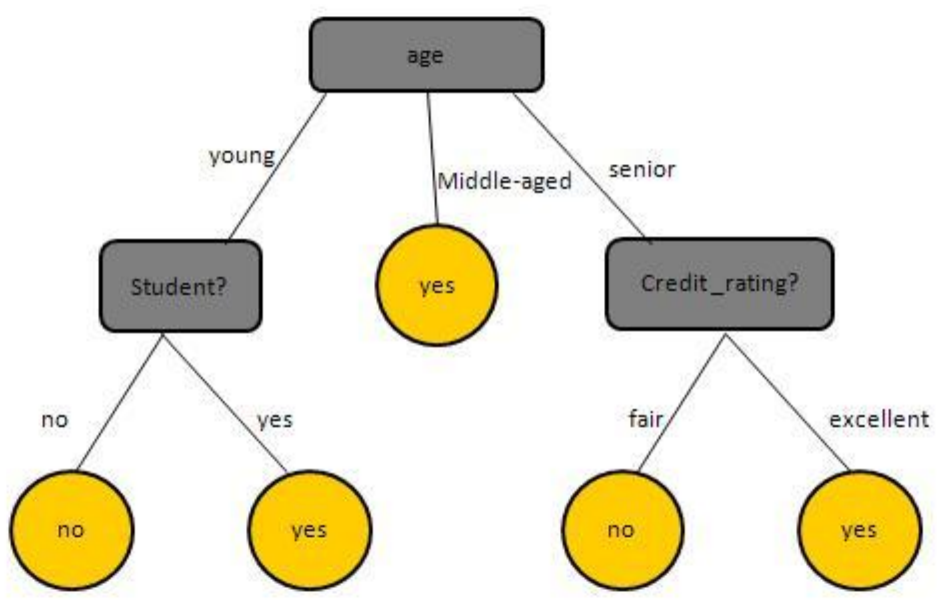
Data Mining - Decision Tree Induction

Introduction

The decision tree is a structure that includes root node, branch and leaf node. Each internal node denotes a test on attribute, each branch denotes the outcome of test and each leaf node holds the class label. The topmost node in the tree is the root node.

The following decision tree is for concept buy_computer, that indicates whether a customer at a company is likely to buy a computer or not. Each internal node represents the test on the attribute. Each leaf node represents a class.



Advantages of Decision Tree

- It does not require any domain knowledge.
- It is easy to assimilate by human.
- Learning and classification steps of decision tree are simple and fast.

Decision Tree Induction Algorithm

A machine researcher named J. Ross Quinlan in 1980 developed a decision tree algorithm. This Decision Tree Algorithm is known as ID3(Iterative Dichotomiser). Later he gave C4.5 which was successor of ID3. ID3 and C4.5 adopt a greedy approach. In this algorithm there is no backtracking, the trees are constructed in a top down recursive divide-and-conquer manner.

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Generating a decision tree form training tuples of data partition D
Algorithm : Generate_decision_tree

Input:
Data partition, D, which is a set of training tuples
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and their associated class labels.
attribute_list, the set of candidate attributes.
Attribute selection method, a procedure to determine the
splitting criterion that best partitions that the data
tuples into individual classes. This criterion includes a
splitting_attribute and either a splitting point or splitting subset.

Output:
 A Decision Tree

Method
create a node N;
if tuples in D are all of the same class, C then
   return N as leaf node labeled with class C;
if attribute_list is empty then
   return N as leaf node with labeled
   with majority class in D;|| majority voting
apply attribute_selection_method(D, attribute_list)
to find the best splitting_criterion;
label node N with splitting_criterion;
if splitting_attribute is discrete-valued and
   multiway splits allowed then  // no restricted to binary trees
attribute_list = splitting attribute; // remove splitting attribute
for each outcome j of splitting criterion
   // partition the tuples and grow subtrees for each partition
   let Dj be the set of data tuples in D satisfying outcome j; // a partition
   if Dj is empty then
      attach a leaf labeled with the majority
      class in D to node N;
   else
      attach the node returned by Generate
      decision tree(Dj, attribute list) to node N;
   end for
return N;
```

Tree Pruning

Tree Pruning is performed in order to remove anomalies in training data due to noise or outliers. The pruned trees are smaller and less complex.

TREE PRUNING APPROACHES

Here is the Tree Pruning Approaches listed below:

- **Prepruning** - The tree is pruned by halting its construction early.
- **Postpruning** - This approach removes subtree form fully grown tree.

Cost Complexity

The cost complexity is measured by following two parameters:

- Number of leaves in the tree

- Error rate of the tree

Source:

http://www.tutorialspoint.com/data_mining/dm_dti.htm