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Attribution Reduction Algorithm Based on Improved Binary Dicernibility Matrix

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Abstract: In order to reduce the time and space complexity of algorithm for attribute reduction based on discernibility matrix, and make it can deal directly with inconsistent decision-making system. A modificatory Binary discernibility matrix and attribution reduction algorithm based on binary dicernibility matrix are proposed. An ordering and the simple link in the algorithm have been increased. So reduce the size of the table. An example is used to illustrate the efficiency of the new algorithm, which can reduce the amount of computation and storage space.

Keywords: Binary Dicernibility Matrix ,Attribution Reduction, Rough set,Complexity

1. Introduction

Attribution reduction algorithm based on binary dicernibility matrix [1~6] is one of important attribute reductions Based on rough set,Many attribute reduction and the expansion of the work is on this basis [7-10].But,this method only applies to the compatibility decision table,Inconsistent decision table will get the error result of reduction.To overcome this inapplicability of distinction matrix definition to inconsistent decision tables,References presented a new concept of discernibility matrix of decision table,And discussed its nature.But,Of the inconsistent decision tables, in accordance with the references [7] the definition of matrix will have many redundant information,affect calculation of reduction,And reduction of these algorithms is not high quality.To improve the efficiency reduction,This paper presents an improved binary discernibility matrix attribute reduction algorithm.

2. The basic concept of rough set

To introduce improved binary discernibility matrix attribute reduction algorithm, we introduce some concepts of the following：

Definition 1：For a given decision-making systemS=(U, C∪D, V, f),reduction of condition attribute set C is a non-empty subset of C ——P. It meets：

① $\forall a \in P$, Can not be omitted by D

② $POS_p(D) = POS_c(D)$

Claimed :P is a reduction of C,the set of all reduction of C denoted RED(C).

By the reduction of the definition, every decision-making system reduction may have several, but reduction is equivalent,that is say they have the same classification ability. The reduction of nuclear is the most important attribute set, which includes all of the reduction. Definition 2：Identification of matrix is Proposed by Skowron Professor.System of decision-making table S=(U, R, V, f),R=PYD is the set of attributes,subset $P=\{a_i \mid i=1, 2, \ldots, m\}$and D={d} Are called condition attributes set and decision attribute

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set,U={X_1, X_2, …, X_n} Is the domain,ak(x_j) is the sample x_j's value on the property a_k.C_D(i,j)denotes dicernibility matrix the i row j column element, defined as the identification matrix $C_D$is：

$$C_D(i,j)=\begin{cases}\{a_k \mid a_k \in p \Lambda a_k(x_i) \neq a_k(x_j)\}, d(x_i) \neq d(x_j);\\ 0, d(x_i)=d(x_j);\end{cases}$$

Among i,j=1, 2, …, *n*.

Recognition based on improved binary matrix attribute reduction algorithm based on discernibility matrix and make up logical combination of attribute reduction algorithm can only consistent decision table attribute reduction of the shortcomings of the two types of consistent and inconsistent decision tables to arrive at a correct result of attribute reduction

3. Reduction Algorithm of based on the Combination of Discernibility Matrix and Logic Operation

We introduced the concept of discernibility matrix,discernibility matrix based on indiscernibility relation is one of the tools used in rough set knowledge discovery,It can be used to pad missing values、reduct attributes、reduct rules and so on.References [11] introduced reduction algorithm of based on the combination of discernibility matrix and logic operation.

Step 1: From the relevant definitions in this chapter , calculate the discernibility matrix of decision tableC_D.

Step 2: for all elements of non-zero value, non-empty sets C_{ij} in the discernibility matrix, establish the relative disjunctive logic expression L_{ij}, $L_{ij}=\bigvee_{a_i \in C_{ij}} L_{ij}$.

Step 3: operate conjunctively all the disjunctive logical expression,get a conjunctive Paradigm L, $L=\bigwedge_{C_{ij}\neq 0, C_{ij}\neq \Phi} L_{ij}$.

Step 4: convert conjunctive paradigm into disjunctive Paradigm , $L'=\bigvee_i L_i$.

Step 5: output attribute reduction results.

In disjunctive Paradigm each item on the conjunction corresponds to a result of attribute reduction,attributes contained in each conjunction item formed condition attributes set after reduction.

4. Attribute Reduction Algorithm based on Improved Binary Dicernibility Matrix

analysis of algorithms：First of all, scan the line of binary discernibility matrix,Obtain nuclear properties. If a row is only one element 1, then with the elements of a column where the corresponding property of the nuclear properties that must be included in the attribute reduction. Followed by scanning the binary discernibility matrix of the column, find the maximum number of elements in a column. Here elements of each column to measure the properties of a number of importance, a number of the more, the corresponding decision table the column attribute for the contribution of the overall classification ability of the larger, more important the attribute. When the two a number of the same, to the column where the value of a property line of a number of add, the smallest of the property taken and the most important attribute, because the number of lines can also be a measure of the importance of property When the line of a smaller number that can distinguish between two instances of the line corresponds to the properties of the less so that the more important of these properties. Then, from the binary discernibility matrix M by deleting the selected elements in one column and the corresponding line of the column, the remainder constitute a recognition of a new binary matrix. Repeat the above steps until M is empty. All the columns selected in turn constitutes an attribute reduction.

5. Analysis

To compare reduction algorithm of based on the combination of discernibility matrix and logic operation with attribute reduction algorithm based on improved binary dicernibility matrix, the following gives an example to illustrate：

TABLE 1 A DECISION-MAKING SYSTEM

condition attribute				decision attribute
the field	a	b	c	d
1	3	3	3	2
2	3	3	1	3
3	3	3	0	3
4	2	3	3	2
5	2	2	1	2
6	2	3	0	3
7	2	2	1	3
8	2	3	0	2

As can be seen from the table, rule d5|C=d7|C, but d5|D≠d7|D,d6|C=d8|C, but d6|D≠d8|D,So the decision table is inconsistent decision tables.U/{a}={{1,2,3},{4,5,6,7,8}},U/{b}={{1,2,3,4,6,8},{5,7}}, U/{c}={{1,4},{2,5,7},{3,6,8}},U/C={{1},{2},{3},{4},{5,7},{6,8}},U/{a,b}={{1,2,3},{4,6,8},{5,7}},U/{a, c}={{1},{2},{3},{4},{6,8},{5,7}},U/{ b,c}={{1,4},{2},{3,6,8},{5,7}},U/D={{1,4,5,8},{2,3,6,7}}

$POS_{(C)}(D)$={{1},{2},{3},{4}},$POS_{\{a,b\}}(D)=\phi \neq POS_{(C)}(D)$,$POS_{\{a,c\}}(D)$={{1},{2},{3},{4}} $=POS_{(C)}(D)$,$POS_{\{b,c\}}(D)$={{1,4},{2}}$\neq POS_{(C)}(D)$,$POS_{\{a\}}(D)=\phi \neq POS(C)(D)$,$POS_{\{b\}}(D)=\phi \neq POS_{(C)}(D)$,$POS_{\{c\}}(D)$={1,4}$\neq POS_{(C)}(D)$

so{a,c} is the reduction of decision system Shown in Table 1,so nuclear is{a,c}too.

Table 1 shows the decision-making systems, its discernibility matrix:

$$\begin{bmatrix} & & & & & & \\ c & & & & & & \\ c & 0 & & & & & \\ 0 & ac & ac & & & & \\ 0 & ab & c & 0 & & & \\ ac & 0 & 0 & c & bc & & \\ abc & 0 & 0 & c & \phi & 0 & \\ 0 & ac & a & 0 & 0 & \phi & bc \end{bmatrix}$$

There is empty element in the matrix ,so we can judge that it is inconsistent decision-making system.for all elements of non-zero value, non-empty sets in the discernibility matrix, establish the relative disjunctive logic expression L, $L = c \wedge c \wedge (a \vee c) \wedge (a \vee b \vee c) \wedge (a \vee c) \cdots (b \vee c)$,Transforme L, get a conjunctive Paradigm $L' = (b \vee a) \wedge (b \vee c)$ shall be the result of attribute reduction table.Compare with Z.PawlakReduction algorithm results, Reference[11] Pointed out that the matrix and logic operations based on identification with combined reduction is obtained Nenggoudedao Decision Table may attribute reduction Jieguoxianran Bu Cheng Li, Fenxi because it can only Chuliyizhi decision Ji Tong, and when the property of a larger number of traverse Quanbu of property portfolio with a higher time complexity. So this paper, a recognition based on improved binary matrix attribute reduction algorithm can directly deal with inconsistent decision-making system, and attribute reduction algorithm reduces the complexity, according to the improved binary discernibility matrix attribute reduction algorithm is known,

$$X = \begin{vmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \end{vmatrix}$$

So we get the results of the attribute reduction {a,c}.

6. The Innovation of This Paper

1. converte into a binary matrix identification identification matrix, can be seen more clearly on the decision table for each property classification ability of the contribution, the importance of the size of the property.

2. Recognition based on improved binary matrix attribute reduction algorithm based on discernibility matrix and make up logical combination of attribute reduction algorithm can only consistent decision table attribute reduction of the shortcomings of the two types of consistent and inconsistent decision tables to arrive at a correct result of attribute reduction.

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