International Journal of Application or Innovation in Engineering & Management (IJAIEM)
Web Site: www.ijaiem.org Email: editor@ijaiem.org
Volume 11, Issue 5, May 2022 **ISSN 2319 – 4847**

SOME TECHNICAL DIFFICULTIES IN THE GENERAL CARDIOVASCULAR RISK SCORE-THE FRAMINGHAM HEART STUDY

[1]Rimpi Datta, [2]Arpita Barman Santra, [3]Arnima Das, [4]Sangita Roy

1,2,3,4 Narula Institute of Technology, 81, Nilgunj Road, Agarpara, West Bengal

Abstract

Numerous US specialists bring up an individual's future improvement of coronary illness utilizing a gamble assessor which depends on the perceptions from a drawn out study led in Framingham. This is alluded to as the Framingham risk or the Framingham risk score. The Framingham risk assessor is utilized to compute the gamble for people who have not previously had a cardiovascular failure or any coronary illness. There are two Framingham Risk Scores, one for men and one for ladies. This chance score is the gamble of having a cardiovascular failure or passing on from coronary illness inside the time span of 10 years. By concentrating on this Framingham Risk Score (FRS) we have seen here that there is a constraint. We are attempting to eliminate this limit by utilizing the Fuzzy Logic and furthermore need give the FRS another model. In this standardized manner we are attempting to direct the Framingham Risk Score and furthermore need to build the down to earth physibility of FRS. That is the reason we are utilizing the calculation or ongoing subtleties of 10 years Cardiovascular Risk which is assessed by FRS. By making the enrollment elements of various boundaries related with the FRS framework we get more reasonable physibility in this issue space.

Key Words- Framingham Risk Score (FRS), Fuzzy Logic, Cardiovascular Risk.

Introduction

Framingham Heart Study is an enormous scope and long haul concentrate on that predicts the gamble for people who have not previously had a coronary episode or any coronary illness [1]. This study was done in the town Framingham in the United States to create and approve a few gamble forecast calculations for various sorts of explicit Cardiovascular Diseases like coronary illness (CHD), Stroke, cardiovascular breakdown and so on. This cardiovascular sickness is a quiet executioner and it might go after all of a sudden so it ought to should be analyzed and legitimate preventive clinical therapy. The Framingham heart study empowers us to gauge the gamble level of various kinds of CVD approaching 10 years. Later this review was reached out to assess general Cardiovascular Risk Score with negligible arrangement of lab tests. In any case, this scoring framework experiences a few specialized hardships. We have built two engineered counter models with the assistance of the gamble factors like-Age, sex, Total cholesterol, HDL cholesterol, Systolic Blood pressure, Smoking, Diabetic and so on where in one model the actual portrayals and score assessing boundaries are practically indistinguishable however the current scoring framework distinguishes one of them as a generally safe profile and one more as a transitional gamble profile. Additionally, different models sort one individual in the high gamble classification and someone else in the halfway gamble classification in spite of their practically comparable spellbinding highlights.

These two models show that a few specialized alterations are required to make the calculation pertinent in genuine situation and not to create illogical outcomes. Assuming we intently look at our developed models, obviously the gamble lies in choosing the numbers close to the limit. Since the limit is exceptionally sharp, assuming we select two numbers each from one or the other side of the limit, the subsequent change turns out to be extremely huge making a colossal impact in the end-product. It is extremely natural that to conquer this issue, we must be very alerts while crossing the limit. Rather than intense and discrete changes, smooth and nonstop progress is important. Actually fluffy set hypothesis is ideal in this present circumstance say for instance to characterize the terms child, youthful and old, it will be truly challenging assuming we placed an in the middle between. For instance, assuming we consent to say that assuming an individual's mature is 5 years to 30 years we will call him youthful then what will we call individual with age 4 years 11 months and 25 days? We will be constrained to that person child by our definition which is absolutely strange in light of the fact that there is no pragmatic distinction between the age of 5 years and 4 years 11 months and 25 days. Yet, we call one individual youthful and the other individual child. Fluffy set hypothesis precariously beats what is happening developing ceaseless enrollment capacities for smooth change. In our current issue we are attempting to produce a consistent and smooth progress with the assistance of Lagrange Interpolation to make the appropriate participation work.

There is an extraordinary limit in the Framingham Risk Score. In the new information or calculation we see that hazard factors for people are doled out as per the various classifications like age. absolute cholesterol.HDL cholesterol, circulatory strain, smoking and so forth. Assuming we go through it we can calls attention to that there is a major issue for risk factors that is on the off chance that we consider a man at 34 years old, we see that from FRS his Risk Factor is relegated as 0. After only year on account of that man his Risk Factor will be allocate as 2.There is a tremendous contrast between the Risk Factors of than man's current age and only a year later. In this a year there is an immense contrast between that individual's Risk Score. This limit issue is the restriction of Framingham Risk Score.

Solution:

We know that a fuzzy set is a pair of (A,m) where A is a set and $m : A \to [0,1]$.

For each $x \in A$, $m(x)$ is called the **grade** of membership of x in (A,m). For a finite set $A = \{x_1,...,x_n\}$, the fuzzy set (A,m) is often denoted by $\{m(x_1) / x_1,...,m(x_n) / x_n\}$.

Let $x \in A$. Then x is called not included in the fuzzy set (A,m) if $m(x) = 0$, x is called fully included if $m(x) = 1$, and x is called a **fuzzy member** if $0 < m(x) < 1$ [10]

We are attempting to adjust the CVD Scoring framework with the assistance of the Fuzzy Set hypothesis. Fluffy sets are the sets whose components have levels of participation work. Fluffy sets were presented all the while [5] by Lotfi A. Zadeh [6] as an expansion of the old style thought of set hypothesis. In old style set hypothesis, the participation of components in a set is addressed in double terms as per a bivalent condition — a component either has a place or doesn't have a place with the set. Fluffy sets sum up old style sets, since the pointer elements of the traditional sets are exceptional instances of the participation capacities in fluffy sets, on the off chance that the last option just take values 0 or 1 [7]. In fluffy set hypothesis, old style bivalent sets are normally called fresh sets. Presently a-days the fluffy set hypothesis can be utilized in the wide scope of the spaces in which data is deficient or uncertain. That is the reason we have pick this sort of delicate registering instrument to eliminate this limit in this issue.
In the Framingham risk Score we have seen that there is some impediment and are attempting to eliminate this sort of restriction. So we are picking various variables of FRS for all types of people. Our work is to lay out the different enrollment capacities for each elements. We have seen there is limit issue, on the off chance that we can produce the enrollment work then on account of limits there exists coherence and we come by our ideal outcome.

FORMULATION OF THE PROBLEM:

By developing manufactured counter models we can show the weakness and impediment of Framingham Risk Score of Cardiovascular sickness. At first we pick two men An and B and both are smokers. The actual portrayal of An and B are practically comparative yet with greatest distinction in score of their profiles. Presently we can put forth a defense study with the assistance of the two profiles. Without delving into additional subtleties, we refer to two models which are obvious.

Methodology:

Case Study 1:

Assume the age of A is 39 years. At his age we consider his complete cholesterol is 280 mg/dl. His systolic pulse is 119 mm hg. also, HDL cholesterol is 49 mm./dl. For another situation we pick a man whose age is 39 years and 9 months for example his age is 39.9 years. At his age the complete cholesterol is 279 mg/dl. His systolic pulse is 120 mm hg. what's more, HDL cholesterol is 50 mm./dl. Presently from the scoring of worldwide appraisal for Framingham Risk Score we can get them the places of their Risk Score of the opportunity for fostering the Cardiovascular Disease inside next 10 years. To make it more justifiable we are making a diagram of their

case study profile:

RISK FACTORS	MAN A	MAN B	SCORE POINTS FOR RISK FACTORS OF MAN A	SCORE POINTS FOR RISK FACTORS OF MAN B
AGE	39	40	2	5
TOTAL CHOLESTEROL	279	280	3	4
HDL CHOLESTEROL	49	50	0	-1
BLOOD PRESSURE (UNTREATED)	119	120	-2	0
SMOKER	YES	YES	4	4
DIABETIC	YES	YES	3	3

Presently including all the gamble points of man A we get

FOR MAN A:
[2+3+0+ (- 2)+4+3]=10

FOR MAN B:
(5+4+ (- 1) +0+4+3)=15

Presently for these focuses we can get the outright upsides of 10 years risk level of cardiovascular sickness.
For the mark of 10 , The rate risk score CVD is 9.4%

For the mark of 15 , The rate risk score CVD is 21.6%

So we can see here that there is an enormous distinction between the two gamble score level of man An and man B. This distinction is 12.2 however the age contrast between man An and man B is only one year. This is an extraordinary issue. We can calls attention to a one more issue that in the gamble classification the10 years outright gamble for advancement of the Cardiovascular Disease –

Risk Categories [1]:

RISK CATEGORY	10 YEARS ABSOLETE RISK (%)
HIGH	>20
INTERMEDIATE	6-20
LOW	0-6

From this table it is clear that the actual portrayals that influence the score focuses are almost indistinguishable. They are near the point that even a solitary individual can display these two arrangement of results assuming the estimations are performed at various times and marginally unique physiological circumstances which happens even in typical circumstances because of complicated human physiological cooperation's. Presently assuming the CVD risk scores are determined for this two people man A, man B from the past score outlines it becomes 9.4% for man An and 21.6 for man B. This implies that man An is in the INTERMEDIATE zone and man b is in the HIGH zone which is absolutely illogical that their actual boundaries are no different either way in every useful reason.

Case Study 2:

We can take an model, here we consider two ladies C and D whose age distinction is only 1 year. We additionally consider that both are non smoker and non diabetic.

Case study profile:

RISK FACTORS	WOMAN C	WOMAN D	SCORE POINTS FOR RISK FACTORS OF WOMAN C	SCORE POINTS FOR RISK FACTORS OF WOMAN D
AGE	39	40	2	4
TOTAL CHOLESTEROL	279	280	4	5
HDL CHOLESTEROL	44	45	1	0
BLOOD PRESSURE (UNTREATED)	149	150	2	4
SMOKER	NO	NO	0	0
DIABETIC	NO	NO	0	0

Presently including all the gamble points of lady C we get

FOR WOMEN C;

[2+4+1+2+0+0]=9

FOR WOMAN D:

[4+5+0 +4+0+0]=13

Presently for these focuses we can get the outright upsides of 10 years risk level of cardiovascular infection.
For the place of 9 , The rate risk score CVD is 5.3%
For the mark of 13 , The rate risk score CVD is 10%

So we can see here that there is an enormous distinction between the two gamble score level of lady C and lady D. This distinction is 4.7 however the age contrast between lady C and lady D is only one year. This is an incredible issue. We can brings up a one more issue that from the gamble class the10 years outright gamble for advancement of the Cardiovascular Disease for lady C the gamble classification is LOW and for lady D the gamble class is INTERMEDIATE. So we can say from this contextual analysis that this scoring framework can't work as expected and there is a limit.

Assuming we intently analyze the developed models, obviously the gamble lies in choosing the numbers close to the limit. Since the limit is extremely sharp, assuming we select two numbers each from one or the other side of the limit, the subsequent change turns out to be exceptionally huge making a gigantic impact in the eventual outcomes. It is exceptionally instinctive that to conquer this issue, we must be very alerts while crossing the limit. Rather than intense and discrete changes, smooth and consistent progress is fundamental. Actually fluffy se hypothesis is ideal in this present circumstance say for instance if we have any desire to characterize the terms child, youthful and old, it will be extremely challenging in the event that we put an in the middle between. For instance, assuming we consent to say that in the event that an individual's mature is 5 years to 30 years we will call him youthful then what will we call individual with age 4 years 11 months and 25 days? We will be constrained to the person in question child by our definition which is absolutely counter high on the grounds that there is no functional distinction between the age of 5 years and 4 years 11 months and 25 days. However, we call one individual youthful and the other individual child. Fluffy set hypothesis interestingly conquers what is happening building constant enrollment capacities for smooth progress. In our current issue additionally we will utilize this apparatus.

Risk points and Heart age:

We have additionally seen from CVD expectation Score and Heart age in the accompanying that for man A and for man B there is an enormous contrast between their heart age for example man A's heart age is 54 and 72 heart age is for man B. So there is a gigantic distinction for example 18. So can reason that man A and man B's actual depiction are practically comparative however the heart time of them has huge contrast. In the event of ladies like lady C and lady D additionally both are practically comparative however lady C's heart age is 55 and lady D's heart age is 73. Here we can see likewise an enormous contrast for example 18 between the age of their heart.

For Woman [1]:

POINTS	HEART AGE OR VASCULAR AGE
<1	30
1	31
2	34
3	36
4	39
5	42
6	45

7	**48**
8	**51**
9	**55**
10	**59**
11	**64**
12	**68**
13	**73**
14	**79**
15+	**>80**

For Man [1]:

POINTS	HEART AGE OR VASCULAR AGE
<0	**<30**
0	**30**
1	**32**
2	**34**
3	**36**
4	**38**
5	**40**
6	**42**
7	**45**
8	**48**
9	**51**
10	**54**
11	**57**
12	**60**
13	**64**
14	**68**
15	**72**
16	**76**
>= 17	**>80**

Importance of the solution:

Not just CVD risk scoring framework experiences this limit issue, all the Framingham risk scoring frameworks including diabetes risk scores, hypertension risk scores experience the ill effects of a similar issue; a basic and cautious look can

without much of a stretch recognize the issues wherever in this sort of scoring frameworks. So an answer for this current issue will open another road towards taking care of this class of issues overall. So this will be an exceptionally broad arrangement that will be appropriate in various circumstances effectively.

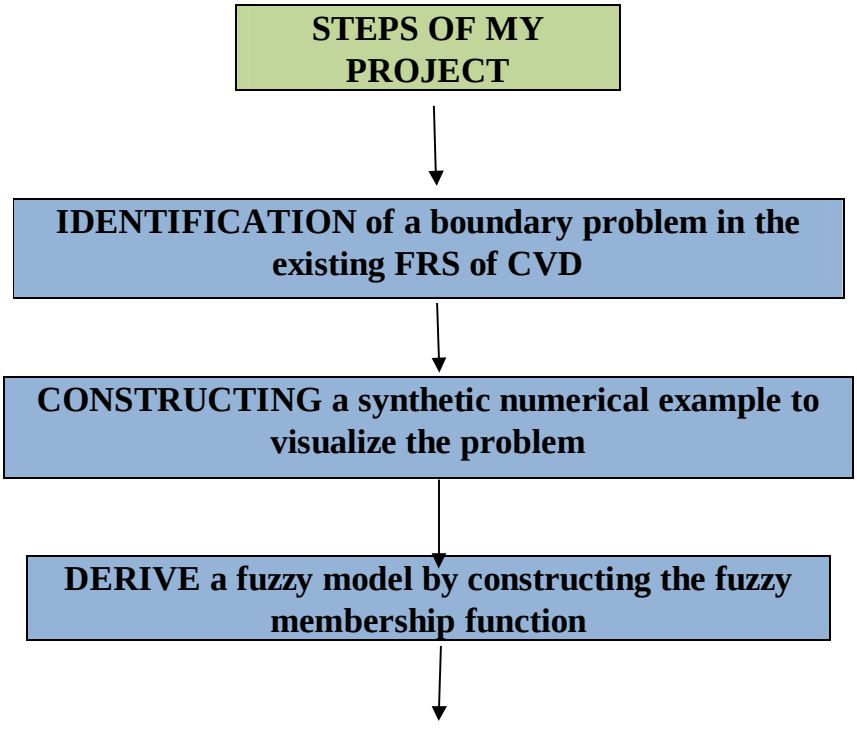
Our Approach:

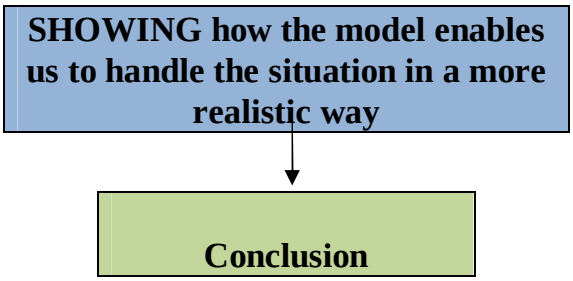
For the development of Membership work two kinds of scaling strategies are utilized like-Direct technique and indirect strategy. On account of abstract judgment of backhanded technique it is more straightforward to respond to the easier inquiries and to the different inclination it is less delicate. In any case, the immediate task is exceptionally hard that it's judgment isn't extremely simple it is perplexing. So we are attempting to build the fluffy participation work with roundabout scaling technique [8]. Presently we consider the various variables age, complete cholesterol, HDL cholesterol, SBP, smoker and diabetic and for each component we need to build the fluffy participation capacity to infer a fluffy model and afterward need to perform conglomeration activity. In the wake of doing this activity we get risk score.

In Framingham risk score profile for CVD we notice something else that is on account of smoker there hazard score point is allotted as 4 for men and for ladies it is 3. Be that as it may, for non smoker it's point is 0. In the event that an individual take everyday 20 cigarettes, he is called smoker and he get 4 focuses and assuming someone else take just a single cigarette day to day he is additionally smoker and he likewise gets 4 focuses and therefore their gamble rate will contrast.

If there should arise an occurrence of Diabetic it's gamble point is allotted as 3 for men and 4 for ladies. Whenever the diabetic cross the level 140 then for diabetic the gamble point is allocating as 3 for man. In any case, the issue is that the one who has diabetic level 300 his gamble point is additionally allotted as 3. In both the cases the gamble point task is same.

Flow Chart our Work:





Conclusion:

We have introduced the rudiments of Framingham Heart Study and Fuzzy set hypothesis and showed how fluffy set can take of ceaseless changes. At the point when one variable (condition of the framework) ceaselessly and easily continues to another variable (another state), Fuzzy set hypothesis can deal with this present circumstance effectively. We brought up two circumstances where the current scoring framework produces conflicting and ridiculous outcomes. We likewise portrayed a diagram to make an exit from this off-kilter circumstance.

References:

[1]. General cardiovascular risk profile for use in primary care: the Framingham Heart Study. D'Agostino RB Sr, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, Kannel WB. Circulation. 2008 Feb 12.

[2] Lanza GA (February 2007). "Cardiac syndrome X: a critical overview and future perspectives". *Heart* **93** (2): 159–66. doi:10.1136/hrt.2005.067330. PMC 1861371. PMID 16399854. http://www.pubmedcentral.nih.gov/articlerender.fcgi?tool=pmcentrez&artid=1861371.

[3] Reddy S, Yusuf S. Emerging epidemic of Cardiovascular Disease in Developing Countries. Circulation. 1998; 97:596-601.

[4] Bulatao RA, Stephens PW. Global estimates and projections of mortality by cause. Washington DC: Population, Health and nutrition Department; World Bank; pre-working paper 1007, 1992

[5] Michael Winter (2007). *Goguen categories: a categorical approach to L-fuzzy relations*. Springer. p. ix. ISBN 9781402061639. http://books.google.com/books?id=5wy_tope2VEC&pg=PR9.

[6] L. A. Zadeh (1965) "Fuzzy sets". *Information and Control* 8 (3) 338–353.

[7] Goguen, Joseph A., 1967, "*L*-fuzzy sets". *Journal of Mathematical Analysis and Applications* **18**: 145–174

[8] Assigning Membership in a Fuzzy Set Analysis Jay Verkuilen, University of Illinois, Urbana-Champaign.

[9] General cardiovascular risk profile for use in primary care: the Framingham Heart Study. D'Agostino RB Sr, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, Kannel WB. Circulation. 2008 Feb 12.

[10] Assigning Membership in a Fuzzy Set Analysis Jay Verkuilen, University of Illinois, Urbana-Champaign.