

## JAGGERY MARKETING EXPERT SYSTEM USING DECISION TREE

**B V A N S S PRABHAKAR RAO<sup>1</sup>, M SURESH KUMAR<sup>2</sup>, P V VENKATESWAR RAO<sup>3</sup>,  
MATTA SANKARA SASTRY<sup>4</sup> and VADALI SRINIVAS<sup>5</sup>**

<sup>1</sup>*Dept. of CSE, Miracle School of Engineering,*

*Miracle Educational Society Group of Institutions, Vizianagaram, Andhra Pradesh, India*

<sup>2</sup>*Dept. of Computer Science, GITAM University, Visakhapatnam, India*

<sup>3</sup>*Dept. of CSE, AITAM, Tekkali, Andhra Pradesh, India*

<sup>4</sup>*Dept. of MCA, Miracle School of Computing,*

*Miracle Educational Society Group of Institutions, Vizianagaram, Andhra Pradesh, India*

<sup>5</sup>*Dept. of CSE, Kakinda Institute of Engineering Technology-2, Kakinada, India*

### ABSTRACT

This paper is aimed at providing services regarding the Jaggery marketing. The concept of Jaggery Marketing plays an influential role in the lives of people, because most of them use Jaggery for their rations. In India, leaving out a few metropolitan cities, all the districts and industrial townships are connected with Jaggery markets. Due to the social and backward condition of the rural people, the personal selling effort requires the special measures in rural marketing. The Jaggery Marketing Expert System maintains details about the current prices of a particular item, updates information whenever necessary, delete an item if it is not in use and also various marketing information. This system is developed using ID3 decision tree algorithm. It provides an interface to the users and asking a set of questions to the users. Based on the response the system evaluates and computes the availability, price and season to the end-user.

**Keywords:** Jaggery, Expert System, ID3, Entropy, Gain, and Rural Marketing.

### [I] INTRODUCTION

An expert system is a computer program conceived to simulate some forms of human reasoning and capable to manage an important quantity of specialized knowledge. A system that uses human knowledge captured in a computer to solve problems that ordinarily require human expertise. Jaggery from India is also well known for its quality, which has wide demand in international market. Marketing is one of the important activities in the production process of jaggery, which facilitates the movement of goods from site of production to ultimate consumer through various ways and by different intermediaries within the minimum period.

This system involves various services for the product Jaggery like required color, available packing, location where the item is actually available quality, quantity and season etc.

Decision tree is commonly used for gaining information for the purpose of decision-making. Decision tree starts with a root node on which it is for users to take actions. From this node, users split each node recursively according to decision tree learning algorithm. The final result is a decision tree in which each branch represents a possible scenario of decision and its outcome [1] & [7]. Jaggery or gur refers to the unrefined sugars used widely in the South Asian and South East Asian

regions. Per se, it refers to the sugarcane sugar but is also used to refer to the products derived from both sugarcane and the date palm. It is a relatively pure and wholesome sugar, possessing high amounts of nutrients [4]. Traditional Indian medicine or Ayurveda considers Jaggery to be the most useful food in the treatment of various lung and throat infections. It is considered a better choice than refined sugars as it is a rich source of iron and other required minerals salts and is, therefore, highly recommended as part of a healthy lifestyle. Jaggery is a popular part of the cuisines of the Indian subcontinent and is used in the various sweet dish preparations. According to the Indian culture, it is to be eaten in the raw form before any important occasion or any new project or venture is undertaken. The sap of the date palm is regarded as the ideal source for producing the best type of sugar and it is, therefore, highly valued. As sugarcane is not grown in as widespread an area as the northern part of the country, Jaggery is produced from the sago and the coconut palms in the southernmost parts of the subcontinent. The centrality of the Jaggery can be attested to by the fact that the two largest Jaggery markets in the world are located in the districts of Uttar Pradesh and Andhra Pradesh in India [2].

Jaggery is considered by some to be a particularly wholesome sugar and, unlike refined sugar, it retains more mineral salts. Moreover, the process does not involve chemical agents. Indian Ayurvedic medicine considers Jaggery to be beneficial in treating throat and lung infections Gandhi felt that Jaggery was healthier than refined sugar, as it was not introduced into the blood as rapidly. As such, he used it in his own personal diet and recommended it to use in his invented goat-milk diet (and all other diets/eating styles) as well. Jaggery is very rich in iron, which, a composite of haemoglobin prevents anemia. Jaggery is often called the 'medicinal sugar. So much so, you can

become an emergency doctor with Jaggery. It is also very useful in health problems like -- Dry Cough, Cough with Sputum, Indigestion, and Constipation [3].

### 1.1 Uses of Jaggery

Jaggery is widely used in the Indian cooking including those of the South Indian and Gujarati cuisines, The various South Indian foods like rasam, dal and sambar are also prepared with the addition of Jaggery. In addition to its consumption in the raw form, it is used in the traditional dishes where it lends a touch of sweetness to the sourness and spiciness of the preparations. Further, it is used in the preparation of alcoholic beverages and to make items like candy, toffees, Jaggery cakes and other similar sweet preparations. Its regular usage is advocated in the daily diet as it is a healthy and unrefined form of sugar. Interestingly, Jaggery is used for the coating of insides of a tandoor oven to enable better flavor of dishes. In south east Asia, Jaggery is prepared from the toddy palm syrup. In Burmese cuisine, Jaggery is a highly relished delicacy and is prepared with coconut shredding, plum purees or sesame depending on the area. It is regarded as delicacy and is referred to locally as Burmese chocolate. It is a preferred addition in the Burmese cuisine as it enhances the flavors and the colors of the dishes [1].

### 1.2 Health Benefits

Jaggery is ascribed with various medicinal properties and other health benefits. A pure and wholesome food, it shares the variety of essential amino acids, minerals and vitamins of the sugarcane juice and this is why it is considered a healthier option. It is also high on calcium which is required for maintenance of bone strength and is a healthy and delicious snack. Being rich in iron, it prevents diseases like anemia and also contains essential nutrients like magnesium and potassium.

Magnesium is vital for the proper functioning of the nervous systems and the potassium regulates the blood pressure and the heart functions.

While manufacturing processes in sugar utilizes chemicals such as sulphur dioxide, lime and other bleaching agents, Jaggery is prepared in a natural way and is a relatively unrefined sugar. It purifies the blood, prevents rheumatism and bile disorders and is highly nutritious in value. Jaggery is also useful in combating problems like cough and stomach ailments like indigestion, acidity and constipation. Recent scientific research has reaffirmed the benefits of Jaggery for the sensitive organs of the human body like the lungs. Consumption of Jaggery is useful for those who are exposed to pollution on a regular basis like industrial workers. It has been lauded for its ability to help the human body to fight off the ill effects of pollution.

### 1.3 Jaggery: A Healthy Choice

Although not firmly associated with disease, the greatest potential threat of white sugar stems from the processing it undergoes. Initially, the sugarcane plants are washed, shredded, crushed, and rolled to extract the cane juice. In fact, the fibrous residual is often recycled as fuel for the mill furnaces. However, the cane juice is then "clarified" by the addition of lime. After evaporation and centrifugation, it is then further refined through the addition of sulphur dioxide, phosphoric acid, and decolorizers. These processes remove all the phytonutrients, including the vitamins and minerals, and leave only the empty calories behind for us to put in our tea, coffee, and recipes.

### 1.4 The following steps are involved in preparing Jaggery

Fortunately, not all forms of sugarcane products are nutritional wastelands. For centuries, Jaggery has been used

throughout India as a healthy sweetener. Jaggery actually comes from the sap of either the sugarcane plant we've been discussing or from several species of sugar palm trees. To convert the sap into Jaggery, simple evaporation or crude centrifugation is the only process. No chemicals or bleaches are added. It is then simply poured into moulds to form small cakes. Farmers have found a very simple method, which involves special iron vessels and a single machine to manufacture Jaggery. This is the simplest way to do so.

Let us start off the process.



Step1. Cutting sugar cane from fields

Step2. Feeding the grinder to extract juice

Step3. Boiling the juice

Step4. Adding Ingredients

Step5. Tray Feeding

White sugarcane have a very rich content in sugar, white sugar cane is the main source of raw material in a sugar factory to manufacture sugar.

**[II] PROBLEM ANALYSIS**

Always Jaggery producer unable to get the minimum support price and at the same time the consumer can't get the benefit. These kinds of issues are proved in the case of onion marketing and now in red-grams marketing. The steps taken by the Government of India to cut down the poverty line have improved the condition of the rural masses but not on the price control. Jaggery Marketing is much talked and less practiced subject needing serious attention from all stake holders.

**[III] KNOWLEDGE BASE**

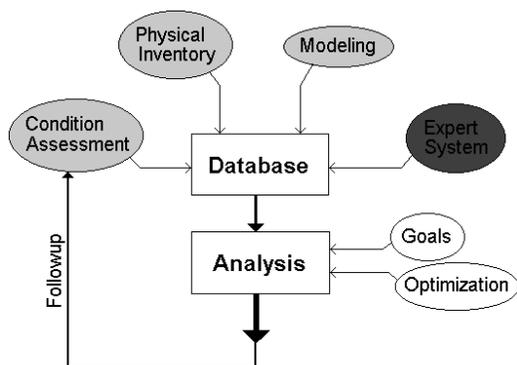
Representing the facts and rules in the knowledge base

**3.1 Architecture Design:**

The science of designing expert systems, like AI in general is largely experimental [5].

What makes it so is its modus operandi of "leaping from the known into the unknown".

Every expert system should be considered an experiment, subject to validation on the basis of empirical results.



In addition, the development of expert systems has three special design criteria:

1. The domain - Planning
2. The expert – Knowledge Engineering

3. The user environment - Implementation

The three phases of developing expert system

- Planning -
- Specify objectives
  - Define problems and sub-problems
  - Develop controls and measures

- Knowledge Engineering-
- Select Experts
  - Extract Knowledge
  - Develop Knowledge Base

- Implementation-
- Programming
  - Preliminary testing
  - Refinement

**3.2 The Inference Engine**

The inference engine applies the knowledge to solution of actual problems. It is essentially an interpreter for the knowledge base.

The task of the interface engine is as follows:

- It compares information supplied in the user's query with information in the knowledge base.
- It seeks specific event-related goals or causal relationships.
- It evaluates the relative certainty of facts, based on the respective confidence values associated with each fact.

**Program Modules for the Inference Engine**

The inference engine's pursuit of rules:

FIND\_RULE will search the rule list to locate the first rule that applies to the object whose value is currently being sought.

CONCLUDE implements the conclusions of a rule.

PURSUE acts on the name of an object, and attempts to apply the rules to give the object a value.

P\_RESULT causes the system to display the results of the consultation.

**Creating the Rules file:** The rules file includes the following syntax.

**Rule (n):** if PREMISE Then CONCLUSION

**Creating the legal values file:** The legal value includes the following syntax.

OBJECT = VALUE 1 VALUE 2  
VALUE 3 VALUE 4

**Creating the questions file:** the questions include the following syntax.

(OBJECT) = (QUESTION).

**3.3 Machine Learning Algorithm Design:**

Decision tree learning algorithm has been successfully used in expert systems in capturing knowledge. The main task performed in these systems is using inductive methods to the given values of attributes of an unknown object to determine appropriate classification according to decision tree rules.

**3.4 What is Decision Tree?**

A decision tree is a tree in which each branch node represents a choice between a number of alternatives, and each leaf node represents a decision.

'Decision tree learning is a method for approximating discrete-valued target functions, in which the learned function is represented by a decision tree. Decision tree learning is one of the most widely used and practical methods for inductive inference'[6].

Decision trees classify instances by traverse from root node to leaf node. We start from root node of decision tree, testing the attribute specified by this node,

and then moving down the tree branch according to the attribute value in the given set. This process is the repeated at the sub-tree level.

**3.5 Decision Tree Learning Algorithm**

ID3 is a simple decision tree learning algorithm developed by Ross Quinlan (1983). The basic idea of ID3 algorithm is to construct the decision tree by employing a top-down, greedy search through the given sets to test each attribute at every tree node. In order to select the attribute that is most useful for classifying a given sets, we introduce a metric---information gain [8]. To find an optimal way to classify a learning set, what we need to do is to minimize the questions asked. Thus, we need some function which can measure which questions provide the most balanced splitting. The information gain metric is such a function. The information gain,  $Gain(S,A) = Entropy(S) - \sum_{v \text{ from } 1 \text{ to } n \text{ of } (|S_v|/|S|) * Entropy(S_v)}$

We can use this notion of gain to rank attributes and to build decision trees where at each node is located the attribute with greatest gain among the attributes not yet considered in the path from the root.

**[IV] RESULTS**

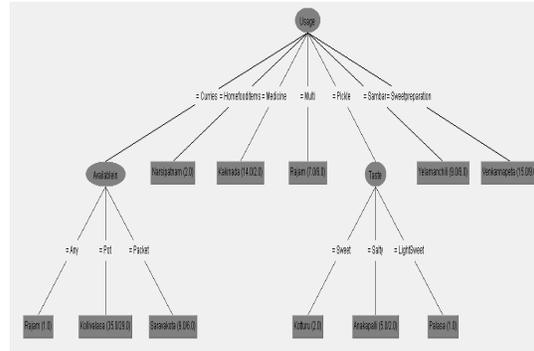
**The required database format is addressed as below:**

Color	Taste	Available	Quantity	Quality	Usage	Location
Black	Sweet	Any	Large	First	Curries	Rajam
Black	Sweet	Pot	Large	First	Curries	Chintada
Red	Sweet	Pot	Medium	Second	Curries	SKota
Black	Sweet	Packet	Large	First	Curries	Saravakota
Black	Sweet	Pot	Large	First	Curries	Chintada
Red	Salty	Packet	Large	First	Curries	Anakapalli
Black	Sweet	Pot	Large	First	Curries	Hiramandalam
Black	Sweet	Pot	Medium	Second	Curries	Amadalavalasa
Black	Sweet	Pot	Large	Second	Sweets	Amadalavalasa
Red	Sweet	Pot	Medium	Second	Sweets	Amadalavalasa
Black	Sweet	Pot	Large	First	Sweets	Venkannapeta
Black	Sweet	Pot	Medium	First	Sweets	Venkannapeta
Red	Sweet	Pot	Medium	First	Sweets	Venkannapeta
....	...	...	...	...	...	...
....	...	...	...	...	...	...
....	...	...	...	...	...	...
....	...	...	...	...	...	...

**Output of the Decision Tree Algorithm:**

```

if( Usage == "Multi")
{
  if( Color == "Black") {
    if( Taste == "Sweet") {
      if( Availablein == "Any") {
        if( Quantity == "Large") {
          if( Quality == "First") {
            Location = {"Rajam" };
          } else if( Availablein == "Pot")
          {
            Location = .....
          }
        }
      }
    }
  }
}
    
```



**Fig 2 DecisionTree**

**Rules Generated form Decision Tree**

**RULE:**

IF Usage = Curries  
 AND IF Color = Black  
 AND IF Availablein = Any  
 THEN Location = Rajam

**RULE:**

IF Usage = Curries  
 AND IF Color = Red  
 AND IF Availablein = Packet  
 AND IF Quantity = Large  
 AND IF Taste = Salty THEN  
 Location = Anakapalli

**Fact:**

Salt Jaggery is available in “Anakapalli”

The cause for Jaggery to salt in taste is:  
*This is salt in taste because of the soil type in that lands and the ingredients that are used in preparing the Jaggery. And it is well suited for storing for long period also as it is in crystal format.*

Please provide the following information to know market status

Specify Jaggery Color:

Specify Jaggery Taste:

Specify Available in Type of Package:

Specify Jaggery Quantity:

Specify Jaggery Quality:

Specify Usage:

**Fig 1 Jaggery Marketing Expert System**

**[V] DISCUSSION**

**Decision Table Run Information**

Instances: 149

Attributes: 7

- Color
- Taste
- Availablein
- Quantity
- Quality
- Usage
- Location

==== Classifier model

- Usage = Curries
  - | Availablein = Any: Rajam (1.0)
  - | Availablein = Pot: Kollivalasa (35.0/29.0)
  - | Availablein = Packet: Saravakota (9.0/6.0)
- Usage=Homefooditems:Narsipatnam (2.0)
- Usage = Medicine: Kakinada (14.0/2.0)
- Usage = Multi: Rajam (7.0/6.0)
- Usage = Pickle
  - | Taste = Sweet: Kotturu (2.0)
  - | Taste = Salty: Anakapalli (5.0/2.0)
  - | Taste = Normal: Palasa (1.0)
- Usage = Sambar: Yelamanchili (9.0/6.0)
- Usage = Sweets: Venkannapeta (15.0/9.0)

Number of Leaves : 11

Size of the tree : 14

Time taken to build model: 0 seconds

=== **Summary** ===

Correctly Classified Instances 49  
32.8859 %

Incorrectly Classified Instances 100  
67.1141 %

Kappa statistic 0.2796  
Mean absolute error 0.0505  
Root mean squared error 0.1645  
Relative absolute error 77.1788 %  
Root relative squared error 90.9656 %  
Total Number of Instances 149

**[VI] CONCLUSION**

This application was developed using java server pages and MySQL database is used as backend. Its main emphasis is to have a well designed interface for giving Jaggery Marketing related advices and suggestions marketing of Jaggery products by providing facilities like dynamic interaction between expert system and the consumer without the need of domain expert at all times.

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**Biography of Author(s)**

**B V A N S S Prabhakar Rao** obtained his



Bachelor's degree in Electronics, MCA, M.Tech (CST) from Andhra University and also pursuing his Ph.D in Software Engineering through JNTUK. Previously he worked with Govt. Degree College and Dr. V S

Krishna Govt. Degree College as Lecturer in Computer Applications & Science. With GITAM University as Assisnat Professor. Presently he working as Associate Professor with Miracle Educational Society Group of Institutions.

**Suresh Kumar Maddila**, pursuing his



M.Tech in CST from AU College of Engineering, Andhra University. He received his MCA Degree from Andhra University affiliated college in 2003. He joined in January

2009, Department of Computer Science, GITAM University, India as Assistant Professor. He joined in July (2006-2008), Dept of MCA, Anil Neerukonda Institute of Technology and Sciences, Visakhapatnam, Andhra Pradesh, India as Assistant Professor. His areas of interest are Networks, Multimedia and Computer Graphics.



**P V Venkateswara Rao**

working as Associate Professor in Department of CSE, AITAM, Tekkali, Andhra Pradesh, India. He has completed his B.Tech from JNTU College of Engineering Kakinada and M.Tech from Berhampur University. At present he is pursuing his PhD from JNTUK. His area of interest is Computer Networks, Mobile Computing, Information Security, Human Computer Interaction, Operating Systems. He has 20 years of experience in teaching and industries.



**M Sankara Sastry**

obtained his Bachelor's degree in Computer Science & Statistics from Andhra University, Master of Science in Statistics from Andhra University. He has completed his M.Tech with Computer Science & Technology from GITAM University. Previously he worked with Sri Prakask Institute of Technology as Assistant Professor, Tuni. Presently he working as Assistant Professor with Dept. of MCA, Miracle Educational Society Group of Institutions, Vizianagaram.



**Vadali Srinivas**

obtained his Bachelor's degree in Electronics from Andhra University, Master of Science in Electronics from Andhra University. He has completed his M.Tech (CST) from GITAM University. Previously he worked with N E S College of Information and Technology as Assistant Professor. Currently he working with Kakinda Institute of Engineering and Technology-II, Kakinda as Assistant Professor in Dept. of CSE and also pursuing his Ph.D through JNTUK, Kakinada.