Robotic Task-Planning By Using Markov Logic Networks

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Abstract: Generating plans in real world environments by mobile robot planner is a challenging task due to the uncertainty and environment dynamics. Therefore, task-planning should take in its consideration these issues when generating plans. Semantic knowledge field has been planned as a source of information for deriving implicit information and generating semantic procedure. This paper extend the Semantic-Knowledge Based (SKB) plan generation to take into account the uncertainty in accessible of objects, with their type and property, and proposes a new approach to construct plans based on probabilistic values which are resultant from Markov Logic Networks (MLN). An MLN module is established for probabilistic knowledge and inferencing jointly with semantic information to provide a basis for plausible learning and reasoning armed forces in at the bottom of of robot task-planning. In addition, an algorithm has been devised to construct MLN from semantic information. By provided that a means of model uncertainty in system archit ecture, task-planning serves as a behind tool for programmed applications that can profit from probabilistic conclusion within a semantic domain. This come up to is illustrate by means of test scenario run in a domestic environment using a mobile robot.

Keywords: Robots and automation, Task planning, Markov logic network.

I. INTRODUCTION

The Robotics technology have evolved quickly over the past few years. Robotics involves the design, construction, and operation of a robot. A robot is a machine that performs complicated tasks and is guided by automatic controls. Automatic control is achieve by using the programmable automation. Programmable automation is use for operate a robot under control of a program. A robot is a Reprogrammable, Multifunctional manipulator considered to budge substance, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks. A popular variety of robot given its simplicity is the mobile, or wheeled robot. Hobbyist robotic platforms are commonly of this design due not just to its simplicity, but the minimal cost. The control of the mobile platform is relatively simple when compared to a other variety of robot.

A. Robotics

Robot is a reprogrammable, multifunction manipulator designed to move material, parts, tools or specialized devices through changeable programmed motion for the routine of a variety of tasks: Robot Institute of America. The word robot was coined by a Karel Capek in a 1920. Robot is a word for worker or servant.There are various types of robot such as Fixed Robot, Legged Robot, Wheeled Robot, Underwater Robot,Aerial Robot,etc. Robot term from Websters dictionary: An automatic device that performs function or- dinarily ascribed to human being. 'Automation' refers to a mode of operation in which any machine or piece of equipment is capable of working without human intervention. Automation as a technology concerned with the use of mechanical, electrical/electronic, and computer base system to control production processes. There are basic three rule that may be followed by the robot:

1. A robot may not injure a human being.
2. A robot must obey orders given to it by human beings.
3. A robot must protect its own existence as long as such protection does not conic with a higher order law.

B. Automation

Automation is a technique or a logic that are concerned with mechanical, electrical/electronic, computer base system created by human being and use on a machine. Machine that perform like a human and animals i.e. , work by itself with little or no direct human control. There are three type of Automation

1. Fixed Automation
2. Flexible Automation
3. Programmable Automation

1. Fixed automation

Fixed Automation is used when the volume of production is very high and utilizes expensive special equipment to process only one product. Fixed Automation widely use in a automobile industry, where highly integrated transfer line are used to perform machining operations on engine and transmission components.

2. Flexible Automation

Flexible Automation is used for medium production volume and utilizes a central computer to control the process of different products at same time. Flexible Automation is use in industry for a remotely control robots and a machineries. In which the robot travel from one place to another but with the human interaction.

3 Programmable Automation

Programmable Automation is used for production volume operated under control of a program. It processes one batch of similar products at a time. This adaptability feature is accomplished by operating the equipment under the organize of a "plan" of commands that has been prepared especially for the given product. The production arrangement tools is considered to be flexible to variations in a product configuration. There are many application on the programmable automation Line Follower is one the best application for a programmable automation.

II. RELATED WORKS

Planning under deterministic conditions suffers from a few number of issues compared to planning under undeterministic situation. The preparation domain can be generate by integrating semantic action models with rational understanding base. These domain are input into a robot planner to generate a suitable plan for a given tasks. Semantic data can be effectively used to support robot task-planning. Previous research included defining a definite type of semantic map, which incorporate hierarchical spatial information and semantic knowledge. This approach is dependent on assert in sequence and does not take into thought the uncertainty of robot operation. Another approach had projected a hierarchical task-planning that handle insecurity in both the state of the world and the end product of events. It introduce mechanism to grip situation with incomplete and uncertain information about the state of the environment by using belief states to represent incomplete information about the state of the world, and actions are allowed to have stochastic outcomes. Partially observable Markov decision processes (POMDPs)7 provided a principled general framework for robot activity development in undecided and active environment. Furthermore, POMDPs had been used in for motion setting up under indecision. Semantic information can be used as a tool to improve the task-planning in multifaceted scenario where other planners easily may find themselves in intractable situations. The move toward occupied construct a "semantic" plan composed of categories of objects, places, etc. that solved a "generalized" version of the request job, and then use that plan for removal irrelevant information in the definitive planning carried out on the representative instance of those basics (that correspond to physical elements of the world with which the robot can operate). Further work in this area10 included developing a formalism of symbolic model of the environment to solve the issues of processing large amounts of information in planning and being efficient in human–machine communication in a natural form through a human-inspired mechanism that structures knowledge in multiple hierarchies. Planning with a hierarchical representation may be able even in cases where the lack of hierarchical information would make it intractable. However, this process was depended on deterministic in sequence. To deal with uncertainties, probabilistic methods can be use to association the organization variables between each other and construct a network among these variables. Markov Logic Networks3 and Bayesian Logic Networks11 can be utilized to process probabilistic information to support many applications such as task-planning.

Combining a logical approach with probabilistic modeling has gained interest in recent years. (Getoor and Mihalkova 2011) introduce a language for describing statistical models over typed relational domains and demonstrate model learning using noisy and uncertain real-world data. (Poon and Domingos 2006) introduce statistical sampling to improve the efficiency of search for satisfiability testing. (Richardson and Domingos 2006; Singla and Domingos2007; Poon and Domingos 2009;Raedt 2008) introduce Markov logic networks, and form the joint distribution of a probabilistic graphical model by weighting the formulas in a first-order logic.Our approach shares with Markov logic networks the philosophy of combining logical tools with probabilistic modeling. Markov logic networks utilize a general first-order logic to help infer relationships among objects, but they do not explicitly address the planning problem, and we note the formulation and solution of planning problems in first-order logic is often inefficient. Our approach instead exploits the highly structured planning domain by integrating a widely used logical plan validator within the probabilistic generative model.

III. MARKOV LOGIC NETWORKS (MLNS)

The formal definition of MLN L is given by a set of pairs <*Fi* , *wi*>, where *Fi* is a method in first-order reason and *wi* is a real-valued weight. For each finite domain of constants *D*, an MLN L defines a *ground*

Markov network ML,D = <*X,G*> as follows (see11 for more details):

- *X* is a set of Boolean variables. For each potential foundation of each predicate appear in L, add a Boolean variable (ground atom) to *X*.
- *G* is a set of weighted ground formulas, i.e. a set of pairs <*Fj', we'*>, where *Fj'* is a ground formula and *wj'* is a real-valued weight.

A. Learning MLN

The learning of a statistical relational model involves the construction of a model from observed training data. The structure of the model can either be known a priori, leaving only the parameters to be determined, or can be part of the learning problem. One consequently differentiates parameter learning from the harder problem of structure learning. The first move toward towards knowledge the constitution of MLNs was presented by15. While structure learning is clearly significant if Artificial Intelligent (AI) systems are to build up probabilistic models with as little human assistance as possible, realistic approaches will silent rely on engineered structure for the most division. Parameter learning, therefore, is the most significant feature for information engineers who typically qualitatively assess the properties of a distribution and indicate the dependency connecting the variables but cannot quantitatively define the degree to which these variables depend on one another. In a Markov logic network, the objective of limitation culture is to set the weights of the model's formulas such that they reproduce explanation that have been made about the particular part of the world the model is concerned with. The observations that were made are delegate of the exacting aspect of the world that are to be captured by the model, such that they allow the reproduction to take out precisely the general principles. The observations used for learning can be stored in a teaching folder that uses the equal words as the model. Since MLNs use logical predicates, the database should thus contain the truth values of a number of ground atoms. The entities appearing in the training database implicitly classify a set X of land atom. Any ground atom in X whose fact values are not given in the training database are unspecified to be fake (closed world assumption). below this supposition, the training database thus specifies a full assignment X = x.

CONCLUSIONS AND FUTURE WORK

This paper develops a new method to enable the robot to deal with uncertainty. A template of the MLN model is created based on in order store in the semantic-knowledge base. Then this model is trained in arrange to get educated MLN, which has the ability to answer any query that is generated from the SKB and can infer (in a probabilistic method) the types and the continuation of objects or places in the robot environment. Future work includes obtaining more preparation data in arrange to cover up the majority of the situation that may face the robot operations and using it to find out the representation and get better from situation when the domain parameters are not deterministic. The use of other types of numerical relational representation such as Bayesian Logic network in supporting of the task planner will also be considered.

ACKNOWLEDGEMENT

I experience large happiness in submitting this Paper on **"Robotics Task-planning by using Markov logic network ".** I hope to there right skill of thanks towards my Principal Dr. R. P. Singh and my H.O.D.,**Prof.D.D.Patil.** I also wish to thank my teacher **Prof.R.P.Chaudhari** who at very discrete step in preparation of this Paper contributed his expensive guidance and assist to solve every problem that arose. Also, With all respect and gratitude, I would like to express thanks all the community, who have helped me directly or indirectly. I owe my all success to them.

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