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On the Proper User of Man and Machines

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On the Proper Use of Man and Machines

What Is Medical Informatics?

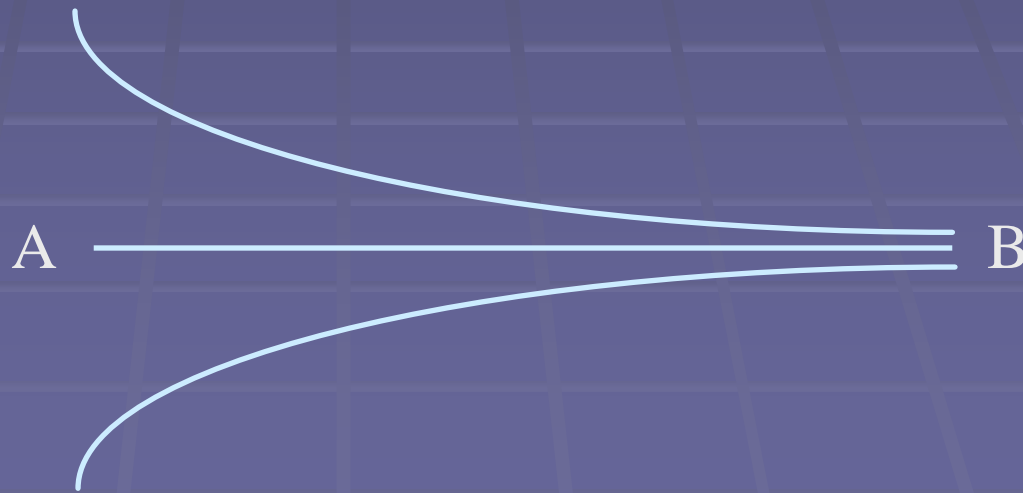
- “The field of information science concerned with the analysis and dissemination of medical data through the application of computers to various aspects of health care and medicine.” (MeSH)
- “A field of study concerned with the application of information science and technology to medicine”
 - How do you use technology effectively?
 - Organizing information
 - Discovering new relationships
 - What is the experience with patients like mine?
- Not just “Show and Tell”

An Aside into History

- The Setting - Strong AI
- Conventional Wisdom
 - Machines mirror mans mind
 - Man's fallibility will be replaced by machines (infallible)
- Blois' Response
 - Clinical Judgment and Computers
 - NEJM, 1980

The Argument

- Where do machines work well?
- What things do humans do best?
- The funnel



A Digression into Experience

Current Medical Information and Terminology (CMIT)

- 3,000+ Diseases
- Structured description
 - Telegraphic Style
 - Uncontrolled vocabulary
- Produced by AMA

The RECONSIDER experience

- Used CMIT
- Suggested possible diagnoses
 - Selectivity scores of terms
 - Used synonym dictionary

Selectivity Scores

- Kayser-Fleischer rings
 - Pathognomic
 - A sufficient attribute
 - Occurs in 1 description
- Rash
 - Occurs in 300+ descriptions
- Score = $1 - (n/3262)$

A Clinical Trial

- 100 consecutive first admissions to University Hospital
- Data abstracted at admission
- Entered by 4 persons blinded to patient
- List scored after patient discharged

Results

- 61% of diagnoses overall suggested correctly
- But 93% of correct diagnosis suggested at least once
- Harder with multiple diagnoses
- Some interesting anecdotes
 - Liver and kidney failure with fever
 - Skin rash and intermittent arterial blockage

Cooperative Computation

- Effective use of technology
- Example - Recall versus Judgment
- Let humans do what they do best
- Let machines do what they do best
- Complementary, not competitive

What Humans Do Well

- Recognize Context
- Exercise Judgment
- Recognize Patterns
- Communicate despite differences
 - Locke's private language
 - Shared ideas

Processes of Information Handling

- Generalization and Specialization
- Abstraction
- Both Can be Described as Attribute Analysis

Generalization

- Specialization
 - Separate primates from mammals
- Generalization
 - Change a description of a primate to one of mammals
 - What do you eliminate?

Abstraction

- A model
- “Throwing away bits of the truth” - Bohr
- Diseases
- How do you know if it is a good model?
- RxNorm model of clinical drugs

What Machines Do Well

- Symbol Manipulation
- Memory (Recall)
- Reproducible
- NOT Recognition of Context

Contextual Communication

- Structured Text
- Syntax approximates Semantics
- Information Model

Formalization

- Enables Computation
- Technological necessities
 - Tokenize (symbolize) objects
 - Establish formal methods of manipulation
- Hard for humans to manipulate
 - Higher level programming languages
 - Shades of meaning (and puns) not allowed
- Aids Conception
 - Rigor in model and expression
 - Requires highly functional interfaces

Terminological Imperative

- Necessity for Cooperative Computation
- Machine processible
- Human understandable