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APPLICATION OF NORMAL PARAMETER REDUCTION OF SOFT SETS IN DECISION MAKING

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ABSTRACT

In this paper we discuss normal parameter reduction of Soft sets and we apply the normal parameter reduction algorithm to decision making problem of choosing a better smart phone which are available in Indian market.

INTRODUCTION

Soft set theory is mathematical tool for dealing with uncertainties which is free from the inadequacy of the parameterization tools, which was first proposed by D.Molodstov [5] in 1999. Soft set theory has rich potential for applications in several directions such as data mining, decision making, data analysis, game theory few of which had been shown by Molodstov in his pioneer work. This theory is very convenient and easy to apply. In lots of applications, information and knowledge is stored and represented in an information table, where a set of objects is described by a set of attributes. Using the entire attribute set for describing the property is time consuming and constructed rules may be difficult to understand and apply or verify. In order to deal with this problem, attribute reduction is required. The objective of attribute reduction is to reduce the number of attributes and at the same time, preserve the property of information.
Degang Chen, E.C.C. Tsang, DanielS, Yeung, Xizhao Wang have discussed the parameterization reduction of Soft sets and its applications. P.K.Maji, A.R.Roy has given an application of Soft sets in Decision making problem. Kong Z, Gao. L, Wang ssL, and Li S have given the normal parameter reduction of soft sets and its algorithm.
In the present paper we discuss the daily life problem of buying a mobile phone as per our needs solved by normal parameter reduction method.

PRELIMINARIES

2.1 DEFINITION [5].Soft set
Let U be an universe and E be a set of parameters.
Let P (U) denote the power set of U and A be a non-empty subset of E. A pair (F, A) is called a soft set over U, where F is a mapping given by F: A → P(U). In other words, a soft set over U is a parameterized family of subsets of the universe U. For ε ∈A, F (ε) may be considered as the set of ε-elements of the soft set (F, A) or as the set of ε-approximate elements of the soft set. Clearly, a soft set is not a (crisp) set.

EXAMPLE:
Suppose the following.
U is the set of houses under consideration.
U= $\{h_1, h_2, h_3, h_4, h_5, h_6, h_7, h_8, h_9, h_{10}\}$
E is the set of parameters (each parameter is a word or sentence)
E= {expensive, beautiful, wooden, cheap, modern, in good repair, in bad repair}
In this case a soft set means to point out expensive houses, beautiful houses, wooden houses and so on.
The soft set (F, E) describes the attractiveness of the houses.

2.2 DEFINITION [5] Soft subset
For two soft sets (F, A) and (G, B) over a common universe U, we say that

(F, A) is a soft subset of (G, B) if
(i)A ⊂ B**,** and
(ii) For all ε ∈ A, F(ε) and G(ε) are identical approximations.
We write (F, A) ⊂(G, B).
(F, A) is said to be a soft super set of (G, B), if (G, B) is a soft subset of (F, A). We denote it by
by (F, A) ⊃ (G, B).

2.3 DEFINITION [5] Equality of Two Soft sets
Two soft sets (F, A) and (G, B) over a common universe U are said to be soft equal if (F, A) is a soft subset of (G, B) and (G, B) is a soft subset of (F, A).

2.4 DEFINITION. [5] Value Class
The class of all value sets of a soft set (F, E) is called value-class of the soft set and is denoted by $C_{(F,E)}$
Clearly $C_{(F,E)} \subseteq P(U)$

2.5 DEFINITION. [5] Reduce of Knowledge
A reduce of knowledge is its essential part, which suffices to define all basic concepts occurring in the considered knowledge.

2.6 A NEW EFFICIENT NORMAL PARAMETER REDUCTION ALGORITHM (NENPR)[1]
Here for soft set (F, E), U={$h_1, h_2 \ldots . h_n$} and E={$e_1, e_2, \ldots \ldots, e_m$ }
Define $h_{ij}$is an entry in the table of (F, E). For $e_j \in$ E, if
$h_{1j} = h_{2j} = \cdots \ldots . = h_{nj} = 0$ or $h_{1j} = h_{2j} = \cdots \ldots . = h_{nj} = 1$ we denote
e_j as e_j^0 and e_j^1 respectively.

NENPR ALGORITHM:

(1)Input the Soft set (F, E) and the parameter set E
(2) If there exists e_j^0 *and* e_j^1, they will be put into the reduced parameter set denoted by C and a new Soft set (F, E') will be established without e_j^0 *and* e_j^1, where U={$h_1, h_2 \ldots . h_n$}, E'={$e_{1'}, e_{2'}, e_{3'}, \ldots \ldots, e_{i'}$}
(3)For the soft set (F, E'), Calculate S($e_{j'}$) of $e_{j'}$(that is oriented-parameter sum), for j′=1′,2′…..t′
(4)Find the subset A⊂ E' in which S_A is the multiple of |U|, then put A into a candidate parameter reduction set.
(5)Check every A in the candidate parameter reduction set, if $f_A(h_1) = f_A(h_2) = \ldots\ldots = f_A(h_n)$, it will be kept; otherwise it will be omitted.
(6)Find the maximum cardinality of A in the candidate parameter reduction set, then E-A-C as the optimal parameter reduction.

REAL LIFE APPLICATION OF NENPR ALGORITHM:

The mobile phone data is obtained from www.gsmarena.com which is online mobile website. From this website we have collected information of various mobiles such as xiomi redmi1s, Moto E, Galaxy star, Lava iris 400s, Samsung z, Sony Xperia T3, Samsung Galaxy S5,Moto G, Gionee Elife E7 etc based on the parameters Dual sim, Screen size, Operating system version, Internal storage, RAM, Camera capacity, Front camera, Battery capacity, WLAN Facility, Price.
For the parameter dual sim and WLAN Yes=1,No=0 and for Screen size greater equal to 5 inch is defined as 1 otherwise 0, OS Version is having updated than v4.0 then 1 otherwise 0, Internal storage ≥ 10 GB then defined as 1 , < 10 GB is defined as 0,RAM greater than equal to 1GB is 1 less than it is 0, Camera capacity if greater by 10 mega pixel considered as 1 if less will be 0,Front camera capacity greater equal by 5 mega pixel is defined to be 1 otherwise 0, Battery capacity if greater than equal to 2000mah then defined as 1 otherwise 0, lastly for price ranging between 3900-10000 is defined as 1 and greater than 10000 is 0.
Thus the universe set U={$m_1, m_2, m_3, \ldots . m_9$} ={ xiomi redmi1s, Moto E, Galaxy star, Lava iris 400s, Samsung z, Sony Xperia T3, Samsung Galaxy S5, Moto G ,Gionee Elife E7} and parameter set
E= {$e_1, e_2, e_3, \ldots \ldots e_{10}$}

= {Dual sim, Screen size, Operating system version, internal storage, RAM, Camera capacity, Front camera, Battery capacity, WLAN Facility, Price}

PROBLEM

Suppose Mr.X wants to buy low price mobile with dual sim facility, good RAM storage and battery capacity among the universal set and Mr.Y wants to buy high price mobile with quiet good internal storage, camera capacity and with front camera.
The tabular representation of a Soft set for mobile phone data set is as shown in Table 1

Table1

U/E	e_1	e_2	e_3	e_4	e_5	e_6	e_7	e_8	e_9	e_{10}	f(.)
m_1	1	0	1	0	1	0	0	1	1	1	6
m_2	1	0	1	0	1	0	0	0	1	1	5
m_3	1	0	1	0	0	0	0	0	1	1	4
m_4	1	0	1	0	0	0	0	0	1	1	4
m_5	1	0	0	1	1	0	0	1	1	0	5
m_6	0	1	1	0	1	0	0	1	1	0	5
m_7	0	1	1	1	1	1	0	1	1	0	7
m_8	1	0	1	0	1	0	0	1	1	0	5
m_9	0	1	1	1	1	1	1	1	1	0	8

From table it is very clear that m_1 is the optimal choice for low price and m_9 is optimal choice for high price mobile because $f(m_1)=6$ and $f(m_9)=8$.
Similarly m_2 is the suboptimal choice for low price mobiles and m_7 is the suboptimal choice for high price mobiles.
Using New efficient Normal Parameter Reduction algorithm on Mobile phone data set, from the executed results we get C= $\{e_9\}$ and one set A satisfies$f_A(m_1) = f_A(m_2) = \cdots = f_A(m_9)$,
A= $\{e_1, e_2\}$
Finally E-A-C= $\{e_3, e_4, e_5, e_6, e_7, e_8, e_{10}\}$
Now the Tabular representation for this set is given by Table 2.

Table 2

U/E	e_3	e_4	e_5	e_6	e_7	e_8	e_{10}	f(.)
m_1	1	0	1	0	0	1	1	4
m_2	1	0	1	0	0	0	1	3
m_3	1	0	0	0	0	0	1	2
m_4	1	0	0	0	0	0	1	2
m_5	0	1	1	0	0	1	0	3
m_6	1	0	1	0	0	1	0	3
m_7	1	1	1	1	0	1	0	5
m_8	1	0	1	0	0	1	0	3
m_9	1	1	1	1	1	1	0	6

Thus after applying NENPR the optimal and suboptimal choices remains the same. The reduct set will be $\{e_1, e_2, e_9\}$.
Thus Mr.X will buy Xiomi Redmi 1s(m_1) and Mr.Y will buy Gionee Elife E7(m_9).

CONCLUSION

There are many methods for finding the reduct of a Soft set, this method of NENPR is simple to understand and easy to apply. In this present paper we have given real life application of this algorithm for selecting the best mobile phone as per needs.

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