

Dominant Problems of Rural Deprived Persons with Disability Using Fuzzy Cluster Analysis

A. Praveen Prakash, J. Esther Jerlin, P. Anitha

Abstract: Fuzzy models such as Fuzzy Cognitive Mapping (FCM), Fuzzy Associative Memories (FAM), Bi-Associative Memories (BAM), Fuzzy Relational Maps(FRM)etc are mathematical tools that have been introduced to study and analyze neural networks, social problems, psychological problems of persons living under difficult circumstances (PLUDC), political decision making etc. In this paper we arrive at the dominant problems of the rural deprived Persons with Disabilities (PWDs) using Fuzzy Clustering approach. This paper consists of four sections. Section one is introductory in nature that gives the background of the problem under study and gives the justification for having chosen to use the “Fuzzy Clustering” approach to seek the dominant problems by solving which, a majority of other problems will find solution. Section two gives the preliminaries and the basics of Fuzzy Clustering approach. Section three deals with the application of the said approach in determining the cluster of problems, that fall under the categories ‘low’, ‘moderate’ and ‘high’. And, the final fourth section gives the main findings as conclusion and necessary suggestions to improve the situation for the happy and contented living of the PWDs.

Index Terms: Clustering, Fuzzy Clustering, Degrees of membership, PWDs

I. INTRODUCTION

‘Disability’ was once considered to be the result of the curse of God. Generations to generations the idea on the cause of disability, and the approach of community around them in full filling their needs changed. There was a time when the children born were taken to the hill- top and thrown to death. As per Roman law, a child born disabled should be brought to the knowledge of the few neighbors and could be killed. According to Hindu Philosophy “People suffering with both Mental and Physical Disability is thought to be part of unfolding of *Karma* and if the consequence of past inappropriate action that occurred in either one’s current life or in a past life”. This view is shared by Buddhism and Sikhism too. According to Manu (Hindu Law Giver) Smirithi, PWDs don not deserve any rehabilitation measures to help them is to go against the will of God. He advocated the seclusion of PWDs from others. Hence they are denied of sharing property and in the process of decision making.

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A disabled person cannot become a priest to perform religious rites in the temple. Only during the last century, the UN Through its Convention on Rights of Persons with Disabilities (CRPD) had brought the issue to focus and the people started thinking in the scientific line on the causes and causalities of disabilities. The world wars caused many “Jawans” to lose their limbs. The whole idea about the causes of disability took a change. As a result the ‘charity based approach’ had given rise to ‘development approach’ which in turn had given rise to the ‘Right based approach’ in dealing with the rehabilitation of the persons with disabilities (PWDs).

The UN Conventions on the Rights of PWDs (CRPD) became one of the most quickly supported human rights instruments in human history; With support from all region groups, 155 states have signed the convention upon the opening in 2007 and 126 states ratified the convention within its first five year period. The convention was the first human rights treaty of the third millennium.

India as a signatory to the UN “Convention on the rights of persons with disabilities”, happen to be the major signatory of “Asian and pacific decade of disabled persons” (1992-2002) and in later decade (2003-2012). During the Asian decade (1993-2002) that followed the UN decade (1982-1992), the Indian parliamentarians woke up to the reality and after a protracted discussion passed the persons with disability (Equal Opportunities, Protection of Rights and Full Participation) Act, 1995 shortly called as PWD Act 1995. It was during this decade that NGOs, mostly religious ones started changing their charity based approach to development based and later to Right based approach in dealing with PWDs.

Many new NGOs started realizing the importance of working for the rights of PWDs. In 2004 seven NGOs joined together in the name of Liberation Action Movement of People “LAMP Net” and conducted a scientific survey of two Blocks viz, Melmalayanur and Kurinjipadi in Villupuram and Cuddalore Districts in Tamil Nadu, India, consisting of 55 and 38 Panchayats from Villupuram and Cuddalore Districts respectively, covering a total population of 1.2 lakh that identified 3539 PWDs (2.8 percent) of which a majority of 2115 (60 percent) are men and the rest are women. This network was chaired by the author of this paper. Of these 3539 PWDs, orthopedically affected were 51 percent, Speech and

Hearing Impact (S&HI) 16 percent, Mentally retarded (MR) 8 percent, Leprosy Cured (LC) 6 percent, Total Blind(TB) 4 Percent, Low Vision(LV) and Mental Illness(MI) 3 percent each, Cerebral Palsy (CP) 2 percent and Multiple Disability(MD) 7 percent. The community development workers who administered the survey using census method for three months numbering 56 were given 15 days of intensive residential training, demonstration and pilot study, in three phases. The list of twenty one problems of PWDs is listed in this paper are the outcome of the survey stated above. In this paper we attempt to list the dominant problems by finding solution to which many of the other listed problems could find solution. The Project proposal of this network LAMP Net was partnered by INGO viz, MZF, Germany, It involved in raising awareness among the masses on the causes and causalities of the disabilities following Community Based Rehabilitation (CBR) approach. More than eighty percent of the PWDs were found to be ineligible to receive any Government Rehabilitation measures as they did not possess the National Identity Cards required for the purpose. It brought to light that there were twenty one lakh persons with disabilities whereas only six lakh persons were identified as PWDs.

II. PRELIMINARIES

A. Hard Clustering

In Hard Clustering we make a hard partition of the data set Z. In other words, we divide the min to $c \geq 2$ clusters. With a partition, we mean that

$$\bigcup_{i=1}^c A_i = Z$$

and $A_i \cap A_j = \phi, \forall i \neq j$ (1)

Also, none of the sets, A_i may be empty. To indicate a partitioning, we make use of membership functions $\mu_k(x)$. If $\mu_k(x)=1$, then object x is in cluster k . Based on the membership functions, we can assemble the Partition Matrix U, of which $\mu_k(x)$ are the elements. Finally there is a rule that

$$\sum_{i=1}^c \mu_k(x) = 1 \quad \forall x \quad \dots\dots\dots (2)$$

In other words, every object is only part of one cluster.

B. Fuzzy Clustering

Hard clustering has a disadvantage. When an object roughly falls between two clusters A_i and A_j , it has to be put into one of the clusters. Also, outliers have to be put in some cluster. This is undesirable. But it can be fixed by fuzzy clustering.

In Fuzzy clustering, we make a Fuzzy partition of the data. Now, the membership function $\mu_k(x)$ can be any value between 0 and 1. This means that an object Z_k can be for 0.2 parts in A_i and for 0.8 parts in A_j . However, requirement (2) still applies. So, the sum of the membership functions still has to be 1. The set of all fuzzy partitions that can be formed in this way is denoted by MFC. Fuzzy partitioning again has a downside. When we have an outlier in the data (being an object that doesn't really belong to any cluster), we still have to assign it to clusters. That is, the sum of its membership functions still must equal one.

C. Fuzzy C-Means Clustering

In fuzzy clustering, each point has a degree of belonging to clusters, as in fuzzy logic, rather than belonging completely to just one cluster. Thus, points on the edge of a cluster, may be in a cluster to a lesser degree than points in the center of cluster for each point x there is no coefficient giving the degree of belonging in the k th cluster $\mu_k(x) = 1$. Usually, the sum of those coefficients is defined to be 1.

$$\sum_{n=1}^m \mu_k = 1 \quad \forall x \quad \dots\dots\dots (3)$$

With fuzzy c-means, the centroid of a cluster is the mean of all points, weighted by their degree of belonging to the cluster

$$Center_k = \frac{\sum_x \mu_k(x)^m x}{\sum_x \mu_k(x)^m} \quad \dots\dots\dots (4)$$

The degree of belonging is related to the inverse of the distance to the cluster

$$\mu_k(x) = \frac{1}{d(Center_k, x)} \quad \dots\dots\dots (5)$$

Then the coefficients are normalized and fuzzy field with a real parameter $m > 1$ so that their sum is 1. So

$$\mu_k(x) = \frac{1}{\sum_j \left(\frac{Center_k, x}{Center_j, x} \right)^{2/(m-1)}} \quad \dots\dots\dots (6)$$

Form equation 2, this is equivalent to normalizing the coefficient linearly to make their sum 1. When mis-close to 1, then cluster center closes to the point is given much more weight than the others, and the algorithm is similar to k -means.

III. METHODOLOGY

A. Objectives

1) To bring out the major problems faced by the PWDs from the point of view of the PWDs themselves, their care

givers/parents and the NGO leaders who have been striving for their rightful share in earth resources

2) To apply Fuzzy Clustering approach to find out the dominant (key) problems by solving which many of the other issues get resolved

3) To suggest remedies based on the main findings

List of Problems faced by Rural Deprived PWDs: The following is the List of problems affecting the PWDs in rural India

1. Suffer inferiority complex
2. Unemployed/Unskilled to earn a living on their own
3. Ill-treated by the family members and consider them as appendages
4. Suffer from mental stress & trauma
5. Denied good food, clothing, shelter, health care, etc.
6. Discriminated/marginalized
7. Lack of mobility
8. Low self-esteem/No self-image
9. Live a depressed life without any interest/suicidal tendency
10. Not able to be independent and depend upon others for their day-today activities
11. Poverty
12. Marriage remains a question mark
13. No education/insufficient education
14. Lack political will and insufficient rehabilitation measures
15. Welfare measures seldom reach them
16. Considered to be the result of "Curse of GOD"
17. No knowledge on welfare measures such as SSHG (Special Self Help Group)
18. Loss of Identity (ID)
19. No share in property
20. Not considered in decision making process either at home or in the society
21. Addressed by disabilities 'Name' like 'Kurudan' (Blind), 'Sevidan' (Deaf), 'Nondi' (Orthopedically handicapped), etc.

B. A Brief description of the nodes identified for clustering

Suffer inferiority complex

The PWDs don't feel that they are like any other individual. Even if they are capable of achieving high the feeling of inferiority pulls them down not to behave the way the normal people do. The parents, family members and the community at large treat them in such a way the remaining subdued in all walks of life.

Unemployed/Unskilled to earn a living on their own

From the Childhood they grow as neglected member in the family and in society. There are no adequate institutions to train them in certain job skills. Though the PWD act 1995 provide for the employability skill development among the PWDs, the rural PWDs are still in the dark on the provisions of the PWD act.

Ill-treated by the family members and consider them as appendages

Though the PWDs deserve a special individualized care, it doesn't happen in reality. As they are asset less and lack skill to earn a living, they are ill-treated. But we can notice the family members enjoying over the earning of a PWD, if he happened to be earning by getting a Government job due to reservation policy. Even if they benefit by the earning of the PWD they do not care to arrange a marriage for such person.

Suffer from mental stress & trauma

Due to inability to be independent, the PWDs suffer psychologically. Suicides among the adolescent's girls are on the rise. There are no concerted effort to provide counselling to the PWDs in remote rural villages when they are in distress

Denied good food, clothing, shelter, health care, etc

As disabled persons they have the right to Special Care. But in reality, they are denied even the basic necessities of life such as food, clothing, shelter, etc. As per Hindu Law of Karma, the persons were born/made to be disable due to the sins committed by them in either current or past life. Manu the Hindu law giver wants God's wrath to those who help such persons with disabilities. Though there has been attitudinal change among the persons, there lies self-contentment if not involved in helping the PWDs

Discriminated/marginalized

One can witness the PWDs left at home to be as guards when the rest of the family members go out on a tour or for attending a function. There is a common feeling among the people that it's inauspicious to have their presence in auspicious occasions.

Lack of mobility

It is a major Problem of the orthopedically handicapped persons. This denies them to participate in events equally, like the rest of the members. To go to school or to place of worship or to work place, immobility is the biggest hurdle.

Low self-esteem/No self-image

The PWDs do not move about freely due to lack of self-image. People in rich families don't even reveal to the society about the existence of an extremely disabled person in the family. From the birth such members are kept in a remote corner room of their big houses.

Live a depressed life without any interest/suicidal tendency

One can find frequent suicides among the adolescent PWDs compared to normal Adolescents.

Not able to be independent and depend upon others for their day-to-day activities

When the person suffer from Multiple Disability(MD), Cerebral Palsy(CP), Mental Retardation(MR) and Autism they need constant support from parents/care givers even to do their daily routine works such as answering the call of nature, brushing the teeth, taking bath etc. Mental Health ACT 1987, Rehabilitation council of India Act 1992 and National Trust Act 1999 are the Acts that were in acted for the welfare of the above mention four types of disabilities. They are not covered under PWD Act 1995

Poverty

Families that are below poverty line, suffer a lot if there is a PWD in the family. There are families where the parent’s care is constantly needed for the PWDs. Even normal persons are denied of the opportunity to work and earn. As a result of the presence of PWD in the family.

Marriage remains a question mark

As humans, they too have all the feelings of sex. Naturally they suffer when their marriage is not a topic of discussion in certain families. There are even families that live on the income of the PWDs who secured government job based on the reservation but without caring for the marriage of that person.

No education/insufficient education

When a child is born disabled, their education is not given much importance. As a result they suffer for want of qualification while searching a job. There are provisions for the educational development of PWDs in PWD Act 1995. But people from remote rural areas are not aware of even the existence of such act.

Lack political will and insufficient rehabilitation measures

The government measures are seldom sufficient to meet their need as the number of PWDs are under estimated. In the sample areas survey it was found that only 80 percent of the PWDs are possessing the National ID card. In Tamil Nadu as per the government record there are only six lakh PWDs were as the actual number is claimed by the Voluntary Organization is 25 lakh. Naturally the allotted funds cannot be sufficient to meet the PWDs. The Final allocation mostly turned out to be a pittance compared to the special care the PWDs required.

Welfare measures seldom reach them

The small amount of welfare measures do not reach the PWDs in full due to Corruption. Mostly the parties in power allocate the funds and make them reach those who belong to that party

Considered to be the result of “Curse of GOD”

Ancient Hinduism according to the law of Manu, the disabilities occur only due to Karma and helping such persons was considered to be the act against will.

No knowledge on welfare measures such as Special Self Help Group (SSHG)

The PWDs are not even aware of the need to get the National ID card. About three fourth of them are not having the ID. Naturally one can understand their level of awareness on the rehabilitation measures, which could be obtained only by those whose possess ID cards.

Loss of Identity (ID)

About three fourth of the rural disabled do not possess the ID cards. The process of getting the ID card also is not made easy. The PWDs have to travel all the way go to the District Head Quarters to get the same. They cannot get the ID by just going once. The District Head Quarters might have fixed particular time during a particular day of the week during this purpose. A person with disability after reaching the Head Quarters with difficulty will have to return empty handed for no fault of theirs. Even if he goes on the right time in the right day, he may be turned back on such a flimsy grounds. But the person who pays a bride can get the card without much difficulty even without medical checkup.

No share in property

As the PWD is not considered as a full person, the members of the family seldom give the due share in the ancestor’s properties.

Not considered in decision making process either at home or in the society

Generally when a PWD voices his concern either in the family or in society at the public meeting it is not well received. Naturally he has no voice in decision making.

Addressed by disabilities ‘Name’ like ‘Kurudan’ (Blind), ‘Sevidan’ (Deaf), ‘Nondi’ (Orthopedically handicapped), etc.

Instead of calling him/her name, people call the PWD by the ‘Disability’ that he/she suffers. We can find even the youngsters calling the elderly PWDs by their ‘Disability’.

C. Clustering Process

The list of problems are grouped into three clusters viz, Low, Moderate and High based on the mean responses of the respondents as narrated below.

Table I
Level of 3-Clusters

	Cluster 1	Cluster 2	Cluster 3
Range	2.5-5.5	3.5-8.5	7.5-10
Mid Value	4	6	8.75
Classification	LOW	MODERATE	HIGH

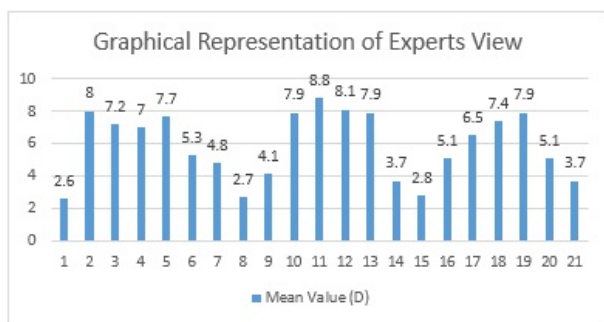


Fig. 1. Mean Rating

D. ALGORITHM TO FIND A MEMBERSHIP VALUES FOR THE ATTRIBUTES

STEP1: Start

STEP2: Fix, the values of 21 attributes on a 10-point rating scale in a set D (say)

STEP3: Fix the cluster, which is defined as Cluster1=LOW, whose range beginning with 2.5(**bv1**) End with 5.5(**ev1**). Cluster 2 = MODERATE, whose range beginning with 3.5(**bv2**) and end with 8.5(**ev2**). Cluster3=HIGH, whose range beginning with 7.5 (**bv3**) and end with 10(**ev3**).

STEP4: Choose an element x in D

STEP5: If $x < ev1$, Go to **STEP6**, else go to **STEP8**

STEP6: If $x > bv2$, then x lies in cluster 1 and cluster 2 whose membership value is defined as $\mu_k(x) = ev1-x : x-bv2$, go to **STEP12**, else go to **STEP7**.

STEP7: Then x lies in cluster 1 only, the membership value is $\mu_k(x) = 1$ go to **STEP12**

STEP8: If $x < ev2$ go to **STEP9**, else go to **STEP11**

STEP9: If $x > bv3$, then x lies in cluster 2 and cluster3, whose membership value is defined as $\mu_k(x) = ev2-x : x-bv3$, Goto**STEP12**, else go to **STEP10**

STEP10: Then x lies in cluster2 only, the membership value is $\mu_k(x) = 1$ else go to **STEP11**

STEP11: Then x lies in cluster3 only, the membership value is $\mu_k(x) = 1$

STEP12: go to **STEP4**, until all the values in D have been checked

STEP13: Stop

Here '**bv**' denotes the beginning value and '**ev**' denotes the ending the value.

E. Interpretation on the result of Clustering

Degree of membership of the attributes that refer to the problems of PWDs is found using the above algorithm is shown in Table: II. Attributes 1, 8, 15 with a mean rating 2.6,

2.7 and 2.8 are entirely (100%) with a membership value of 1 in cluster 1 is **LOW**.

Table II
Degree of Membership of Attributes

Attributes	Mean	Low	Moderate	High
1	2.6	1	0	0
2	8	0	0.5	0.5
3	7.2	0	1	0
4	7.0	0	1	0
5	7.7	0	0.8	0.2
6	5.3	0.1	0.9	0
7	4.8	0.35	0.65	0
8	2.7	1	0	0
9	4.1	0.7	0.3	0
10	7.6	0	0.9	0.1
11	8.8	0	0	1
12	8.1	0	0.4	0.6
13	7.9	0	0.6	0.4
14	3.7	0.9	0.1	0
15	2.8	1	0	0
16	5.1	0.2	0.8	0
17	6.5	0	1	0
18	7.4	0	1	0
19	7.9	0	0.7	0.3
20	5.1	0.2	0.8	0
21	3.7	0.9	0.1	0

Attributes 3, 4, 17, 18 with a mean rating 7.2, 7.0, 6.5 and 7.4 are entirely (100%) with a membership value of 1 in cluster2 is **MODERATE**.

Attribute 11 with a mean rating 8.8, is entirely (100%) with a membership value of 1 in cluster3 is **HIGH**.

Attributes 2, 5, 10, 12, 13, 19 with a mean ratings 8, 7.7, 7.6, 8.1, 7.9, 7.9 belong to 50% in cluster2 and 50% in cluster3, 80% in cluster2 and 20% in cluster3, 60% in cluster2 and 40% in cluster3, 40% in cluster2 and 60% in cluster3, 90% in cluster2 and 10% in cluster3 are between **MODERATE and HIGH**.

Attributes 6, 7, 9, 14, 16, 20, 21 with a mean ratings 5.3, 4.8, 4.1, 3.7, 5.1, 5.1, 3.7 belong to 90% in cluster1 and 10% in cluster2, 20% in cluster1 and 80% in cluster2, 70% in cluster1 and 30% in cluster2, 80% in cluster1 and 20% in cluster2, 35% in cluster1 and 65% in cluster2, 65% in cluster1 and 35% in cluster2, 85% in cluster1 and 15% in cluster 2 are between **LOW and MODERATE**

IV. CONCLUSION

The Fuzzy Clustering analysis highlighted “Poverty” (11) as the main problem, solving which the PWDs could be relieved of their stressful marginalized status. The problems that is clustered as “**HIGH**” are: Unemployed/Unskilled to earn a living on their own (2), Denied good food, clothing, shelter, health care, etc. (5), Not able to be independent and depend upon others for their day-to-day activities (10), Problem of getting married (12), Insufficient or lack of education (13) and Denial of share in the family property (19).

The problem such as Ill-treated by the family members and consider them as appendages (3), mental stress & trauma suffered by PWDs (4), Lack of knowledge on welfare measures such on SSHG (Special Self Help Group) (17) and lack of awareness on possessing the National ID card as PWDs (18) fall under the cluster labelled “**MODERATE**”.

V. SUGGESTION

Prevention is better than cure, so more than providing opportunities for their educational employment, health and rehabilitation measures it's important to safe guard the future generation by preventive and early detections of disabilities. So the “government, local authorities and the voluntaries sector shall

1. Undertake or cause to be undertaken surveys, investigations and research concerning the cause of occurrence of disabilities;
2. Promote various methods of preventing disabilities.
3. Screen all the children at-least once in a year for the purpose of identifying at “Risk Cases”;
4. Provide facilities for training to the Staff at the primary health centers:
5. Sponsor or Cause to be sponsored awareness campaigns and is disseminated or caused to be disseminated information for general hygiene, health and sanitation;
6. Take measures for pre-natal, parental and post-natal care of mother and child;
7. Educate the public through pre-schools, schools, primary health centers, village level workers;
8. Create awareness amongst the masses through television, radio and other mass media on the causes of disability and the preventive measures to be adopted”. As detailed in chapter four of the PWD Act 1995.

We all are aware that we are a part of launching of new Asian decade of persons with disabilities (2013-2022). We need to continue focusing on the ever increasing challenges to empower and self-esteem of PWDs in the years to come.

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