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A method of agent running mechanism based on bayesian network

Yu Lin*, Zhang Jie, Cai Jin

Northwestern Polytechnical University, 127 Youyi Xilu, Xi'an Shaanxi 710072, (P.R.CHINA)

E-mail : shuijingputaofish@163.com

ABSTRACT

Bayesian Network has provided a convenient frame structure to express causal relationship, by regarding influence diagram as a special Bayesian Network, then the value of each decision variable is imposed externally to meet the goals, rather than derive from determination probability of father node. Using influence diagram to describe the node types of directed acyclic graph has been studied, which includes Decision nodes, Chance nodes and Value node. Agent itself is also an environmental model, variable (V_E) is the belief of node in environment, utility node (U_E) denotes the self-preference of Agent, which is the objective defined by multi-Agent self-organizing system. © 2013 Trade Science Inc. - INDIA

KEYWORDS

Bayesian network;
Agent;
Influence diagram;
Communication agent.

INTRODUCTION

Two main problems, behavior choice and experiential learning[1], have to be resolved for intelligent Agent. Behavior choice means that Agent needs to have the capability to set goals. Experiential learning refers to the capability of Agent to update knowledge. How to realize the consultation between Agents under the uncertain circumstance is always the difficult point in the realization process of intelligent Agent. In recent years, because of the advantage in handling uncertain problems, Bayesian Network has been widely applied in inference and decision of complex problems[2-5]

BAYESIAN NETWORK AND INFLUENCE DIAGRAM DECISION-MAKING

Bayesian Network is probability distribution to describe a group of variables, which can be expressed as a condition independence hypothesis on a subset of variable, that is to say, Bayesian Network has much less restrictions on overall hypothesis of conditional independence than that of simple Bayesian classifier, and more practical than the calculation conditional dependence in all variables. Pearl has made the detailed definition of Bayesian Network[8], one of the significant features of Bayesian probability in describing uncertainty is the conditional independence among variables. While chain rule has provided a more compacted method to present joint probability, which makes probability calculation more easier.

A simple bayesian network structure.

Including the following contents (as picture 1):

Confirm the steps to establish bayesian network

Confirm the variable and its parameter relating to modeling. Abstract the event as node, and establish the link between nodes according to the relationship be-
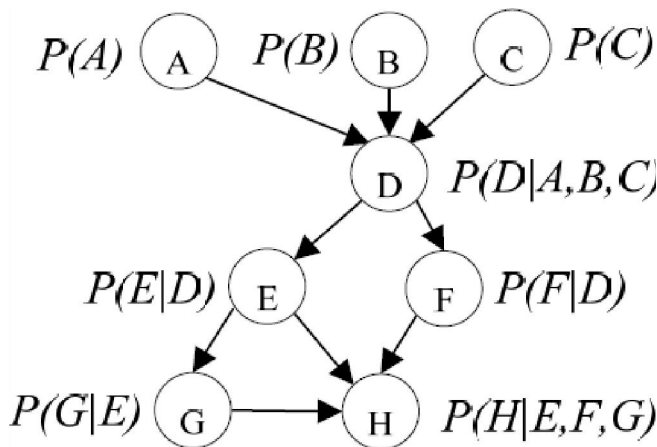
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Figure 1 : DAG of simple Bayesian Network structure

tween nodes.

1 Confirm the variable and its parameter relating to modeling. Abstract the event as node, and establish the link between nodes according to the relationship between nodes.

2 Establish a DAG expressing conditional independence, the key to decide the sequence of node is to determine the parent node of each node.

3 The process to confirm parent node for each X_i can be finished by searching for the conditional independence relationship among variables.

The above steps could be cross finished.

Decision-making steps of influence diagram.

The node type of DAG, descried by influence diagram, As shown in Figure2.
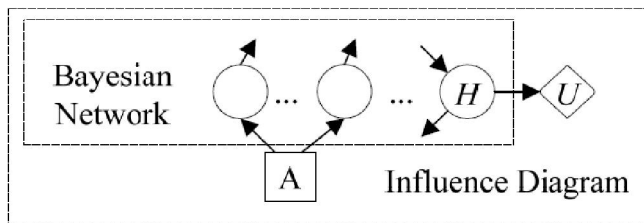

Figure 2 : Influence diagram of an action set

The method and step to clarify the evidence in influence diagram:

(1) Set as the evidence variable of current status.

(2) As to the probable value of each decision-making node:

  1 Set value corresponding to decision-making node;

  2 Use standard probabilistic reasoning algorithm to calculate the posterior probability;

  3 To calculate the results of utility function of action.

(3) Go back to the action with highest utility.

AGENT STRUCTURAL DESIGN

The input of perception program of Agent is based on the current perception, Agent function takes the entire perception history as input. Pseudo-code describes Agent program. Given that Agent program is not able to learn from the environment, if the action of Agent depends on the whole perception sequence, then Agent must obtain the whole perception information. This is similar to the condition of full and observable various in Bayesian Network. Table-Drive-Agent program is used to describe Agent program by call pseudo-code:

```
Function Table-Drive-Agent(percept) returns an action
  Static: percepts, a sequence, initially empty
          Table, a table of action, indexed by percept sequences, initially fully specified
  Append percept to the end of percepts
  Action   lookup (percepts, table)
  Return action
```

Utility Agent model and Objective Agent model.

On this basis, Goals-based Agent and Utility-based Agent are mainly described. As shown in Figure 3 and 4.
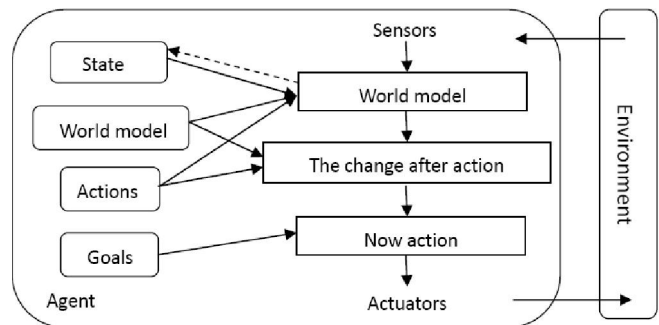

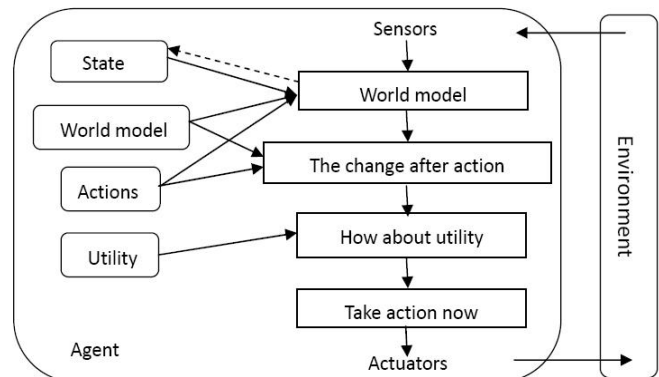**Figure 3 : A model based on goal driven Agent (World model here refers to Bayesian Network)**

Figure 4 : A model based on utility Agent

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Goal-driven Agent is more flexible to solve complex problems, the knowledge to support its decision is to display expression. But in practice, goal-driven is not enough to be the high quality behavior in most environments. If a Bayesian Network state is more favored than the other, it means a higher utility to Agent.

A STRUCTURE OF INTELLIGENT AGENT

Agent itself is also an environmental model, variable V_E denotes the belief of node in environment, utility node (U_E) represents the self-preference of Agent, which is the goal defined by multi-Agent self-organizing system. utility (U_E) is the belief function of environment (V_E). As shown in Figure 5.
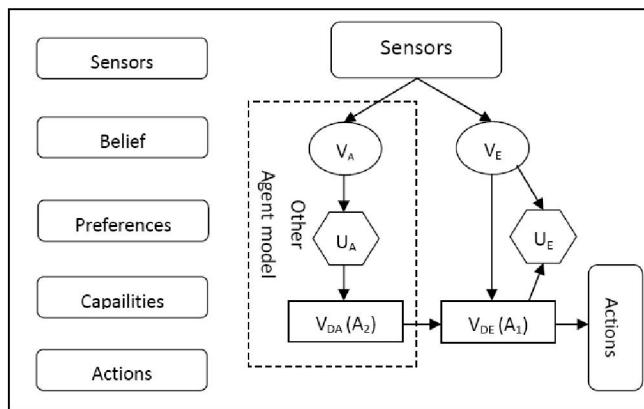

Figure 5 : A structure of intelligent Agent

DESIGN AND APPLICATION OF COMMUNICATION AGENT

Agent communication based on SOAP.

Apply SOAP agreement-based KQML communication realization method on the basis of webService technology. The following is the expression of sending inquiry message from Agent A to Agent B in XML through SOAP agreement:

Agent B can also use the same message structure to reply Agent A. Multi-Agent cross-platform communication can be realized through SOAP-based Agent communication.

Realization of communication agent.

Realize the communication between Agent through SOAP message mechanism, part of message are defined as follows:

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<SOAP-ENV:Envelope
xmlns: SOAP-ENV =http://schemas.xmlsoap.org/soap/envelope/
SOAP-ENV:encodingStyle =http://schemas.xmlsoap.org/soap/encoding/>
    < SOAP-ENV :BODY>
    <message xmlns:m="Some-URI">
    <operation value="evaluate"/>
    <sender name="A"/>
    <revceiver name="B"/>
    <language name="KIF"/>
    <ontology name="policy"/>
    <reply-with value+"ql"/>
    <content>
    <item name="val"/>
    <para value="USB"/>
    </item>
    </content>
    </message>
  </SOAP-ENV:Body>
</ SOAP-ENV:Envelope>
```

NM1HeartbeatResponse: heartbeat response
NM1HeartbeatRequest: heartbeat request
NM1MessageErr: wrong state response
NM1MessageOK: successful state response
NM1MessageSetup: configurable state response
NM1ClintInfoRequest: client information request
NM1ClintInfoReponse: client information response
NM1SendTacticRequest: issue strategy information;

Binding SOAP message in HTTP request:

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<SOAP-ENV:Envelope
xmlns: SOAP-ENV =http://schemas.xmlsoap.org/soap/envelope/
SOAP-ENV:encodingStyle =http://schemas.xmlsoap.org/soap/encoding/>
    < SOAP-ENV :BODY>
    <message xmlns:m="Some-URI">
    <operation value="evaluate"/>
    <sender name="A"/>
    <revceiver name="B"/>
    <language name="KIF"/>
    <ontology name="policy"/>
    <reply-with value+"ql"/>
    <content>
    <item name="val"/>
    <para value="USB"/>
    </item>
    </content>
    </message>
  </SOAP-ENV:Body>
</ SOAP-ENV:Envelope>
```

CONCLUSION

Influence diagram is used to describe the relationship between actions, further is to use theoretical de-

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sign Agent of influence diagram to describe the relationship between action groups, and integrate it into Bayesian Network, and itself is also a learning problem of Bayesian Network. The specific learning style is: giving Agent a initial model and history for its observed behavior, new model could be constructed by improving parameters of initial model influence diagram.

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