

## COMPUTER IN MEDICINE:

### INDIAN SCENARIO -

#### ISDN: (INTEGRATED SERVICES DIGITAL NETWORK)

- is a new technological advances which will now allow the four forms of communication; i) voice, ii) text, iii) data and iv) images/videos, to be economically joined together through a uniform digital base.

ISDN reduces telecommunication costs, and accelerates the flow of information.

Multifunctional terminals such as those which Siemens offers, integrate a number of machines into one unit.

This integration gives the user an opportunity to be more dynamic as well as enrich ~~the~~ ability to communicate.

#### Case study:

For instance, a Professor of medicine in medical college and research institute has read an abstract of an interesting article. The article has several pages and pictures (figures) and discuss ~~scientific~~ the content to transmit in less than 10 second.

→ Switching to efficient, employs Siemens



EWSD Switching system.

Special purpose software, hardware geared to the broad band ISDN.

INDONET: - A NATIONAL COMPUTER NETWORK

INDONET, is an integrated information management and distributed data processing facility spanning the entire country.

In the first phase, five major cities - Delhi, Mumbai, Chennai, Calcutta and Hyderabad with communication access links with 3 other cities

(Pune, Ahmedabad and Bangalore) have been connected by means of ~~Post and~~ Indian department (communication) up to MBPS.

INDONET computers can be accessed through satellite links.

In the second phase, it is expected that over 35 major cities in India. Fast and reliable communication will be provided between INDONET centres through INSAT satellite link.



The band will be of order  $\frac{1}{2}$  of a transponder, computer terminals will be able to communicate at a speed up to 9600 dps (min). The error rate is less than 1 in 10 million ( $\frac{1}{10,000,000}$ ).

The INDONET centres will communicate with a central HUB through 3m Earth Stations (ES). The HUB will ~~be~~ communicate through (DOT) 11 mts ES.

VHF/UHF radio links, employing multiple access digital packet radio scheme will be provided.

Large medical data bases (MEDLARS) is available.

All medical college hospital and Research institutes and equal number of

Premier Private sectors communicate with international networks with need to know. Policy would be provided between data to users. ~~to~~ Protection and Confidentiality and integrity of the data by using encryption in the network.



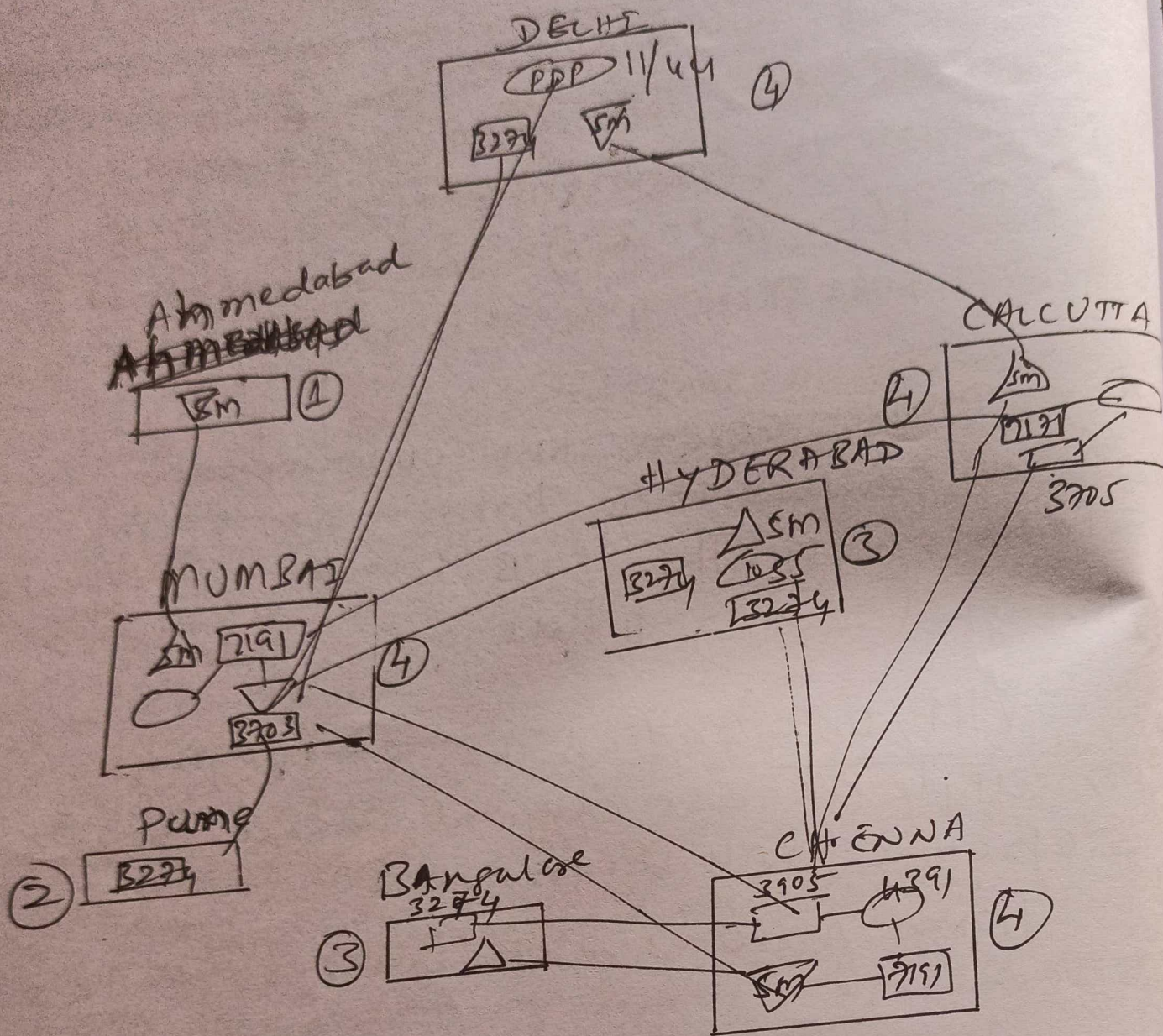


Fig: INDONET - Phase I configuration

Legends: Uplink (4) - 2191  
 down link (4) 4391  
 Substation - 3905

} VHF BW in GHz Txn.



## Computers in clinical laboratory:

### CHROMOSOME ANALYSIS BY COMPUTER:

- In recent years, a number of human disorders have been found to be related to abnormalities in chromosomes.

- Many medical institutions now routinely offer the test of Chromosome Analysis for diagnosis, for which cells samples are required.

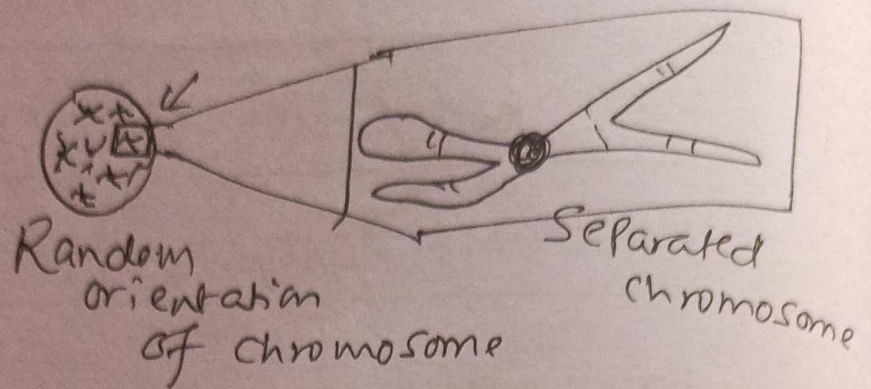
- Blood lymphocytes obtained from the patient are used.

(WBC - which has nuclei)

This task (automated detection) can now be assigned to computer.

→ Human beings have 23 pairs of chromosomes which are classified according to their size and shape of chromosome as well as position of centromere along the length of the chromosome.





When seen in cytological preparation, they are arranged in random orientation. Usually they are well separated, occasional overlaps. [→ Artifacts between chromosomes are (spaces) are - another snag → overlap is also disadvantage]

### Analysis:

- The first stage is computerized pattern recognition & is the image digitization.
- This is achieved with a flying spot microscope which converts the chromosome pattern into a density array in the computer store (memory).



The computer starts by 'looking' for the individual chromosomes, and it normally begins at the top left-hand corner of the array. It scans each pixel row by row until it finds one with a density above the background density

- This could be edge of the chromosome.

- The (computer) algorithm written to look neighbouring pixel - using 'keep turning left' rule until it finds on the edge.

- Program continues to trace around the chromosome outline and transferred to another array in store.

- The program now moves on to look for next chromosome, and when it finds another check its memory on to identify them in pairs.

- A number of methods have been (tried) attempted and one described by Mendel-Sohn is simplest



From the coordinates of the outline,  
The chromosome axis can be determined.  
The density profile along this axis  
is then calculated by summing each  
pixels along perpendicular axis (histogram)

- Profile length
  - Size, shape
  - Centromere
  - Identical pair
  - Numbers
- are the criteria.

Pattern recognition  
'Syntactical  
grammar'  
technique.

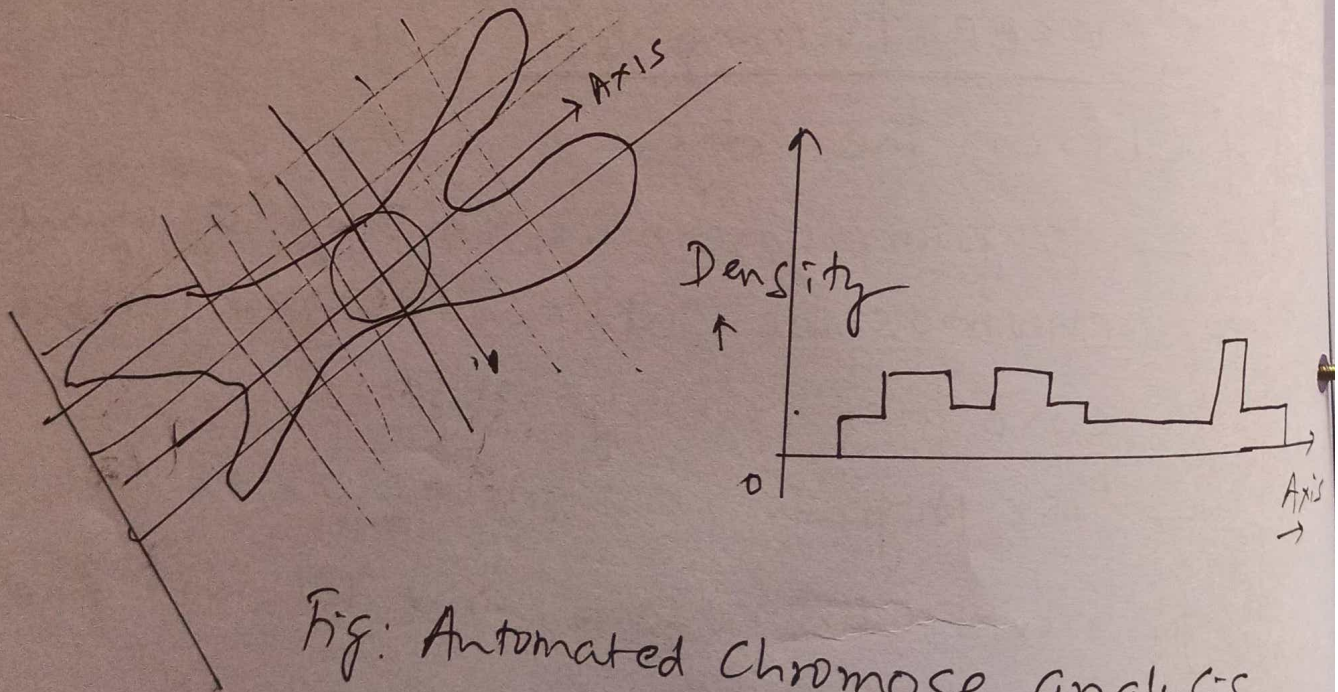


Fig: Automated Chromosome analysis  
by Computer.



## Computer-Assisted Medical Decision Making (CAMD): (CMD)

Decision-making by clinician in the management of his patients is a highly intellectual activity which involves:

- i) Gathering and evaluation of new info.
- ii) ability to readily recapitulate the info
- (iii) Utilize the large body of medical knowledge, which expresses relationship
  - knowledge
  - diagnostic
  - prognostic
  - therapeutic.

[ - Three tasks ]

CMD System might provide a solution to much of the problem created by this information explosion.



• The idea of computer Programs that can directly assist the doctor with decision making is at once intriguing (arousing curiosity or interest) and disconcerting (feel uncertain and uncomfortable or worried):

↳ intriguing because of potential to improve

↳ disconcerting because of potential for abuse and alternate practice of contemporary medicine.

### Definition:

A CMD System can be defined as an interactive computer system that directly assist doctors or other health care professionals with clinical decision-making tasks.

— When clinician says that 'common things occur commonly', the computer algorithm uses 'Baye's Theorem' of Conditional Probability.

— Clinician uses a branching logic according to the ~~system~~ symptom

② Present or absent.



Dr. James Reggia of the U'ny of Maryland, USA has described perspective in the development of CMD systems.

- Statistical Pattern classification
- Artificial intelligence
- Application - independent software

are used for constructing CMD systems.

### GENERAL MODEL OF CMD:

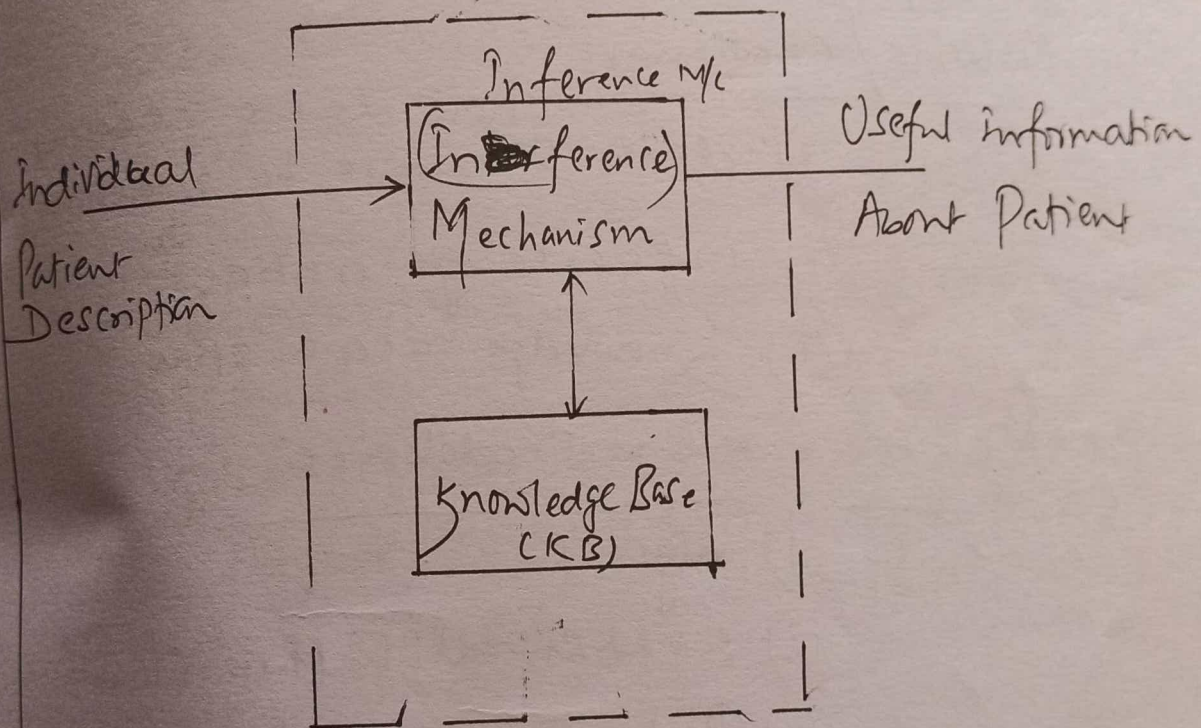


fig. General Model of CMD.



Dr. James Reggia has described a general model of a CMD system as depicted in fig.

The input is a typical description of some specific patient (Age, Sex, Symptoms and Signs). → Appropriate screening tests, diagnosis etc.

KB → encoded to solve problem in some some medical area.

Problems/Challenges: how do we represent

- i) data structure by machine?
- ii) inference generation
- iii) knowledge acquisition

Representative methodologies:

- i) Algorithm
- ii) Statistical Pattern Classification
- iii) Production rule systems (Rule based)
- iv) Cognitive models.