Chapter: 5

A Rule Based Inference Engine for Document Selection

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5.1 Introduction

The expert system that has been build for the present work is modeled on similar lines to that of MYCIN. In MYCIN the system asks the patient a number of questions with regard to the presence or absence of various symptoms. Once the system gathers the information about various symptoms it invokes the inference engine and concludes as these are the symptoms the patient is suffering from a particular disease. The present system also asks its user various questions with regard to relevance of the title, its coverage and various other questions and assigns values to the choices made by the users. Once the choices and values against each choice is gathered the system computes the total score assigned to a particular title and finally infers whether the title should be procured on first priority or second priority or third priority.

5.2 Questions the Expert System Poses

To arrive at conclusions the following questions are put forward to the user.

The score against each value is given in parenthesis.

Q1 To which subject the document belongs to?

Q2 Is the document inter disciplinary? (1 for yes and 0 for no)

Q3 If yes what is the focus of the document?
   a Main subject (3)
   b Sub subject (2)
   c Applied aspect (1)
Q4 How is the document related?
   a Directly supports the program (23)
   b Supports the institutional emphasis (22)
   c Major field of scholarship (21)
   d Ancillary to the programs (14)
   e Specialized topic (13)
   f Minor field of scholarship (12)
   g Reference book (11)
   h Tangential to the programs (2)
   i Marginal area of scholarship (1)

Q5 How is the subject matter arranged?
   a General to specific (3)
   b General work (2)
   c Narrowly focused work (1)

Q6 What kind of source material the document is?
   a Primary (3)
   b Secondary (2)
   c Tertiary (1)

Q7 Is the document support the
   a Ongoing teaching (3)
   b Ongoing research (2)
   c Future projected area (1)

Q8 Define the intellectual content of the document?
   a Key work in the field (20)
   b Key author (19)
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c  Major critical study (18)
d  Substantial new contribution to learning (17)
e  General essays (12)
f  Narrowly focused work (11)
g  Narrow intellectual perspective (10)
h  Popular treatment (9)
i  Raw or unedited material (4)
j  Marginal work (3)
k  Trivial literature (2)
l  Propaganda literature (1)

Q9 How is the author of the document rated?
 a  Well known author (3)
b  Key author (2)
c  Less / unknown author (1)

Q10 Who is the target user of the document?
 a  Students (3)
b  Research scholars (2)
c  Faculty members (1)
d  Others (0)

Q11 Expected average percentage of users
 a  Less than 10% (1)
b  More than 10% (2)

Q12 How is the document rated for use?
 a  Known research area (16)
b  User request based on need (15)
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- Need based on known interest (14)
- General interest (9)
- Recommended by the patron without specific need (8)
- Immediate use unlikely (7)
- Background reading (3)
- Presents problems of accessibility (2)
- Infrequent use (1)

Q13 Who is the publisher of the document?
- Distinguished publisher (14)
- Significant sponsoring body (13)
- Specialized publisher of high quality (12)
- Major trade publisher (11)
- Popular publisher (9)
- Specialized publisher (8)
- Less know publisher (7)
- Unknown publisher (6)

Q14 What is the nature of publication?
- Published theses (5)
- Research report (4)
- Collection of papers (3)
- Working papers (2)
- Pamphlets / Ephemera (1)

Q15 What is the date of publication?
- Latest (3)
- Less than 3 year old (2)
- More than 3 year old (1)
Q16 Is the existing collection sufficient to support teaching and research in the core area?
   a Yes (2)
   b No (1)

Q17 If yes do you want to further strengthen the core area?
   a Yes (2)
   b No (1)

Q18 How is the document compared with the existing collection in the library?
   a Central to the existing collection (10)
   b Closely related (9)
   c Necessary for intellectual integrity (8)
   d Good series (7)
   e Develops existing collection strengths (5)
   f Historical collection strength (4)
   g Additional copies required (3)
   h Completes a series serial and set (2)
   i Very specialized material (1)
   j Unrelated material (0)

5.3 Features of the Expert System

   a) The system presents the questions in a sequence along with the possible choices
   b) In case of yes/no questions the system may skip asking some questions
c) Depending on the user's answers the system assigns values
d) The system computes the total value of the score
e) The system uses inference mechanism to make suggestions to the decision makers
f) The system is not GUI based. Though its main emphasis is on the proof of concept and to develop a computational model for document selection it is fairly user friendly

5 4 Explanation of the PROLOG Code

The basic code the system uses to present questions along with possible answers is

\[
q5 \leftarrow \\
\text{repeat} \\
\text{nl nl} \\
\text{write( Q5 How is the subject matter arranged? ) nl nl} \\
\text{write( 1 General to specific ) nl} \\
\text{write( 2 General work ) nl} \\
\text{write( 3 Narrowly focused work ) nl nl} \\
\text{write( Enter one of the numbers )} \\
\text{read_line(0 Ans)} \\
\text{int_text(Ansi Ans)} \\
\text{check_answer(Ansi 1 3)} \\
\text{score(q5 Ansi)} \\
q6
\]

The above predicate \( q5 \) is mnemonically indicates that it is the fifth question. The head of the predicate is accordingly given the name \( q5 \). In the body, the clauses after the \text{repeat} clause is meant to present the same question if the user enters a wrong answer which is out of range of the possible values. The next line merely prints to blank lines so that the output is not cluttered. The next line actually presents the question to the user. The following three lines print various choices of which one of the choices should be made by the user. The \text{read_line} clause read the answer of the user. As PROLOG reads the ASCII values of the user input
it requires to be converted into an integer value. The predicate `int_text` performs the conversion. The `check_answer` predicate checks the user's answer against the minimum value (the second argument) and the maximum value (the third argument). The `score` predicate assigns a value against each answer in order to compute the final value arrived after answering all the questions. The last clause branches out the flow of the program to the next question.

As the predicates `check_answer` and `score` are not built-in predicates and are defined by the present system, both require further explanation.

The `check_answer` deals with two types of question viz., yes/no type and multiple choices. As the user may enter either capital or small letter for the yes/no questions and as the system input mechanism takes the ASCII values of the letters, the following predicates checks whether the user's answer is `N` (ASCII value 78) or `Y` (89) or `n` (110) or `y` (121).

```prolog
check_answer(Ans) :-
    (Ans = 78)
    (Ans = 89)
    (Ans = 110)
    Ans = 121
```

If the user enters none of the acceptable answers, the expert system prints an error message using the following clauses:

```prolog
check_answer(_) :-
    nl nl
    write( ERROR Please enter either y or Y or n or N ). nl
    fail
```

However, in case of multiple choice questions, the system uses `check_answer` with three arguments or `arity` in PROLOG parlance. The first argument is the actual user's choice, whereas the second and third
arguments are the minimum and maximum values acceptable by the system respectively.

\[
\text{check\_answer}(\text{Ans Min Max}) - \\
\text{Ans} \geq \text{Min} \\
\text{Ans} \leq \text{Max}
\]

If the user's choice does not fall in between the minimum and maximum values, the system prints an error message and forces failure, which means to PROLOG that the question should be asked again.

\[
\text{check\_answer}(\_ \text{Min Max}) - \\
\text{nl nl} \\
\text{write( ERROR Enter Values between) } \\
\text{write( Min) } \\
\text{write( and) } \\
\text{write(Max) nl} \\
fail
\]

Once an acceptable value is gathered from the user, the system attempts to assign score to the user's choice using the following score predicate.

\[
\text{score(q5 1)} - \text{count(3)} \\
\text{score(q5 2)} - \text{count(2)} \\
\text{score(q5 3)} - \text{count(1)}
\]

The first argument of the score predicate tells for which question it is meant. The above example indicates that it is dealing with the fifth question. The second argument consists of one of the choices. The body of the predicate invokes the count predicate. In other words, if the user choice is 1, the count(3) predicate gets invoked; if it is 2, the count(2) predicates get invoked. The argument of the count predicate actually contains the score that should be assigned in order to compute the final value.

The count predicate is given below.

\[
\text{count}(P) - \\
\text{recorded(ans Points R)} \\
\text{Score is Points + P} \\
\text{erase(R)} \\
\text{recorda(ans Score _)}
\]
As PROLOG does not have assignment operator we need to store the values using the `record` built-in predicate and recall the values of the previous question using the `recorded` predicate. The second line of the body computer to total values of the questions thus far answered (Score is Points + P) and erases from the internal databases the values of the previous question.

The final step of the program is to use rule base to arrive at the suggestions to the user. As the Maximum total value is 113 the system normalizes it to hundred using the following `print_answers` predicate:

```prolog
print_answers -
    recorded(ans A R),
    nl, write( The total score is ) P is (100 * 112)/113
    statement(P),
    erase(R),
    fail
print_answers
```

The following three statement predicates are meant to print the suggestions to the user depending the total computed value by the system which is in a way serves as the rules of the present expert system. The codes implements the following rules:

Rule 1 If the total values is more than 67 the title should be acquired on First priority

Rule 2 If the total value is less than 67 and greater than 33 the title should be acquired on second priority.
Rule 3 if the total value is below 33 the title is only of last priority

statement(P) -
    recorded(subject Subject R)
    nl nl nl
    write( The title belongs to the subject ) write(Subject) nl nl
    erase(R)
    write( The total score is ) write(P) nl
    P > 67
    write( As the title receives more than 67 points ) nl
    write( it ranks to be of 1st priority ) nl

statement(P) -
    P > 33
    P < 67
    write( As the title receives more than 33 and less than 67 points ) nl
    write( it ranks to be of 2nd priority ) nl

statement(P) -
    P > 1
    P < 34
    write( As the title receives more than 1 and less than 34 points ) nl
    write( it ranks to be of 3rd priority ) nl

5.5 Complete PROLOG Source Code of the Expert System

main -
    eraseall(ans)
    eraseall(ans1)
    eraseall(subject)
    q1

--- Following are questions along with the possible answers ---

q1 -
    nl nl
    write( Q1 To which subject the document belongs to? ) nl
    read_line(0 Ans)
    recorda(subject Ans _)
    q2
q1 - q2
q2 -
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nl nl
write( Q2 Is the document inter-disciplinary? (y/n) )
get0(Ans)
check_answer(Ans)
score(q2 Ans)
q3

q3 - recorded(ans 1 R)
repeat
nl nl
write( Q3 If YES What is the focus of the document? ) nl nl
write( 1 Main Subject ) nl
write( 2 Sub-Subject ) nl
write( 3 Applied Subject ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 3)
score(q3 Ans1)
q4

q3 - q4

q4 -
repeat
nl nl
write( Q4 How is the document related? ) nl nl
write( 1 Directly supports the program ) nl
write( 2 Supports the institutional emphasis ) nl
write( 3 Major field of scholarship ) nl
write( 4 Ancillary to the programs ) nl
write( 5 Specialized topic ) nl
write( 6 Minor field of scholarship ) nl
write( 7 Reference book ) nl
write( 8 Tangential to the programs ) nl
write( 9 Marginal area of scholarship ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 9)
score(q4 Ans1)
q5

q5 -
repeat
nl nl
write( Q5 How is the subject matter arranged? ) nl nl
write( 1 General to specific ) nl
write( 2 General work ) nl
write( 3 Narrowly focused work ) nl nl
write( Enter one of the numbers )
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read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 3)
score(q5 Ans1)
q6

q6 -
repeat
nl nl
write( Q6 What kind of source material the document is? ) nl nl
write( 1 Primary ) nl
write( 2 Secondary ) nl
write( 3 Tertiary ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 3)
score(q6 Ans1)
q7

q7 -
repeat
nl nl
write( Q7 Is the document support the ) nl nl
write( 1 Ongoing teaching ) nl
write( 2 Ongoing research ) nl
write( 3 Future projected area ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 3)
score(q7 Ans1)
q8

q8 -
repeat
nl nl
write( Q8 Define the intellectual content of the document? ) nl nl
write( 1 Key work in the field ) nl
write( 2 Key author ) nl
write( 3 Major critical study ) nl
write( 4 Substantial new contribution to learning ) nl
write( 5 General essays ) nl
write( 6 Narrowly focused work ) nl
write( 7 Narrow intellectual perspective ) nl
write( 8 Popular treatment ) nl
write( 9 Raw or unedited material ) nl
write( 10 Marginal work ) nl
write( 11 Trivial literature ) nl
write( 12 Propaganda literature ) nl nl
write( Enter one of the numbers )
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read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 12)
score(q8 Ans1)
q9

q9 -
repeat
nl nl
write( Q9 How is the author of the document rated? ) nl nl
write( 1 Well known author ) nl
write( 2 Key author ) nl
write( 3 Less / unknown author ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 3)
score(q9 Ans1)
q10

q10 -
repeat
nl nl
write( Q10 Who is the target user of the document? ) nl nl
write( 1 Students ) nl
write( 2 Research scholars ) nl
write( 3 Faculty members ) nl
write( 4 Others ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 4)
score(q10 Ans1)
q11

q11 -
repeat
nl nl
write( Q11 Expected average percentage of users ) nl nl
write( 1 Less than 10- ) nl
write( 2 More than 10- ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 2)
score(q11 Ans1)
q12

q12 -
repeat
nl nl
write( Q12 How is the document rated for use? ) nl nl
write( 1 Known research area ) nl
write( 2 User request based on need ) nl
write( 3 Need based on known interest ) nl
write( 4 General interest ) nl
write( 5 Recommended by the patron without specific need ) nl
write( 6 Immediate use unlikely ) nl
write( 7 Background reading ) nl
write( 8 Presents problems of accessibility ) nl
write( 9 Infrequent use ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 9)
score(q12 Ans1)
q13

q13 -
repeat
nl nl
write( Q13 Who is the publisher of the document? ) nl nl
write( 1 Distinguished publisher ) nl
write( 2 Significant sponsoring body ) nl
write( 3 Specialized publisher of high quality ) nl
write( 4 Major trade publisher ) nl
write( 5 Popular publisher ) nl
write( 6 Specialized publisher ) nl
write( 7 Less know publisher ) nl
write( 8 Unknown publisher ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 8)
score(q13 Ans1)
q14

q14 -
repeat
nl nl
write( Q14 What is the nature of publication? ) nl nl
write( 1 Published theses ) nl
write( 2 Research report ) nl
write( 3 Collection of papers ) nl
write( 4 Working papers ) nl
write( 5 Pamphlets / Ephemera ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 5)
score(q14 Ans1)
q15
q15 -
repeat
nl nl
write( Q15 What is the date of publication? ) nl nl
write( 1 Latest ) nl
write( 2 Less than 3 year old ) nl
write( 3 More than 3 year old ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 3)
score(q15 Ans1)
q16

q16 -
repeat
nl nl
write( Q16 Is the existing collection sufficient to support teaching and research in the core area? ) nl nl
write( 1 Yes ) nl
write( 2 No ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 2)
score(q16 Ans1)
q17

q17 -
recorded(ans 1 _)
repeat
nl nl
write( Q17 If yes do you want to further strengthen the core area? ) nl nl
write( 1 Yes ) nl
write( 2 No ) nl nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 2)
score(q17 Ans1)
q18

q17 - q18

q18 -
repeat
nl nl
write( Q18 How is the document compared with the existing collection in the library? ) nl nl
write( 1 Central to the existing collection ) nl
write( 2 Closely related ) nl
write( 3 Necessary for intellectual integrity ) nl
write( 4 Good series ) nl
write( 5 Develops existing collection strengths ) nl
write( 6 Historical collection strength ) nl
write( 7 Additional copies required ) nl
write( 8 Completes a series serial and set ) nl
write( 9 Very specialized material ) nl
write( Enter one of the numbers )
read_line(0 Ans)
int_text(Ans1 Ans)
check_answer(Ans1 1 10)
score(q18 Ans1)
print_answers

SCORES
---
--- For each question depending on the choice the system
--- the system assigns scores
---
score(q2 89) - recorda(ans 1 _)
score(q2 121) - recorda(ans 1 _)
score(q2 78) - recorda(ans 0 _)
score(q2 110) - recorda(ans 0 _)
score(q3 1) - count(3)
score(q3 2) - count(2)
score(q3 3) - count(1)
score(q4 1) - count(23)
score(q4 2) - count(22)
score(q4 3) - count(21)
score(q4 4) - count(14)
score(q4 5) - count(13)
score(q4 6) - count(12)
score(q4 7) - count(11)
score(q4 8) - count(2)
score(q4 9) - count(1)
score(q5 1) - count(3)
score(q5 2) - count(2)
score(q5 3) - count(1)
score(q6 1) - count(3)
score(q6 2) - count(2)
score(q6 3) - count(1)
score(q7 1) - count(3)
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<th>Count</th>
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<td>2</td>
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<tr>
<td>q7 3</td>
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<td>1</td>
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<td>q8 1</td>
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</table>
score(q15 1) - count(3)
score(q15 2) - count(2)
score(q15 3) - count(1)

score(q16 1) - count(1)    recorded(ansl 1 __)
score(q16 2) - count(0)    recorded(ansl 0 __)

score(q17 1) - count(1)
score(q17 2) - count(0)

score(q18 1) - count(10)
score(q18 2) - count(9)
score(q18 3) - count(8)
score(q18 4) - count(7)
score(q18 5) - count(5)
score(q18 6) - count(4)
score(q18 7) - count(3)
score(q18 8) - count(2)
score(q18 9) - count(1)
score(q18 10) - count(0)

count(P) -
    recorded(ans Points R)
    Score is Points + P
    erase(R)
    recorded(ans Score __)

print_answers -
    recorded(ans A R)
    nl write( The total score is ) P is (100 * A)/114
    statement(P)
    erase(R)
    fail
print_answers

statement(P) -
    recorded(subject Subject R)
    nl nl nl
    write( The title belongs to the subject )
    write(Subject) nl nl
    erase(R)
    write( The total score is ) write(P) nl
    P > 67
    write( As the title receives more than 67 points ) nl
    write( it ranks to be of 1st priority ) nl

statement(P) -
P > 33
P < 67
write( As the title receives more than 33 and less than 67 points ) nl
write( it ranks to be of 2st priority ) nl
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statement(P) -
  P > 1
  P < 34
  write( As the title receives more than 1 and less than 34 points ) nl
  write( it ranks to be of 2st priority ) nl

--- The following predicates validates the choices made---
--- by the user ---
--- If required prints an error message ---

check_answer(Ans) -
  (Ans = 78)
  (Ans = 89)
  (Ans = 110)
  Ans = 121

check_answer(Ans Min Max) -
  Ans >= Min
  Ans <= Max

check_answer(_ Min Max) -
  ' nl nl
  write( ERROR Enter Values between ) nl
  write(Min)
  write( and ) nl
  write(Max) nl
  fail

5.6 Conclusion

The above expert system has been tested on a large number of titles and produced the acceptable answers. The suggestions made by the inference mechanism of the system are in conformity with the expectations for which it has been modeled. A model interactive session is presented in the Appendix.
5.7 References

1 ADSHEAD (D.) Towards an expert system designing knowledge based program for teaching Russian at all levels. *Journal of the American Society for Information Science* 4(2) 1991 pp 34–42


4 AMBA (S.) Expert system a literature review. *Library Science with a Slant to Documentation* 25(2) 1988 pp 112–129

5 BAILEY (Charls W.) and FADELL (Jeff) ‘The Indian expert system a knowledge based system to assist users to select index. *Reference Librarian* 17(4) 1989 pp 19–28


7 BORROW (D G.) and WINOUGARD (J.) An Overview of KRL a Knowledge Representation Language. *Cognitive Science* 1 1977 pp 3–46

8 BRAJNIK (Guida) and TASSO An Expert Interface for Effective Man Machine Interaction (L Bolc and M Jarke [eds]) *Cooperative
Chapter 5 A rule based inference engine

Interfaces to Information Systems Springer Verlag Berlin FRG 1986 pp 259 – 308

9 CLOCKSIN (W F) and MELLISH (C S) Programming in Prolog 3rd rev ext ed Narosa Publishing House New Delhi 1993

10 DEBROWER (AMY M) and JONES (Deanna T) Application of expert system to collection development donation processing in a special library Library Software Review 10 (6) 1991 pp 384 – 389

11 GAZDAR (G) and MELLISH (C) Natural language processing in prolog and introduction to computational linguistics Addison-Wesley New York 1989 504 p


13 MINSKY (Marvin) A Frame for Presenting Knowledge Psychology of Computer Vision (Winston P H [ed]) McGraw Hill New York 1975

14 NEWELL (A) Heuristics programming III structured problems Progress in Operation Research (J Aronofsky [ed]) Vol 3 John Willey New York 1969

15 THE ARITY Prolog Compiler/interpreter version 6 1 1992 Arity Corporation Massachusettus
Chapter 5 A rule based inference engine

16 VICKERY (A) BROOKS (H M) ROBINSON (B A) STEPHENS (J) and VICKERY (B C) Expert system for referral
British Library 1988 233 p


18 WINSTON (Patrick Henry) Artificial intelligence 2nd ed Addison Wisley 1984