

# **PREDICTING FRAUDULENT FINANCIAL STATEMENTS USING SEMANTICS**

## **PRESENTED BY**

### **GUIDED BY**

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# MOTIVATION

- To improve foreign/corporate investments by identifying trust factor of companies from investor's perspective.

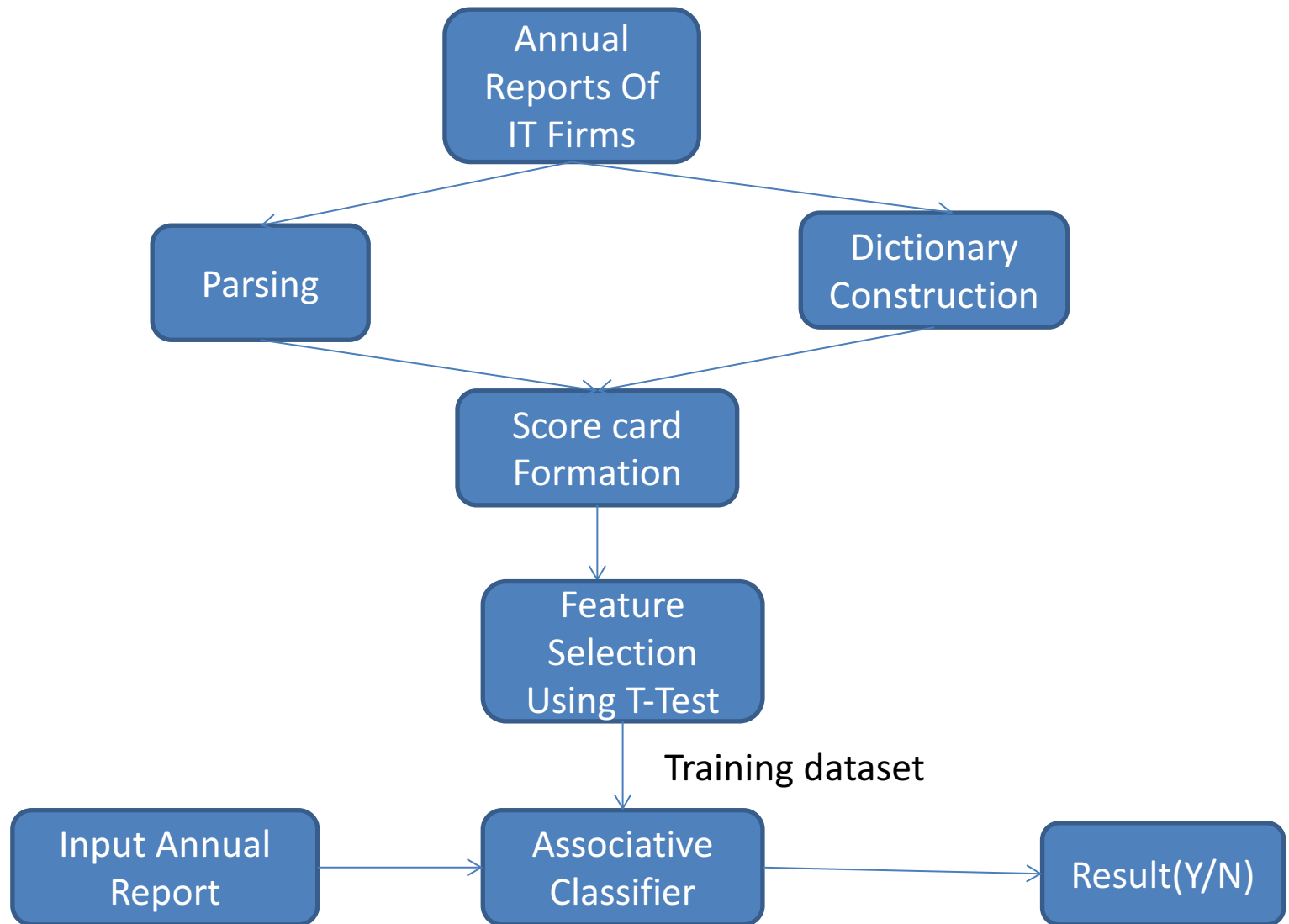
# OBJECTIVE

- Finding fraudulent data provided by companies
- Helping customers in identifying the status of the company based on its annual reports

# NEED FOR THE PROJECT

- Effective business analytical tools
- Extract insight of corporate data
- Deliver higher level of efficiency and profit

# Proposed methodology



# Implementation

Collection of annual reports of firms:

- Available in PDF format.

Identification of keywords:

- The keywords required for Dictionary are identified

# Contd.,

## GOVERNANCE PARAMETERS:

- Board matters
- Nomination matters
- Remuneration matters
- Audit matters
- Communication

# Contd.,

Score card formation:

- Annual Report is parsed using PDF Parser.
- Score is assigned based on dictionary.

T-Test Evaluation:

- T-value is calculated as follows

$$t = (m1 - m2) / SD$$

where m1, m2 = mean of sample1 and sample2 respectively

SD = Standard Deviation

- Feature selection is done.



# Contd.,

- Associative Classification :
  - Association Rule Mining + Classification.
- Associative classification involves 2 stages
  - Generation of Class Association Rules (CAR) from training dataset.
  - Classification of test dataset into predefined class labels.

# Screen shots

Score card-2003.xls [Compatibility Mode] - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Add-Ins

Clipboard: Paste, Cut, Copy, Format Painter

Font: Calibri, 11, Bold, Italic, Underline, Text Color, Background Color

Alignment: Wrap Text, Merge & Center

Number: General, Percentage, Decimal places, Rounding

Conditional Formatting, Format as Table

B118 Does the board provide shareholders with quarterly reports on the business and prospects even if it is not r

	A	B	C	D	E	F
1		score card				
2		parameters		score value		
3	1	Statement of Company's philosophy on code of governance		2		
4		<b>BOARD MATTERS</b>				
5	2	Is the frequency of board meetings disclosed?		1		
6	3	Did the board meet at least 4 times in the year?		1		
7	4	Is the aggregate board attendance disclosed?		1		
8	5	Are all directors attending at least 80% of the board meetings?		1		
9	6	Do independent directors constitute more than 1/3 of the board?		1		
10	7	Do independent directors constitute more than 1/2 of the board? - Score 5 if Y and 0 if N		5		
11	8	Is attendance of individual directors at board meetings disclosed?		1		
12	9	Are the type of material transactions that must be approved by the board disclosed?		1		
13	10	Does the company provide training (either in-house or externally) for all of its directors?		1		
14	11	Does the company provide ongoing training (in-house or externally) on issues beyond basic director duties and liabilities?		1		
		Are the details of training provided to directors disclosed? (like number				

# Score card

Book1.xlsx - Microsoft Excel

HomeInsertPage LayoutFormulasDataReviewViewAdd-Ins

Paste

Courier New10.5

**B***I*U

Font

Alignment

General

Number

Conditional Formatting

Format as Table

Cell Styles

Styles

Insert

Delete

Format

Cells

Sort & Filter

Find & Select

Editing

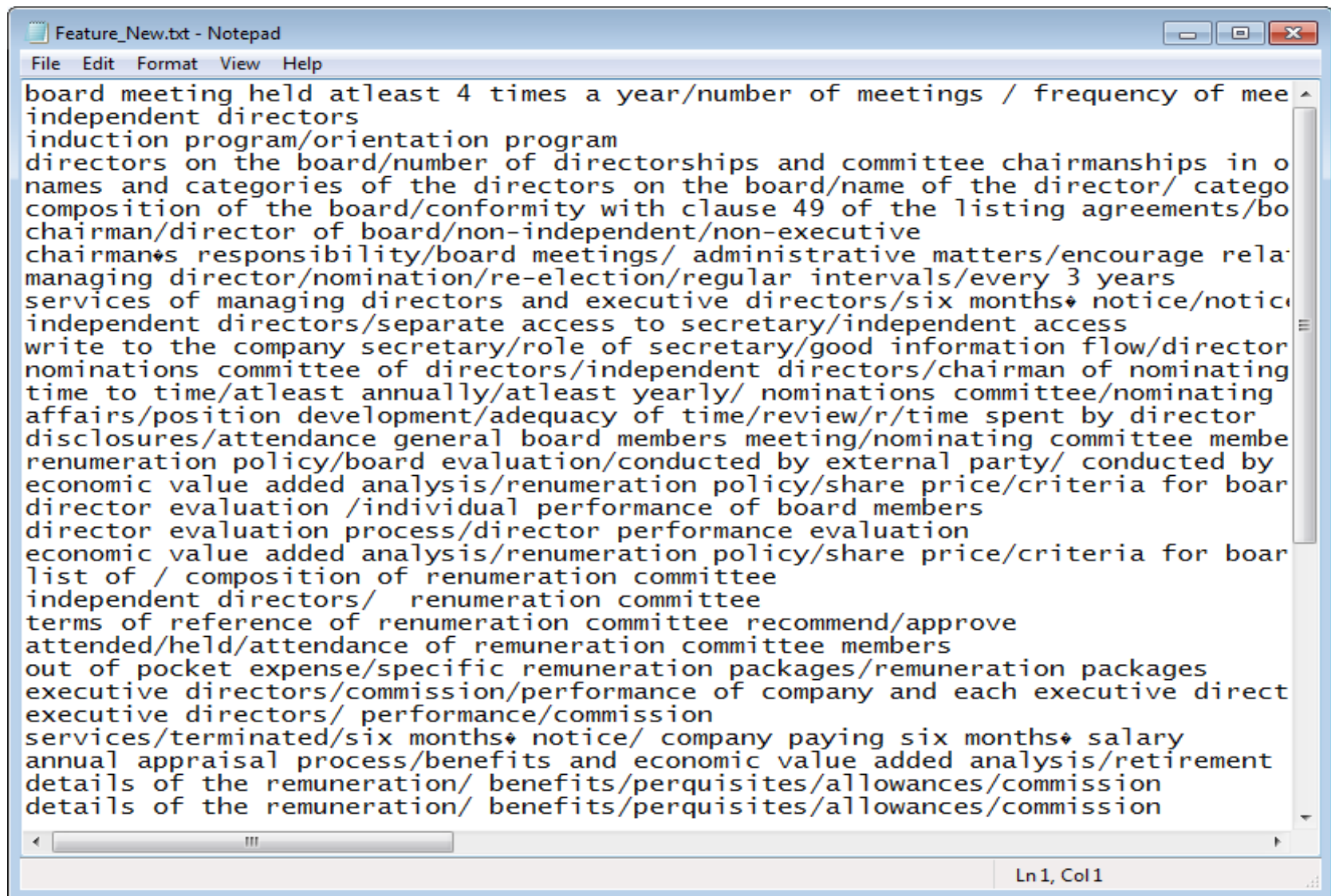
S14fx1

	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	
1	2007-08			2008-09			2009-10			2010-11					
2	WIPRO	TCS	HCL	CTS	WIPRO	TCS	HCL	CTS	WIPRO	TCS	HCL	CTS	WIPRO	TCS	HCL
3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
4															
5	1	1	1	0	1	1	1	0	1	1	1	0	1	1	
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
7	1	1	1	0	1	1	1	0	1	1	1	0	1	1	
8	0	1	1	0	0	1	1	0	1	1	1	0	0	1	
9	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
11	0	1	1	0	0	1	1	0	0	1	1	0	0	1	
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13	1	1	1	0	1	0	1	0	1	0	1	0	0	1	

Sheet1Sheet2Sheet3

Ready100%

# Selected Features



The image shows a Notepad window with the title bar 'Feature\_New.txt - Notepad'. The menu bar includes 'File', 'Edit', 'Format', 'View', and 'Help'. The text area contains a list of features, each on a new line. The features are: board meeting held atleast 4 times a year/number of meetings / frequency of mee, independent directors, induction program/orientation program, directors on the board/number of directorships and committee chairmanships in o, names and categories of the directors on the board/name of the director/ catego, composition of the board/conformity with clause 49 of the listing agreements/bo, chairman/director of board/non-independent/non-executive, chairman's responsibility/board meetings/ administrative matters/encourage rela, managing director/nomination/re-election/regular intervals/every 3 years, services of managing directors and executive directors/six months\* notice/notici, independent directors/separate access to secretary/independent access, write to the company secretary/role of secretary/good information flow/director, nominations committee of directors/independent directors/chairman of nominating, time to time/atleast annually/atleast yearly/ nominations committee/nominating, affairs/position development/adequacy of time/review/r/time spent by director, disclosures/attendance general board members meeting/nominating committee membe, remuneration policy/board evaluation/conducted by external party/ conducted by, economic value added analysis/remuneration policy/share price/criteria for boar, director evaluation /individual performance of board members, director evaluation process/director performance evaluation, economic value added analysis/remuneration policy/share price/criteria for boar, list of / composition of remuneration committee, independent directors/ remuneration committee, terms of reference of remuneration committee recommend/approve, attended/held/attendance of remuneration committee members, out of pocket expense/specific remuneration packages/remuneration packages, executive directors/commission/performance of company and each executive direct, executive directors/ performance/commission, services/terminated/six months\* notice/ company paying six months\* salary, annual appraisal process/benefits and economic value added analysis/retirement, details of the remuneration/ benefits/perquisites/allowances/commission, details of the remuneration/ benefits/perquisites/allowances/commission. The status bar at the bottom right shows 'Ln 1, Col 1'.

```
Feature_New.txt - Notepad
File Edit Format View Help
board meeting held atleast 4 times a year/number of meetings / frequency of mee
independent directors
induction program/orientation program
directors on the board/number of directorships and committee chairmanships in o
names and categories of the directors on the board/name of the director/ catego
composition of the board/conformity with clause 49 of the listing agreements/bo
chairman/director of board/non-independent/non-executive
chairman's responsibility/board meetings/ administrative matters/encourage rela
managing director/nomination/re-election/regular intervals/every 3 years
services of managing directors and executive directors/six months* notice/notici
independent directors/separate access to secretary/independent access
write to the company secretary/role of secretary/good information flow/director
nominations committee of directors/independent directors/chairman of nominating
time to time/atleast annually/atleast yearly/ nominations committee/nominating
affairs/position development/adequacy of time/review/r/time spent by director
disclosures/attendance general board members meeting/nominating committee membe
remuneration policy/board evaluation/conducted by external party/ conducted by
economic value added analysis/remuneration policy/share price/criteria for boar
director evaluation /individual performance of board members
director evaluation process/director performance evaluation
economic value added analysis/remuneration policy/share price/criteria for boar
list of / composition of remuneration committee
independent directors/ remuneration committee
terms of reference of remuneration committee recommend/approve
attended/held/attendance of remuneration committee members
out of pocket expense/specific remuneration packages/remuneration packages
executive directors/commission/performance of company and each executive direct
executive directors/ performance/commission
services/terminated/six months* notice/ company paying six months* salary
annual appraisal process/benefits and economic value added analysis/retirement
details of the remuneration/ benefits/perquisites/allowances/commission
details of the remuneration/ benefits/perquisites/allowances/commission
Ln 1, Col 1
```

# classification

```
Output - MainProject1 (run) ⌘
```

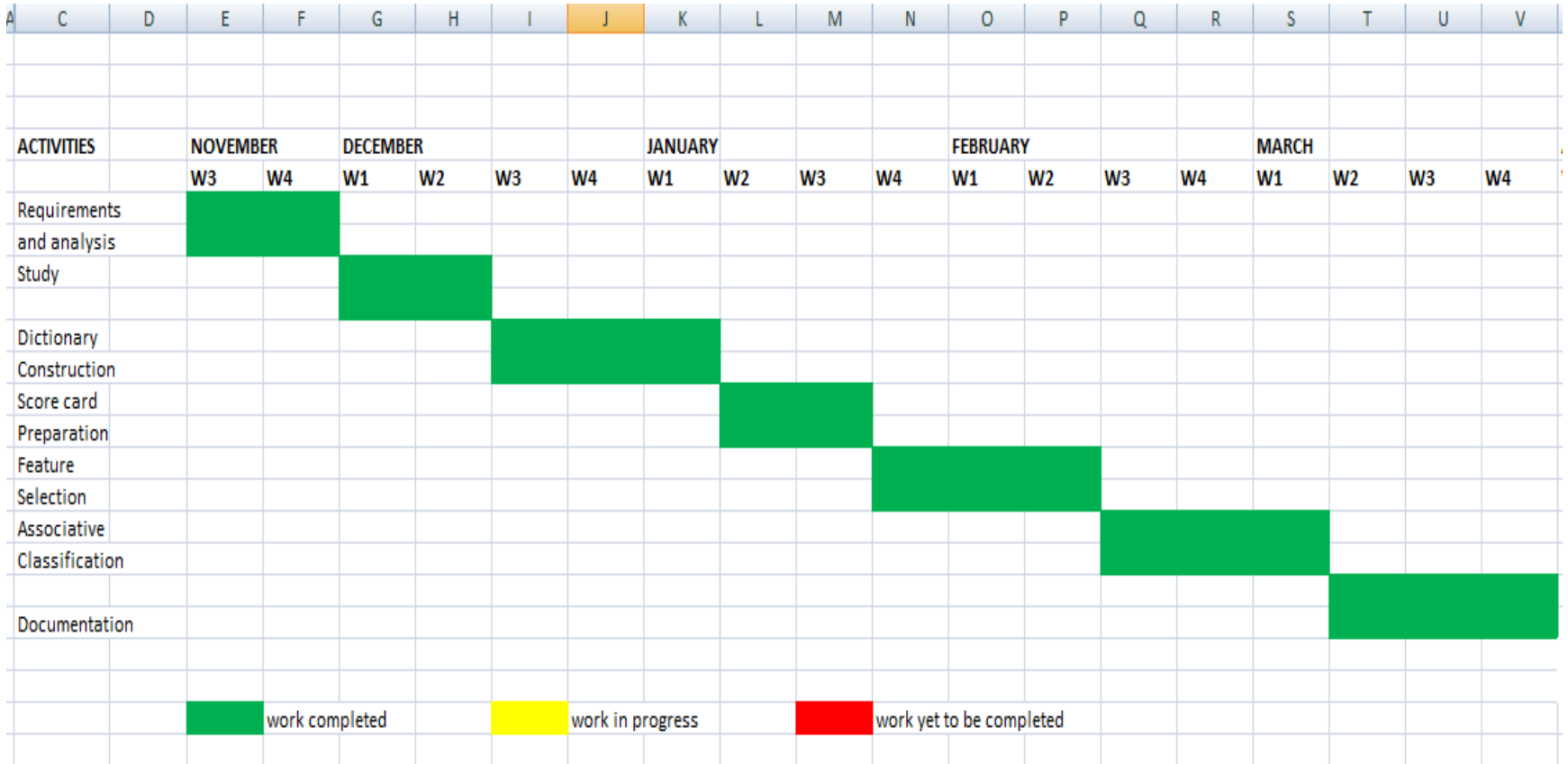
```
run:  
*****Rules*****  
[[[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,  
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 2, 0, 5, 23]  
, [1, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 1, 0, 0, 0, 0, 1  
, 1, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 2, 0, 5, 23]  
], [1, 1, 0, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0,  
1, 1, 0, 0, 1, 1, 1, 1, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 2, 0, 5, 2  
4], [1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,  
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 2, 0, 5,  
23], [1, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 1, 0, 0, 0, 0,  
, 1, 1, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 2, 0, 5,  
24], [1, 1, 0, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,  
0, 1, 1, 0, 0, 1, 1, 1, 1, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 2, 0, 5  
, 24]]  
*****Number Of Rules*****  
6  
  
*****Test_data*****  
[[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,  
1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 2, 0, 5]  
*****RESULT*****  
Given Annual Report is a GOOD One  
BUILD SUCCESSFUL (total time: 0 seconds)
```

# ACCURACY

$$\text{Accuracy} = \frac{\text{Number of correctly predicted test data}}{\text{Total number of test data}}$$

	Accuracy (in percentage)	Number of Rules
Without Feature Selection	75.0	16
With Feature Selection	87.5	16

# Timeline



# ADVANTAGES

- Increased profitability for customers
- Easier way of crediting a firm
- Identify fraudulent statements



# REFERENCES

- “Predicting fraudulent financial statements with machine learning techniques” by Sotiris Kotsiantis , Euaggelos koumanakos, Dimitris Tzelepis and Vasilis Tampakas,2006.
- “Detecting financial statement fraud” by Johan L. Perols ,2008.
- “Prevention and Detection of Financial Statement fraud” by Rajan Gupta, Nasib Singh Gill, 2007.
- (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 3, No. 8, 2012

Thank  
you