A NATIVE MUTATION TRACKING SYSTEM OF CABLE INDUSTRY DIGITIZATION USING DATA ANALYTICS

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Abstract—Predictive level of Technology Adaptation is very hard to measure due to uncertainty occurs in real environment. Intelligence of Knowledge Base is key factor to generate quality of results. Cable TV Industry is one of the prominent area, where Technology Adaptation dramatically change due to variant nature of involved users. Other factors are occurred due to mutation (mt), uncertainty of distance (uDist), ability to understand technology (tAdpt), quality of service (qos) and advancement level (aLvl) in Cable TV Industry. Mathematical Predictive Algorithm and Data Mining Algorithm provide the combine solution for mutation tracking related to Technology Adaptation in cable industry. In this paper we analyse the technology mutation from analog to digital and adaptation level of native technology by cable operators, to predict level of Mobil Technology Adaptation with its Order of Adaptability (oAdpt) based on geographical locality.

Keywords—*GIS; Decision Making; Technology Adaptation; Mutation Tracking; Euclidian Minimum Distance.*

I. INTRODUCTION

Mutation tracking to generate qualitative knowledge base is key factor to predict efficient results for any mutant technology. Native era generates necessary requirements to adopt intelligent approaches for efficient predictive results. Cable TV Industry is the one of the prominent area in the race of adopting advance technologies. Analysis of mutation between analogy and digitize technology adaptation generate strong knowledge base for prediction of Mobile Technology adaptation.

Karayiannis & Randolph-Gips [4] present Euclidean minimum distance algorithm, which is helpful to calculate the distance between their nearest neighbors and it is work swiftly with data clusters. Wan et al. [7], recommend that pay per channel approach is beneficial to increase the demand of digitization which helps to generate fast movement on pay TV Broadcasting in real-time environment. However, Gupta et al. [3], focus on the digitization benefits over the Analog data Transmission but there is need to measure the growth of digitization which clearly defines the positive effect on Cable TV Industry. The study was presented by Ramírez-Gallego et al. [5], discussed on the different classifier technique. This classifier helps to find the neighbor root over to the set of data. This helps to find out the distance of cable operator that choose for digitization.

Gangl [1] presents the change in analog to digital television and convergence of television, computers and telecommunication requires complexity of testing for measurement of multimedia applications which help to test the Mutation Tracking System. The study presented by Robert et al. [6], gives a clear idea of different services given by the cable operator but these services require higher bit rate that must be cost effective. Gaudiano & Cuccarese [2] recommend the various opportunity for the society that are economical and bridging the gap between old and new era of telecommunication.

Key purpose of the study is to find efficient factors in historic mutation and use them with intelligent approach to generate future mutant predictive results, especially for Cable TV industry. This study generates good results, with real time data feed with the co-ordination of cable operators and technology providing companies. Due to indirect co-ordination between cable customers and technology providers generate knowledge gap. To fill this gap, we are adding more effective geographical factors in cable operator's data set, which categories the role of cable operator and its customers trend in specific geographical locality.

II. METHODOLOGY

Efficient predictive results are generated with the efficiency of knowledge base and quality of historic training sets. In Cable TV industry, data sets have lack of knowledge base efficiency. To overcome this problem, we apply various classifications and cluster based data mining algorithms to generate intelligent knowledge base and training sets.

This intelligent knowledge base further combines with geographical data sets to generate more accurate and specific results in geographical search space with the power of efficient Mathematical Algorithms. Proposed novel mutation tracking system initially used classification technique, to generate city/state based data sets, then further these data sets used clustering algorithm, to generate two clusters categorized on technology adaptive customers and non-technology adaptive customers. After data mining finally combine these result sets with geographical search space, to generate predictive order of technology adaptation with the help Euclidean minimum Distance Algorithm.

A. Theoretical Framework (Data Analytics Approach)

Measurement the level of success for native Technology Adaptation is complex problem, which needs to be efficient knowledge base and mathematical approach. We understand the situation of cable industry, especially Punjab cable industry and proposed a suitable solution in form of novel mutation tracking system based on data analytics and mining approach.

TABLE I. SAMPLE DATA SET PARAMETERS

Parameter	Description
ID	Cable Operator Id
Name	Cable Operator Name
DigitizationStatus	True: if Digital; False: if not Digital
City	Cable Operator City
District	Cable Operator District
State	Cable Operator State
Zipcode	Digitization Area Zipcode
Area	Cable Operator Area
Longitude	Longitude of Cable operator Location
Latitude	Latitude of Cable operator Location
AnalogSoftwareDate	Date when cable operator adopted Analogy Software
DigitalSoftwareDate	Date when cable operator adopted Digital Software
DigitizationDate (aCust/nCust)	Date when cable operator fully digitized with digitized Software Already Customers those Digitization Date is before current Date else null for non-customers.

B. Year (2017 & 2018) and Era (2017-2020) Based Native Customer Prediction

Algorithm: Year (2017 & 2018) and Era (2017-2020) Based Native Customer Prediction.

Input: List of Cable Operators X of N Elements.

Output: List of Cable Operators Y*

Step 1: Apply classification algorithm on X input set based on city/state and generate Xn* data stubs.

Step 2: Apply clustering technique on each Xn* data stub, to generate two clusters in form of already customers and non-customers of digital technology by service provider.

Step 3: Find average of already customers (fully adopted digital technology, before current date). Evaluate avg(Xn*(year)) data stub based on each year from 2010 to 2016 for Year Prediction and evaluate avg(Xn*(era)) data stub based on each era from (2010 to Mid-2014) and (Mid-2014 to Mid-2016) for Era Prediction.

Step 4: Evaluate Predictive Operators based on Probability of already customers Xn*(aCust) against non-customers Xn*(nCust) on each Xn* data stub.

$$p(\text{nCust}|\text{aCust}) = \frac{p(nCust \cap aCust)}{p(aCust)}$$

Step 5: Combine Xn* data stub along with Gn* data stub (Geographical Search Space) and generate Yn* cable operator's data stub along with evaluated average, probability values and geographical co-ordinates.

Step 6: Apply Minimum Euclidean Distance by mapping non-customers Yn*(nCust) with opponent of already customers Yn*(aCust) using respective co-ordinates on each Yn* data stub.

Step 7: Sort each Yn*(nCust) data stub based on minimum distance.

Step 8: Now select top minimum distance cable operators based on Step 4 probability value along with step 3 average value and discard others in each Yn*(nCust) data stub and generate final Yn*(pCust) data stub.

Step 9: Combine all Yn*(pCust) data stub and generate final Predictive operators list Y*(pCust).eit Year (2017 & 2018) and Era (2017-2020).

C. Year (2017 & 2018) and Era (2017-2020) Based Mobile Technology Adaptation Prediction

Algorithm: Year Based Mobile Technology Adaptation Prediction (2017 & 2018).

Input: List of Native Predictive (Year or Era Based) Cable Operators Y1(pCust), all cable operator's data stub along with geographical parameters Yn*, probability of

Output: List of Cable Operators Y**

Step 1: Apply Minimum Euclidean Distance by mapping already customers Yn*(aCust) with opponent of predictive customers Yn*(pCust) using respective co-ordinates on each Yn* data stub.

Step 2: Sort each Yn*(aCust) data stub based on minimum distance.

Step 3: Now select top minimum distance cable operators based on probability value along with average value of avg(Xn*(year)) or avg(Xn*(era)) and discard others in each Yn*(aCust) data stub.

$$p(\text{nCust}|\text{aCust}) = \frac{p(nCust \cap aCust)}{p(aCust)}$$

Step 4: Combine all Yn*(aCust) data stub and generate Predictive old operators list Y2(aCust).

Step 5: Now combine list Y1(pCust) and Y2(aCust) and generate final predictive operators list Y**(pCust).

III. RESULTS AND DISCUSSION

A. Input Data Set (X)

Cable Operators Data Set generates using classification based on various parameters like ID, Name, Digitization Status, City, District, State, Zipcode, Area, Longitude, Latitude, Analog Software Date, Digital Software Date, and

Digitization Date. Source of sample data sets accumulate from Yashvee Infosys (Technology Provider), Fastway (Hub of Cable Industry in Punjab) and directly from Cable Operators.

B. *Predictive Results of Native Customers (Y*)*

Predictive Results(Y*) are generated after applying proposed algorithm in two variations. Firstly, bias algorithm applies after city/state based classification to predict technology adaptation value, then combine these result sets in geographical search space and use Euclidian minimum distance algorithm, to get final predictive result sets. Figure 1 shows y-axis represent total fully technology adaptive cable operators and x-axis represent years, in which 2017 and 2018 are two predictive years, which represent how much cable operators adopt native digital technology. Figure 2 represent technology adaptive mutation in different era.

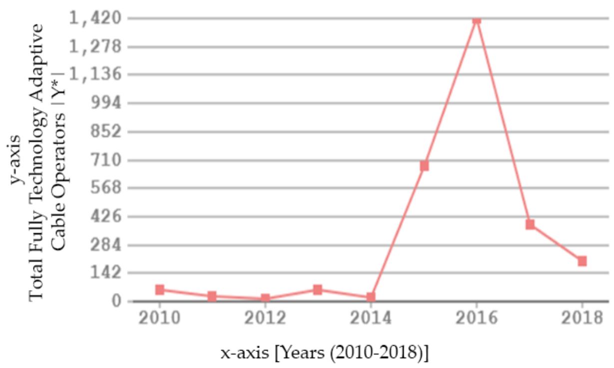

Figure 1: Year Based Native Customer Prediction (2017 & 2018)

TABLE II. TECHNOLOGY ADAPTATION - NATIVE CUSTOMER PREDICTION [YEAR PREDICTION - (2017-2018)]

Year	Total Fully Technology Adaptive Cable Operators |Y*|
2010	56
2011	26
2012	16
2013	62
2014	20
2015	681
2016	1418
2017 (Predictive Year)	385
2018 (Predictive Year)	204
2010	56
2011	26
2012	16

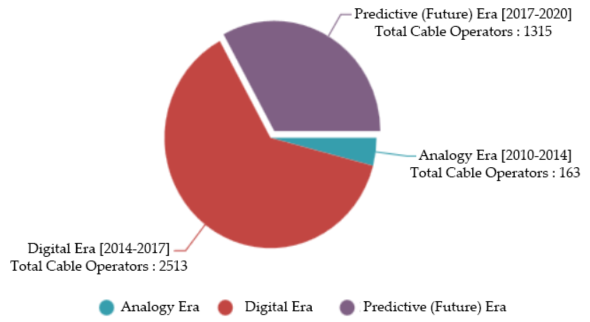

Figure 2: Era Based Native Customer Prediction (2017-2020)

TABLE III. TECHNOLOGY ADAPTATION – NATIVE CUSTOMER PREDICTION [ERA PREDICTION - (2017-2020)]

Era (Start Year to End Year)	Total Fully Technology Adaptive Cable Operators |Y*|
2010-2014 (Analogy Era)	163
2014-2017 (Digital Era)	2513
2017-2020 (Predictive/Future Era)	1315

C. *Predictive Results of Mobile Technology Adoptive Customers (Y**)*

Predictive Results of Mobile Technology Adaptive Customers(Y**) are generated based on the native customer's predictive results, in which native predictive customer treat as already customer along with actual already customer and apply algorithm process on extended geographical search space. Figure 3 and Table 4 shows y-axis represent total fully technology adaptive cable operators and x-axis represent years, in which 2017 and 2018 are two predictive years, which represent how much cable operators adopt future mobile technology. Figure 4 shows technology adaptive mutation in different Analogy, Digital and Predictive/Future Era.

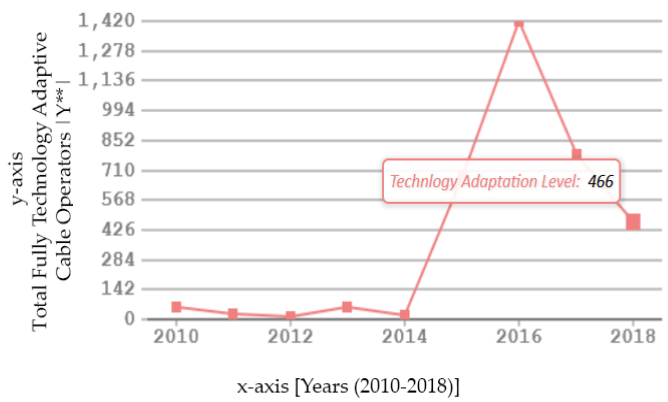

Figure 3: Year Based Mobile Technology Adaptation Prediction (2017 & 2018)

TABLE IV. MOBILE TECHNOLOGY ADAPTIVE CUSTOMERS PREDICTION [YEAR PREDICTION - (2017-2018)]

Year	Total Fully Technology Adaptive Cable Operators
	*|Y**|*
2010	56
2011	26
2012	16
2013	62
2014	20
2015	681
2016	1418
2017 (Predictive Year)	783
2018 (Predictive Year)	466

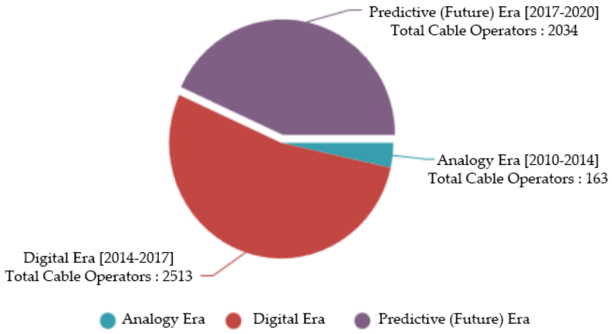

Figure 4: Era Based Mobile Technology Adaptation Prediction (2017-2020)

Era (Start Year to End Year)	Total Fully Technology Adaptive Cable Operators
	|Y**|
2010-2014 (Analogy Era)	163
2014-2017 (Digital Era)	2513
2017-2020 (Predictive/Future Era)	2034

Table 5. Mobile Technology Adaptive Customers Prediction [Era Prediction - (2017-2020)]

IV. CONCLUSION

Technology Adaptation in cable TV industry is very crucial aspect due to uncertainty in the nature of cable customers, which is very difficult to predict. To overcome this problem, a novel mutation tracking system is proposed, which helps to generate efficient knowledge base with intelligent scientific approach for future prediction. This knowledge base combines with geographical search space and generates more efficient and specific results with priority order of technology adaptation that is the key advancement in proposed system. This proposed system able to work more efficiently with real time data feeds and provide more accurate predictive results.

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