A Survey on Data Mining Techniques With Various Applications: Two Decades From 1997 To 2017

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Abstract- *Data mining is one of the major areas of research. An extensive research is being done on classification, Clustering, Association rules which are the functionalities of data mining. In the past two decades various Data Mining Techniques (DMT) with various applications were developed. In this paper we review, the data mining Classification articles from 1997 to 2017. With respect to the knowledge, analysis and architecture type the data mining techniques are classified. These DMT and their methods were applied to different areas such as Rain fall forecasting, weather prediction and fraud detection. It is our hope that this survey will provide the great advantage of DMT and their applications.*

Keywords- Data mining, SVM, Neural Networks, Rain Fall forecasting, Classification

I. INTRODUCTION

Data mining is a variety of technique to identify suggest of information or decision making knowledge in the data base and extracting these in a way that they can be put to use in areas such as decision support, predictions, forecasting and estimation. In 1960s artificial intelligence (AI) was introduced as a branch in Data Mining. According to Ha, Bae, & Park, 2000, the innovative changes in technology was developed in web based education. Weiss & Indurkhya -1998, a search was developed in data mining, a large volume of data. In 1996, Fayyad, Djorgovski, & Weir explained the growth of different data bases need to develop the data ware house and extract the knowledge using different Data mining techniques.

Recently, a large number of Data Mining Techniques were developed and they use several kinds of data mining methods, including generalization, characterization, classification, clustering, association, evolution, pattern matching, data visualization and meta-rule guided mining. These techniques are reviewed here.

II. DIFFERENT APPROACHES IN DMT

The data collected dates from 1997 to November 2017, in all the functionalities of Data mining ie: Decision tree, Clustering, Classification, Artificial neural network, Association rule, Artificial intelligence, Bioinformatics, Customer relationship, Fuzzy logic, and their applications are presented in this survey.

a).Approach-I: Algorithm and Analysis of System Architecture

A finite well defined instruction was described to calculate a function in Algorithm architecture. To define the structure the conceptual model was used in system architecture analysis. Software and hard ware elements are used in the design of composite system.

Applications of Algorithm Architecture	Gap statistic algorithms, chi-square automated interaction detection models and algorithms, GRASP, OLAP, k-means, Clustering algorithms, decision forest algorithms, classification and regression trees, Euclidean distance, bagged clustering algorithms, fuzzy logic, association rules, C&RT, Apriori algorithms, C5, anomaly-based IDS, clustering, genetic algorithms, CRISP-DM models, thyroid stimulation and SVM
Applications of Analysis of system Architecture	semantic analysis, regression analysis, statistical analysis, discriminative analysis, association analysis, Cluster analysis, decision making, decision support systems, consumer behavior analysis, binary logistical regression analyses, market basket analysis, collaborative filtering, data analysis, decision tree based models, principal component analysis, multi-feature selection, intrusion detection and hem dialysis

b).Approach-II: Dynamic Prediction and Artificial Neural Network

Unlike human brain the Artificial Neural Network (ANN) has heuristic knowledge. The main characteristic of such a computing system is the number of highly interconnected processing elements (neurons) working together to solve specific problems without being programmed with step-by-step instructions. Instead, ANN's are capable of learning on their own or by example through a learning process that involves adjustments to the connections that exist between the neurons. The dynamic prediction based approach is a mathematical mod-el for stochastic dynamics; used in modeling molecules, but it also finds applications in the stock market, among other areas.

Applications of Artificial Neural Network	Radial basic function network, neural classification, Bayesian confidence propagation neural networks, Fuzzy recurrent neural network, back propagation artificial neural network, General regression neural network.
Applications of Dynamic Prediction	Ophthalmic oncology, vehicle fault diagnosis, grid computing, dyadic wavelet, pre-fetching, fault restoration prediction models, fault prediction models, Maxwell equations, chemical reactivity predictions, real time vehicle tracking, forecasting, anomaly detection, churn prediction and predictive models.

c).Approach-III: Intelligence agent systems and System optimization

An intelligent agent system (IAs) is an autonomous entity, which observes and acts upon an environment. Intelligent agents may also learn, or use knowledge to achieve their goals. They may be very simple, or very complex. A reflex machine, such as a thermostat is an intelligent agent, as is a human being, as is a community of human beings working together towards a goal. System optimization refers to the selection of a best element from some set of available alternatives. The problems in which a real function is maximized are solved by systematically choosing the value of real or integer variables from within an allowed set.

Applications of Intelligence agent systems	Multi-agent systems, complex systems, computer interface design, multiuser database systems, intelligent analysis, manufacturing intelligence, intelligent tutoring systems, support vector machines, supervisory and specialist systems,

	computing intelligence, artificial intelligence systems.
Applications of System optimization	Electrical nerve stimulation, vertical partitioning, logistical regression, analytical hierarchy processes, polynomial regression, biogeography based optimization, particle swarm optimization, finite element methods, asymptotic methods and parallel computing.

d).Approach-IV: Modeling and Information systems

Modeling technology can provide quantitative methods for the analysis of data, to represent, or ac-quire expert knowledge, using inductive logic programming, or algorithms, so that AI, cognitive science and other research fields are afforded broader platforms for the development of DMT. Information systems are the products of an academic discipline. They occupy a place between the business world and computer science bridging the business field and the well-defined computer science field that is evolving toward a new scientific area of study. An information system relies on the theoretical foundations of information and computing which allows researchers a unique opportunity to engage in academic studies of various business models and related algorithmic processes that are pertinent to computer science.

Applications of Modeling systems Cost modeling, model-based diagnosis, forest fire proliferation modeling, model output statistics, intonation modeling, XML document modeling, Cox proportional hazard modeling, load damage exponents, polynomials, similar waveforms, simple additive weight, computer numerical control, meta learning and drug utilization

e).Approach-V: Knowledge-based systems and their applications

Knowledge-based systems are artificial intelligent tools that work in a narrow domain, to provide intelligent decisions, with justification.

The most common definition of KBS is human centered, since KBS have their roots in the field of artificial intelligence (AI). Wiig - 1994, represent attempts to understand and initiate human knowledge, in computer systems. Knowledge is acquired and represented, using various knowledge representation techniques, rules, frames and scripts.

The below Table illustrates different data mining techniques applied to the different area from last two decades. From 1997 to 2017 Data Mining Techniques were applied very efficiently to all the areas where the machine learning is used.

TABLE I. DIFFERENT DATAMINING TECHNIQUES FROM LAST TWO DECADES

S.No	Year	Researcher	Data Mining Technique (DMT) Used	Applied to
1	1997	Heckerman David	Bayesian Networks	Data Mining Knowledge Discover
2	1997	Mooley DA and Munote	Artificial Neural Network	Different datasets
3	1997	T Kurino	Infrared Techniques	Estimating deep precipitation
4	1998	RJ Kuligowski and APBarros	Localized precipitation forecasting	Weather forecast
5	1998	Guoqiang Zhang, B.Eddy Patuwo	Artificial Neural Network	Weather forecast
6	1998	C Kummerow, W.Barnes and T.Kozu	TRMM-Tropical Rainfall Measuring Mission	Rain Fall Forecasting
7	1999	Liu,JNK Lee,Rs.T	Neural Network	Rain Fall Forecasting from multiple point sources
8	1999	Jin Long ,Chen Ning and Lin	Artificial Neural Network	Prediction of Weather
9	1999	Brath.A	Numerical weather predicting model	Flood Forecasting
10	1999	Suykens J.A.K, vonde walle	Least square SVM Classifier	Neural processing letters
11	2000	Lee et al	Correlation Analysis	Analysis of System Architecture
12	2000	Kaichang	Inductive Learning System	Intelligent Systems
13	2000	Holger R Maier and C.Dandy	Neural Network	Forecasting of Weather
14	2001	Clifton phua1, Vincent lee , and Kate smith	supervised Approach	Fraud Detection Research on Structured data
15	2001	Saptarsi Goswamia, Sanjay Chakrabortya SanhitaGhosh	Different data mining techniques	Combat Natural Disasters
16	2001	Ninan Sanjeeth Philip and Babu JosephK	Adaptive Basic Function NN (ABCNN)	Neural Networks
17	2001	Manjunath T. N., Ravindra S. Hegadi, Umesh I. M	Realistic Analysis of Data Warehousing and Data Mining	Education Domain
18	2002	Trafalis	Feed Forward Neural Network	Neural Network
19	2002	Huang and Lin	Grap Statistical Algorithm	Algorithm Architecture
20	2002	Jegelevicius	Ophthalmic Oncology	Dynamic Prediction
21	2003	Fong et al	Dynamic Prediction	Vehicle Fraud Detection
22	2003	Symeonidis	Multi agent system	Intelligent Systems
23	2003	Trafalis and White	Complex Systems	Intelligent Systems
24	2004	Sanchez et al	Dynamic prediction	Grid Computinh
25	2004	Merceron, A. & K. Yacef,	Web Mining	Mining Student Data Captured from a Web-
26	2004	Mostow, J.	Design Tactics for Mining ITS Data	ITS Data
27	2005	Srivastava	Radial Basic Function Networks	Neural Networks
28	2005	Lu et al	Statistical Analysis	Analysis of System Architecture
29	2005	Lancashire	Models and algorithms	Algorithm Architecture
30	2006	Ribeiro	Generic search Algorithm for the Satisfiability Problem(GRASP)	Algorithm Architecture
31	2006	Singhal & JaJodi	On Line Analytical Processing-OLAP	Algorithm Architecture

32	2006	Adachi	Discriminative Analysis	Analysis of System Architecture
33	2006	Al-Hamami	Association Analysis	Analysis of System Architecture
34	2006	VK Somarshi and OP Pandey	Auto Regressive Integrated Moving Average (ARIMA)	Rain Fall Forecasting
35	2007	Cesama	Bayesian Confidence Propagation Neural Network	Neural Network
36	2007	Ma and Chan	Gene Regularity Networks	Neural Network
37	2007	Adderley	K-Means	Algorithm Architecture
38	2007	Balzano and Del Sorbo	Clustering Algorithms	Algorithm Architecture
39	2007	Jain	Pre fetchnig	Dynamic prediction
40	2008	Aliev	Fuzzy recurrent Neural Network	Neural Network
41	2008	T Sai and Chen	Neural Network	Neural Network
42	2008	Hsia	Decision forecast algorithm	Algorithm Architecture
43	2008	Qjang	Classification and Regression Trees	Algorithm Architecture
44	2008	Hwang	Fault restoration prediction model	Dynamic prediction
45	2008	Ranjan	Decision making	Analysis of System
46	2009	Jimenez	Fuzzy Logic	Algorithm Architecture
47	2009	Huang	Bagged Cluster Algorithms	Algorithm Architecture
48	2009	Shih	Association Rules	Algorithm Architecture
49	2009	Ture	C&RT	Algorithm Architecture
50	2009	Bara	Decision Support Systems	Analysis of System Architecture
51	2009	Hsieh and Chu	Consumer behavior analysis	Analysis of System Architecture
52	2009	Jilani	Binary Logistic Regression Analysis	Analysis of System Architecture
53	2009	Parhizi	Factor Analysis	Analysis of System Architecture
54	2009	Mucherino	Support Vector Machines	Analysis of System Architecture
55	2009	Riquelme	Program diagnostics systems	Analysis of System Architecture
56	2009	Shaharabi and Neyestani	Market Basket Analysis	Analysis of System Architecture
57	2010	Marx	C5	Algorithm Architecture
58	2010	Chen and Baj	Appriori Algorithm	Algorithm Architecture
59	2010	Assous and Chaskalovic	Vlasov-Maxwell Equation	Dynamic prediction
60	2010	Heet	Forecasting	Dynamic prediction
61	2010	Tsai and Lu	Churn prediction	Dynamic prediction
62	2010	Kim	Collaborative filtering	Analysis of System Architecture
63	2010	Miranda	Data Analysis	Analysis of System Architecture
64	2010	DeAndrade	Supervisory and Specialist systems	Intelligent Systems
65	2011	Lin	Back Propagation Artificial Neural network	Neural network
66	2011	Rivas	Bayesian Networks	Neural network
67	2011	Tu	General Regression Neural Networks	Neural network
68	2011	Zhang and Ramirz-Marquz	Flow networks	Neural network
69	2011	Ahn	Genetic Algorithms	Algorithm Architecture
70	2011	Chen and Huang	CRISP-DM Models	Algorithm Architecture
71	2011	Ravishankar	SVM	Algorithm Architecture
72	2011	Bae and Kim	Decission Tree based models	Analysis of System Architecture

73	2011	Bhramaramba	Principal Component Analysis	Analysis of System Architecture
74	2011	Chang	Multi feature selection	Analysis of System Architecture
75	2011	Thiruvadi & Patel	Intrusion Detection	Analysis of System Architecture
76	2011	Fiol-Riog	Artificial Intelgent	Intelligent Systems
77	2011	Li	Predictive Model	Dynamic Model
78	2011	R SamuelSelvaraj & Geetha	Back Propogation Neural Network	Rain fall prediction
79	2012	Chin-Hung	Green Supply Chain	Dynamic forecasting
80	2012	Sushil kumar	Algorithm c4.5	Anomaly detection in network
81	2012	Shilpa Dharkar	Web mining	Analysis of health dies recommendation system
82	2012	Albert Bifet	Streaming Data Analysis	Mining big data
83	2012	Changal Rao	Decision Theoretic in SQL	Different data sets
84	2013	Clwu and Kwchau	Time series using Modular soft computing	Predicting rain fall
85	2013	Santhosh kumar and Prasad	ANN	Predicting rain fall
86	2013	AR Naik and SKPathan	Robust Back Propagation ANN	Rain Fall Classification
87	2013	Gyanesh, Karmakar and Manojkumar	Back Propogation Neural network	Long range forecasting of monsoons
88	2014	Vipulk Dabhi and Sanjay	Hybrid wavelet Postfix GP Model	Predicting rain fall
89	2014	Priya, shilpa and vashista	Time series analysis	Rain Fall Forecasting
90	2014	TaoHong,PierrePinson and ShuFan	Decision Support System	Probabilistic energy forecasting
91	2014	Vikas Chaurasia & Saurabh Pal	Bagging algorithm	Detect Heart Diseases
92	2015	M. Durairaj, V. Ranjani	the existing data mining techniques with data mining algorithms	Healthcare Sector
93	2015	Ashutosh Sharma and Manish kumar	Bayesian network	Rain Fall Forecasting
94	2015	Dhananjay P and Rushi	Statistical Modeling	Rain Fall Forecasting
95	2015	Ommera Jan Heena Khana	Bayesian filters	Analysis of misclassification Error Detection in Mails
96	2015	Feng Chen, Pan Deng & Jiafu Wan	data mining algorithms	IoT to extract hidden information from data
97	2016	Dr.SP Victor & M.Xavior Rex	Data Analysis	Web structured Mining
98	2016	Vishal bheemwala & Dr. ashok Patel	Distributed Data Mining	Grid Environments
99	2016	Ch.Suresh, N.Sweetha and Dr.K.Thammi Reddy	Different Data mining Techniques	Detecting suspicious accounts in money laundering
100	2016	Memorie M Wang & Jackson Phiri	BI Data Mining Tool	Fraud detection on Bulk Tax data
101	2016	Hemanth kumar & Sanjeev sharma	Association Rule mining	A data profiling and prospective approach
102	2017	Aakash P and Mistree	Machine Learning Techniques	Rain Fall Forecasting
103	2017	SMS Shafaei & MLoghavi	Adaptive Neuro Fuzzy Inference system(ANFIS)	Predict Draft Forecasting
104	2017	Ananta Man Singh and Yun-Taekim	MLPANN	Flood Forecasting
105	2017	Vikas Chaurasia	RepTree, RBF Network and Simple	To Predict and Resolve Breast

		Saurabh Pal	Logistic	Cancer Survivability

III. DATA COLLECTION

In this survey, we have collected research papers published in the field of Data mining for past 22 years through internet. Data samples picked were 110 IEEE, ELSEVIER and related research papers. Out of which, predominantly 17 papers were published in timeline 1997-2001 year, 17 papers lies between 2002-2006, and maximum papers in between 2007 – 2011 and in the year between 2012-2017 another 27. The above details were depicted in the below tables and plotted in graphs.

Table 1: Data Mining Research Paper publication

Years	No. of Research papers
1997 – 2001	17
2002 – 2006	17
2007 – 2011	44
2012 - 2017	27
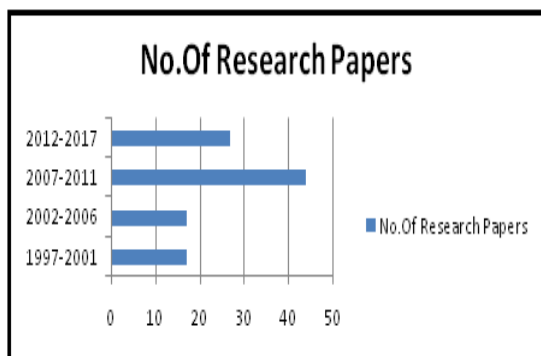
Figure 1: Year wise comparison

IV. CONCLUSION

Different Data Mining Techniques from 1997 to 2017 was presented in this paper. It explains the rapid development in DMT from last two decades. Various Mining Techniques used for variety of applications in real world problems. It is suggested that different social science methodologies, such as psychology, cognitive science and human behavior might use DMT as an alter-native methodology. Different statistical analysis methods, classification, clustering algorithms were used for various predictions and fore castings. We concluded that there is no end for Data Mining Techniques; it is always bound less area in Machine Learning.

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