

## COMPARATIVE SURVEY ON DATA MINING TECHNIQUES FOR ENDOMETRIAL CANCER DIAGNOSIS AND PREDICTION

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### Abstract

Data Mining plays a vital role for uncovering innovative developments in healthcare society which in turn helpful for all the parties associated with this field. This study scrutinizes the efficacy of a range of Data Mining techniques such as classification, clustering, association, regression in health care realm. Cancer is one of the key predicament today, diagnosing cancer in prior period is still exigent for doctors. Identification of genetic and natural factors is very noteworthy in developing novel methods to detect and prevent cancer. Endometrial cancer is the most extensive feminine gynecologic malignant cells, is typically a curable disease. It is the most widespread of all cancers and the leading cause of cancer demises in the world of women. In this paper we have presented a survey on the data mining techniques for the endometrial cancer diagnosis and prediction, analysis of the threat aspects and the survivability rate of endometrial cancer patients.

**Keywords:** Data mining; classification; clustering; association; regression; endometrial;

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### Introduction

Data mining is the method of extracting the useful data from the huge dataset [1]. Data mining technique involves the use of sophisticated data analysis tools to discover previously unknown, valid patterns and relationships in large data set. These tools can include statistical models, mathematical algorithm and machine learning methods in early detection of cancer [2]. Classification is one of the technique in data mining to allocate objects to one of the several predefined groups. Data Classification is a two step method consisting of knowledge step used to make a classification model and a categorization step to calculate the class labels for a given data [1]. Clustering is a Data mining technique, used to grouping the data into classes or clusters so that the objects within each cluster have high similarity in comparison with one another [3]. In association learning, any association among features is sought, not just ones that predict a particular class value.

### Endometrial Cancer

Endometrial cancer is a cancer that takes place from the endometrium, that is, the inside layer of the uterus or womb. It is the effect of the irregular progress of cells that have the ability to occupy or spread to other parts of the body [4]. During the premature section of the sequence, before the ovaries release an egg, the ovaries form hormones known as estrogens. Estrogen causes the endometrium to condense so that it could cultivate an embryo if pregnancy occurs. A woman's hormone stability took a part in the growth of most endometrial cancers. Many of the risk factors for endometrial cancer influence estrogen levels [5]. It is a gynecological malignancy which predominantly affects older and post menopausal women. The main aim of this study was to determine the factors using Data Mining Techniques which are significantly associated with

endometrial cancer. These Techniques have wide application because it is supported by two methods which are Massive databases and Data mining algorithms. Hidden patterns and relationships are often discovered. The only remedy for this situation is by using advanced data mining techniques. Medical profiles could predict the likelihood of patients getting a cancer disease. It enables the knowledge relationships between medical factors related to cancer disease, to be established [6].

### Related Work

Shweta Kharya et al. [7] summarizes various review on breast cancer diagnosis and prognosis also focused on current research being carried out using the data mining techniques to enhance the breast cancer diagnosis and prognosis and proposed Decision tree algorithm is the best predictor with 93.62%.

Ramya rathan et al. [8] conducted a study on endometrial Carcinoma using novel assays and applied Association rule mining algorithm and classification technique on endometrial cancer data and proved when the woman having more than 60 years of age, undergone menopause and a non vegetarian diet and when these factors are involved the occurrence of cancer is high. Also the occurrence of the disease is not due to heredity.

Hong Tang et al. [9] conducted a Diagnosis of Ovarian Cancer Based on Mass Spectra of Blood Samples, using Decision trees, support vector machines, and neural networks to determine the values of the points that indicate ovarian cancer. The effectiveness of these techniques varies across the available data sets.

Friberg et al. [10] analyzed the diabetes (largely type 2) and endometrial cancer, based on 16 studies including 96,003 participants and 7,596 cases of endometrial cancer. Twelve of the studies showed a statistically significantly increased risk and four a non-significant increased risk of endometrial cancer. Using meta-analysis they found that diabetes was statistically significantly associated with an increased risk of endometrial cancer.

Smt. Girija D.K et al. [11] summarizes numerous data mining techniques on Fibroid diagnosis and prognosis and tend to present an outline of the present research being carried out using the data mining techniques to reinforce the Fibroid diagnosis and prognosis. The algorithms C4.5, Naive Bayes, ID3 were used and Naïve Bayes gives the highest accuracy is 96%.

Elisabete Weiderpass et al. [12] performed a population-based, nationwide case-control study among postmenopausal women aged 50-74 years and compared lean women with overweight women had a 50% increase in risk for endometrial cancer. Obesity and diabetes mellitus (Types 1 and 2) are associated with endometrial cancer risk.

Parazzini.F et al. [13] confirm that non-insulin-dependent diabetes is associated with the risk of endometrial cancer. Association persists after taking into account the potential confounding effect of recognized risk factors for endometrial cancer, particularly overweight, and is consistent across strata of major identified covariates. This association may be related to elevated estrogen levels in diabetic women.

I. P. Constantinou et al. [14] presents an integrated system for supporting the diagnosis of endometrial cancer. The system consists of an electronic patient record that incorporates a hysteroscopy imaging CAD system for the early detection of endometrial cancer. The highest percentage of correct classifications score for the SVM classifier was 79% & C4.5 models were also supported with classification rules.

Huiqiao Gao and Zhenyu Zhang et al. [15] systematically characterize the expression of endometrial cancer associated genes and to analysis the functions, pathways, and networks of EC-associated hub proteins. The data also help to reveal the molecular mechanisms of EC development and provide implications for targeted therapy for EC.

SLihua Li, Hong Tang et al. [16] identifies serum proteomic patterns that distinguish the serum of ovarian cancer cases from non-cancer controls. A support vector machine-based method is applied in this study, in which statistical testing and genetic algorithm-based methods are used for feature selection respectively. The results showed that data mining techniques can be successfully applied to ovarian cancer detection with a reasonably high performance; In other words, the pattern selection and its classification efficiency are highly classifier dependent.

Yan Xu et al. [17] propose a new learning method, multiple clustered instances learning (MCIL), to classify, segment and cluster cancer cells in colon histopathology images. Experimental result demonstrates the efficiency and effectiveness of MCIL in detecting colon cancers. C. Kalaiselvi et al. [18] found the classifiers efficiency for the prediction of heart disease and cancer in diabetic patients. To improve the classification accuracy and to achieve better efficiency a new approach like Adaptive Neuro Fuzzy Inference System (ANFIS) is proposed. Rui Xu et al. [19] utilized Semi supervised Ellipsoid ARTMAP combined with particle swarm optimization to distinguish tumor tissues with more than two categories through analyzing s-gene expression profiling. The proposed combination of methods achieves qualitatively good results on three publicly accessible benchmark data sets. The machine learning technique shows that EAM/PSO can outperform them on all three data sets and the difference in classification accuracy is found to be statistically significant.

Sally Yepes et al. [20] Identify and confirm cancer subtypes, It is obtained by machine learning strategies and the use of clinically characterized cohorts are contributing to a better understanding of the molecular heterogeneity of cancer. Priyanka.A et al. [21] proposed the cancer prediction system based on data mining. This system estimates the risk of the breast, skin, and lung cancers. This system is validated by comparing its predicted results with patient’s prior medical information and it was analyzed by using weka system. Ramachandran et al. [22] used classification algorithm to classify the pattern and Clustering algorithm to subdivide the cancer into six types.

Sangal Renu et al. [30] conducted a study on 200 cases between the ages of 40 to 70. Endometrial aspiration and endometrial biopsy was done in each cases to detect malignant and pre malignant change of endometrium and to correlate between findings of cytology and histology. Irregular and abnormal uterine bleeding was the complaint in most of the cases.

Chandra, Vishal et al. [31] screened a series of synthetic compounds consisting of benzopyran derivatives against endometrial hyperplasia and endometrial cancer cells, evaluated the efficacy of the lead molecules and finally validated the molecular targets. Yamamoto.K et al. [32] found a more preferable model which fits the data better than some existing models. Under the preferable model, we have seen that the average dose of oestrogen for case in a matched pair tends to be more than that for control in the pair.

**Comparative Survey Table**

| S. No. | Year | Author   | Journal  | Methodology / Technique /Tool Used                              | Outcome / Accuracy Measures                             |
|--------|------|--|--|---|---|
| 1      | 2012 | Shweta Kharya et al. [7]                       | International Journal Of Computer Science, Engineering And Information Technology, Vol.2, No.2, April 2012.                | Naïve Bayes, Artificial Neural Net, C4.5, Decision Tree         | Decision Tree Is Found To Be Best Predictor With 93.62% |
| 2      | 2013 | Ramya Rathan, Sridhar R, Balasubraminian.S [8] | International Journal Of Advanced Research In Computer Science And Software Engineering, Volume 3, Issue 10, October 2013. | Association Rule Mining Algorithm And Classification Techniques | Association Rule Mining                                 |
| 3      | 2004 | Hong Tang, Yelena Mukomel, Eugene Fink [9]     | IEEE Journal, 0-7803-8566-7/04, 2004   | Decision Trees, Support Vector Machines, And Neural Networks    | Decision Trees Is Between 82% And 99%, Support Vector   |

|    |      |  |   |  |   |
|----|------|--|---|--|---|
|    |      |  |   |  | Machines Is Between 83% and 99%, Neural Networks Is Between 82% And 99%.  |
| 4  | 2007 | E. Friberg & N. Orsini & C. S. Mantzoros & A. Wolk [10]  | Springer-Verlag 2007  | Meta-Analysis Of Case Control Studies  | Relationship Between Diabetes And Increased Risk Of Endometrial Cancer.   |
| 5  | 2013 | Smt Girija D.K, Dr. M.S. Shashidhara [11]  | 978-1-4673-5090-7/13/\$31.00 ©2013 IEEE   | C4.5, Naive Bayes, Id3   | Naïve Bayes Gives The Highest Accuracy Ie., 96%   |
| 6  | 2000 | Weiderpass E, Persson I, Adami Ho, Magnusson C, Lindgren A, Baron Ja [12]                                | Cancer Causes And Control - Published By Springer   | Case Control Study   | Overweight /Obesity, Diabetes Are Associated With Endometrial Cancer  |
| 7  | 1999 | Parazzini F, La Vecchia C, Negri E [13]  | Article In International Journal Of Cancer · May 1999<br>DOI: 10.1002/(SICI)1097-0215(19990517)81:4 (539::Aid-ljlc)3.0.Co;2-Q | Case Control Study   | Diabetes Is A Risk Factor   |
| 8  | 2009 | I.P. Constantinou, et. al [14]   | Information Technology And Applications In Biomedicine, Italy 2009, Larnaca, Cyprus, 5-7 November 2009                        | SVM And C4.5   | SVM Classifier Gives 79.4%  |
| 9  | 2015 | Huiqiao Gao And Zhenyu Zhang [15]  | Biomed Research International Volume 2015, Article Id 615825  | Text Mining Based On NLP   | The Data Help To Reveal The Molecular Mechanisms Of EC Development And Provide Implications For Targeted Therapy For EC |
| 10 | 2004 | Lihua Li,Hong Tang,Zuobao Wu, Jianli Gong, Michael Gruidl, Jun Zou, Melvyn Tockman, Robert A. Clark [16] | Artificial Intelligence In Medicine, Volume 32, Issue 2, October 2004, Pages 71-83  | Support Vector Machine-Genetic Algorithm   | The Genetic Algorithm Consistently Outperformed   |
| 11 | 2012 | Yan Xu,Jun-Yan Zhu, Eric Chang And Zhuowen Tu [17]   | 978-1-4673-1228-8/12/\$31.00 ©2012 IEEE   | Multiple Clustered Instance Learning (MCIL)  | MCIL Is Best For Detecting Colon Cancer   |
| 12 | 2015 | C. Kalaiselvi And G. M. Nasira [18]  | Indian Journal Of Science And Technology, Vol 8(14), IPL 018, July 2015   | ANFIS With Adaptive Group Based K-Nearest Neighbor (AGKNN) Algorithm Has Been Used To Classify The Data. | ANFIS With AGKNN Along With Feature Subset Selection Using Pso  |
| 13 | 2007 | Rui Xu, Georgios C. Anagnostopoulos, And Donald C. Wunsch Ii [19]  | IEEE/ACM Transactions On Computational Biology And Bioinformatics, Vol. 4, No. 1, January-March 2007                          | Semi supervised Ellipsoid ARTMAP Combined With Particle Swarm Optimization                               | SSEAM/ PSO Can Perform, On All Three Data Sets  |
| 14 | 2016 | Sally Yepes And Maria Mercedes Torres [20]   | Journal Of Data Mining In Genomics & Proteomics Data Mining Genomics Proteomics 2016  | SOM Is A Type Of Artificial Neural Network (Ann),  | Sequential Minimal Optimization (SMO) has higher prediction accuracy  |

|    |      |  |   |  |   |
|----|------|--|---|--|---|
| 15 | 2013 | A.Priyanga,<br>Dr.S.PRAKASAM<br>[21]   | International Journal of Computer Applications (0975 - 8887) Volume 83 - No 10, December 2013   | J48, ID3, Naïve Bayes  | ID3 - 100%  |
| 16 | 2014 | P.Ramachandran,<br>N.Girija,<br>Bhuvanewari [22]   | International Journal of Computer Applications (0975 - 8887) Volume 97- No.13, July 2014  | Classification & Clustering  | K- Means  |
| 17 | 2006 | Munevver Kokuer,<br>Raouf N. G.<br>Naguib, Peter, H.<br>Banfield and<br>Roger C. Green<br>[23] | IEEE Transactions On Information Technology In Biomedicine, Vol. 10, No. 3, July 2006   | SOM, LR, And PCA   | PCA   |
| 18 | 2016 | Ms. Hency Juliet,<br>Dr.R.<br>Padmajavalli [24]  | Indian Journal Of Science And Technology, Volume 9(28),DOI: 10.17485/IJST/2016/v9i28/93846, July 2016.                                    | Naïve Bayes, Byesnet, Smo, lbk, Kstar, Jrip, Bagging, Vfi, Adaboostm1, Decision Table, Random Forest, Random Tree, J48, Ftree, Multiclass Classifier | In Terms Of Time & Accuracy lbk Is Better. In Terms Of Correctly Classified Instance, Random Forest Is Best.                |
| 19 | 2016 | Ms. Hency Juliet,<br>Dr.R.<br>Padmajavalli [25]  | International Conference on Viable Synergies in Mathematical and Natural Sciences   | K-Means, Hierarchical, Farthest First, Filtered Cluster, Dbscan, Em And Density Based Clustering Algorithm   | In Terms Of Time and Accuracy K-Means Is Better. In Terms Of Correctly Classified Instance, Hierarchical Clustering Is Best |
| 20 | 2012 | Zhiwen Yu, Le Li,<br>Jane You, Hau-<br>San Wong, and<br>Guoqiang Han<br>[26]                   | IEEE/ACM Transactions On Computational Biology And Bioinformatics, Vol. 9, No. 6, November/December 2012                                  | Kmeans algorithm, spectral clustering algorithm, and the self-organizing map   | SC3 and SC2Ncut, which integrate the spectral clustering algorithms multiple times into the ensemble framework              |
| 21 | 2013 | David A. Iglesias<br>et. al [27]   | Molecular cancer therapeutics. DOI:1158/1535-7163.MCT-13-0439 Published 1 December 2013   | A novel mechanism of action via K-Ras Influences for metformin   | A novel mechanism of action for metformin   |
| 22 | 2013 | M.A.Nishara Banu,<br>B Gomathy [28]  | International Journal of Technical Research and Applications e-ISSN: 2320-8163, www.ijtra.com Volume 1, Issue 5 (Nov-Dec 2013), PP. 41-45 | K-mean based MAFIA , MAFIA with ID3 , MAFIA with ID3 and C4.5  | K-mean based MAFIA with ID3 and C4.5  |
| 23 | 2016 | P. Saranya, B.<br>Satheeskumar<br>[29]   | International Journal of Computer Science and Mobile Computing, Vol.5 Issue.5, May- 2016, pg. 713-719                                     | decision tree, ANN, Support Vector Machine, Naïve bays, Back propagation and Regression  | decision tree, ANN, Support Vector Machine, Naïve bays, Back propagation and Regression                                     |
| 24 | 2015 | K.Arutchelvan,<br>Dr.R.Periyasamy<br>[6]   | International Research Journal of Engineering and Technology (IRJET) Volume: 02 Issue: 08   Nov-2015 www.irjet.net                        | Decision Tree  | Decision Tree   |
| 25 | 2012 | Kouji Yamamoto<br>and Sadao<br>Tomizawa  | J Biomet Biostat 3:147. doi:10.4172/2155-6180.1000147, 2012   | proposed asymmetry model LDPS, CLDPS   | CLDPS is better for Case  |

## Discussion and Proposed Work

Based on the literature review on endometrial cancer data, we could analyze the risk factors of the endometrial cancer, diagnosis and prognosis of cancer, survival rate of cancer patients, early detection and prevention of cancer. Most of the authors done the statistical analysis on endometrial cancer data and predicted the symptoms for the cancer. Some authors used the effectiveness of data mining technique to build the cancer prediction system. Algorithms such as clustering, classification and association rule are used on endometrial cancer data, and presented the accuracy of the algorithm by conducting performance analysis. Endometrial cancer is more common in menopausal women, but when certain risk factors are present, it can be detected in younger women as well.

The association between the endometrial cancer and diabetes was analyzed. Even in the absence of direct information on type of diabetes, only diabetes mellitus diagnosed after 40 years of age was associated with the risk of endometrial cancer.

The obesity is associated with multiple adverse medical effects. It is a known risk factor for endometrial cancer. The risk for endometrial cancer has long been linked to obesity. Obese and overweight women have two to four times the risk of developing this disease than the women of a normal weight, regardless of menopausal status. Many studies have also found that the risk of endometrial cancer increases with increasing weight gain in adulthood, particularly among women who have never used MHT. Although it has not yet been determined why obesity is a risk factor for endometrial cancer, some evidence points to a role for diabetes, possibly in combination with low levels of physical activity. High levels of estrogen produced by fat tissue are also likely to play a role.

In our proposed work, we have planned to work with classification and association rule mining on endometrial cancer data, to find the association between the risk factors associated with endometrial cancer. Each method utilizes a learning algorithm to recognize a model that best fits the liaison between the attribute set and class label of the input data. An important point of the learning algorithm is to construct the representation with generalization facility i.e., the representation precisely forecast the class labels of formerly unidentified instances. Association analysis is the discovery of association rules showing attribute-value conditions that occur frequently together in a given set of data. The aim of this study is to construct the multilevel ensemble model that should be informative and practicable one, which may be adopted by the health managers and doctors. The major challenge therefore, is to ensure proper management and control strategies to decrease the endometrial cancer incidence.

## Conclusion

Data mining plays a major role in extracting the hidden information in the medical data base. Several possible mechanisms have been suggested to explain the association of obesity with increased risk of endometrial cancers. We need no further support for recommending lifestyle changes that are associated with countless benefits. Therefore, rather than waiting for medical problems to develop, obese patients should be provided with the necessary information to give them motivation for making everyday lifestyle changes, which is often challenging.

Further development of the system based on association mining technique can become an effective technique for the prediction and early diagnosis of the risk factors associated with endometrial and also to construct the multilevel ensemble model for the prediction of endometrial carcinoma using classification algorithms.

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