better clinical decisions
 - Replace human judgement in certain functional areas of healthcare (eg, radiology).
 - up-to-date medical information from journals, textbooks and clinical practices
 - Experienced vs fresh Clinician
 - 24x7 availability of expert
- Early diagnosis
- Prediction of outcome of the disease as well as treatment
- Feedback on treatment
- Reinforce non pharmacological management
- Reduce diagnostic and therapeutic errors
- Increased patient safety and Huge cost savings associated with use of AI
- AI system extracts useful information from a large patient population
- Assist making real-time inferences for health risk alert and health outcome prediction
- Learning and self-correcting abilities to improve its accuracy based on feedback.



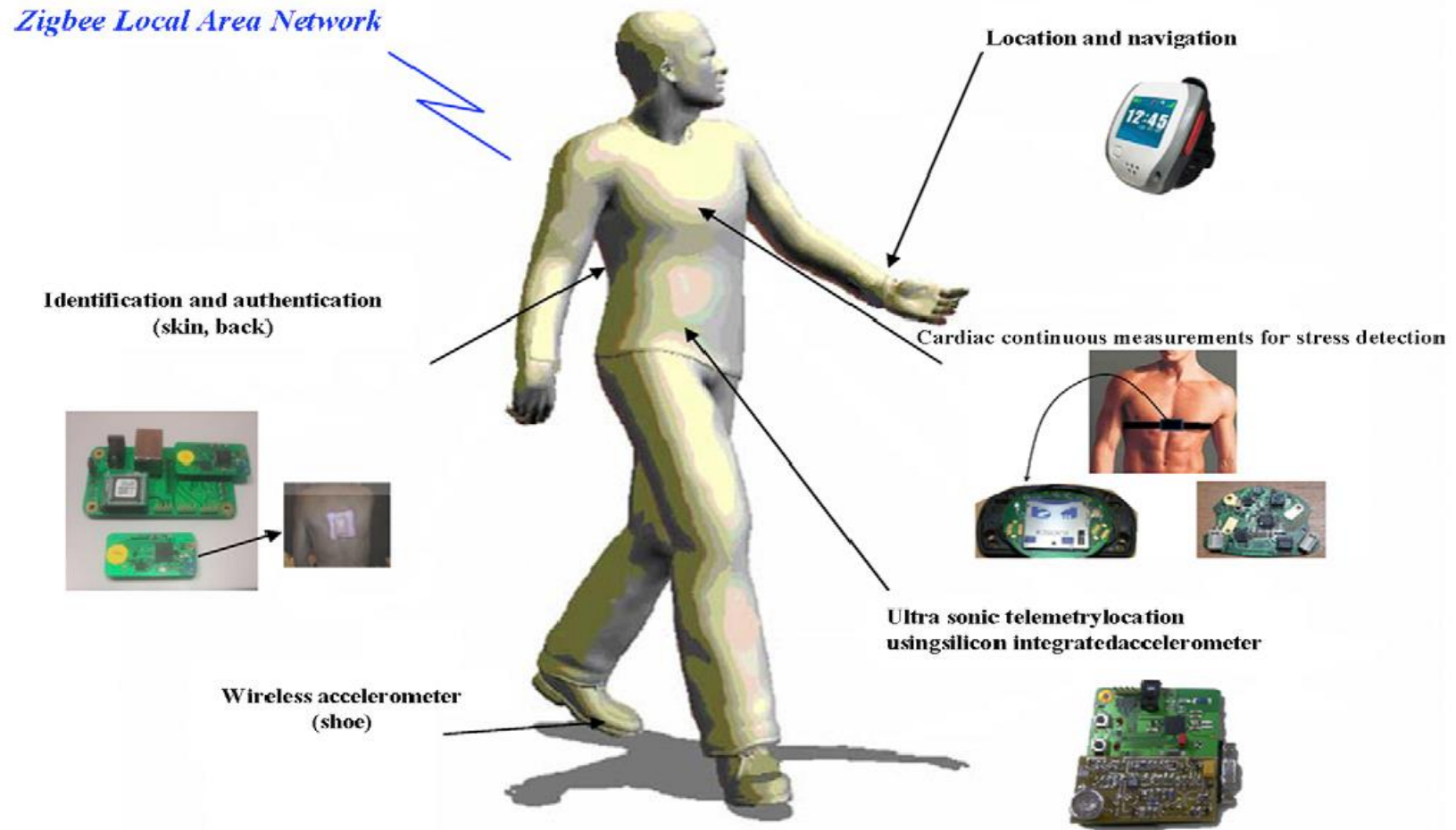
Cancer Classification



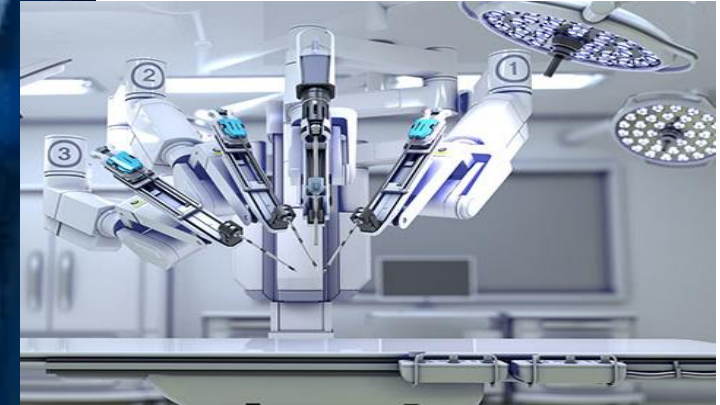
Artificial intelligence in medicine: The physical branch

It includes:

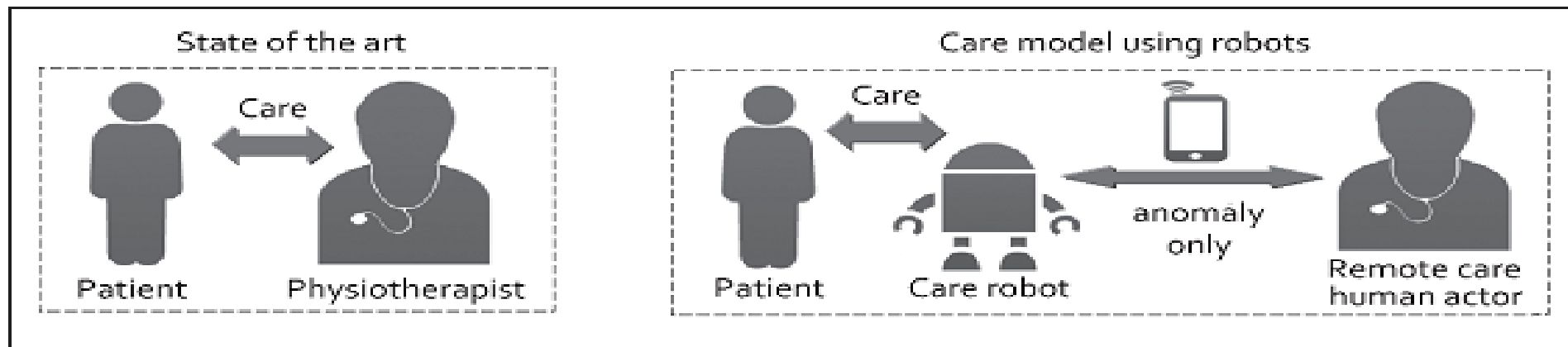
- Physical objects,
- Medical devices
- Sophisticated robots for delivery of care (carebots)/ robots for surgery.



Use of robots to deliver treatment - Robotic surgery

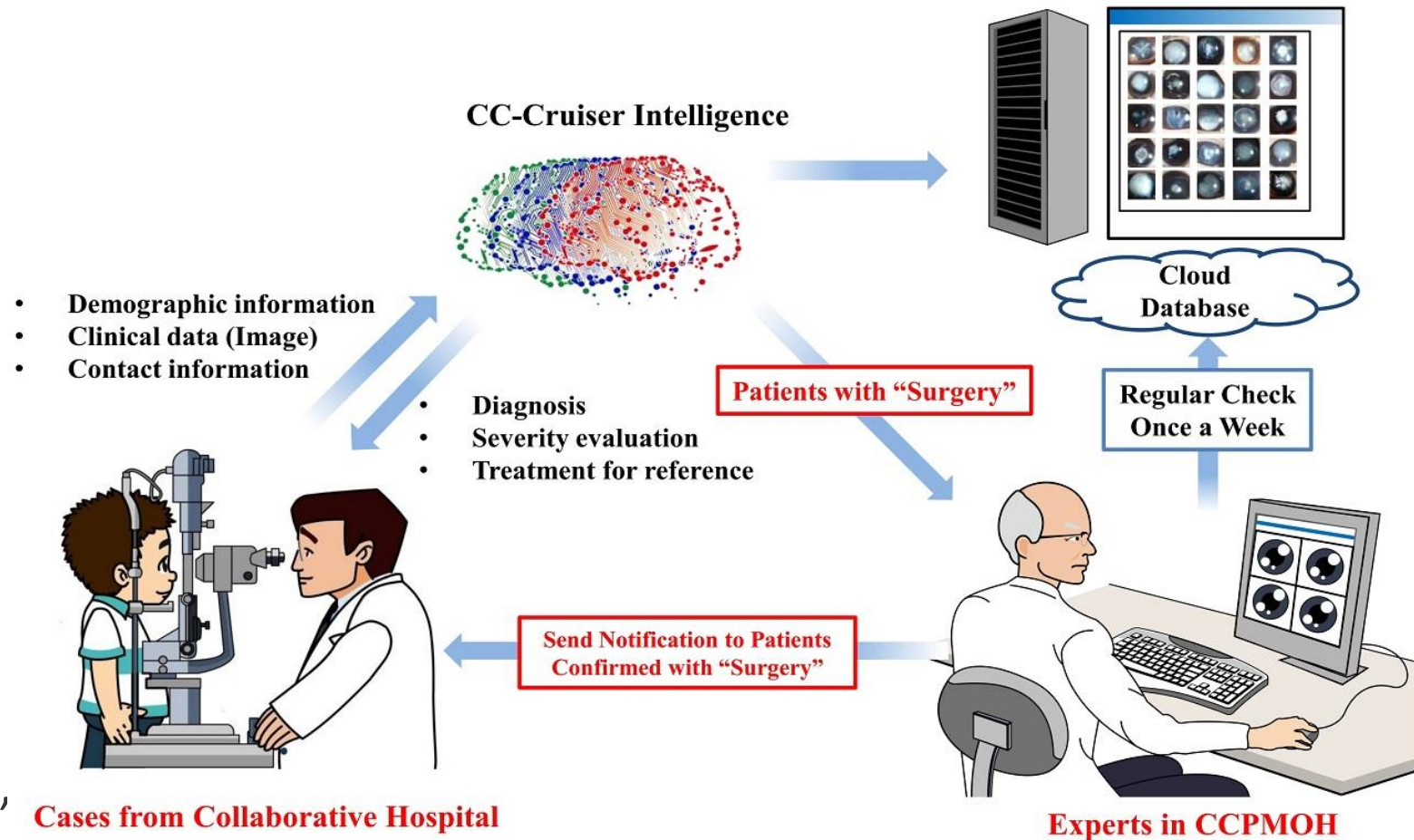


Use of robots to monitor effectiveness of treatment



Growth drivers of AI in healthcare

- Increasing individual healthcare expenses
- Larger Geriatric population
- Imbalance between health workforce and patients
- Increasing Global Health care expenditure
- Continuous shortage of nursing and technician staff. The number of vacancies for nurses will be 1.2 million by 2020
- AI is and will help medical practitioners efficiently achieve their tasks with minimal human intervention, a critical factor in meeting increasing patient demand.



Potential challenges

- Development costs
- Integration issues
 - Ethical issues
 - Reluctance among medical practitioners to adopt AI
 - Fear of replacing humans
- Data Privacy and security
 - Mobile health applications and devices that use AI
 - Lack of interoperability between AI solutions
- Data exchange
 - Need for continuous training by data from clinical studies
 - Incentives for sharing data on the system for further development and improvement of the system. Nevertheless,
 - All the parties in the healthcare system, the physicians, the pharmaceutical companies and the patients, have greater incentives to compile and exchange information
- State and federal regulations
- Rapid and iterative process of software updates commonly used to improve existing products and services

Industry Challenges ^{11,12}
High initial capital requirement
Potential for increased unemployment
Difficulty in deployment
Reluctance among medical practitioners to adopt AI
Ambiguous regulatory guidelines for medical software
Lack of curated healthcare data
Concerns regarding privacy and security
Lack of interoperability between AI solutions
State and Federal Regulations

Future Indian Scenario

- **Collaboration** between medical and technical institutions
- Stop working in silos
- Remove **Firewall** of clinical load and hope of IPR
- Government **funding** – more intelligent and result oriented rather than you pat – i pat
 - Scientific mafia or scientist Mafia
- **Current status of medical records**
 - incommunicable silos of wasted information for the health system and for knowledge acquisition. Laboratories and clinics need to collaborate to accelerate the implementation of electronic health records
- Data need to be captured in real-time, and institutions should promote their transformation into intelligible processes
- New scientific and clinical findings should be shared through open-source, and aggregated data must be displayed for open-access by physicians and scientists and made automatically available as point-of-care information.
- Integration and interoperability including ethical, legal and logistical concerns are enormous
- Simplification, readability and clinical utility of data sets
 - Each result must be questioned for its clinical applicability.
 - Aim of increasing their clinical value and decreasing health costs
- **Electronic medical or health records**
 - *are* essential tools for personalized medicine
 - Early detection and targeted prevention, again