

BLOOD GROUPS MATCHER FRAME WORK BASED ON THREE -LEVEL RULES IN MYANMAR

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Abstract

Today Blood donation is a global interest for world to be survival lives when people are in trouble because of natural disaster. The system provides the ability how to decide to donate the blood according to the rules for blood donation not to meet the physicians. In this system, there are three main parts to accept blood from donors when they want to donate according to the features like personal health. The application facilitates to negotiate between blood donors and patients who need to get blood seriously on page without going to Blood Banks and waiting time in queue there.

Keywords

Decision Table, Decision Tree, Feature, Knowledge

1. INTRODUCTION

Any application uses a web browser as a client and also known as web-application. The application is popular due to the ubiquity of web browsers. And convenience of using a web browser as a client sometimes called a thin client. Common web applications include web mail, online retail sales, online auctions and many other functions. Methods frequently used for knowledge representation are: Rule-based Knowledge, Frame-based Knowledge, Semantic Network, Logic theory and Ontology theory. Among the types of knowledge based methods, Rule-based Knowledge is the most usual use expressive method. Rule-based systems should expose in a comprehensible way knowledge hidden in data, And provide logical justification for drawing conclusions, showing possible inconsistencies and avoiding unpredictable conclusions.

Sets of rules are useful if rules are not too numerous, comprehensible, and have sufficiently high accuracy. Rules are used to support decision making in classification, regression and association tasks. In Rule-based systems various forms of rules that allow expression of different types of knowledge are used. They are Classical Propositional Logic Rules(C-rules), Association Rules (A-rules), Fuzzy Logic Rules (F-rules), M-of-N or Threshold Rules(T-rules), and Similarity or Prototype-based Rules (P-rules). Among of these rules, classical propositional logic rules provide the simplest and most comprehensible way of expressing knowledge. Arguments and conclusion are logical functions that may take two values, true or false [1-4].

2. BACKGROUND THEORY

2.1. Web-based Matcher Frame Work

Web-based matcher is a web-based application. There are three types of members – blood matcher, blood donors and patients. Blood donors and patients represent as clients of Web-based Matcher. Blood matcher acts as server to match donors and patient pair compatibly by using rule-based knowledge. Firstly blood matcher has to save legal information from blood donor by using rules based features. There are three parts of features for blood donors; these are serious features, major features and minor features of blood donors. Moreover, blood matcher regards the period of blood donation for blood donor. And also specify the donation period for donor. Sometimes patients can match with their blood group and sometimes they do not match with their blood group [3] [4]. At that time blood matcher can give all of information not only symmetric blood group but also other blood groups which can be received. The blood matcher can give blood information to patient by using blood types matching table.

2.2. Rules based Blood Donor Specifications

Knowledge is a theoretical or practical understanding of a subject or a domain. In general, may system like as our system, the area of the domain may be limited. The domain expert is a skilful person who can do things with the strong experience in a particular domain. Rule-based knowledge method is frequently used for knowledge representation. And it is the most usual use expressive method.

The first, the most extensively developed models of decision making for the blood matcher is rule based system. In the proposed system classically; rely on extensive interviewing techniques in order to extract the blood acceptance knowledge from the domain expert to blood donors.

Then the system use with blood type tables which is composed of functional blood types pattern from blood donors for patients. And then the system also control the period of blood donors' acceptances blood information for the next donation, eligible blood within time period by using expire date of blood. Therefore in generally, the system blood matcher control for blood donor major three parts of categories such as categories for Blood Donors (interview section), periods rules and blood types matching tables [5].

2.2.1. Blood Matching Rules

In this system, blood matching rules are divided to two main parts. These are consultation questions for Donors and Periods matching Rules and Blood Type Matching Table. In consultation questions part, Blood Matching rules are used with rule set for donor conditions, decision tree, decision tables. And then period matching rules and blood type matching rules are handled by system date time and blood type formula table. These rules are continuing explain the next sections [6] [7].

2.3. Decision Tree for Blood Donors

The form or cast for the blood donors is composed with three parts of interview sections. These are serious features (Part A), major features (Part B) and minor features (Part C). All of the portion of blood donation Part A, B and C the decision tree and decision table will be used to

decide the acceptance the donation of blood donor. The decision tree for the blood donation stage is as shown in the Figure 1.

The system makes a list of attributes that are measured to produce the rule set. The decision tree for blood donor is a binary tree. A binary tree is an ordered tree such that each son of a node (condition) is distinguished either as a left son (condition) or as a right son (condition), and no node has more than one left son (condition) nor more than one right son (condition). Ordered tree is a tree in which the sons of each node are ordered (normally from left to right).

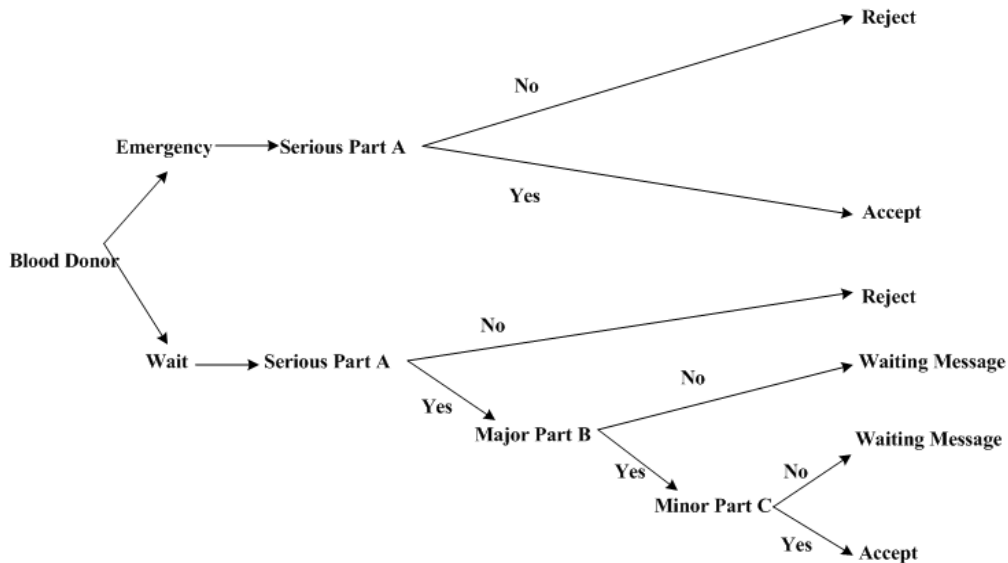


Figure 1. Decision Tree for Blood Donor

2.3.1. Rule Set for Serious Part A

According the part serious Part A of decision tree as shown in the Figure 3.1, the rule set is produced for blood donor. Both of rules upon conditionN and conclusion (action) of rules are Boolean type {yes, no} and the example of rule set representation is as shown in the following:

IF Condition1 (X) AND Condition2 (X)AND ConditionN (X)
Then Conclusion(X)

Example

condition1 = Have you had a serious illness or major surgery in the past?
 condition2 = Have you ever injected yourself with drugs?
 condition3 = Did you have hepatitis after your 11th birthday?
 IF condition1(X) AND condition2(X) AND condition3(X)
 THEN conclusion(X)
 IF condition1= 'no' AND condition2= 'no' AND condition3= 'no'
 THEN blood is accepted
 ELSE blood is rejected

Therefore condition X is boolean {yes,no} and also conclusion X is boolean value{accepted, rejected}.

2.3.2. Rule Set for Major Part B

When the serious Part A rule set was completed and passed, the donor will examine with rule set for Major Part B. In this part the donor condition depends on the result of Part A. And this part has Boolean type rules {yes, no} upon conditionN. But the conclusions (actions) are not Boolean type which depends on conditions' result of rules.

IF condition1(X) OR condition2(X) OR ... conditionN(X) THEN conclusion(Xn)

e.g., condition1 = Have you often visited a doctor or dentist?

condition2 = Have you suffered from diarrhea in last week?

condition3 = Have you had a tattoo in the last four months?

IF condition1 =yes OR condition2 = yes OR condition3 = yes

THEN reply message 1 or 2 or 3

ELSE IF condition1= no OR condition2=no OR condition3=yes

THEN reply message3

ELSE IF condition1=no OR condition2= yes OR condition3=yes

THEN reply message2 or 3

ELSE IF condition1=yes OR condition2=no OR condition3=no

THEN reply message1

ELSE IF condition1=yes OR condition2=yes OR condition3=no

THEN reply message1 or 2

ELSE blood is accepted

The merge rule sets of two parts are :

IF condition1(X) THEN conclusion(X) Part A is complete

IF step1 is complete AND condition2(X) THEN conclusion(X)

e.g., condition1 = Accept Blood by Part A?

condition 2 = Accept Blood by Part B?

IF condition1 = "yes" THEN donor is accepted Part A is complete

IF Part A is complete AND condition2 = "yes" THEN donor is accepted

IF Part A is complete AND condition2= "no" THEN donor is reply message

2.3.3. Rule Set for Minor Part C

When both upper two Parts were completed and passed, the donor will examine with rule set for Minor Part C. In this part the donor condition depends on the results of both Part A and B. And this part has Boolean type {yes, no} rules upon conditionN. But the rules upon conclusionN (actions) are not Boolean type which depends on conditions' result of rules. There is only an accept action and no reject action. Instate of reject action the reply message action which is the combination of wait state and acceptable action.

2.4. Decision Tables for Blood Matching

In this section, blood donor will be passed in the check of binary decision tree and decision table rules. The serious part A has the n condition and the binary result. And other two parts are not binary results. The tables are composed of 4 parts: conditions, actions, condition alternatives (each column is a rule), and actions for the rules.

2.4.1. Serious Conditions (Part A) and Decision Table for Blood Donor

The decision table is drawn from the above decision tree. The rules set is passed on conditions or features and drawn the boolean action. The decision table of the serious Part A is as shown in

Table 3.1 which has serious conditions are questions of the system to donors. The actions are boolean type according to the rules upon conditions. Donors should never donate blood if their answers meet with one of the following conditions.

1. Have you ever had hepatitis A or B or C?
2. Have you ever suffered from one or more of the following diseases – Heart Disease, Lung Disease, Kidney Disease, Abnormal Bleeding Tendency, Allergic Disease, Asthma, Tuberculosis?
3. Have you ever injected yourself with drugs?
4. Are you at risk for exposure to HIV, the virus that causes AIDS?

Table 1. Decision Table for Serious Part A

Conditions	Rules														
Question1	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	N
Question2	Y	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	N		N
Question3	Y	Y	Y	N	Y	Y	Y	N	N	N	Y	Y	Y		N
Question4	Y	Y	N	Y	Y	Y	N	N	Y	Y	Y	N	Y		N
Action															
Accept	X														
Reject		X	X	X	X	X	X	X	X	X	X	X	X	X	X

There are n conditions and each has a binary result, then there will be 2ⁿ columns. Last, add rows on the bottom of the table for each response. But the action is depend on the all of conditions alternatives are true then the blood will be accepted, otherwise reject.

Determine the same action if there are different conditions (columns) that have the same rules. If so, determine if these are rules that are identical except for one condition and for that one condition, all possible values of this condition are present in the rules in these columns. Except one rule that all conditions alternatives are true, other rules are rejected. Therefore the table can be drawn as following Table 2.

Table 2. Optimize Decision Table for Part A

Conditions	Rules	
Question1	Y	-
Question2	Y	-
Question3	Y	-
Question4	Y	-
Action		
Accept	X	
Reject		X

2.4.2. Major Conditions (Part B) and Decision Table for Blood Donor

In this part, the rules set is passed on conditions or features and drawn the boolean action. The conditions and actions table of the major Part B is as shown in Table 3 which has major conditions are questions of the system to donors. The actions are also Boolean type according to

the rules upon conditions. Donors should donate blood if their answers meet with all of the following conditions as shown in Table 3. The decision table for these conditions and actions are shown in the Table 4.

There are n conditions and each has a binary result, then there will be 2^n columns. Last, add rows on the bottom of the table for each response. Determine the same action if there are different conditions (columns) that have the same rules.

2.4.3. Minor Conditions (Part C) and Decision Table for Blood Donor

In this minor conditions part C, the conditions are optional. If the donor answer this questions correctly, the system calculates the accept date and reply message to donor.

The decision table for these conditions and actions are shown in the Table 6. There are n conditions and each has a binary result, then there will be 2^n columns. Last, add rows on the bottom of the table for each response.

Determine the same action if there are different conditions (columns) that have the same rules. Although the decision table makes actions with condition attributes, the condition can absent which are optional. The last column of the decision table is no answer for all conditions but the system accepts the donor. When the different conditions conclude as the same action, then the different conditions of different rules can be merged as the same rule for these different conditions.

2.5. Periods Rules for Blood Matching

The blood matcher handle the period of donations for donors. The periods rules is the donor must wait at least 16 weeks between donations of whole blood. And expire date for the donated blood until 16 weeks. The donor must fill for donation request form for next time donation which will become 16 weeks later of before donated time. Moreover the donors must obey not only the serious part (Part A) rules for accept or reject but also the major part (Part B) periods rules for waiting yearly or monthly. But Part(C) is optional.

2.6. Blood Types Matching Table

The donor's blood type must be determined if the blood will be used for transfusions. The collecting agency usually identifies whether the blood is type A, B, AB or O and the donor's Rh(D) type and will screen for antibodies to less common antigens. More testing, including a crossmatch, is usually done before a transfusion. Group O is often cited as the "universal donor" but this only refers to red cell transfusions. For plasma transfusions the system is reversed and AB is the universal donor type.

Blood types become very important when a blood transfusion is necessary. In a blood transfusion, a patient must receive a blood type that is compatible with his or her own blood type—that is, the donated blood must be accepted by the patient's own blood. If the blood types are not compatible, red blood cells will clump together, making clots that can block blood vessels and cause death.

Type O- blood is considered the "universal donor" because it can be donated to people of any blood type. Type AB+ blood is considered the "universal recipient" because people with this type can receive any blood type. The blood type matching is as shown in the Table 4.

Table 4. Decision Table for Major

Conditions	Rules																
Question1	T	F	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Question2	T	T	F	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Question3	T	T	T	F	T	T	T	T	T	T	T	T	T	T	T	T	T
Question4	T	T	T	T	F	T	T	T	T	T	T	T	T	T	T	T	T
Question 5	T	T	T	T	T	F	T	T	T	T	T	T	T	T	T	T	T
Question6	T	T	T	T	T	T	F	T	T	T	T	T	T	T	T	T	T
Question7	T	T	T	T	T	T	T	F	T	T	T	T	T	T	T	T	T
Question8	T	T	T	T	T	T	T	T	F	T	T	T	T	T	T	T	T
Question9	T	T	T	T	T	T	T	T	T	F	T	T	T	T	T	T	T
Question10	T	T	T	T	T	T	T	T	T	T	F	T	T	T	T	T	T
Question11	T	T	T	T	T	T	T	T	T	T	T	F	T	T	T	T	T
Question12	T	T	T	T	T	T	T	T	T	T	T	T	F	T	T	T	T
Question13	T	T	T	T	T	T	T	T	T	T	T	T	T	F	T	T	T
Question14	T	T	T	T	T	T	T	T	T	T	T	T	T	T	F	T	T
Question15	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	F	T
Question16	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	F
Question17	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	F
Action																	
Accept	X																
Try 18 yrs		X															
Haemoglobin 12.5g/dL			X														
wait (1) year					X			X								X	X
6 months wait							X										X
check malaria									X								
check HIV, Hepatits A,B,C				X		X				X	X	X		X	X		
check syphilis													X				

Table 6. Decision Table for Minor

Conditions	Rules											
Question1	T	F	T	T	T	T	T	T	T	T	T	F
Question2	T	T	F	T	T	T	T	T	T	T	T	F
Question3	T	T	T	F	T	T	T	T	T	T	T	F
Question4	T	T	T	T	F	T	T	T	T	T	T	F
Question 5	T	T	T	T	T	F	T	T	T	T	T	F
Question 6	T	T	T	T	T	T	F	T	T	T	T	F
Question 7	T	T	T	T	T	T	T	F	T	T	T	F
Question 8	T	T	T	T	T	T	T	T	F	T	T	F
Question 9	T	T	T	T	T	T	T	T	T	F	T	F
Question 10	T	T	T	T	T	T	T	T	T	T	F	F
Wait 3 weeks		X										
Wait 2 weeks			X									
Wait 1 week				X	X						X	
Wait 1 day						X	X					
Accept	X							X	X	X		X

Table 7. Blood Type Matching Table

Blood Type	You Can Give Blood To (for Donor)	You Can Receive Blood From (for Patient)
A+	A+ , AB+	A+ , A- , O+ , O-
O+	O+ , A+ , B+ , AB+	O+ , O-
B+	B+ , AB+	B+ , B- , O+ , O-
AB+	AB+	Everyone
A-	A+ , A- , AB+ , AB-	A- , O-
O-	Everyone	O-
B-	B+ , B- , AB+ , AB-	B- , O-
AB-	AB+ , AB-	AB- , A- , B- , O-

3. SYSTEM FLOW DIAGRAM FOR DONOR

The diagram as shown Figure 2 explains the donor role and processes for his/her data to the system. First of all, the donor's verification process assumes has been finished. Then the donor put his/her information into the system. The system acquires the donor with knowledge rules which are developed by the blood matcher. If the donor can pass three parts of acquisitions of the system such as Part A, Part B and Part C, then the compounder accept the donor's information with his/her profile. If the donor failed when he/she enter the Serious Part A acquisitions, then the donor must be rejected from the system.

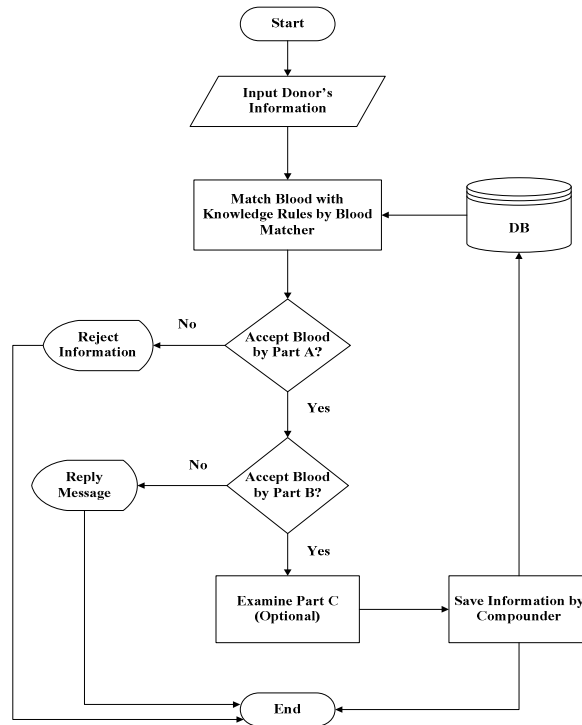


Figure 2. System Flow Diagram for Donor

4. SYSTEM FLOW DIAGRAM FOR PATIENT

The System Flow Diagram for Patient as shown in Figure 4 shows how the patient can get his/her desire blood from the matcher. First Patient gives his/her information and blood type to the compounder. The compounder saves his/her information to makes the match process.

Type	You Can Give Blood To	You Can Receive Blood From
A+	A+ / AB+	A+ / A- / O+ / O-
O+	O+ / A+ / B+ / AB+	O+ / O-
B+	B+ / AB+	B+ / B- / O+ / O-
AB+	AB+	Everyone
A-	A+ / A- / AB+ / AB-	A- / O-
O-	Everyone	O-
		AB- / A- / B- / O-

Please fill Following Facts if you want to get blood from blood donor by matching our Blood Donation System.

Patient Name : HninPhyu
 Password : hnin
 Patient EMail : hninphyu@gmail.com
 ID card Number : 10/MN(N)009888 * 13/MYM(N)123456
 Blood Type : A B
 Submit

Figure 3. Patient and Donor Blood Match Table

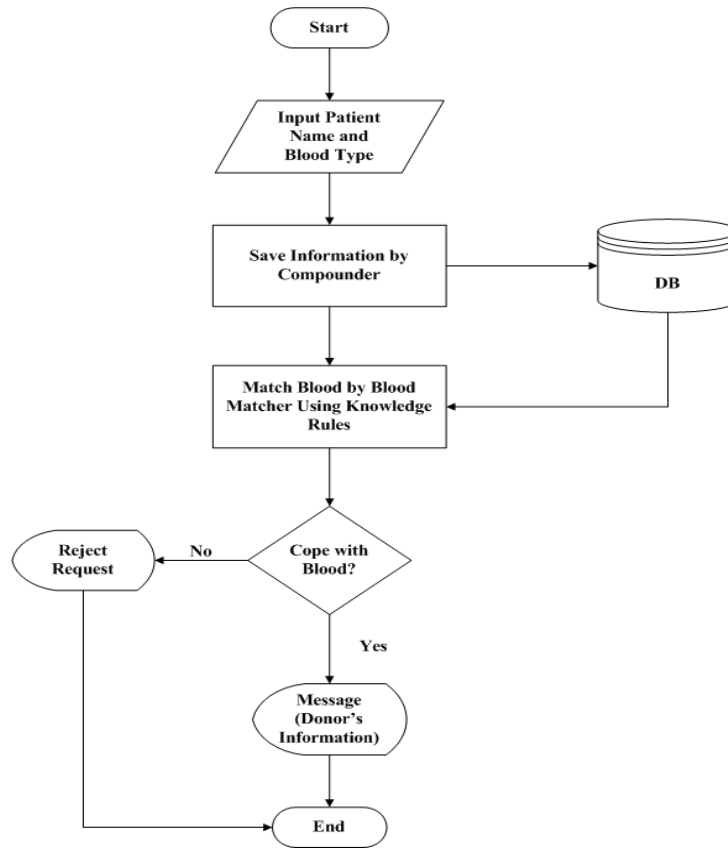


Figure 4. System Flow Diagram for Patient

The patient is rejected or the patient rejects his/herself from system when he/she did not meet with his/her blood type. But the patient can reenter to the system by using his/her profile such as name, password and blood type on the next day. When the patient can match with donor who is included in matching list of blood matcher the system display donor information to the patient.

5. CONCLUSION

This matcher can act Blood Banks that save information about their donors and alarm their health to be care when they access this application. Also this system educates what are needed to be a blood donor. People who are ready to donate their blood can search online every time to support patients needed blood seriously.

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