Development of a Hospital Financial Analysis System Using Rule-Based Engine

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Abstract

The financial analysis is needed to evaluate efficiency in hospitals. A prototype using rule-based engine was developed and the results of the user evaluation suggested the effectiveness of the system.

Keywords

- Financial Management
- Computer Reasoning
- Rule-Based Engine

Backgrounds

- Financial analysis
  - a method to analyze the financial status of companies
  - used both for external analysis / for internal analysis

- Demand for efficient management to hospitals

  → Demand for financial analysis in hospitals

- Financial analysis system for hospital managers is possible to save cost and time.

↓

Objective

To verify the effectiveness of financial analysis system for hospital managers by developing a prototype system and evaluating it.

Methods(1) - Requirements

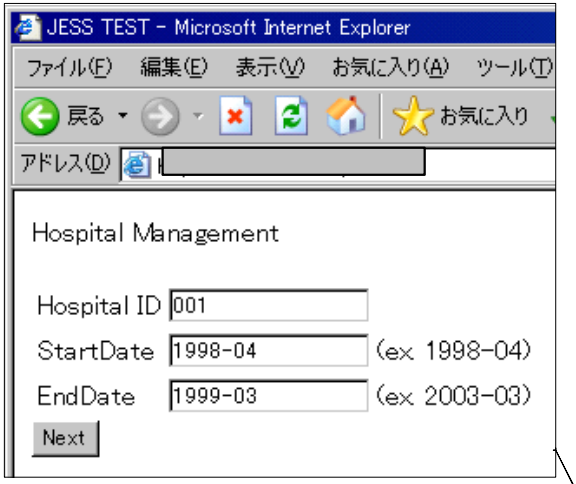
- Mandatory functions
  1) Define indices
  2) Calculate index values
  3) Evaluate index values
  4) Find root cause.

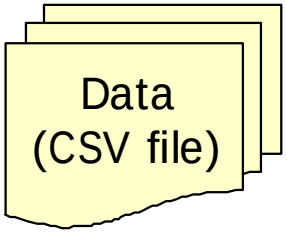
- Development methods
  - Rule-based engine
  - Production system and knowledge representation using frames
  - Forward chaining

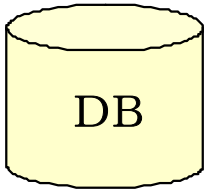
  (from the characteristics of the financial data and financial analysis)

Methods(2) - Prototype System

Input Parameters

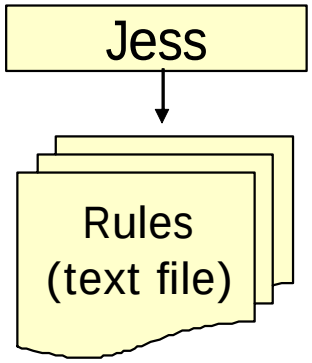


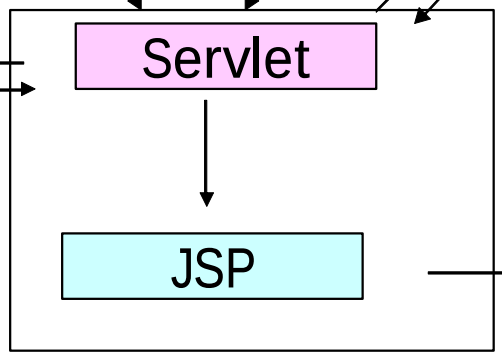




Output Results

Rule-Based Engine





System Output (Examples)

- Financial Indices Evaluation

Viewpoint	Index	Value	Evaluation	Standard	Explanation
Stability	Labor Productivity per person	8,301,128.21	--	-	This index shows ....
Stability	Labor's Share	94.57	NG	60 - 70	This index shows .... When it is too low, it will.... and when it is too high, it will...

- Profit Tree Analysis

Operation profit does not meet the standard because...
=> Operation cost does not meet the standard
Operation Cost does not meet the standard because...
=> Personnel expense does not meet the standard
Personnel expense does not meet the standard because...
=> Personnel expense per labor does not meet the standard

Methods(3) - Evaluation

- Levels of agreements to the analyzed results
  - By 5 end-users (medical doctors)
  - By 5 professional consultants

- Required functions for financial analysis
  - By 5 professional consultants

Evaluation Results
(Levels of Agreement)

	End-users					Consultants				
	1	2	3	4	5	1	2	3	4	5
a. Index items are enough for practical use	0	**2**	**3**	0	0	0	0	**1**	**4**	0
b. election of the index items are reasonable.	0	**2**	**3**	0	0	0	**2**	**2**	**1**	0
c. Evaluation of the index values are reasonable	0	**5**	0	0	0	0	**1**	**4**	0	0
d. Explanation of the evaluation is enough	0	**2**	**2**	**1**	0	0	**1**	**3**	**1**	0
e. From the synthetic viewpoint, the financial status is analyzed.	0	**2**	**3**	0	0	0	0	**2**	**3**	0

[Levels of Agreement] 1: I agree a lot. 2: I agree. 3: I agree a little. 4: I don't agree. 5: I have no idea.

- All Evaluation result by end-users is in the affirmative.
- Evaluation result by consultants is not positive, but not completely negative.

Possibility of hospital financial analysis system using rule-based engine was shown.

Evaluation Results
(Required Functions for Financial Analysis)

#		Number of subjects to check each item
	(Input Data)	
1	Input of non-financial data (ex. years after foundation)	1
2	Input of financial data for longer period	2
	(Output)	
3	More detailed explanations	**3**
4	More variety of representation (ex. graphical interface)	**4**
5	Comprehensive evaluation (not only evaluation of each index)	2
	(Analysis Methods)	
6	Adjustment of standard value by characteristic of hospitals	**4**
7	Evaluation by multiple steps (ex. Good / Fair/ Bad)	2
8	Comparison with best-practice facilities	**4**
9	Analysis over consideration of external environment change	2
	(Others)	
10	Others	2

Discussion

#3 More detailed explanations
#4 More variety of representation (ex. graphical interface)

➡ Additional functions are required for better comprehension.

#6 For adjustment of standard value by characteristics of hospitals
#8 Comparison with best-practice facilities

➡ Additional input data are required.

Ex.
- Years after foundation
- Type of the organization (private / public)
- Size of the organization (number of beds etc.)

Conclusion

- A prototype system for hospital financial analysis using rule-based engine was developed.
- Possibility of hospital financial analysis system using rule-based engine was shown.
- It is suggested to add :
  - More functions for better comprehension
  - More input data for adjustment of standard value by characteristic of hospitals and for comparison with best-practice facilities

By equipping those functions and data...

It is expected to increase end-users' satisfaction and to reach the level enough for practical use.

- References

[1] Ernest Friedman-Hill: JESS IN ACTION Rule-Based Systems in Java, MANNING, 2003.

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