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Horizontal Aggregation in SQL to Prepare Datasets and Decision Tree

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Abstract: ***Data mining is similar to discovering an innovative idea. When data are structured under RDBMs it will be very critical task to make it out. Many data mining concepts and algorithms are used to create prepared datasets in tabular format which consist complex queries, joining tables in data mining. Tabular format take proper input to prepare data sets but existing SQL aggregations having limited capacity to prepare data sets and it is very time consuming task. They return one column per aggregated group. Hence fundamental methods are used to determine horizontal aggregation to signify an outline made by SQL code to return in a horizontal tabular format by using SPJ, CASE and PIVOT methods. This group of new function is called as horizontal aggregation. Aim of this work is to present classification on prepared datasets and further, generating the decision tree by using C4.5 algorithm to reduce the time constraints. Proposed work might be useful for the programmers to interpret the knowledge in the form of decision tree.***

Keywords: aggregations, SQL, pivoting, data preparations.

1. Introduction

Data mining is the analysis step of the ("Knowledge Discovery and Data Mining" process, or KDD), It is the computational process of discover patterns in huge data sets involving a lot of methods at the intersection of machine learning, statistics, and database systems. In general aim of the data mining process is to extract information from a data set and transform it into an understandable structure for advance use. Data mining include major elements are transform, extract and data transformation onto the data warehouse system. It keeps and manage the data in a multidimensional database system. Data may be facts, numeric or text that can be access by computer. Data may be operational e.g. Sales data or nonoperational data such e.g. forecast data and Meta data that is data about data. The method of data preparation consists of three stages – data discovery, data characterization and data set gathering. In data discovery, selected data are made available from their sources and on that basis given data are suitable used for data mining. The data is evaluated for their convenience in data mining, which involves the use of data profile and variable status report. Then a data set is created from the sample through an exact focus based on selected fields or features. The data set improved and enhanced by the data mining tool for data transformations which is used for data preparation. Data preparation ends with a concluded set of reports.

Describing the data and the data sets. There are common terms such as point dimension, statistics literature, observation variable under the data mining. Data mining have a lot of challenges to turn the huge amount of data into knowledge cube for global challenges. Existing SQL Query in DBMS return a data sets but they having limitation to return a data by using complex queries, joining tables and tables.

In this project, three fundamental methods are used to evaluate horizontal aggregation in SQL to prepare data sets. Two common data preparation tasks are explained in this project.

1) Transposition/aggregation and
2) Transforming definite attributes into binary dimensions. For this purpose include two strategies to evaluate horizontal aggregations using follows strategy.

SPJ strategy

CASE strategy

Selection-Projection –Join (SPJ) this method is fully depends on the relational operators, Pivot method is use to exchange rows and columns, that appears the data transformations useful to create the data into visualization mode and data modeling. Lastly, CASE method is used to construct the SQL CASE programming.

Horizontal aggregations collect extra features of standard SQL aggregations, which return a set of values in a horizontal layout which is standard denormalized tabular layout. This is standard layout used in most data mining algorithms .With the help of three fundamental methods aggregate the data into standard layout. By using three standard methods it gives same result. That prepared datasets is stored in the form of .arff format. On the prepared data sets C4.5 algorithm is applied, further the decision tree is generated in the form of tree structure. IF –Else condition is more comprehensible that interpret easily understand the database.

2. Literature Survey

There exist many proposals research that have extended SQL code for the data mining operations. Related works extended on query optimization, comparison between horizontal aggregations with alternative to perform aggregation, pivoting and transposition.

This paper explains the technique to use the data mining methods to illustrate the datasets by mining the data from various tables at the same time. The CASE, SPJ and PIVOT are used for data mining operation. CASE method has two possible view i.e. Vertical view and also the Horizontal View proposed in [1] and reduces reducing the burden on the databases for recovery of data. In 2013, proposed system, a new pivoting option is included in [2] achieved with the tool SAAS (SQL Server Analysis Services).Given data is converted into knowledge cube with the help of MDX (Multidimensional expression) queries. Then the knowledge data will be modified based on "Generalized and Suppression Algorithm" .SQL aggregated functions extended with k-means algorithm [4] to cluster the aggregated column which facilitate to generate datasets for data mining interrelated work. K-means algorithm is faster than in this paper .This paper include Euclidean distance to compute and pivot value with pivot operator .CASE, SPJ and PIVOT [5] methods extended for horizontal aggregations. This proposed work carry to execute constructs of SQL code and the secondary data set is described for OLAP that means Online Analytical Processing. PIVOT operator, which is offered by a number of DBMSs. It does experiment with big tables and compare the proposed query with SPJ, CASE and Pivot methods. CASE method has same speed to the PIVOT operator and it is much more rapidly run than the SPJ method [6]. Horizontal aggregations are explored to automatically generate efficient SQL code with three sets of parameters: grouping columns, sub-grouping columns and aggregated column [7]. Similarly, this work extended "BY" clause, to modify the SQL parser and query optimizer. Main difference among vertical and horizontal aggregations, from the user point of examination, is just the include of sub-grouping columns. In 2012, proposed an abstract, but smallest, addition to SQL usual aggregate functions to calculate horizontal aggregations. Proved the three fundamental methods and main role of CASE method in [8] since the programmed join by GROUP-BY and CASE statements. In 1998, proposed association rule mining consists various methods. Coupling through a SQL query is an encapsulation of a data mining algorithm. Another method is proposed to store the data to a file system using loose coupling and cache procedure architecture, it used Apriori Algorithm in [19]. The existing systems are not defined for the dissimilar fact tables that need better indexing and extraction in 2012. To solve this drawback by using multiple fact tables and k- means algorithm in [9]. In 2012, query graph models are not enough for construct model of outer join queries with complex predicates. The needed hyper graph abstraction and algorithms Conflict free Assignment algorithm [10] used for reordering such queries with joins and outer joins in 1995.

Finally, this paper is a significant extension of the preliminary work presented in [3],where horizontal aggregations is carry out by the three fundamental methods are SPJ,CASE and PIVOT methods. In previous work, three fundamental methods provide summarize for SQL code to produce organized datasets in tabular layout for data mining analysis. But, existing SQL query having limited capacity to prepare datasets is very time consuming task. It consist large table. Those prepared datasets tables cannot easily interpret. This paper is helpful to understand the prepared datasets in the form of decision tree structure by using c4.5 algorithm in WEKA.

3. Existing System

- Issues in the existing system

  An existing system to prepare a data set for analysis is usually the mainly time consuming task in a data mining project, require a lot of compound SQL queries, combination of tables and aggregating columns. Existing SQL aggregations have boundaries to create data sets because they return one column per aggregated group.

- Disadvantages of Existing System:

1) Existing SQL aggregations have boundaries to create data sets.
2) To return single column per aggregated group.

4. Proposed Model

Addressing the constraints of time limitation and complexity with respect to query formation, it is planned to alleviate these hurdles by using three fundamental methods such as SPJ, CASE and PIVOT method for horizontal aggregation in SQL to prepare datasets. The proposed model consists of four **modules 1:** Login Application for User, **module: 2**. Implementation of aggregated SPJ, CASE and PIVOT methods, **module 3:** Implementation of c4.5 algorithm and module: 4. Decision Tree illustrated in system architecture for proposed plan is given in fig.1 as follows.

1) First, they correspond to a template to create SQL code from a data mining tool. Such SQL code directly writing SQL queries, optimize them, and check them for correctness. This SQL code decrease physical work in the data preparation stage in a data mining project.
2) Second, given that SQL code is generated it is likely to be extra capable than SQL code written by an end user. For example, anyone who does not know SQL well or someone who is not well-known with the database schema (e.g., a data mining practitioner). Therefore, data sets can be created in less time.
3) Third, the data set can be produced entirely within the DBMS. In current database environments, it is common to send the denormalized data sets to be further cleaned and changed outside a DBMS in external tools (e.g., statistical packages).
4) Further prepared a datasets is classified into decision tree with the help of C4.5 Algorithm.

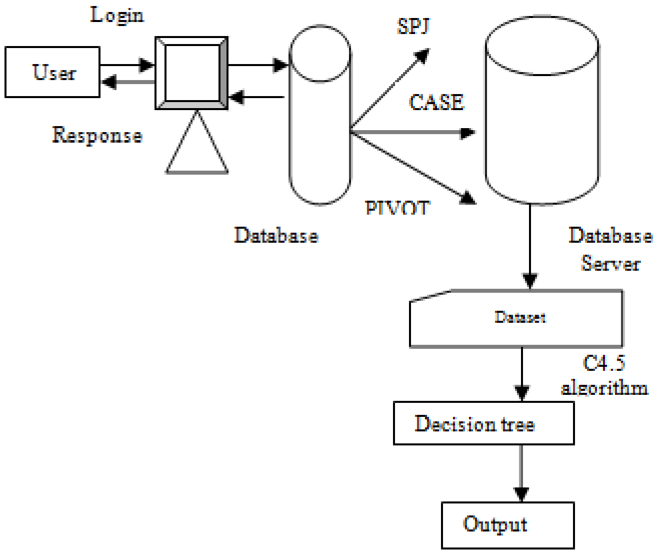


Figure 1: System Architecture for Proposed model

5. Proposed Methodology

In this section proposed horizontal aggregations provide process for creating datasets in data mining analysis. The main goal of this paper to define creates an outline to produce SQL code in tabular layout from data mining tools, these SQL code can be created using SQL complex queries, joining tables and used for prepared datasets in SQL for data mining analysis. A Second goal of this paper to create decision tree by using C4.5 algorithm in WEKA on the prepared datasets. Proposed methodology is explained for four modules given as below.

1) Login Application for User

Proposed work will be able to upload various details regarding separate username and password. Firstly it will create new login application form, will be registered with various user name and password. It access only authorized person. It provides privacy for prepared datasets within DBMS. If new user want to create account in login application form. It will be created then the dialog box shows the message as login successfully. If username and password are mismatched then dialog box shows incorrect username and password. Datasets are created using SPJ practically. Database created in Microsoft SQL Server 2008. The Microsoft SQL Server 2008 Database Engine is a service for accumulate and giving out data in either a relational (tabular) format or as XML documents. Datasets are preparing from the output of all these three method and linked with java language .Net Beans 7.3.1 used for IDE. so by applying SPJ, PIVOT and CASE methods on given database. Dataset are found in .arff file format. On the database, C4.5 algorithm applied and decision tree is generated.

2) Implementation of aggregated SPJ, CASE and PIVOT Methods

Addressing the problem with the prepared datasets this paper proposes three fundamental methods are SPJ, CASE and PIVOT used for horizontal aggregation in SQL to prepare datasets. The methodology adopted for the proposed plan of implementation, transposition and aggregations by following methods:

- SPJ method :

In SPJ Method sub query execute first. After that parent query execute. Select-projection-join (SPJ) method depends on the relational operator. Vertical operations are used in SPJ method. For every column one table is generated in this model. Afterwards, the tables generated are joined in order to obtain final horizontal aggregations Left Outer Join is use in SPJ method, the left outer join is evaluated in between two table's i.e. right part of table and left part of table. The common fields of both the right and left tables are returned and uncommon fields of left column are also returned. Consider dataset is created with 300 attributes. In a horizontal aggregation having four input parameters to create SQL code:-

(i) The known input table F
(ii) The record of GROUP BY columns L1, …… ,Ln
(iii) The column which to be aggregate into (A) and
(iv) The record of transposing columns R1… Rk.

The actual implementation is based on the details given in data sets having outlook, temp., weather and windy
(SELECT outlook, avg (temperature) AS temp, avg (humidity) as hum FROM weather

WHERE play='yes' GROUP BY outlook) F1 left outer join
(SELECT outlook, avg (temperature) AS temp, avg (humidity) as hum FROM weather
WHERE play='No' GROUP BY outlook) F2 on F1.outlook=F2.outlook;

The execution of this query in detail by breaking down the query into sub-query.

The first sub-query as follows,

SELECT outlook, avg (temperature) AS temp, avg (humidity) as hum FROM weather
WHERE play='yes' GROUP BY outlook

In this part of query selection of Outlook, average of temperature, average of humidity is selected from Weather database when play is yes. Group by outlook means all the value for same outlook having play = yes are Aggregated. Consider one example, when outlook is overcast see for play when play is yes. Aggregate all the temperature value for this condition looking at this database.

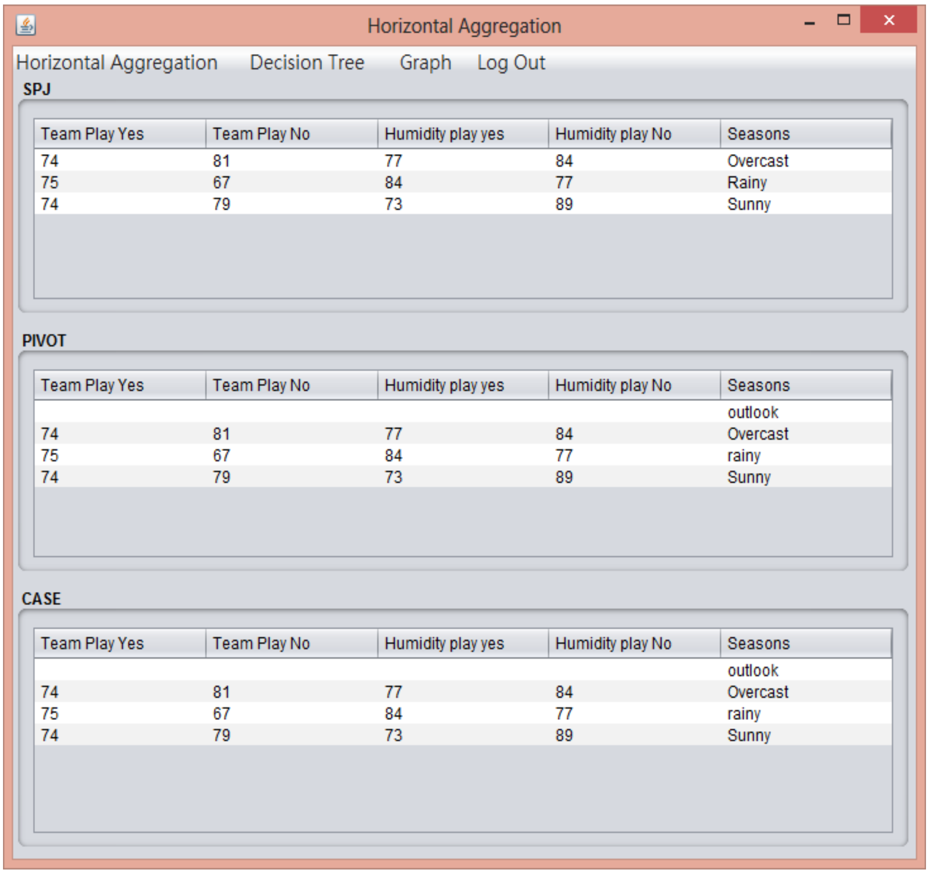
a) CASE Method

This task is based on the CASE construction provided by SQL. It has a lot of built in Boolean expressions. Out of them one of the expressions is returned. Aggregation or Projection is like to this from relational query point of view. In SQL CASE constructs are available in the SQL CASE programming .It can be done by using many conditions with conjunctions. In this case horizontal aggregations exhibit two strategies.

1) Firstly, the computations of query can be done directly from the given input database table.
2) Secondly, evaluate vertical aggregation and the results are sent to an arbitrary table. This table is used again in horizontal aggregation generation.

b) PIVOT Method

RDBMS has built in PIVOT operator. This is used for the PIVOT operation proposed in this paper. This construct can provide transpositions. It transposes the fewer of rows into additional new column. Therefore, for evaluating horizontal aggregations pivot operator is used to transfer the data from row into column in it. By applying SPJ, CASE and PIVOT methods give equivalent horizontal aggregated result.



SPJ

Team Play Yes	Team Play No	Humidity play yes	Humidity play No	Seasons
74	81	77	84	Overcast
75	67	84	77	Rainy
74	79	73	89	Sunny

PIVOT

Team Play Yes	Team Play No	Humidity play yes	Humidity play No	Seasons
				outlook
74	81	77	84	Overcast
75	67	84	77	rainy
74	79	73	89	Sunny

CASE

Team Play Yes	Team Play No	Humidity play yes	Humidity play No	Seasons
				outlook
74	81	77	84	Overcast
75	67	84	77	rainy
74	79	73	89	Sunny

Figure 2: Horizontal Aggregated result

3) Implementation of C4.5 algorithm

Decision tree builds classification models in the form of a tree structure. It splits down in a dataset into smaller and smaller subsets while at that time a related decision tree is incrementally developed. The last outcome is a tree with decision nodes and leaf nodes.

C4.5 algorithm is the latest version of ID3 algorithm. In this module implementation of the C4.5 algorithm will be perform by using the Weka tool. The dataset created by three SPJ, PIVOT and CASE methods, this Prepared dataset is given as an input to C 4.5 algorithm with the help of WEKA tool to generate Decision tree or classification. On that prepared dataset calculate the Entropy and Information gain .Operation are then performed and an appropriate decision rules are produce. Depends on that rule Decision Tree is created. Entropy of each attribute is calculated in every branch. C4.5 algorithm is implemented in WEKA and linked with java file.

4) Decision Tree

Graphical representation of the output of all the methods implemented before in proposed model. Decision tree is generated on the basis of the prepared datasets.

B) Data Flow Work

Data flow chart fig. 2 shows initially create new login form it will be registered with various user name and password. It access only authorized person. If new account is created then the dialog box shows the message as login successfully.SPJ, PIVOT and CASE method applied on the query. Give the same result by three methods. Prepared datasets store in the form of .arff format. On the prepared datasets c4.5 algorithm is applied and finally the decision tree is generated.

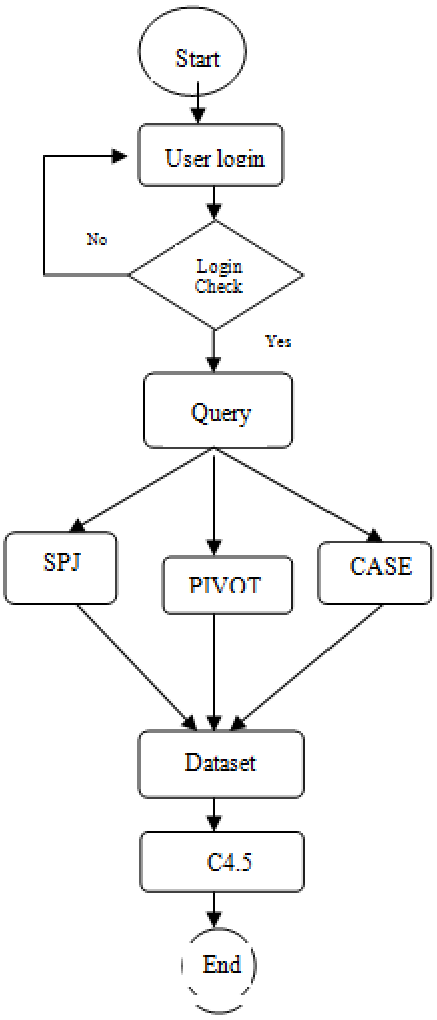


Figure 2: Data Flow Chart

6. Vi. Algorithm Design

A) C4.5 Algorithm

C4.5 algorithm constructs classification model in the form of tree structure and its predecessor, that summaries training data in a decision nodes and leaf nodes. Along with final result is a tree with child nodes leaf nodes makes logical rules to satisfy IF-Else condition. Leaf node represents a categorization or decision. The topmost decision node in a tree which corresponds to the top predictor called root node. Decision trees have capacity to handle both definite and numerical data. C4.5 Algorithm is latest version of ID3 algorithm. C4.5 Algorithm is a well-liked tree based classifier, is used to generate decision tree and from a set of training examples. Nowadays C4.5 is named as J48 classifier in WEKA tool, an open source data mining tool. The function of heuristic used in this classifier is depending on the concept of information entropy.

In general, steps in C4.5 algorithm to build decision tree are:
step1: Choose attribute for root node
Step2: Create branch for each value of that attribute
Step3: Split cases according to branches
Step4: Repeat process for each branch until all cases in the Branches have the same class .Choosing which attributes to be a root is based on highest gain of each attribute.

To count the information gain, we use formula 1, below:

Gain(S,A)=Entropy(S)--

$$\sum_{i=1}^{n} \frac{Si}{S} * Entropy(Si) \text{...........(1)}$$

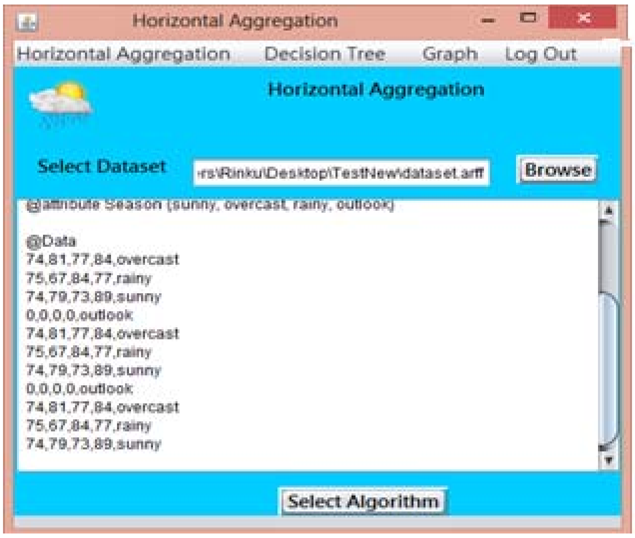
With:
{S1,... Si,… Sn} = partitions of S according to values of Attribute A
n = number of attributes A
|Si| = number of cases in the partition Si
|S| = total number of cases in S
While entropy is gotten by formula 2 given as below:

$$\text{Entropy(S)} = \sum_{i=1}^{n} - pi * \log_2 \text{pi..................(2)}$$

With:
S : Case Set
n : number of cases in the partition S
pi : Proportion of Si to S

- **Tool used**

Weka tool was developed at the University of Waikato in New Zealand. It is most popular. Weka is a set of machine learning algorithms for data mining tasks. Weka include tools for classification (e.g. KNN, C4.5 Decision Tree, Neural Networks), data pre-processing (e.g. Data Filters), clustering, association rules, and visualization etc. Input data in the Weka tool is in the form .arff format. This tool is an open source data in Java. Generally, WEKA tool apply on the given dataset it consists Relation attributes, data sections. he frame looks like below in fig .4



-rs\Rinku\Desktop\TestNew\dataset.arff

```
@attribute Season {sunny, overcast, rainy, outlook}

@Data
74,81,77,84,overcast
75,67,84,77,rainy
74,79,73,89,sunny
0,0,0,0,outlook
74,81,77,84,overcast
75,67,84,77,rainy
74,79,73,89,sunny
0,0,0,0,outlook
74,81,77,84,overcast
75,67,84,77,rainy
74,79,73,89,sunny
```

Figure 3: Decision Tree Data

After that select the frame choose the algorithm and WEKA tool to visualize the decision tree.

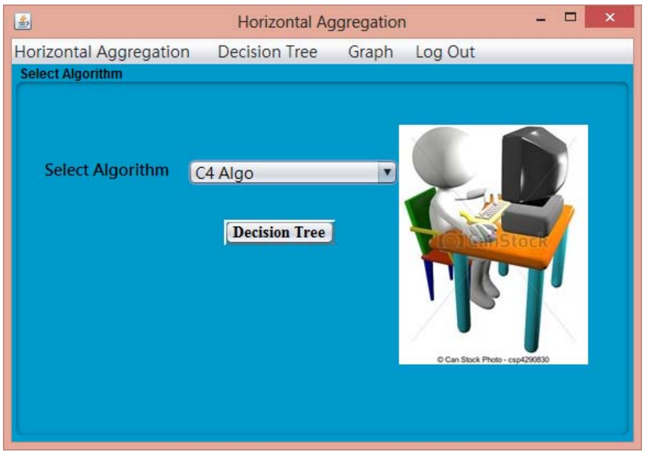
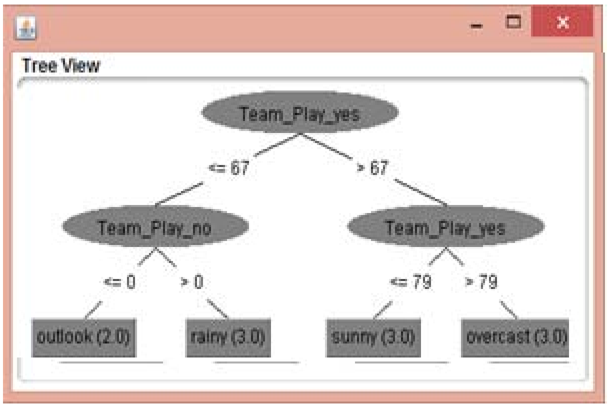


Figure 4: Select Algorithm after Selecting Algorithm

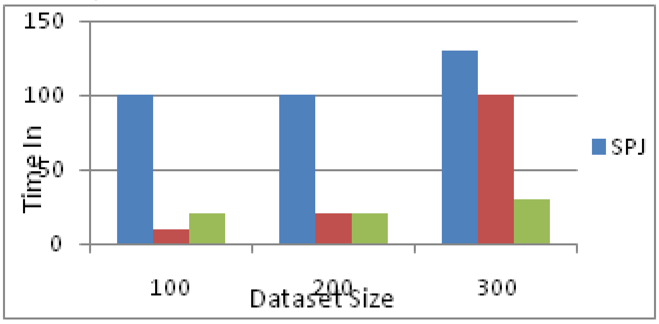
Decision tree is generated by using C4.5 algorithm in WEKA tool as follows:



There is search time comparison in between SPJ, CASE and PIVOT methods. Search time is calculated in millisecond.

Dataset size	100	200	300
SPJ	100	100	100
CASE	10	20	100
PIVOT	20	20	30

Time to get result (in milliseconds)



7. Conclusion and Future Scope

This paper presents methods to support horizontal aggregation through Structured Query languages (SQL) queries in RDBMS. This paper achieves horizontal aggregation through some constructs joining tables, complex queries, SQL queries. The fundamental methods SPJ, CASE and PIVOT are used to estimate horizontal aggregation in SQL to prepare datasets. It gives equivalence results by using SPJ, CASE and PIVOT methods practically and this result is capable for data mining operations. But it is very time consuming task. CASE and PIVOT methods much better than SPJ method. So, proposed plan works on this prepared datasets and the decision tree is generated by using C4.5 algorithm in WEKA. Model built by C4.5 algorithm is require less time than that of ID3 algorithm. Memory used for storing C4.5 Dataset is comparatively less than ID3.In future, use of C4.5 algorithm will helps to decrease time limit required for building model of a particular dataset and also it require less memory to store its Datasets.

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