(16)

Decision Networks

&

Value of Information

★ Decision Networks

MEU {Maximum Expected Utility}

↳ Choose the action which maximizes the expected utility given the evidence.

⇒ New node tape:

⬭ ⇒ Chance node (Just like BNs)

▭ ⇒ Actions (cannot have parents, act as observed evidence

◇ ⇒ Utility node (Depends on action & chance nodes

(#) Action selection

- Instantiate all evidence
- Set action node(s) each possible way
- Calculate posterior for all parents of utility node, given the evidence
- Calculate expected utility for each action
- Choose maximizing action.

★ Value of Information

- Idea: Compute value of acquiring evidence

$$VPI(E'|e) = \sum_{e'} P(e'|e)\, MEU(e,e') - MEU(e)$$

⊛ VPI Properties

- Nonnegative

$$\forall E', e : VPI(E'|e) \geq 0$$

- Nonadditive

$$VPI(E_j, E_k|e) \neq VPI(E_j|e) + VPI(E_k|e)$$

★ POMDPs {Partially Observable markov Decision Process}

{I am not sure what my action will do} + {I am also not sure what state I am actually in}

⟹ MDPs have:

- → States S
- → Actions A
- → Transition function $P(s'|s,a)$
- → Rewards $R(s,a,s')$

⟹ POMDPs add:

- → Observations O
- → Observation function $P(O|S)$

$\Rightarrow$ POMDPs are MDPs over belief state b
(distribution over S)