



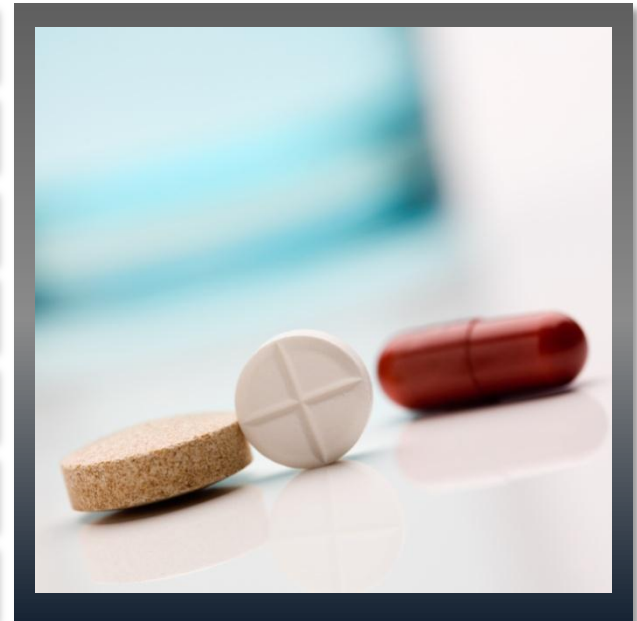
Structured Statistical Approach

...to how a doctor thinks!



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Introduction

What is an Inference ?

- To take one beyond limits of direct experience
- Going beyond the given information

Types of Inference

Deductive Inference

Draw out conclusions that may have been previously unstated but were implicit in the data

Inductive Inference

These inferences go beyond the available data in a more fundamental way, and arrive at conclusions that are likely but not certain given the available evidence.

Different Inductive Approaches

Structured Approach

Can account for the sophistication & complexity of semantic knowledge, but cannot deal with noise & exceptions

Statistical Approach

Do well with noise & exceptions, but often are unable to capture core aspects of the abstract semantic knowledge

A Unified “Structured Statistical Approach”

It helps in explaining how induction is guided by sophisticated background knowledge and how people make flexible inferences in the face of noise & uncertainty

“Structured Statistical” approach

What is the knowledge that guides Induction ?

Knowledge is captured through structures and stochastic processes

How is the knowledge that guides Induction used ?

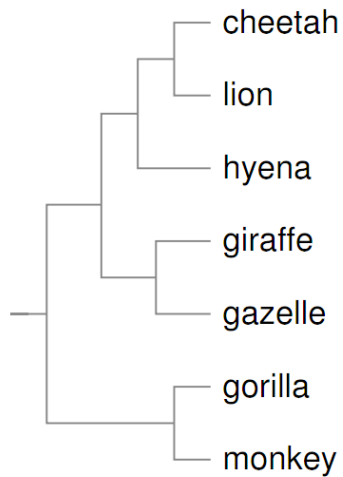
Utilized by a Bayesian framework for Property Induction

How is background knowledge itself acquired ?

The approach itself provides a principled account of learning

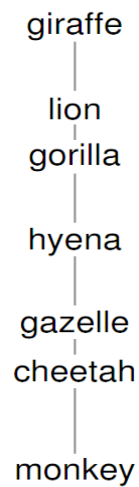
Reasoning Models

Taxonomic Model



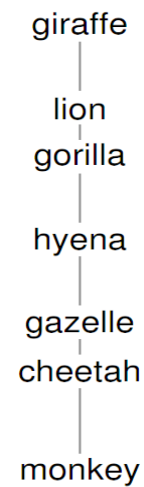
Structural Form (F):
tree
Stochastic Process (T):
diffusion

Spatial Model



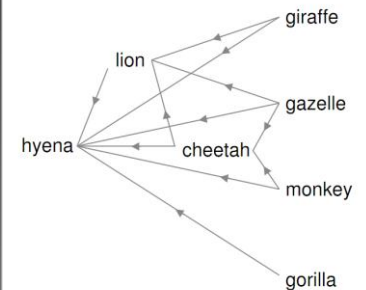
Structural Form (F):
Low dimensional space
Stochastic Process (T):
diffusion

Threshold Model



Structural Form (F):
Low dimensional space
Stochastic Process (T):
drift

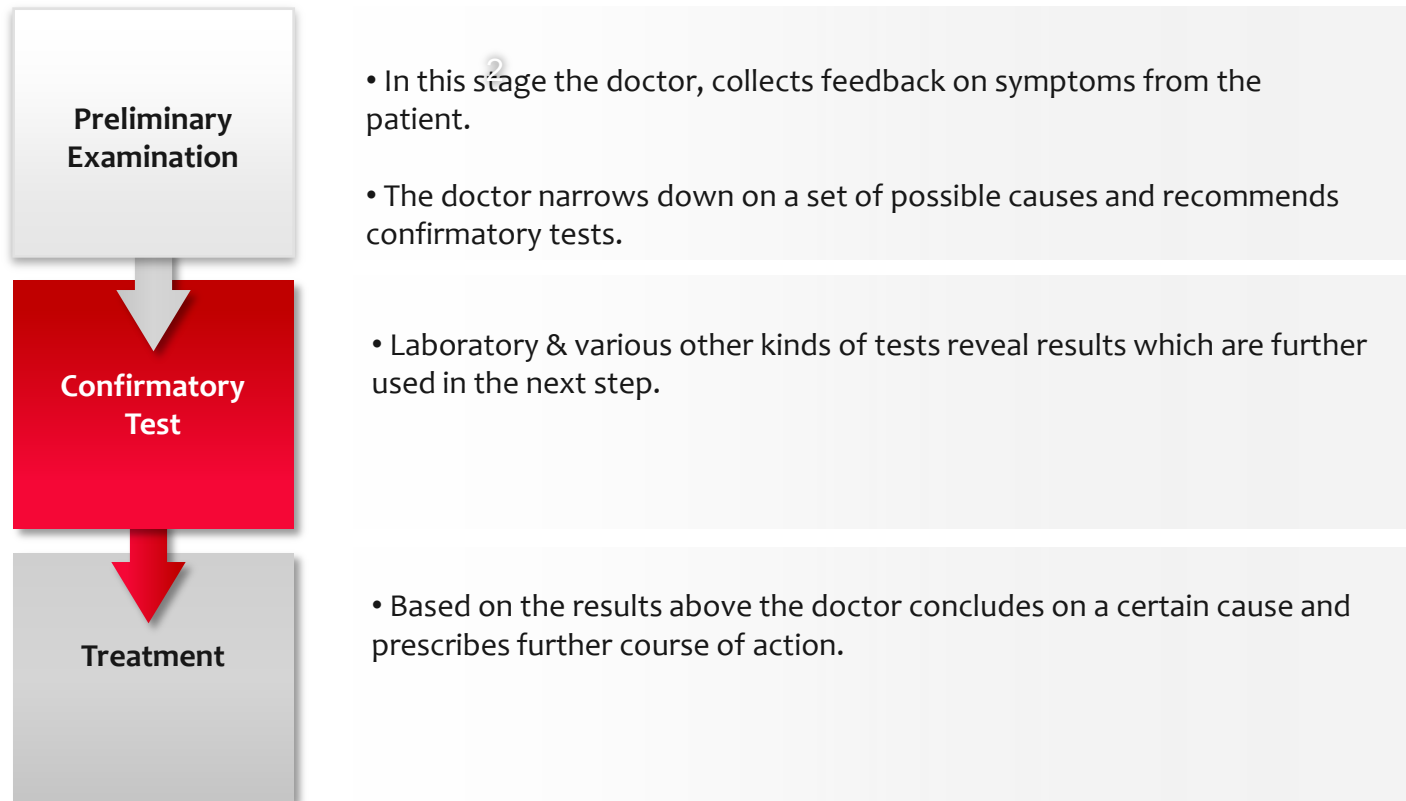
Causal Model



Structural Form (F):
Directed graph
Stochastic Process (T):
transmission

How does a doctor think ?

... a peak into the Doctor's head



... more on Preliminary Examination

1

Doctor inquires about all symptoms

2

The objective now is to identify what the problem is

3

Using the set of symptoms doctor maps them to certain possible diseases

4

Further cross-verifies to narrow down the search

5

Recommends Confirmatory Tests

Model used

We firstly identified the structure that captures the relevant relationships between the categories in the domain. Symptoms of various diseases in our case.

Of the various structures viz. tree, low dimensional space & directed graphs. The most suited structure that relates diseases is a tree structure.

Secondly, we identified a stochastic process that captures knowledge about how properties tend to distribute over this representation.

Diffusion Process offers symmetry i.e. $a \rightarrow b$ & $b \rightarrow a$ are equally strong. Also, offers a distance effect i.e. the strength of a one-premise argument decreases as the distance between the premise and conclusion increases. Also, diffusion is the only possible way to capture the assumption that features vary smoothly over a tree.

tree + diffusion

How does *iDoctor* work?



How far does *iDoctor* think?

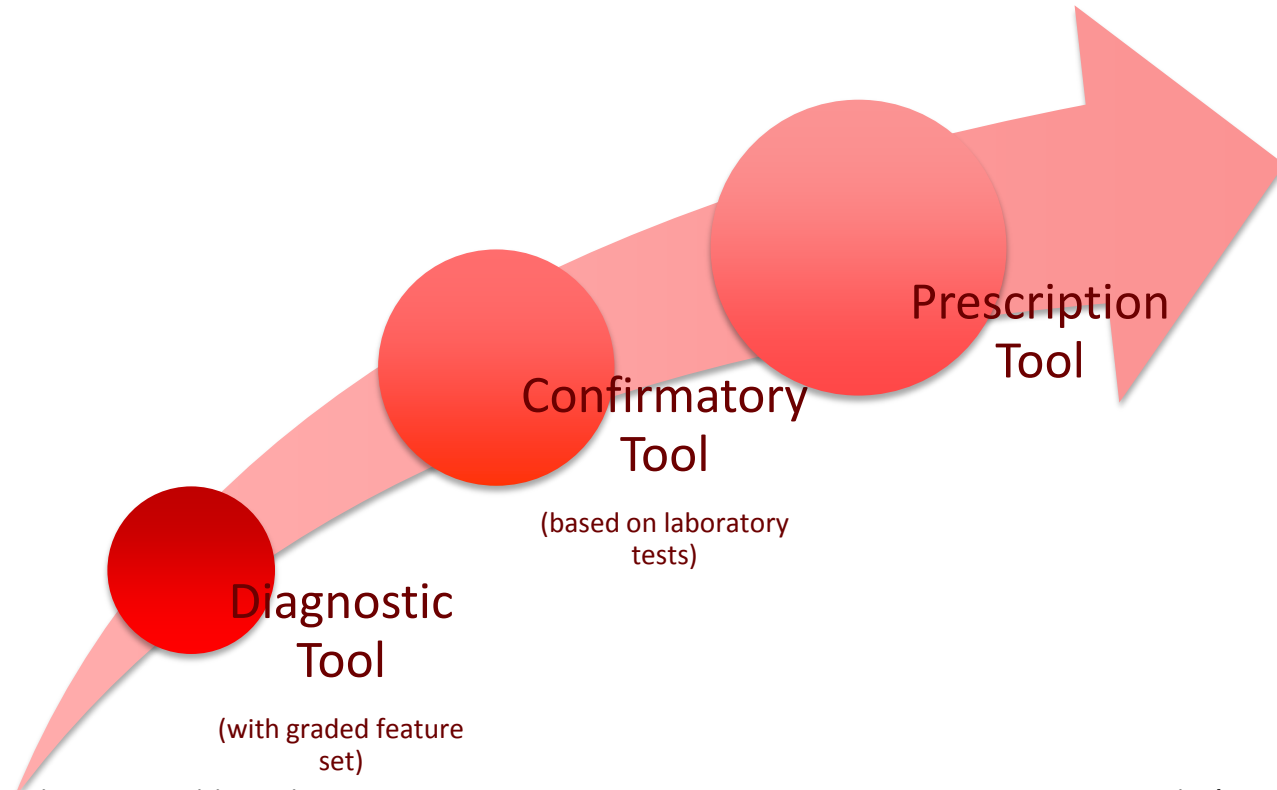
So far only until the Preliminary Test

Based on a set of Features (Symptoms); the structured statistical approach employs all four models to converge at a set of closest diseases.

Our Model can manage over 90 Symptoms

Can detect close to 50 Diseases

Futher Improvements



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Questions ?

Thank You!