International Journal of Advanced Research in IT and Engineering

ISSN: 2278-6244

AN INTRODUCTION TO THE DECISION TREES AND ITS TYPES

Navid Samimi Behbahan*

Milad Samimi Behbahan*

Abstract: *The structure of the decision tree in machine learning is a predictive model which connects all of the observed facts about a phenomenon to the amount of the goal of that phenomenon. The technique of machine learning in order to conclude a decision tree from data is called "decision tree" which is one of the most common ways of data analysis.*

*Department of Computer Engineering, Behbahan Branch, Islamic Azad University, Behbahan, Iran

1- INTRODUCTION

Any corresponding internal node of a variable and any arc to a child demonstrate a possible amount for that variable. By having the amount of variables, which is demonstrated by a route from the root to the node, a loaf demonstrates the predicated amount of the target variable. A decision tree shows a structure in which loafs indicate categories and branches represent the seasonal composition of traits that result in these categories.

Any attributes in decision tree are classified into two types of classification attributes and true attributes in which classification attributes are kind of values which accept two or more discrete values (symbolic characteristics) while real qualities are only from the real numbers [1].

2- THE MAIN OBJECTIVES OF THE CLASSIFYING DECISION TREES

- ✓ To classify the input data as accurate as possible
- ✓ To universalize the learnt knowledge from the the training data in a way that it can classify the unseen data as accurate as possible.
- ✓ In case of addition of new training data, training tree should be able to expand
- ✓ The structure of the resulting trees should be the simplest form possible.

3- TYPES OF DECISION TREES

- ✓ When the outcome of a tree, is a discrete set of possible values, it is called classification tree (for e.g. male or female, winner or loser). These trees represent the function X→C in which C accepts discrete values.
- ✓ When we are able to consider the outcome of the tree a “real value”, we call it regression tree. (For e.g. price of a house or length of stay of a patient in a Hospital). These trees predict the numbers in the node of a loaf and they can use a linear regression or fixed model (mean) or other types of models.
- ✓ CART stands for Classification and Regression Tree. The name refers to both procedures mentioned above.
- ✓ Cluster trees only classify the samples in nods of the loafs

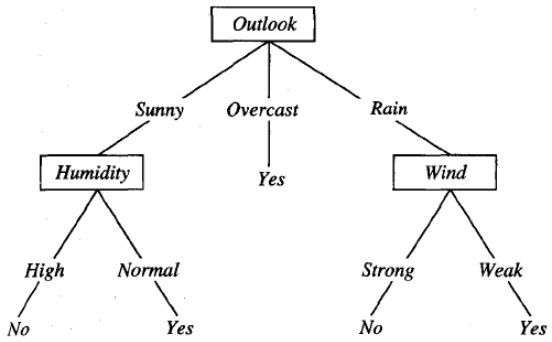
Most of the researches in machine learning are focused on classification trees [2].

4- REPRESENTATION OF DECISION TREE

Decision trees, classify the samples by arranging them in the tree from the nod of the root to the nod of loafs. Any internal nod in a tree examines a quality of a sample and any branch coming out of a node corresponds to a possible value for that quality. Furthermore each node of a loaf is attributed to a category. Each sample is classified with starting from the node root of the tree and examining the quality by the node and moving forward along the branch corresponding to given quality value in the sample. This process is repeated for each sub tree whose root is a new node [3].

Example:

The following decision tree corresponds to the phrase below:



(Outlook=Sunny ∧Humidity=Normal) ∨(Outlook=Overcast) ∨(Outlook=Rain ∧Wind=Weak)

Figure 1: Converting a mathematical equation to a corresponding decision tree

Another way to show the above decision tree

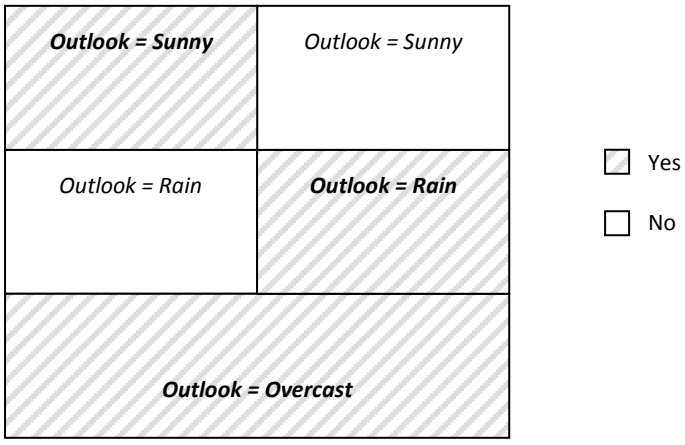


Figure 2: showing the decision tree

Example : representation of the decision tree for the for the function A⅄B

ISSN: 2278-6244

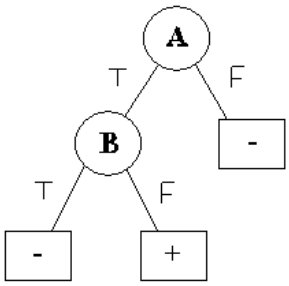


Figure 3: representing the decision tree for mathematical expression

5- EXPANDING DECISION TREES WITH DECISION GRAPHS

Decision graphs are generalizations of decision trees which have leafs and decision nodes. A characteristic that distinguishes decision tree from decision graph is that decision graphs can have linkage. Linkage is a situation in which two nodes have an in common child and this situation represents two subsets which have common features, because of that they are considered to be one set [4].

In decision tree all the paths from the nod of the root to the nod of the loaf, move forward by the conjunction AND. In a decision graph it is possible to use disjunctions or OR to connect two or more paths.

For example classifying for the function (A $\wedge$B) $\vee$(C $\wedge$D) is different. Corresponding decision tree and decision graph of this function is shown in the Fig. below. Decision tree divides the object's space into seven categories while the decision graph divides it into two categories [5].

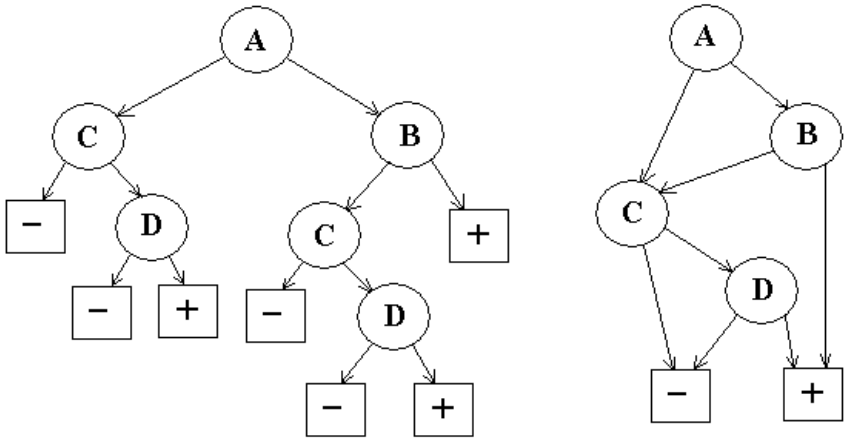


Figure 4: converting the decision tree to the decision graph

6- ISSUES SUITABLE FOR DECISION TREE LEARNING

There are many types of methods developed to learn decision trees with different abilities and requirements [6]. But in general, learning it is suitable for issues with the following features:

- ✓ Issues in which samples are represented in form of attribute-value pairs. In this kinds of issues samples are expressed with fixed set of attributes and values. The simplest situation to learn a decision tree is when any attributes take small number of discrete amounts. However, by developing to basic algorithms, it is also possible to use attributes with continuous values.

  Example: attribute: temperature quantity: {warm, temperate, cool}
- ✓ Issues in which the target function has discrete output values_ the decision tree methods can be expanded in such a way that they can learn to function with output of more than one value.

  Example: the output of a supposed target function {Yes, No}
- ✓ Seasonal attributes might be required_ decision trees are essentially representing seasonal phrases.
- ✓ Educational data may contain errors_ methods of learning a decision tree are resistant to errors in training data.
- ✓ Training data may have attributes which lack values_ the decision tree methods may be used when some of the training examples have unknown amounts.

7- CONCLUSION:

Decision trees are capable of producing human-understandable descriptions from the data sets and can be used for classification and prediction. This technique can be widely used in different fields like diagnosing classifications of plants and customer's marketing strategies.

REFERENCES

[1] LeBlanc, M., & Crowley, J. (1993). Survival trees by goodness of split. Journal of the American Statistical Association, 88, 457–467

[2] Utgoff, P. E., Perceptron trees: A case study in hybrid concept representations Connection Science, 1(4):377-391, 1989.

[3] Zantema, H., and Bodlaender H. L., Finding Small Equivalent Decision Trees is Hard, International Journal of Foundations of Computer Science, 11(2): 343-354, 2000.

[4] Chan P.K. and Stolfo S.J, On the Accuracy of Meta-learning for Scalable Data Mining, J. Intelligent Information Systems, 8:5-28, 1997.

[5] Salzberg, S., Chandar, R., Ford, H., Murthy, S. K., and White, R. Decision trees for automated identification of cosmic-ray hits in Hubble Space Telescope images. Publ. Astron. Soc. Pacific 107:279–288, 1995.

[6] Quinlan, J. R. Bagging, "boosting and C4.5". In Proceedings of the 13th National Conference on Artificial Intelligence (AAAI96), 1996, pp. 725–730.