Survival Rate of Tooth Infected Patients with Peri Apical Lesion using RST

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ABSTRACT: There are numerous things a dentist can speckle through a dental check-up such as weakening older fillings, early signs of gum disease, periodontal disease, gum recessions, tooth and root surface decay, and innumerable distinct oral problems can influence our health. In this paper RST is used as tool for feature extraction and rule generation. An experimental dataset for Peri Apical lesion is used and the experimental result shows that this type of surgery which has the significant role in the survival of patients.

Keywords: **Apical Surgery, RST, Decision Rule.**

Introduction: Proper mouth care is very essential for the overall wellness and appearance of a person. Untreated mouth infection may lead to gum problems, loss of tooth and serious dental issues. [1] Infrequent events that a tooth fails to respond to RCT and root canal retreatment is not a viable option, root canal surgery is necessary to save the tooth. This procedure is specified for apical surgery. This technique is used for providing the opportunity to detect possible root fractures. Apical surgery can be chosen as a standard oral surgical technique. The main aim of apical surgery is to prevent bacterial leakage from the root canal system into peri radicular tissues by placing a tight root- end filling following root- end resection. It is belong to the area of endodontic surgery, which includes incision and drainage, closure of perforations, and root or tooth resections. [2]

RST is the new concept of mathematics in which we study about imprecise, incomplete and uncertain data, such as vagueness which is expressed by boundary region of a set. RST is an extension of the conventional theory which is used for approximations in decision making. RST proposed by Z. Pawlak in early eighty of last centaury. RST was the first non-statistical approach for analyzing data [3].The fundamental concept of

RST is based on approximation (lower and upper). RST can be taken as a mathematical tool to ascertain hidden patterns of data. It can be used for feature selection, feature extraction, data reduction, decision rule generation, and pattern extraction etc. In RST many new methods have been developed for decomposition of large data sets, data mining in distributed, multi-agent systems and granular computing [4]. An information system consisting objects and attributes and it is the representation of data that can be used in RST for further calculation. The RST starts with Indiscernibility relation which is the relation between two or more than two objects. Approximation is the important part of the RST. Approximation is of two types which are Lower approximation and upper approximation. [5, 6, 7]

Lower Approximation: It is a set X with regard to R is the set of all objects, which certainly can be classified with X regarding R.

Lower Approximation = $\cup \{D \in \frac{U}{B} : D \subseteq X\}$

Upper Approximation: It is a set X regarding R is the set of all objects which can be classified with X regarding R.

Upper Approximation = $\cup \{D \in \frac{U}{B} : D \cap X \neq \emptyset\}$

Boundary Region: Upper Approximation - Lower Approximation

If the boundary region of set X = $\emptyset$ then the set is Crisp otherwise rough.

If the boundary region of X is empty set then the set X is exact otherwise it is rough. Rough set also given characterized by $\alpha_B(X) = \frac{card(B^*(X))}{card(B_*(X))}$ known by as accuracy of approximation.

So $0 \leq \alpha_B(X) \leq 1$. If $\alpha_B(X) = 1$, X is crisp. If $\alpha_B(X) < 1$, then X is rough.

Decision Rule: Let $S = (U,\ A,\ B)$ be the decision table. Every $x \in U$ determines a sequence such that $A_1(x),\ A_2(x),\ A_3(x) \ldots \ldots A_n(x);\ B_1(x),\ B_2(x),\ B_3(x) \ldots \ldots B_n(x)$ with

$$\{A_1(x), \quad A_2(x), \quad A_3(x) \ldots \ldots A_n(x)\} = A$$

And $\{B_1(x),\ B_2(x),\ B_3(x) \ldots \ldots B_n(x)\} = B$

Then $A_1(x),\ A_2(x),\ A_3(x) \ldots \ldots A_n(x) \rightarrow B_1(x),\ B_2(x),\ B_3(x) \ldots \ldots B_n(x)$ is called the decision rule & the number Supp $(A,\ B) = |A(x) \cap B(x)|$ is said to be support of the decision.

Strength of the decision Rule = $\sigma(A, B) = \frac{\text{Supp}\,(A, B)}{|U|}$

Certainty Factor: $cer_x(A, B) = \frac{\text{Supp}\,(A, B)}{|A(x)|}$

Coverage Factor: $cer_x(A, B) = \frac{\text{Supp}\,(A, B)}{|B(x)|}$

Description of data set:

The treatment of teeth by apical surgery, root canal etc. This type of treatment depends on the stage of teeth. Sometimes both type of treatment without apical and with apical surgery applied for early and advanced of apical Lesion.

The dataset of the tooth apical disease have been taken from the shree dental clinic Chittorgarh. The dataset consist of 4 attribute where 2 are conditional attribute, one is decision attribute and one is frequency attribute. Table1 Shows the notation for apical lesion attributes with description.

	Stage of Apical Lesion (E = Early , A = Advanced)
A2	Type of Treatment (WO = RCT without apical surgery, WA = RCT with Apical surgery)
D	Survival Status After 5 Year(Yes, No)
F	Frequency

Table I Apical Lesion of dataset attributes description

Experimental Result and discussion

Table II represent the two factors affecting apical lesion which is concerned about eight cases. Let U is the universal set of objects. In Table II Columns C = {A_1, A_2} are the conditional attributes and Column D represent decision attribute. The elementary set of the two attributes is U/C = {{X1, X2} {X3, X4} {X5, X6} {X7, X8}} and equivalence classes is Y = {Yes, No}

U	A1	A2	D	F
X1	E	WO	N	7
X2	E	WO	Y	144
X3	E	WA	N	7
X4	A	WO	N	111
X5	A	WO	Y	13
X6	A	WA	N	4
X7	A	WA	Y	14

Table II Dataset of Apical Lesion

Thus the lower approximation is {X3}

The upper approximation is {X1, X2, X3, X4, X5, X6, X7}

The BNB = {X1, X2, X4, X5, X6, X7}

U	Support	Strength	certainty	Coverage
X1	7	.02	.05	.05
X2	144	.48	.95	.84
X3	7	.02	1	.05
X4	111	.37	.90	.86
X5	13	.04	.10	.08
X6	4	.13	.22	.03
X7	14	.05	.78	.08

Table III Strength, Certainty, Coverage

The following decision rules with certainty factor given below

1. If (A1, E) and (A2,WO) then (D, N) certainty .05
2. If (A1, E) and (A2, WO) then (D, Y) certainty .95
3. If (A1,E) and (A2,WA) then (D, N) certainty 1
4. If (A1, A) and (A2, WO) then (D, N) certainty .90
5. If (A1, A) and (A2,WO) then (D, Y) certainty .10
6. If (A1,A) and (A2,WA) then (D, N) certainty .22
7. If (A1, A) and (A2,WA) then (D, Y) certainty .78

The Inverse decision rules are with coverage factor are given below

1. If (D, N) then(A1, E) and (A2, WO) Coverage .05
2. If (D, Y) then (A1, E) and (A2, WO) Coverage .84
3. If (D, N) then (A1, E) and (A2,WA) Coverage.05
4. If (D, N) then(A1, A) and (A2,WO) Coverage .86
5. If (D, Y) then (A1, A) and (A2,WO) Coverage .08
6. If (D, N) then (A1,A) and (A2,WA) Coverage.03
7. If (D, Y) then If (A1,A) and (A2, WA) Coverage .08

CONCULSION: In this paper RST is used for predict the Survival Rate of tooth infected patients after the treatment of 5 years of their teeth. Decision rules are generated on the basis of the features. Certainty and coverage factors are calculated on the basis of decision and inverse decision rules. Both are helpful to predict the Survival Rate of tooth infected patients after five years. It is concluded that if the Stage of Apical Lesion is early and without apical lesion then the patient survive after five years.

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