AI based Applications of next Era Google source

- Photographs That Become Purchases
  - Amazon incorporated a visual search option on its mobile application
  - take a photo of the item you want, and it will show you something very similar or identical
  - buy it right away and its already in your hands.
- A Better World
  - AI can help us to prevent future damage and better understand how to address developmental needs while focusing on sustainability.
  - Microsoft using AI to study land-use patterns with terrain maps.
  - A deep understanding of these patterns allows it to make better decisions on the use of the land and implement proper preservation techniques.
  - Scientists would be able to use the information obtained to preserve biodiversity and the ecosystem.
  - EarthCube is one of these projects.

AI in Robotics

- Japanese Hotel Run Almost Entirely By Robots
- Robots replace waiters in Chennai Restaurant
- Room service is delivered by robots at hotels in Singapore
- robots: working faster and more reliably than their human counterparts
- performing tasks beyond human capability altogether, e.g. microscopically precise assembly

Need for Learning based Application

- Applications
- Banking and Financial Services
  - macro economic conditions
  - changing market dynamics
  - product centric to customer focused
  - data driven transformation
- Insurance
  - emerging technologies, including drones,
  - Big Data and Analytics to transform
  - claims processing,
  - enhance risk management and
  - streamline overall operations

Artificial Intelligence and Bayesian Network

- Intelligence, Application, Criteria for judging success
- AI - computations to perceive, reason and act
- Engineering goal - solve real world problem using AI as an armamentarium of ideas about representing knowledge, using knowledge and assembling systems
- Scientific goal - to determine which ideas about representing knowledge, using knowledge and assembling systems explain various sorts of intelligence
- in farming - controlled robots - control pests, prune trees, selectively harvest mixed crops

Artificial Intelligence and Bayesian Network

- in manufacturing - robots - do inspection, maintenance job, dangerous and boring assembly
- in household work - advice on cooking, cleaning, shopping, do laundry
- in medical care - help practitioners with diagnosis, monitor patient's condition, manage treatment
- in school - computers act as superbooks, helping students to understand the topics, provides answer to question
- AI helps in analysis, synthesis, learn from examples, experience or data
- AI more essential

Artificial Intelligence and Bayesian Network

- Airlines - allocate gate to arriving flights, schedule departure, avoid potential traffic jam, catering, passenger service, crew scheduling, aircraft maintenance
- representation in artificial intelligence
- representation is a set of conventions about how to describe a class of things
- description makes use of conventions of a representation to describe some particular thing
- finding appropriate representation is a major part of problem solving

Artificial Intelligence and Bayesian Network

- example, farmer wants move a fox, a goose and grain across river his boat tiny he can take only one of his possessions across any trip
- unattended fox will eat a gooses and unattended goose will eat grain
- farmer must not leave fox alone with goose or goose alone with grain
- question is what he should do?
- English is not a good representation
- need to separate important constraints from irrelevant details
- node for each farmer and his three possessions, two banks of river
- $2^{1+3} = 16$ arrangements
- 10 of which are safe in the sense that nothing is eaten

Artificial Intelligence and Bayesian Network

- six unsafe arrangements place an animal and something the animal likes to eat on one side with the farmer on the other
- draw a link for each allowable boat trip
- for each ordered pair of arrangements there is a connecting link if and only if the two arrangements meet two conditions: first farmer changes sides and second at most one of the farmer's possessions changes sides
- there are 10 safe arrangements and there are 10 x 9 =90 ordered pairs but only 20 of these pairs satisfy the conditions required for links
- node-and-link description is a good description with respect to the problem posed
- good description, developed within the conventions of a good representation, leads to problem solving

Artificial Intelligence and Bayesian Network

- a problem is described using an appropriate representation, the problem is almost solved
- good representation, expose natural constraints, able to express one object or relation influences another
- suppress irrelevant details,
- representation should be evaluated based on
  - transparent - understand what is being said,
  - complete - say all that needs to be said,
  - concise - say what you need to say efficiently,
  - fast - store and retrieve information rapidly,
  - commutable - create using existing procedure

Artificial Intelligence and Bayesian Network

- representation - consists of four parts
- lexical part determines which symbols are allowed in the representation's vocabulary
- structural part - describes constraints on how the symbols can be arranged
- procedural part - specifies access procedures that enable you to create descriptions, to modify them and to answer questions using them
- semantic part - that establishes a way of associating meaning with descriptions
- lexical - nod
- structural - links connect node pairs
- procedural - it is in brain for farmer example

Artificial Intelligence and Bayesian Network

- semantic - establishes nodes correspond to arrangements of the farmer and his possessions and links correspond to river traversals
- semantic nets convey meaning
- semantic nets consist of nodes, denoting objects, links, denoting relations between objects and link labels that denote particular relations
- from semantic perspective the meaning of nodes and links depends on the applications
- semantic nets - examples - semantic tree - search tree, decision tree, goal tree, game tree
- it may state space or frame system - value propagation net, constraint net

Bayesian Artificial Intelligence

- AI system -
  - deals with uncertainty,
  - deals with incomplete evidence leading to beliefs
  - that fall short of knowledge, with fallible conclusions and
  - the need to recover from error,
- called non-monotonic reasoning
- AI will need to be able to reason probabilistically, called Bayesian reasoning

Bayesian Artificial Intelligence

- Bayes' Theorem - theorem of the probability calculus
- the probability of a hypothesis h conditioned upon some evidence e is equal to its likelihood $P(e|h)$ times its probability
- prior to any evidence $P(h)$, normalized by dividing by $P(e)$ (so that the conditional probabilities of all hypotheses sum to 1)
- adjusting our beliefs in our hypotheses given new evidence is called conditionalization
- after applying Bayes's theorem to obtain $P(h|e)$ adopt that as posterior degree of belief in h or $Bel(h) = P(h|e)$
- belief updating via probabilities conditional upon the available evidence
- it identifies posterior probability - the probability function after incorporating the evidence

Bayesian reasoning examples

- Breast Cancer
- suppose the women attending a particular clinic show a long-term chance of 1 in 100 of having breast cancer
- suppose also that the initial screening test used at the clinic has a false positive rate of 0.2 (that is, 20% of women without cancer will test positive for cancer) and that
- it has a false negative rate of 0.1 (that is, 10% of women with cancer will test negative)
- the laws of probability dictate from this last fact that
- the probability of a positive test given cancer is 90%
- suppose that there is such a woman who has just tested positive

Bayesian reasoning examples

- what is the probability that you have cancer?

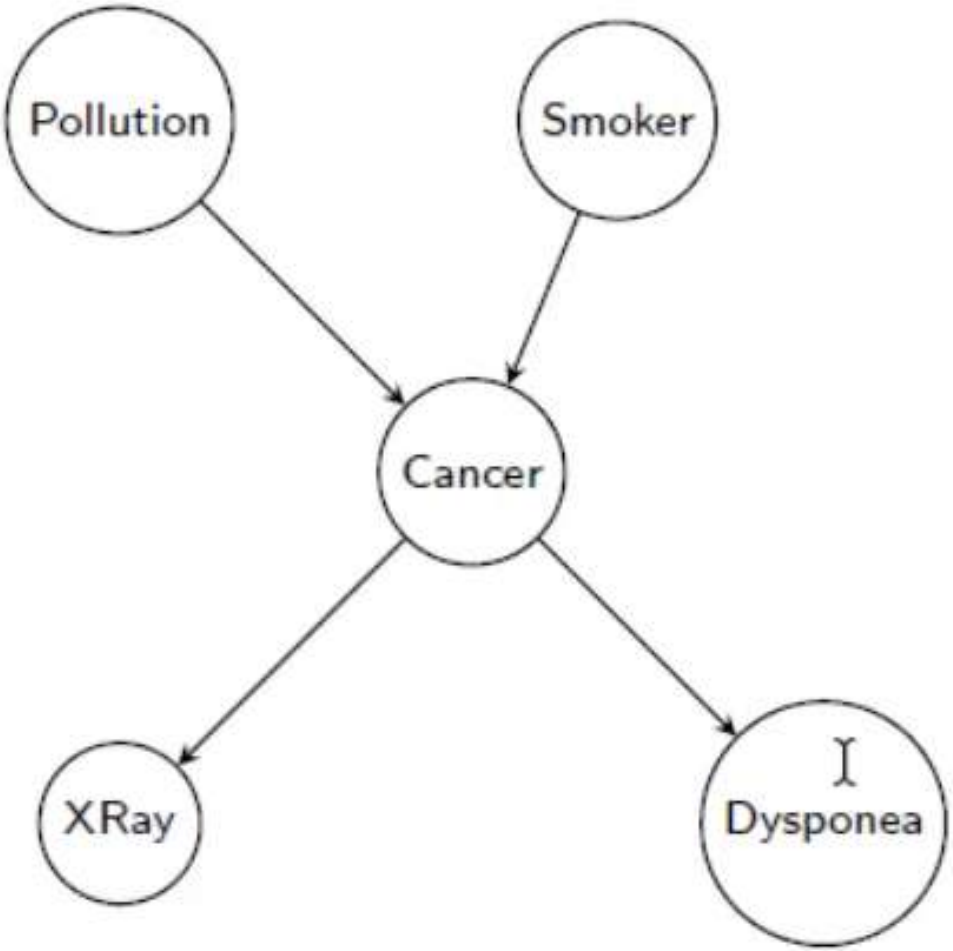
$$P(Cancer|Pos) = \frac{P(Pos|Cancer)P(Cancer)}{P(Pos)}$$

- $P(Pos|Cancer)$ = the probability of Pos given Cancer — which is the likelihood 0.9
- $P(Pos) = P(Pos|Cancer)P(Cancer) + P(Pos|\neg Cancer)P(\neg Cancer) = 0.9 \times 0.01 + 0.2 \times 0.99 = 0.009 + 0.198$
- $P(Cancer|Pos) = \frac{0.9 \times 0.01}{0.009 + 0.198} \approx 0.043$
- the discrepancy between 4% and 80 or 90%

Bayesian Artificial Intelligence

- Lung cancer: a patient has been suffering from shortness of breath (called dyspnoea) and visits the doctor, worried that he has lung cancer
- the doctor knows that other diseases, such as tuberculosis and bronchitis, are possible causes, as well as lung cancer
- doctor also knows that other relevant information includes whether or not the patient is a smoker (increasing the chances of cancer and bronchitis) and
- what sort of air pollution he has been exposed to
- a positive X-ray would indicate either TB or lung cancer

Bayesian Artificial Intelligence



Bayesian Artificial Intelligence

Node name	Type	Values
Pollution	Binary	$\{low, high\}$
Smoker	Boolean	$\{T, F\}$
Cancer	Boolean	$\{T, F\}$
Dyspnoea	Boolean	$\{T, F\}$
X-ray	Binary	$\{pos, neg\}$

P	S	$P(C = T \mid P, S)$
H	T	0.05
H	F	0.02
L	T	0.03
L	F	0.001

C	$P(X = pos \mid C)$
T	0.90
F	0.20

C	$P(D = T \mid C)$
T	0.65
F	0.30

- $P(P = L) = 0.90$, $P(S = T) = 0.30$