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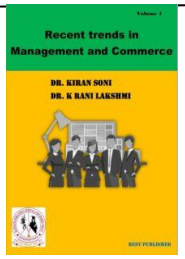

Assessment of Hybrid Gene Selection Using the VIKOR Method

Shah Sunil Navanitlal
SSt College of Arts and Commerce, Maharashtra, India.
*Corresponding author Email: sunilshah@sstcollege.edu.in

Abstract. One of the crucial processes in the classification of microarray data is gene selection. Particle swarm optimization is gaining popularity as a powerful method for genetic selection since it uses fewer parameters and doesn't use complicated evolution operators. Some particle swarm optimization-based gene selection techniques may select non-optimal genes with a high probability because particle swarm optimization is likely to converge to local minima, which may result in premature convergence. It is still difficult to choose prognostic genes with low redundancy without excluding crucial genes.Research significance: Exposure to ionising radiation has been associated to leukaemia, and gene selection often involves two phases. All of the survivors of the World War II atomic bombings in Japan have been shown to have a significant incidence of leukaemia. Functional brain cancer imaging with positron emission tomography and magnetic resonance imaging is widely used to map regional changes in the brain function advanced over Last decade. Appreciating unique contribution of aerobics glycol sis new insights into the role of brain energy metabolism atropines signal transduction have emerged. Diagnoses of colon cancer in the United States the subject of this recommendation is colon cancer. In a different recommendation, rectal cancer is discussed. Smoking status is the most powerful predictor lung function Decrease in smokers with COPD. If you are a smoker advised older people are more likely to quit because they cannot stop smoking or their lungs are already damaged. Similarly, there is a nihilistic approach to that intervenes in smoking cessation. The incidence of Hodgkin's lymphoma, a rare form of cancer, rises in the third decade in women and subsequently drops, whereas in men it stays largely steady after this point. The presence of Hodgkin/Reed-Sternberg cells serves as the basis for the diagnosis of Hodgkin's lymphoma.VIKOR method used in multi-criteria analysis (MCDM). Although a popular method, mcdm problems there are some problems with solving. This study is traditional discussed the problems with VIKOR method. This intention of the take a look at is to resolve issues with the traditional VIKOR technique to keep away from numerical troubles in fixing is modified VIKOR approach to create. From the result it is seen that Leukemia is showing the highest value for SRBCT is showing the lowest value. Resulting in Leukemia ranked first, there SRBCT has low rank.

Keywords: Gene selection, VIKOR Method, Brain Cancer, colon, lungs.

Introduction

One of the crucial processes in the classification of microarray data is gene selection. Particle swarm optimization is gaining popularity as a powerful method for genetic selection since it uses fewer parameters and doesn't use complicated evolution operators. Some particle swarm optimization-based gene selection techniques may select non-optimal genes with a high probability because particle swarm optimization is likely to converge to local minima, which may result in premature convergence. It is still difficult to choose prognostic genes with low redundancy without excluding important genes. Sample classification between various illness phenotypes for diagnostic and predictive purposes is one of the primary uses of microarray data analysis [1]. However, it is challenging to execute a specific biological classification problem and get a thorough grasp of the roles of certain genes for small-scale samples compared to high-dimensional ones with experimental variations in recorded gene expression levels.] One of the crucial processes in the classification of microarray data is gene selection [2]. Selecting an efficient genetic subset improves classification accuracy while lowering computing costs. Filter, wrapper, and embedding methods are the three basic categories into which gene selection techniques fall [3]. Without using a classifier for evaluation, a filter technique selects genes based on generic traits of the training data. When compared to other types of feature selection methods, the classification performance of most filter approaches performs poorly because they consider each feature separately while neglecting feature bias [4]. Wrapper techniques also take into account interactions between feature subset search and model selection in addition to feature dependencies. Wrapper approaches are more computationally intensive than filters, but they also carry a greater risk of overfitting [5]. While being significantly less computationally intensive than wrapper approaches, embedded methods offer the advantage of including interactions with the classification model [6]. Particle Swarm Optimization (BSO) [10] has become more popular as a successful method for global optimization in recent years since there are no complex evolution operators and fewer parameters that need to be modified. PSO has been used to do genetic selection in recent years. The best set of genes was chosen in [11] by combining an extreme learning machine (ELM), particle swarm optimization, and integer-coded GA (ICGA). To find the best gene subsets, the Binary PSO (BPSO) filter approach was utilized [13]. [12] Simpler gene selection, when compared to other similar gene selection approaches based on GA, the method in [13] can choose the right number of genes and achieves good classification accuracy using sup-

port vector machines. In [14], gene selection was carried out using the usual PSO mixed with the ELM method, and the initial gene pool was divided into numerous clusters using the VIKOR method and the K-means method. Which can obtain a small set of informative genes Since traditional BSO is suitable for connecting to local Minima leading to premature convergence, the above BSO-based genetic selection method still has much room for improvement. From the result, it is seen that Leukemia is showing the highest value for SRBCT is showing the lowest value.

Material and Methods

Gene selection: Finding related genes and choosing tiny subsets from related genes are the two procedures that often makeup gene selection. In contrast to [15]'s approaches, a scoring criterion that uses a double filter strategy is suggested in this study to identify the most pertinent genes, which can significantly shrink the gene pool. To choose a tiny gene subset from the purified gene pool, an improved PSO with novel methods to restart the swarm and update Pg is advised. Genomic selection, which may be used to forecast genetic values and prevent stepwise QTL finding, is an enhanced method of marker-assisted selection for quantitative traits. For qualities controlled by polygene, gene selection appears to be more effective than traditional marker-assisted selection. Based on marker data, genetic selection for purebred improvement results in cost savings due to early timing measuring selection before phenotypic. Because the genotypes of hybrids are predetermined by their breeding parents, genetic selection is anticipated to be more effective when utilized for hybridization breeding. A key strategy for raising breeding crop productivity is hybridization. Here, we suggested and utilized an enhanced technique for estimating hybrid performance, of which Possible Hybrids is a subset To forecast the trait values of all potential hybrids, a training model is utilized. Genetic optimum linear regression is the name of this technique. Genetic hybrid breeding is the name of the technique utilized in creating hybrids. 278 randomly chosen hybrids were used. The training sample predicted all 21,945 potential hybrids and was made up of 210 recombinant inbred lines. Comparing the average yield of the top 100 selections to the average yield of all feasible hybrids, there is a gain of 16%. A novel method that could revolutionize hybrid breeding is a proof of concept for a new strategy of marker guidance of hybrid yield.

Leukemia: A significant fraction of pediatric cancer patients—about 20%—experience relapse despite the aggressive frontline therapy now being used [11]. The recurrence of leukemic cells in any area of the body is referred to as a relapse. It could occur once just at one location (medullar or extramedullary), or it could occur many times (medullary and extramedullary). Most relapsed leukemia maintains their initial immunophenotype and genotype; however, a lineage switch of a different cell type is infrequently seen. Hereditary transformation can be distinguished from secondary leukemia, which typically develops many years later, using molecular research [4]. Relapsed leukemia is typically less responsive and demands more intensive therapy. Compared to bone marrow relapse, isolated extramedullary relapse is preferable [13]. Combined relapses have a better prognosis than solitary medullar relapses, even though combined relapses occur later and typically respond better to chemotherapy. Ionizing radiation exposure has also been related to leukemia. All of the survivors of the World War II atomic bombings in Japan have been found to have a high frequency of leukemia, and AML is more common in adults [3]. The chance of leukemia has increased especially during the first trimester, in newborns exposed to diagnostic radiation in the uteri [33]. It is challenging to calculate the likelihood of getting leukemia after postnatal exposure to diagnostic radiography [13]. According to one study [18], pediatric orthopedic patients who needed further diagnostic radiographs were more likely to develop leukemia. Additionally, therapeutic radiation has been connected. All instances of increasing incidence are noted in infant care Children who had their scalps irradiated to treat their tine capitals and enlarged thyme [6]. Results on the risk of being exposed to electromagnetic fields [9] and conventional nuclear power plant emissions are inconclusive.

Brain Cancer: Functional brain cancer imaging with positron emission tomography and magnetic resonance imaging is widely used to map regional changes in brain function advanced over the last decade. Appreciating the unique contribution of aerobics glycol sis new insights into the role of brain energy metabolism atropine signal transduction have emerged. So is our understanding of neurophysiologic Processes responsible for imaging signals advanced a hypothesis A neuron's spiking activity (output) is well suited to focus on its ongoing within brain systems and it has alerted us to costly innateness processes that underlie much Functional activity of the brain. In most textbooks quality teaching is the power required for Brain activity (oxygen that is not used in the brain bound to hemoglobin in red blood cells), which logically follows the brain’s imperative depending on the continuous supply of oxygen through flow for its immediate function. It is provided by the brain through, starting with glycol cist and ending with oxidative phosphorylation it’s easily considered that is inextricably linked to the normal brain cancer.

Colon Cancer: Diagnoses of colon cancer in the United States the subject of this recommendation is colon cancer. In a different recommendation, rectal cancer is discussed. The American College of Surgeons Commission on Cancer found that stomach discomfort, changes in bowel habits, rectal bleeding, and occult blood in the stool are the signs of colon cancer that are most frequently reported nationally. The patient's symptoms, age, personal history of appendicitis, colon polyps, or colon cancer, as well as any family history of colon cancer or a genetic predisposition that predisposes to the disease, are all taken into account in a customized approach to diagnosis (familial adenomatous polyp sis or hereditary non-polyp sis colon cancer). In this context, previously stated practical parameters should be provided by a more cost-effective diagnostic evaluation of the city. When colon cancer is discovered, prompt preoperative assessment and care are needed. Making sure that the patient's whole colon and rectum have been colonoscopically examined for the existence of synchronous neoplasm is an essential component of this evaluation. Within a few months of the final surgery, a colonoscopy should be carried out in cases where colon cancer prevents the investigation of the proximal bowel. The majority of people with colon cancer will require surgery. Various laboratory, radiographic, and cardio respiratory examinations may be necessary to determine the patient's surgical risk depending on their age and state of health.

Lung: Smoking status is the most powerful predictor of lung function Decrease in smokers with COPD. If you are a smoker advised older people are more likely to quit because they cannot stop smoking or their lungs are already damaged. Similarly, there is a nihilistic approach that intervenes in smoking cessation. Previous studies of lung function-related hypertrophy responsiveness in a prospective randomized clinical trial pulmonary we are North American Medical Centers examined two smoking cessation interventions for Light smokers or Moderate airway obstruction. Annually Measure Long Bunch Participants' water stop smoking showed improvements in mean agonist reactivity, baseline Meth choline reactivity, age, sex, race, and baseline year did predict Changes in lung function. Bronchial obstruction and bronchial hyperactivity may benefit from quitting.

Lymphoma: The incidence of Hodgkin's lymphoma, a rare form of cancer, rises in the third decade in women and subsequently drops, whereas in men it stays largely steady after this point. The discovery of Hodgkin/Reed-Sternberg cells in the suitable cellular backdrop of reactive leukocytes and, in some cases, fibrosis, is the basis for the diagnosis of Hodgkin's lymphoma. There are two categories of illness. Organs: Hodgkin lymphoma with nodules in the lymph nodes and conventional Hodgkin lymphoma. 5% of instances of Hodgkin lymphoma are nodular lymphocyte-predominant, according to 2. Men are more likely to develop it, and men typically report minimal nodal illness in the neck but no systemic symptoms. There are four subtypes of classic Hodgkin lymphoma (Panel 1). More than two-thirds of instances of nodular sclerosing classical Hodgkin lymphoma occur in wealthy nations. An illness once categorized as diffuse lymphocyte-predominant Hodgkin's disease now has a new name: lymphocyte-rich classical Hodgkin's lymphoma. The majority of patients identified with this condition are now classed as having the nodular sclerosing disease or analectic large cell lymphomas; lymphocyte-depleted Hodgkin lymphoma is now a rare diagnosis. The current standard of care for classical Hodgkin lymphoma encompasses all subtypes.

VIKOR Method

The VIKOR method is implemented within the mcdm problem introduced as a matching technique, also it isincompatible different units and unique decision making multi attribute decision making with conflicting criteriamethod for the problem solving was created. This method is ranking and focus on choosing alternative means ofpayment and from conflicting criteria determines a compromise option to the problem, which help decision makersarrive at a very last solution. Reconciliation multi standards dimension for ranking, compromise programming usedas an integrating function in the method generated from LP-metric [21]. The VIKOR method solves mcdmproblems with contrasting and comparable different units criteria created to resolve, conciliation is for conflictresolution deeming it acceptable, for the decision maker ideal a closer solution prefers, and evaluates alternatives aredone. All installed criteria. This time is contradictory an alternative to the presence of criteria ranking from set andfocuses on selection, and compromise solutions (one or more) propose. VIKOR systematic weight stability intervalsdeterministic stability analysis and trading compared to decision-making methods the extended VIKOR method hasthree variations. A top is, promethean and electro a numerical example is the VIKOR method explains the application,and four the results of the considered methods are compared [22]. VIKOR method is inconsistent or inconsistent(mcdm) multi criteria decision making, with criteria created to solve problems. For conflict resolution this methodassumes that the compromise is acceptable VIKOR method used in multi-criteria analysis (MCDM). Although apopular method, mcdm problems there are some problems with solving. This study is traditional discussed theproblems with VIKOR method. This intention of the take a look at is to resolve issues with the traditionalVIKOR technique to keep away from numerical troubles in fixing is modified VIKOR approach to create. Modifiedin MCA solution efficiency of VIKOR method several artificial experiments to verify the improvement weredesigned and evaluated [23]. VIKOR for solving complex decision making problems in addition to using themethod successfully, the result depending on the type detailed victor, busy victor, shot theory-past victor, victormodified etc., interval VIKOR methods genres are also in the picture. The decision maker's problem relating torequirements. They have different results are used in situations; there are general properties and math formulas.These five of the VIKOR method the ranking performance of categories is their original there is a better chance tocompare with no. This the main focus of the thesis is two demonstrations all six types while solving the examplescomparing the ranking performance of VIKOR methods aims to spearman's rank correlation using coefficient valuesworks best it tries to detect the VIKOR method [24]. Extended fuzzy VIKOR method, risk based on the overall riskon the factors used sorting out failure modes. This consequently, risk assessment issues in FMEA to deal with, jointweight ambiguous vicar risk assessment method using method is provided. To verify the applicability of the modeland to study its effectiveness, proposed the setting is general at a university hospital risk of anesthesia to analyzeprocedure is used. Fuzzy vikor and ahp client using methods dancer and hacioglu in turkey based on skills evaluatedthe performance of banks. Vend et al many people. Meet the changing needs of customers many people. Meet thechanging needs of customers using fuzzy vikor method to do the concept deals with design choice in an appropriatecontext [25]. Classical VIKOR method is fuzzy VIKOR, interval-valued VIKOR, intuitive fuzzy VIKOR, and intervalvalued various like the reluctantly obscure VIKOR extended in forms. Contradictory VIKOR on dealing with mcdmproblems with criteria as the method is observed to be very powerful, this covering the main idea in the thesis vikorwithin hesitant ambiguous linguistic situations we are motivated to explore an extended [26]. Multiple criteriadecision making (mcdm) VIKOR method evolved from compromise programming an agglomerative denotingcloseness to ideal based on activity. Interval numerical decision making VIKOR method for problems. In this paperis the confidence level of the decision maker introducing sanaye et al. Distribution supplier selection issues in chainorganization for inter-interval comparisons, vikorto deal with fuzzy set theory a hierarchical mcdm using modelfuzzy vikor method based on the proposed method best alternative under each of the selection criteria the bestalternative under

each of the selection criteria and chen and wang to create a compromise solution they provided arational and systematic process. The findings of the study were unclear on several criteria for solving decisionproblems gives an important hint [27]. A new one that includes incomplete scale weights we propose the VIKORmethod. Incomplete our about scale by scale weights can express preferences effectively. The proposed VIKORmethod is the intensity of weights ranks the alternatives using points. VIKOR for decision making under uncertaintywe re-explain the method from scratch. VIKOR the method is multi scale of complex systems developed foroptimization (opricovic, 1998). Compromise by proposing a solution conflicting criteria from the set of alternativesavailable in presence this method of ranking and selection attention VIKOR method, on the other hand, is the risk ofthe result when considered less important, suitable for situations where profit maximization is the goal [28]. Giventhe material selection characteristics identified short of materials in engineering use after making the list, VIKORproposed rank the detailed version, optimized material select can also be used. VIKOR method multiple criteria incomplex systems developed to improve and wide enjoys acceptance. It is contradictory and ranking with criteria ofdifferent units and focuses on choosing from alternatives. A compromise is the ranked VIKOR approach, optimal bycomparing the size closest to the replacement is done, and compromise is by mutual concessions an establishedcontract. By traditional to skip the vikor method number complications in solving the problems developed amodified VIKOR method [29].

Analysis and Discussion

TABLE 1. Determination of best and worst value

	Total Samples	Training samples	Testing samples	Number of genes	Number of classes
Leukemia	72	38	34	527	27
Brain Cancer	65	45	78	608	39
Colon	88	37	65	704	37
SRBCT	45	43	87	712	16
LUNG	105	102	134	826	26
Lymphoma	66	32	67	821	36
Best	**45**	**32**	**34**	**527**	**16**
worst	**105**	**102**	**134**	**826**	**39**

Table 1 shows the Determination of best and worst value of Alternative: Leukemia, Brain Cancer, Colon, SRBCT, LUNG, and Lymphoma. Evaluation Preference: Total Samples, Training samples, Testing samples, Number of genes, Number of classes.Training samples is the Best and Worst Value. It is solved by using the VIKOR method. It is the data set of this paper.

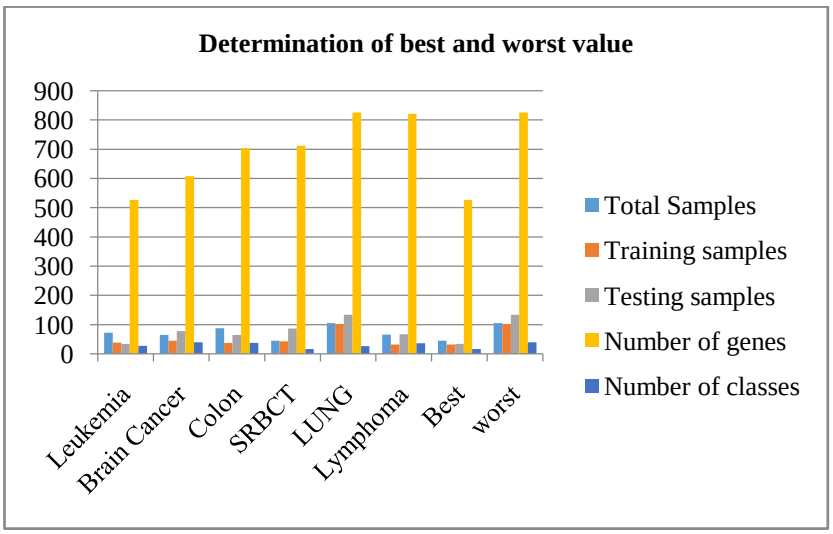

FIGURE 1. Determination of best and worst value

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TABLE 2. CulculationSj and Rj

					Sj	**Rj**
0.1125	-0.02917	-0.04583	2.008333	-0.075	1.970833	2.008333
0.083333	0	0.1375	0.067726	0.25	0.538559	0.25
0.179167	-0.03333	0.083333	0.147993	0.228261	0.605421	0.228261
0	-0.00833	0.175	0.154682	0	0.321349	0.175
0.25	0.2375	0.370833	0.25	0.108696	1.217029	0.370833
0.0875	-0.05417	0.091667	0.245819	0.217391	0.588211	0.245819

Table 2 shows the calculation Sj and Rj is the sum of Normalization of the tabulation 1 which is calculated from the Determination of best and worst value.

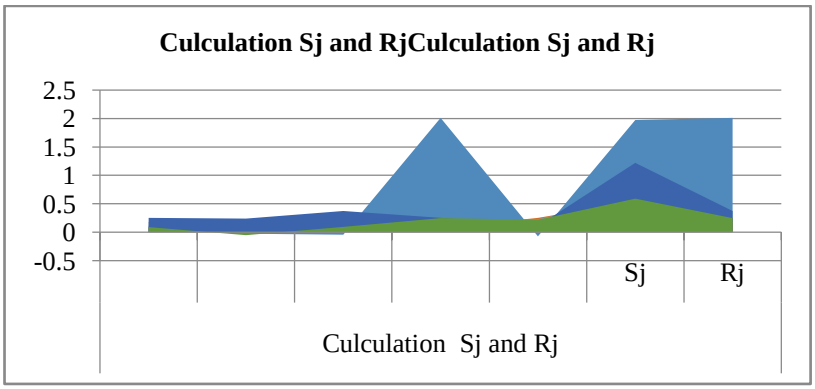

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TABLE 3. CulculationQj

	CulculationQj		
	Sj	Rj	Qj
	3.979167	2.008333	1
	0.788559	0.538559	0.106328
	0.833682	0.605421	0.132623
	0.496349	0.321349	0
	1.587862	1.217029	0.422168
	0.83403	0.588211	0.127572
S+ R+	0.496349	0.321349	
S- R-	3.979167	2.008333	

Table 3 shows the Sj,Rj,Qj by using the previous tabulation it is the sum of the value. Sj and Rj using the S+ R+ Minimum formula, S- R- Maximum formula.

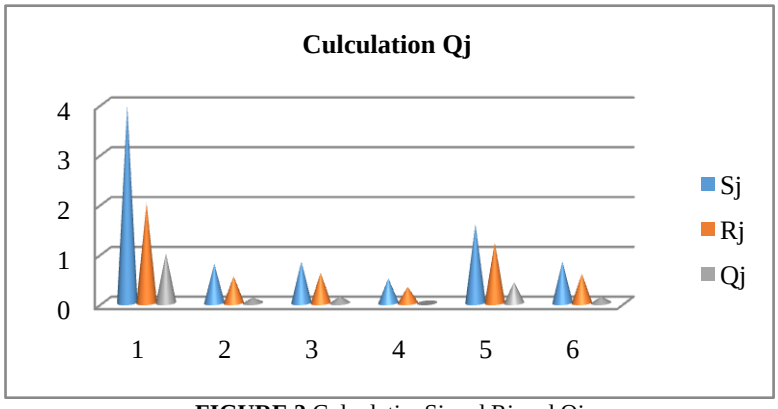

FIGURE 2. CulculationSj and Rj and Qj

Figure 2 shows the graphical view of CulculationSj and Rj& Qj value Qj forLeukemia is showing the highest value and SRBCT is showing the lowest value.

TABLE 4. Rank

	Rank
Leukemia	1
Brain Cancer	5
Colon	3
SRBCT	6
LUNG	2
Lymphoma	4

Table 4 shows the final result of this paper Leukemia in is 1st rank, Brain Cancer in is 5th rank, Colon in is 3rd rank, SRBCT in is 6th rank, LUNG in is 2nd rank, and Lymphoma in is 4th rank. The final result is done by using the VIKOR method. for-Leukemia is showing the highest value and SRBCT is showing the lowest value.

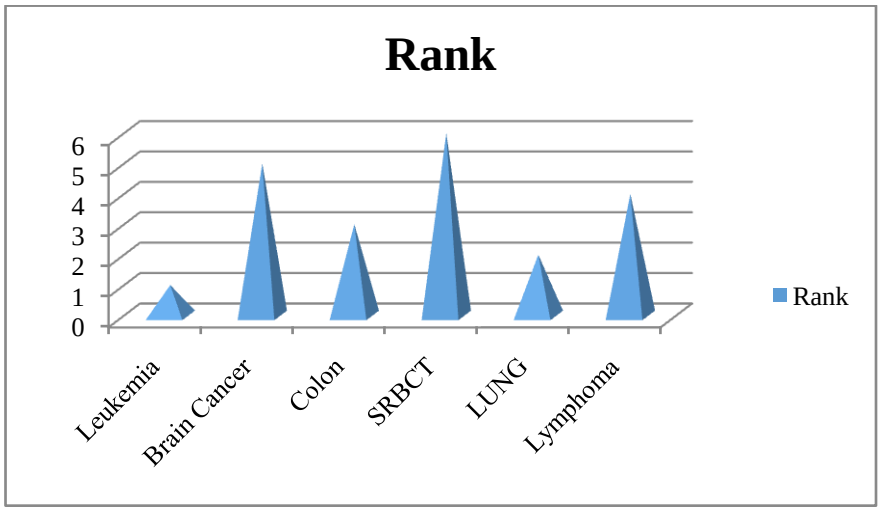

FIGURE 3 Ranks

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Conclusion

To produce predictive genes with low redundancy, a hybrid gene selection technique based on gene score strategy and enhanced selection is proposed in this study. Different methods of relevant gene filtering are used to cut down on computational costs and create a smaller gene pool for further gene selection. The most predictive gene subsets from the gene pool are then chosen using an enhanced proposal. The suggested method outperforms another base- and base-based gene selection method, according to experimental results, and chooses highly predictive and compact gene subsets. However, the suggested technique chooses genes. Future research will focus on how to employ the genetic selection process as presented for data analysis as well as how to encode some prior knowledge. One of the crucial processes in the classification of microarray data is gene selection. Particle swarm optimization is gaining popularity as a powerful method for genetic selection since it uses fewer parameters and doesn't use complicated evolution operators. Some particle swarm optimization-based gene selection techniques may select non-optimal genes with a high probability because particle swarm optimization is likely to converge to local minima, which may result in premature convergence. It is still difficult to choose prognostic genes with low redundancy without excluding crucial genes. Exposure to ionizing radiation has been associated with leukemia, and gene selection often involves two phases. All of the survivors of the World War II atomic bombings in Japan have been shown to have a significant incidence of leukemia. Functional brain cancer imaging with positron emission tomography and magnetic resonance imaging is widely used to map regional changes in brain function advanced over the last decade. Appreciating the unique contribution of aerobics glycol sis new insights into the role of brain energy metabolism atropine signal transduction have emerged. Diagnoses of colon cancer in the United States the subject of this recommendation is colon cancer. In a different recommendation, rectal cancer is discussed. Smoking status is the most powerful predictor of lung function Decrease in smokers with COPD. If you are a smoker advised older people are more likely to quit because they cannot stop smoking or their lungs are already damaged. Similarly, there is a nihilistic approach that intervenes in smoking cessation. The incidence of Hodgkin's lymphoma, a rare form of cancer, rises in the third decade in women and subsequently drops, whereas in

men it stays largely steady after this point. The presence of Hodgkin/Reed-Sternberg cells serves as the basis for the diagnosis of Hodgkin's lymphoma. VIKOR method used multi-criteria analysis (MCDM). Although a popular method, mcdm problems there are some problems with solving. This study traditionally discussed the problems with the VIKOR method. The take look intends to resolve issues with the traditional VIKOR technique to keep away from numerical troubles in fixing are modified VIKOR approach to create. From the result, it is seen that Leukemia is showing the highest value for SRBCT is showing the lowest value.

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