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Enhanced and Secured Big Data Analytics using Fuzzy Set for Effective E-Governance

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ABSTRACT: In the recent years, government around the world are embracing the digital revolution to enhance services for their citizens. Government services are provided using electronic media anywhere and anytime. With the e-governance initiatives, the transactional data is growing exponentially and it has become difficult to analyse such large volume of data stored at multiple locations with traditional data mining tools. The alternative to analyse large data is to use big data analytical tools. Big data refers to data sets that are so large and complex that traditional data processing tools and technologies cannot cope with. The process of examining such data to uncover hidden patterns in them is referred to as big data analytics. This paper focuses on the impact of fuzzy based big data analysis for the e-governance. Getting in sight to the results of the predictive analysis can give huge benefits to the e-governance. Apart from this, analysis of the data its predictive nature results into the better perception of the plans to be implemented using the fuzzy sets.

KEYWORDS:E-government, Bigdata, Fuzzy technics, Data analytics, Data mining

I. INTRODUCTION

With the e-Governance initiatives across the world especially in India, the transactional data is growing exponentially and it has become difficult to analyse such large volume of data stored at multiple locations with traditional data mining tools. The alternative to analyse large data is to use Big Data analytical tools. The tools having capabilities of mining large data sets in distributed environment help in examining and analyzing e-Governance projects. E-Governance refers to providing quality information and government services to citizens and/or other government/non-government organizations effectively and efficiently. Using Big Data Analysis, both service provider (here Government) and citizens availing services will be benefited. It will help Government in making better decisions and people in getting timely and reliable information. This paper focuses on the impact of big data analysis for the E-governance. Getting insight to the results of the predictive analysis can give huge benefits to the E-governance. Apart from this, analysis of the data and its predictive nature results into the better perception of the Plans to be implemented in the future. This paper represents a fuzzy based big data analytics, which provides automatic pattern recognition and attempts to uncover patterns in data that are difficult to detect with traditional statistical methods.

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II. RELATED WORK

With the e-Governance initiatives across the world especially in India, the transactional data is growing exponentially and it has become difficult to analyse such large volume of data stored at multiple locations with traditional data mining tools. The alternative to analyse large data is to use Big Data analytical tools. This explained by PreetNavdeep et al[2]. This paper focuses on role of Big Data analytics in e-Governance projects. Big Data refers to data sets that are so large and complex that traditional data processing tools and technologies cannot cope with. The process of examining such data to uncover hidden patterns in them is referred to as Big Data Analytics This explained by NishantAgnihotriet al[1]. This paper focuses on the impact of big data analysis for the E-governance. Getting insight to the results of the predictive analysis can give huge benefits to the E-governance.

The concept of an e-government system is to provide access to government services anywhere at any time over open networks. This leads to issues of security and privacy in the management of the information systems. Ensuring security of e-government applications and infrastructures is crucial to maintain trust among various departments to store, process and exchange information over the e-government systems. This explained by P.V.S.S.Gangadhar et al[4]. This paper presents an information security evaluation framework based on fuzzy logic techniques to help policy makers conduct comprehensive assessment of government security strategy. Keywords. In the recent years, Governments around the world are embracing the digital revolution to enhance services for their citizens. Government services are provided using electronic media anywhere and anytime. One of the most important issues in e-government is the security. E- government security is considered one of the crucial factors for achieving an advanced stage of e-government. This explained by Nadir Omer FadlElssiedet al[3]. This paper, firstly, presents reviews and discusses the comparison between variant fuzzy-based techniques. This paper has concluded that; Fuzzy set theory is very useful for evaluation of e-government security. With the massive proliferation of online applications for the citizens with abundant resources, there is a tremendous hike in usage of e-governance platforms. Right from entrepreneur, players, politicians, students, or anyone who are highly depending on web-based grievance redressal networking sites, which generates loads of massive grievance data that are not only challenging but also highly impossible to understand. This explained by Sangeetha Get al[3]. the proposed system attempts to understand the possibility of performing knowledge discovery process from grievance Data using conventional data mining algorithms. Designed in Java considering massive number of online e-governance framework from civilian's grievance discussion forums, the proposed system evaluates the effectiveness of performing data mining for Big data.

III. FUZZY BASED BIG DATA ANALYTICS

There are some situations in which information may be hard or even impossible to quantify due to its nature, and thus, it can only be expressed in linguistic terms (e.g., when evaluating the comfort or design of a car, terms like "good", "fair", "poor" can be used). In other cases, precise quantitative information cannot be provided because it is either unavailable or the cost for its computation is too high and an approximate value can be tolerated. Such qualitative information can be mathematically modelled through the use of Fuzzy Sets Theory.

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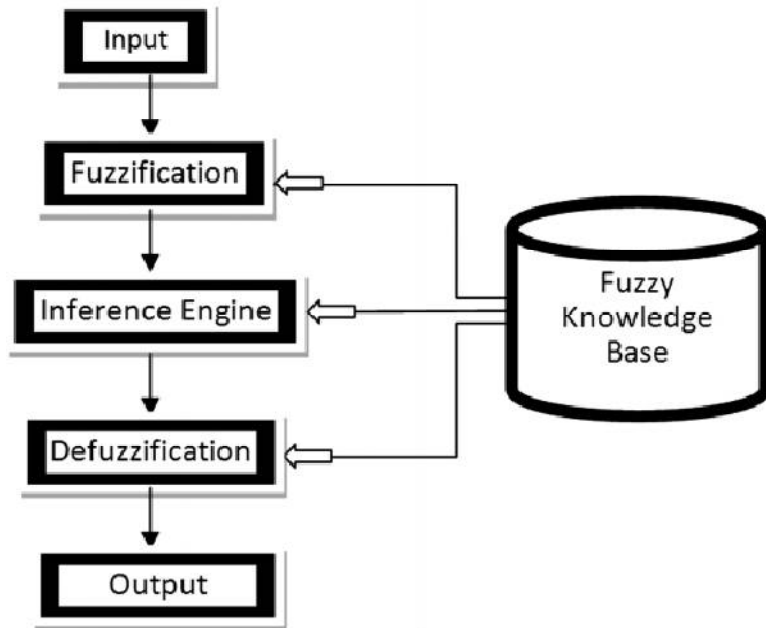


Figure1.1 Fuzzy Based Big Data Analytics

IV.DEVELOPMENT OF FUZZYSYSTEM USING TRIANGULAR

INPUT	INPUTNAME	LINGUISTIC	RANGE
INPUT1	AGE	INFANT	0-5
		MINOR	6-18
		MAJOR	19-60
		SENIOR CITIZEN	61-100
INPUT2	FINGERPRINT	DON'T CAPTURE	0
		POOR	10-30
		NORMAL	30-60
		GOOD	60-80
		VERY GOOD	80-100
INPUT3	IRIS	DON'T CAPTURE	0
		POOR	10-30
		NORMAL	30-60
		GOOD	60-80
		VERY GOOD	80-100

Table1 Fuzzy Input Parameters for Aadhaar Data Set

Figure shows the sample data set collected from various citizens. The input and output fuzzy variables are created from using the sample data set. Table1 contains the input variables and their ranges. Table2 contains the output variables.

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OUTPUT	OUTPUTNAME	LINGUISTIC
DECISION	DATA ANALYTICS ON AADHAAR	REFER PARENT
		USE FINGERPRINT
		USER IRIS
		USE BOTH
		MEDICAL PROBLEM
		USE RECENT PHOTO

Table 2 Fuzzy Output Parameters for Aadhaar Data Set

V.FUZZIFICATION

Fuzzification comprises the process of transforming crisp values into grade of membership for linguistic terms of fuzzy sets. The membership function is used to associate a grade to each linguistic form. Figure2 describes that the three input parameters and one output of the Aadhaar data set and apply to the FIS and arrange the rules then perform data analytics on the Aadhaar data set. In this research the range for the input variables fingerprint and iris represent the number of features selected from the relevant biometric for authentication.

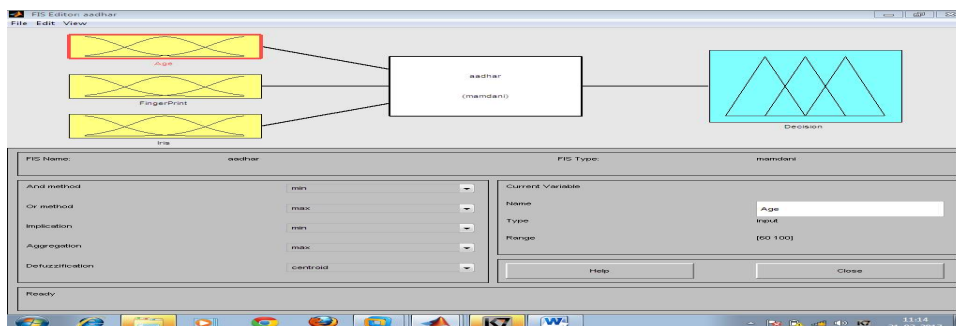


Figure3 FIS Triangular of Aadhaar data set with three input and one output

Figure3, Figure4 and Figure5 describe fuzzification of input parameters Age, Finger print and Iris with their membership functions, the membership functions touching to each other.

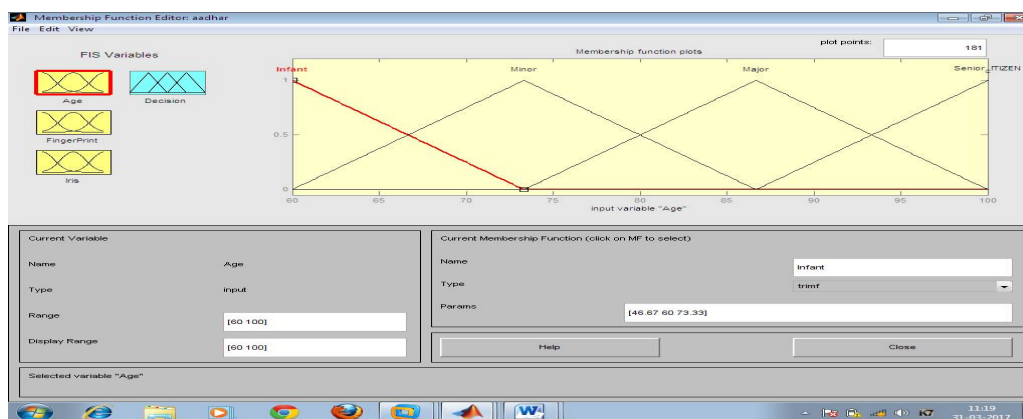


Figure 4 Fuzzification of Age Triangular in Aadhaar data set

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 6, Issue 6, June 2017

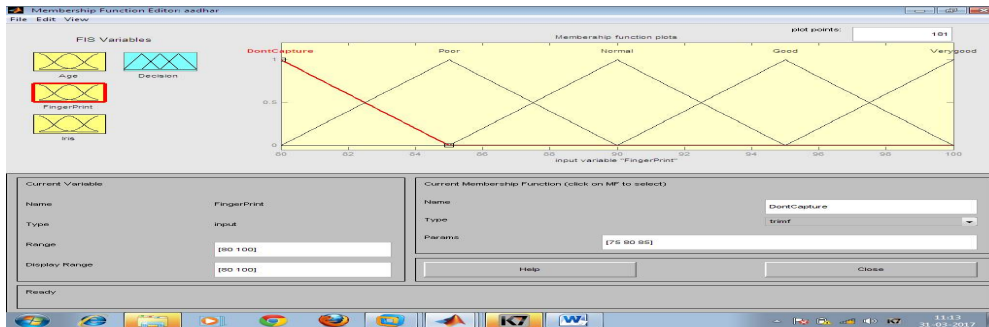


Figure 5 Fuzzification of Finger Print Triangular in Aadhaar data set

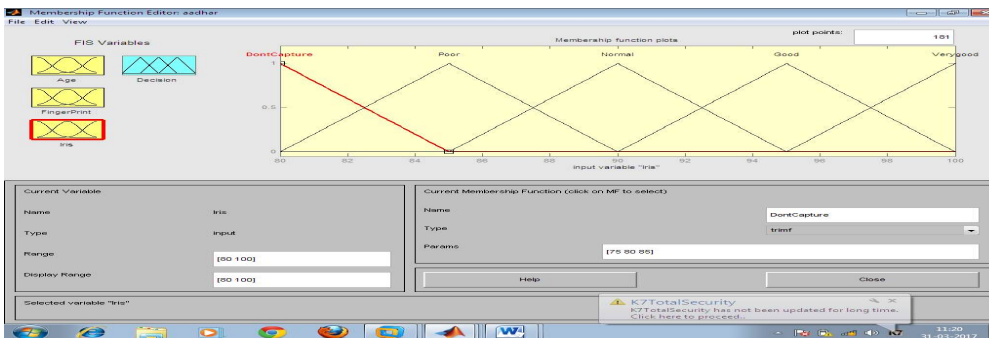


Figure 6 Fuzzification of Iris Triangular in Aadhaar data set

Figure 6 shows fuzzification of output parameter decision of Aadhaar data set with six membership functions and the membership functions are touching with each other for achieving better result.

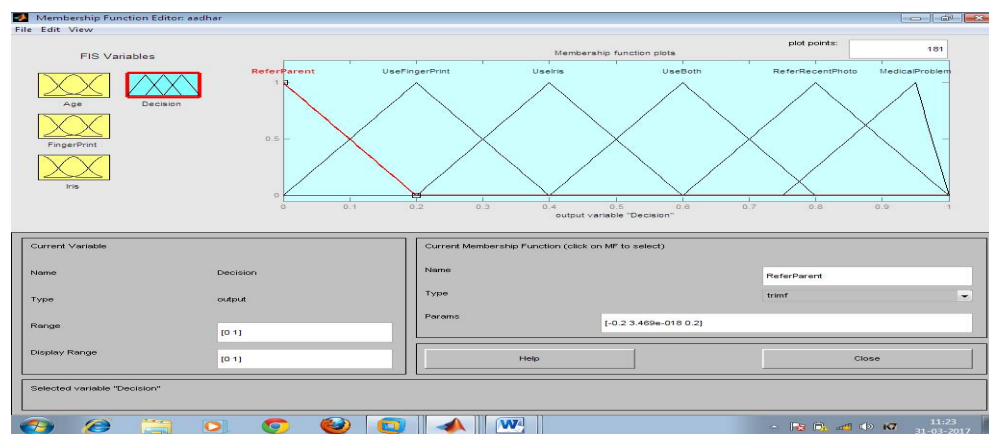


Figure 7 Fuzzification of Decision Triangular in Aadhaar data set

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 6, June 2017

VI. RULE BASED

This proposed research generates rules by fuzzifying the input and output parameters. There are 47 rules generated using 'AND' and 'OR' operator. Figure 6.7 shows the written rules.

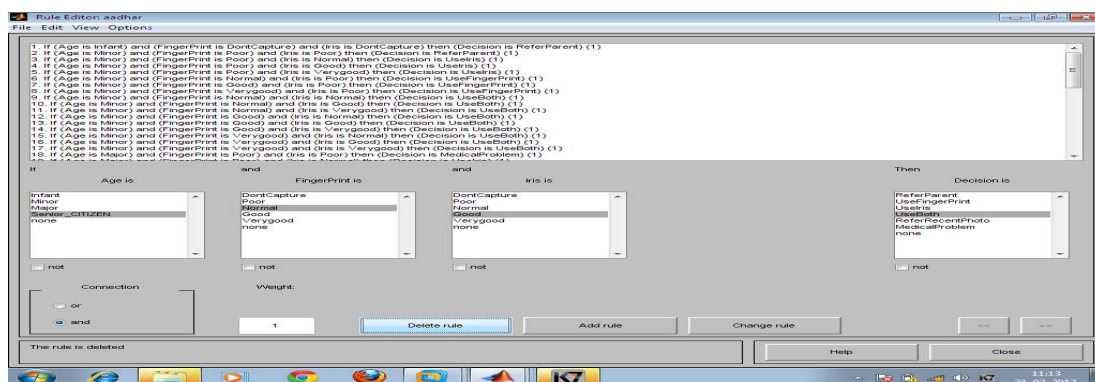


Figure 6.7 Developed Rules for Aadhaar data set

The rules developed for Aadhaar Fuzzy Information System is listed below:

- 1.If (Age is) and (FingerPrint is Dontcapture) and (Iris is Dontcapture) then (Decision is referParent)
2. If (Age is Minor) and (FingerPrint is Poor) and (Iris is Poor) then (Decision is ReferParent) (1)
3. If (Age is Minor) and (FingerPrint is Poor) and (Iris is Normal) then (Decision is UseIris) (1)
4. If (Age is Minor) and (FingerPrint is Poor) and (Iris is Good) then (Decision is UseIris) (1)
5. If (Age is Minor) and (FingerPrint is Poor) and (Iris is Very_good) then (Decision is UseIris) (1)
6. If (Age is Minor) and (FingerPrint is Normal) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
7. If (Age is Minor) and (FingerPrint is Normal) and (Iris is Normal) then (Decision is UseBoth) (1)
8. If (Age is Minor) and (FingerPrint is Normal) and (Iris is Good) then (Decision is UseBoth) (1)
9. If (Age is Minor) and (FingerPrint is Normal) and (Iris is Very_good) then (Decision is UseBoth) (1)
10. If (Age is Minor) and (FingerPrint is Good) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
11. If (Age is Minor) and (FingerPrint is Good) and (Iris is Normal) then (Decision is UseBoth) (1)
12. If (Age is Minor) and (FingerPrint is Good) and (Iris is Good) then (Decision is UseBoth) (1)
13. If (Age is Minor) and (FingerPrint is Good) and (Iris is Very_good) then (Decision is UseBoth) (1)
14. If (Age is Minor) and (FingerPrint is Very_good) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
15. If (Age is Minor) and (FingerPrint is Very_good) and (Iris is Normal) then (Decision is UseBoth) (1)
16. If (Age is Minor) and (FingerPrint is Very_good) and (Iris is Good) then (Decision is UseBoth) (1)
17. If (Age is Minor) and (FingerPrint is Very_good) and (Iris is Very_good) then (Decision is UseBoth) (1)
18. If (Age is Minor) and (FingerPrint is Normal) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
19. If (Age is Minor) and (FingerPrint is Good) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
20. If (Age is Minor) and (FingerPrint is Very_good) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
21. If (Age is Major) and (FingerPrint is Poor) and (Iris is Poor) then (Decision is MedicalProblem) (1)
22. If (Age is Major) and (FingerPrint is Normal) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
23. If (Age is Major) and (FingerPrint is Normal) and (Iris is Normal) then (Decision is UseBoth) (1)
24. If (Age is Major) and (FingerPrint is Normal) and (Iris is Good) then (Decision is UseBoth) (1)

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 6, June 2017

25. If (Age is Major) and (FingerPrint is Normal) and (Iris is Very_good) then (Decision is UseBoth)
26. If (Age is Major) and (FingerPrint is Good) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
27. If (Age is Major) and (FingerPrint is Good) and (Iris is Normal) then (Decision is UseBoth) (1)
28. If (Age is Major) and (FingerPrint is Good) and (Iris is Good) then (Decision is UseBoth) (1)
29. If (Age is Major) and (FingerPrint is Good) and (Iris is Very_good) then (Decision is UseBoth) (1)
30. If (Age is Major) and (FingerPrint is Very_good) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
31. If (Age is Major) and (FingerPrint is Normal) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
32. If (Age is Major) and (FingerPrint is Good) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
33. If (Age is Major) and (FingerPrint is Very_good) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
34. If (Age is Senior_CITIZEN) and (FingerPrint is Poor) and (Iris is Poor) then (Decision is ReferRecentPhoto) (1)
35. If (Age is Senior_CITIZEN) and (FingerPrint is Poor) and (Iris is Normal) then (Decision is UseIris) (1)
36. If (Age is Senior_CITIZEN) and (FingerPrint is Poor) and (Iris is Very_good) then (Decision is UseIris) (1)
37. If (Age is Senior_CITIZEN) and (FingerPrint is Normal) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
38. If (Age is Senior_CITIZEN) and (FingerPrint is Good) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
39. If (Age is Senior_CITIZEN) and (FingerPrint is Very_good) and (Iris is Poor) then (Decision is UseFingerPrint) (1)
40. If (Age is Senior_CITIZEN) and (FingerPrint is Normal) and (Iris is Good) then (Decision is UseBoth) (1)
41. If (Age is Senior_CITIZEN) and (FingerPrint is Normal) and (Iris is Very_good) then (Decision is UseBoth) (1)
42. If (Age is Senior_CITIZEN) and (FingerPrint is Good) and (Iris is Normal) then (Decision is UseBoth) (1)
43. If (Age is Senior_CITIZEN) and (FingerPrint is Good) and (Iris is Good) then (Decision is UseBoth) (1)
44. If (Age is Senior_CITIZEN) and (FingerPrint is Good) and (Iris is Very_good) then (Decision is UseBoth) (1)
45. If (Age is Senior_CITIZEN) and (FingerPrint is Very_good) and (Iris is Normal) then (Decision is UseBoth) (1)
46. If (Age is Senior_CITIZEN) and (FingerPrint is Very_good) and (Iris is Good) then (Decision is UseBoth) (1)
47. If (Age is Senior_CITIZEN) and (FingerPrint is Very_good) and (Iris is Very_good) then (Decision is UseBoth) (1)

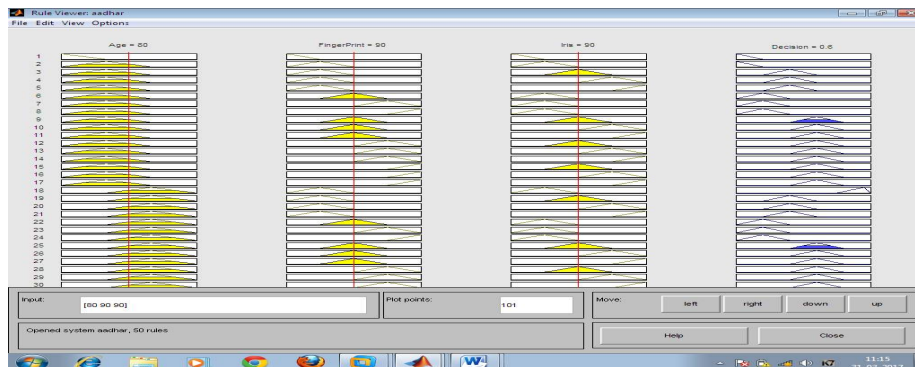


Figure 8 Inference Engine Evaluation Values of Aadhaar FIS Rules

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Website: www.ijirset.com

Vol. 6, Issue 6, June 2017

Figure 6.8 shows the inference engine different evaluation values of Aadhaar FIS rules. In the below explain some of the different evaluations, selected from the sample Aadhaar data set. This can be tabulated in Table 6.3.

1. Age = 1, Finger Print = 0, Iris = 0 then the decision taken by Aadhaar FIS is refer the Parent's Aadhaar Information for further authentication process.
2. Age = 6, Finger Print = 15, Iris = 40 then the decision taken by Aadhaar FIS is use the Iris for authentication and other process.
3. Age = 19, Finger Print = 45, Iris = 50 then the decision taken by Aadhaar FIS is use both of the biometrics finger print and iris for authentication and other process.
4. Age = 40, Finger Print = 80, Iris = 75 then decision taken by Aadhaar FIS is use both of the biometrics finger print and iris for authentication and other process.
5. Age = 45, Finger Print = 15, Iris = 20 then the decision taken by Aadhaar FIS is check whether there is any medical problem for the registered citizen.
6. Age = 80, Finger Print = 20, Iris = 15 then the decision taken by Aadhaar FIS is sometimes biometric features for senior citizen's cannot be captured in effective manner, so please refer the recent photograph to authenticate the senior citizen.

Sl.No	Age	Finger Print	Iris	Decision
1	1	0	0	Refer Parent
2	6	15	40	Use Iris
3	19	45	50	Use Both
4	40	80	75	Use Both
5	45	15	20	Medical Problem
6	80	20	15	Refer Photo
7	70	60	50	Use Both
8	65	20	60	Use Iris
9	60	70	15	Use Finger Print
10	2	0	0	Refer Parent

Table 6.3 Performance of Aadhaar FIS for the sample data set

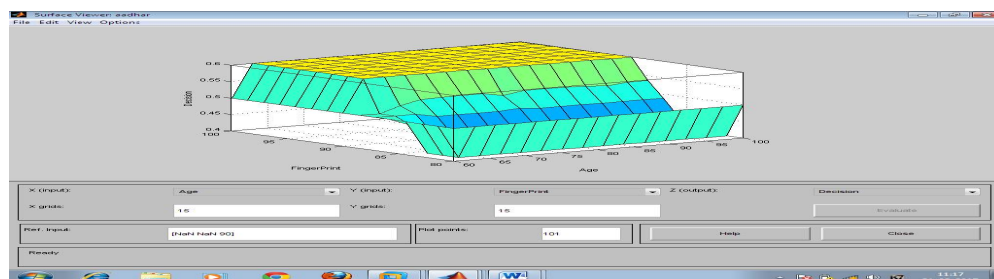


Figure 9 Three dimensional view of Aadhaar FIS Rules

Three dimensional of surface view of rule base explains the rules is on x-axis is age and y-axis is finger print and get the z-axis is decision.

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Vol. 6, Issue 6, June 2017

VII.RESULTS AND DISCUSSION

In this research work, fuzzy sets are implemented to perform data analytics on Aadhaar data set. The proposed system discusses about the fuzzy framework that evaluates the extent of effectiveness of conventional big data analytic techniques on large data captured from e-governance Aadhaar data set in multiple online resources available. A sample data from 1000 users are used in this research work to implement a simple fuzzy set to make a simple analysis. In this proposed work is to develop a Fuzzy Inference System (FIS) to perform a simple data analytics on Aadhaar data set. Various factors are considered to perform simple data analytics, these factors are selected and fuzzified as input fuzzy variable and output variable. Some decisions based on the input fuzzy variables are fuzzified with suitable fuzzy rules and ultimately FIS is developed. Figure 6.1 shows the sample data set collected from various citizens. The input and output fuzzy variables are created from using the sample data set. Table 6.1 contains the input variables and their ranges. Table 6.2 contains the output variables.

INPUT	INPUTNAME	LINGUISTIC	RANGE
INPUT1	AGE	INFANT	0-5
		MINOR	6-18
		MAJOR	19-60
		SENIOR CITIZEN	61-100
INPUT2	FINGERPRINT	DON'T CAPTURE	0
		POOR	10-30
		NORMAL	30-60
		GOOD	60-80
		VERY GOOD	80-100
INPUT3	IRIS	DON'T CAPTURE	0
		POOR	10-30
		NORMAL	30-60
		GOOD	60-80
		VERY GOOD	80-100

Table 6.1 Fuzzy Input Parameters for Aadhaar Data Set

OUTPUT	OUTPUTNAME	LINGUISTIC
DECISION	DATA ANALYTICS ON AADHAAR	REFER PARENT
		USE FINGERPRINT
		USER IRIS
		USE BOTH
		MEDICAL PROBLEM
		USE RECENT PHOTO

Table 6.2 Fuzzy Output Parameters for Aadhaar Data Set

VII. CONCLUSION

Big data is fact playing a major role for the future actions and for providing bet of the services in e-governance plan. Big data analytics is transforming the way government is using sophisticated information technologies to gain insight from their data repositories to make informed decision. The widespread implementation and use of big data analytics across the government becomes more main stream, issues such as guaranteeing privacy, safeguarding security, establishing standard and governance, and continually improving the tools and technologies would gather attention. Big

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Vol. 6, Issue 6, June 2017

data if analyzed with good techniques and technologies can give rise to numerous ideas for the government, in better implementation of e-governance plan. The proposed fuzzy based big data analytics can encourage and prove to be helpful in further improvement, better planning and decision making of e-governance projects.

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