Data mining techniques for Medical Growth: A Contribution of Researcher reviews

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Summary
Since the last decade, data mining is contributing nicely and becoming very rich in different industries, especially data mining is working tremendously in healthcare section to predict the different life taking diseases on time. The introduced applications in data mining can be classified in to two subsets: the set of policy development and the set of decision-making or the decision support. By the huge amount of work in data mining but still it is hard to discover the priceless literature in the area of this technology under healthcare. During the research, number of papers has been reconsidered in this manifesto and comprises them in to the single platform for better reviews and understanding in term of saving time and efforts in terms of schemes, algorithms, techniques and results. This paper comprises the contribution of various researchers of healthcare sectors in a single platform under data mining categorization for predictions and decision-making by elaborating and mentioning different techniques and algorithms working out since decade to cure the life taking diseases like Breast cancer, Heart attacks, HIV, Lungs cancer, Skin infections with their mean accuracy by defining various studies.

Key words:
KDD, data mining in healthcare, algorithms, techniques, lung cancer, breast cancer, diabetes, skin diseases, heart diseases.

1. Introduction

Healthcare industries are engendering and hoarding tremendous amount of data, which can be used to forecast and scrutinize the healthcare ratio of the entire country. This huge amount of data requires to be retrieved when necessary. By using the data mining techniques, it is possible to extract the concealed and useful information's from the datasets. The knowledge expanded in the way of mining useful patterns can be recycled to mend the proficiency and augment the worth of policy and decision-making [1]. The core of data mining is to categorize bonds, arrays and prototypes, which support projections and decision-making development for verdict and treatment design. It being called as a prediction models in meaning of amalgamating hospital's system as a result of decision making and reduction of partiality and the prerequisite of cutting down the decision making time. In short the tremendous amount of data and the capability of extracting useful information's and unseen knowledge in several dataset's is call the knowledge discovery process (KDD) and also the method of operating computers based information system (CBIS), counting new techniques to determine patterns/arrays from records is called data mining [2,1]. As in research' where the data mining techniques are concerned, this survey paper determines the techniques involves in data mining towards the medical dataset's, we have gone through with a journalism reviews and the category of articles from 1997 to 2017. This unambiguous time period is vital because, during this phase many new techniques and algorithms were been introduced by researchers in the healthcare industry to classify the data sets of medical sectors in term of breaking down the disease like lungs and breast cancer, heart disease, diabetes, HIV and many more. But the mentioned are important because these diseases are the symptoms of human life taking. This study has begun from September 2016 with the search of keywords in online databases of IEEE Xplore, Springer link and Science Direct. The complete phrase of article in pursuit contains "applications of data mining in healthcare". Since the period commenced, 2800 articles were discovered. From which 198 were related to the keywords. From the specific figure only 52 articles is used for this review.

The remaining part of paper is organized as follows. Section 2 discusses the overview of data mining in healthcare industry and section 3 discusses the scholar's reviews and the work carried out by them in terms of techniques and algorithms. While section 4 speaks about the summary of related techniques, which are currently using out to predict the medical disease.

2. Data mining Overview

Data mining is the technique of digging data to locate patterns, which could be classified in to the useful knowledge. From the previous years, data mining is spectator of extraordinary progress in healthcare. Medical data mining will manipulate the hidden patterns located in the medical data sets, which was undiscovered from years. Data mining techniques, which are applied practically to medical data, holds association rule mining for finding outlines, and forecasts, classifications and cluster. In past,

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data processing methods are utilized in various domains but it came very late in the healthcare sectors. On the way to success in healthcare sectors, it's being involved in decision-making and prediction of various harsh diseases and also in remote health observations and so on [7]. But today the healthcare industry is rich with information's, that's why there is rising the uncountable demand for data mining tools to improve the quality of healthcare results especially in sections of patients who are suffering from the deadly diseases like cancer, HIV, tuberculosis, diabetes, heart and lungs disorders. Cause it is very hard to control them on the advance stages, that's the reason there is a big demand of classification tools in health sectors to predict the diagnosing and detecting treatments in the early stages of life taking diseases. Still tremendous work is going on in the path of classification tools experiments to control the diseases and enables the cost saving and decision making towards the healthcare industries [8].

By the evaluations of different research papers, data mining is supported by the different masteries like machine learning [3], artificial intelligence [4], statistics [5] and probability [6] methods. These masteries are being acknowledged in many papers, which is recapped in the "Table 1" below [1].

Table 1: data mining disciplines involved in medical data growth

Discipline	Counted Percentage
Machine Learning	60
Artificial Intelligence	5
Statistics	3
Probability	3

When we talk about the models of data mining, two basic models come across which is predictive and descriptive. In healthcare industry predictive models are common because the health datasets are normally based on supervised learning while the descriptive are analyzed by the articles with the ratio of 44/10 as shown in the "Table 2".

Table 2: data mining models studied in papers from 1997 to 2017

Models	Count
Predictive	44
Discriptive	10

Data mining systems can be categorized according to various criteria as given below:

a. Type of data sources mined
b. Database involved
c. Kind of knowledge discovered
d. Mining techniques used
e. Process of Data Mining

Data mining process includes the following few steps:

a. Data Cleaning: It is used to remove noise and inconsistent data.
b. Data Integration: It is used to combine multiple data sources.
c. Data Selection: It is used to retrieve the relevant data from the database for analysis task.
d. Data Transformation: It is used to transformed or consolidated data into particular appropriate form for mining by performing summary or aggregation operations.
e. Data Mining: Here the intelligent methods are applied in order to extract data patterns.
f. Pattern Evaluation: It is used to evaluate the data patterns.
g. Knowledge Presentation: Here the knowledge is represented

Various data mining techniques, which were introduced in health sectors encirclement Apriori [9, 10, 11, 12, 13], FpGrowth [14, 15, 16], Neural networks [17, 18], Genetic linear programming [17], Association mining [19, 20], decision tree algorithms that carries ID3, C4.5, Cart and C5 [22, 23, 24, 25, 26, 27, 28], Bayesian Ying Yang [21], prediction techniques like outlier [29], Fuzzy Cluster [30], Classification algorithms [25, 31, 31], Bayesian algorithms [22, 33], Naïve Bayesian [34], K-mean, Self Organizing Map (SOM) [35] ad their combinations, also with SVM, ANN, ID3 [24], SVM [24], FCM [36], KNN [32] and Bayesian Networks [22].

This paper stipulates the silhouette of mentioned techniques towards the medical data administering or the kits, which being imposed over them.

3. Researchers proposed reviews

Data mining is the operation of extracting data from many sides to figure out the patterns that produce useful results in the business growth [40]. It's playing a tremendous workout in the field of technology to sort out the data from various datasets of different domains. In example of healthcare sectors, data mining is extracting the hidden patterns in the data for the treatment, predictions and diagnosis of various harmful diseases like cancer and HIV. Because of the fruitful results of data mining, the industries are improving their quality of services [14]. It is useful in medical applications like medicines, therapeutic experiments, operation measures and medical catalogs [42]. Apriori and FpGrowth are extensively used in regular pattern mining procedures [43]. The two common algorithms were being reviewed in [10, 11, 12, 13, 14, 15, 16]. These are consumed in therapeutic data mining. The famous researcher Goodwin et al. [44] smeared the data mining system for the birth consequences and Evans et al. [45] had given the theory of that genetic diseases are measurable by using data mining techniques. Two brothers Doron Shalvi and St. DeClaris worked on medical data mining with the Neural Networks for the data visual images [18]. In early 2000, a biotechnology researcher

Krzysztof Cior [46] use data mining terminology and techniques to mine the medical hypermedia classification gist. Regarding the medical issues in data mining, Tsumoto [47] knows that the problems are missing values in data sets and additional unclear facts, where the diverse medicinal programs were being used in hospital information systems. More over Abadi [48] analyzed and discovered the figurative rule mining worktable for spawning initial rule sets and Hoe has controlled in the same projects to discover the rule sets. He has examined the rule set as consequence of intelligence's mining for edifice rule based proficient techniques. Two groups member Bramerier and Banzhaf [17] investigates lineat genetic platform and Neural Networks for the medicinal data mining. Olukunle [19] has suggested the association rule algorithm for mining the medical images and produced the results that can discover the habitually arising stuffs with-in the data sets. Wedge and Xu [21] has worked on the classification system, which livelihoods the Bayesian Ying Yang principle and successfully smeared it to predict the liver disorder and other liver diseases. Regarding mining the medical data of Geno, Brunie et al. [49] has introduced a structure, which is centered by heterogeneous and grid distribution. For the medical image analysis, Muhammad et al. [30] has discovered a call tree data-mining algorithm and also Wang et al. [30] has used Fuzzy Cluster algorithm to mine the medical images, decision tree was been used in their study to classify the irregular and outdated cases. Which was been studied on the lung cancer disease diagnosis and X-ray images [31]. One more outlier prediction method was been discovered by Podgorelec et al. [29] to classify the medical data. Cardio Vascular diseases has diagnosed with the help of classification algorithm by Cheng et al. [25]. He aims to the two-chin detection method, which includes impulsive features choice and proficient verdict. Seng et al. [50] has worked on tele- medicines and introduced web based data mining for it. Ghannad et al. [51] studied on patient data sets and discussed a method to amalgamate the rule mining methods and classification methods. In his analysis, he recycled the Swarm Optimization method (SOM). The moral result shows that their research is valuable in Brain disease prediction and diagnosis. Bethel et al. [20] urbanized an association rule initiate that is based on the earlier Breast cancer patients. The rule initiate is active during "clinical Trial Assignment Professional System". Multi stage victimization diagnosing system has been studied by Tsumoto et al. [52] and he discovered the theory of diagnosing taxonomy. They have aimed the group automation of medical datasets and he also aimed the Naïve Bayesian algorithm to work on efficiency of classifier. More over Verma and Hassan worked with the combination of K-mean, SOM (self organizing map) and Naïve Bayes classifier on a hybrid approach for classification of clinical databases [35]. A Chinese scholar Xue et al. [33] applied Bayesian algorithm for spotting of confusion Coronary Cardiopathy. Time Annotated Sequence Rule (TASR) was been studied by Berlingerio et al. to discover the temporal measurements from medical datasets. The discovered patterns help in improvement of identification by attributes interactions in the entire time sphere [37]. Xing et al. worked on data mining technique in prediction of survival CHD patients. He did combine the three prediction classification tools as: Support Vector Machine (SVM), Artificial Neural Networks (ANN) and Decision Tree (C4.5, ID3, CART and C5) in prediction of CHID patients [24]. In late, Barnathan has introduced a platform for classification, cluster and similarity rifle of biomedical images, which are 2D and 3D in nature [38]. Abe et al. [53] proposed a time series data-mining platform to mine the large amount of clinical data to be extracted in order to get the useful values and rule sets accordingly. Jiquan [54] worked on a framework of Term-Mapping in order to mingle clinical data sources for data processing. Shusaku [55] proposed the theory of multi-scale harmonizing and Clump method on medicinal data.

Evidentially their result shows that the techniques and methods they used are a long way efficient in analyzing and handling the Liver disease data in to factions to support the chronological covariance of Choline esterase, albumin and living affluence accordingly. Two Wang brothers [56] Hai and Shouhong, drove on the role of medical specialists in medicinal data mining and come to consequence that medical experts are more important to deliver the expertise recommendations that could be used along as an input for medical data mining. A lady named as Saraee er al. [26] has worked a long way to the medical data mining and applied a mining technique on medical sets, which was referring to the militants accordingly the death rates happened in Kids with small ages due to accidents. To get the more appropriate results in decision tree, she had used the CART method to mine the medical datasets. Beside all Abdullah et al. [9] practically applied Apriori method to mine the medical data. He isolated the frequently happen arrays in data sets by scrutinizing the connotation between diagnosing and treatments. Famous Indian scientists in medical records Balakrishnan and Narayanaswamy [39] deliberated the qualities of choosing Persecution with SVM (Support Vector Machine) to categorize the diabetics and diabetes data sets. Froelich and Wakulicz [36] well mined the drugs and health consequence by approving the Fuzzy Cognitive Maps (FCM) in their research.

The work done by them has a way to improve the call sustenance and scheming methods in health care spheres to formulate a lot of queries, which also known as a KDQL (Knowledge Discovery Question Language) and has been used to determine the hidden and applicable knowledge in medical data since then. Their work and

research has surveyed a magnificent ways to mine the medical knowledge and shows the bright side to the medical experts while working on medical data mining.

4. Summary

From the past decade medical industry is improving and growing very vastly because of data mining influence, which is helping the medical data to discover the hidden truths inside such as predictions and especially decision making tasks. It is analyzing and providing the efficient treatments to the death diseases like Cancer, Diabetes, Heart and Lungs disorder factors, Cardio Vascular disease and much more. Table 3 will show the summary of how effectively and efficiently the data mining techniques and algorithms are' towards the growth of medical industry and how exactly the techniques are contributing for decision-making approach after the accurate results of data mining techniques and algorithms.

Table 3: Summary of Techniques and Algorithms with accuracy ratio by year in healthcare sectors

Algorithm/Techniques	Hands-on	Heart Disease	Breast Cancer	Lungs Cancer	Diabetes	Skin Cancer	References
Apriori & FpGrowth	To find repeated patterns						12, 13, 14, 15, 16
SVM	Disease classification	92% in 2007	97 % in 2016	95% in 2016		94% in 2016	24, 39
Neural Networks	Extracting patterns	91% in 2007	98% in 2015	93% in 2013		92% in 2009	17, 18
Genetic Algorithm	Dataset classification						17
Association Rule	Find repeated patterns						19, 20
Bayesian Ying Yang	Classification						21
Decision Tree	Decision-making	74% in 2012	95% in 2016	76% in 2014	86% in 2016	92% in 2009	23, 24, 25, 26, 27
Outlier predictions	improve accuracy						29
Fuzzy analysis	Image analysing						20
Classification algorithms	Disease classification						31, 32
Bayesian Network	Modeling & analysis	78% in 2010	97% in 2016	77% in 2010	90% in 2014	80% in 2015	22, 23
Naive Bayesian	improve accuracy	95% in 2012	96% in 2013	89% in 2013	76% in 2015	85% in 2015	34
K-mean/ SOM/Naive Bayes	Medical diagnosis						36, 37
SVM/ ANN/ DT	Classification						24
Cluster & Classification	Cluster & Classification						38
Fuzzy Cognitive Map	Drugs & health effects				94% in 2014		29
KNN	Classification	61% in 2012	95% in 2016	97% in 2016	94% in 2016	95% in 2012	32

5. Conclusion

In this paper, data mining is showing the tremendous performance in the field of healthcare especially in prediction of life taking diseases and also in decision-making process for the specialist. In conclusion, through out there is not an exclusive algorithm or technique available to predict all kind of diseases but yet by the combination of different techniques and methods' data mining is captivating healthcare industry more far with terrific and outstanding growth. But still many more hybrid models have to be introducing in the way of accomplishments, which can resolve the time being issues

beautifully. Our future ambition is to pioneer and enhance the hybrid models for the better and more accurate prediction of diseases and decision-making.

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