Original Article

Analysis and Comparison of SVM-RBF Algorithms for Colorectal Cancer Detection over Convolutional Neural Networks with Improved Accuracy.

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Abstract

Aim: This research is to study the comparison and analysis of (Support Vector Machine - Radial Basis Function) SVM-RBF algorithm for colorectal cancer detection over Convolutional Neural Network (CNN). **Materials and Methods:** The study was conducted using SVM-RBF and Convolutional Neural Network algorithms to analyze and compare colorectal cancer detection. results were computed using matlab software. For each group, twenty samples were used to compare accuracy of SVM-RBF algorithm and CNN algorithm. Sample size was calculated by maintaining G-power 80%, α=0.05, confidence interval 95%. **Results:** Study performance exhibits colorectal cancer detection accuracy over SVM-RBF algorithm and detection from CNN with improved accuracy. The mean value of SVM-RBF algorithm is 91% and CNN algorithm is 89%. It is observed that SVM-RBF algorithm performed better than CNN algorithm (p=0.013) by performing an independent sample t-test. **Conclusion:** SVM-RBF algorithm has significantly greater accuracy in predicting colorectal cancer than CNN algorithm.

KEYWORDS: SVM-RBF Algorithm, CNN Algorithm, Cancer Detection, Innovative colorectal cancer detection, Machine learning.

DOI: 10.47750/pnr.2022.13.S04.011

INTRODUCTION

This research is to improve the algorithms to seek out the optimum parameter of a derived SVM algorithm. Colorectal cancer has a low prediction accuracy and ensemble model is used to classify in groups and developed in prediction analysis, the imbalance disease is based on selecting features genes in colorectal, the SVM is proposed to the most optimal parameters and applied in optimization algorithms. Predictive performance is applied to improve colorectal cancer on the imbalanced data (Zhao et al. 2019). The numerous kernels of SVM are measure utilized as classifiers and the staging is analyzed on colon diagnostic image. The system of colon cancer detection has been proposed and traditional features are compared by performance classification in geometric features. The malignant colon cancer has the variation of structure and utilizes a feature classification in RBF (Zhao et al. 2019; Rathore et al. 2015). In this research work conferred to show that pretrained futures gives sufficient generalization power and applied to a variety of colon image grading. SVM features are accurately detected by the images and it is trained in machine learning to classify the image dataset, convolutional neural network provides the generalization power in sufficient image classification and it is prevented by the validation of RBF features to innovate in detection model ((Rathore, Hussain, and Khan 2015; McAllister et al. 2018). RBF and SVM applied the classifying specimen into three grades of carcinoma. The appearance of probability features are combined with data estimates in machine learning algorithms. The SVM classifier of the algorithm is based on the analysis of data and it is obtained by the image product. The combination of SVM methods between metastatic and non-metastatic sample databases are utilized by the precision to validate the SVM classifier. It is established in optimal RBF classification (Zhi et al. 2018). This strategy reduces the burden related to colon cancer and suspected colon tissue samples are carried out. Normal and abnormal colorectal

tissues in the region are determining the decision consistent, accurate, faster and proposed in localizing models in the whole slide image (Gupta et al. 2021).

Many research articles were published in SVM-RBF algorithms in the last 5 years. In IEEE database 30 articles were published and in pubmed database 48 articles were published. The most cited articles were, the algorithm of structure in SVM compared with the traditional learning method. The classifier capacity and training error has reached a relatively balanced state. Machine learning methods have strong adaptability and promotion ability in support vector machine (Duan 2019). The medical data classification has remained in RBF on most evolutionary algorithms. The relevant features from the dataset are used in the accuracy, sensitivity, specificity and Gmean. The regression models are compared on the basis of multicast data images in an innovative detection model by SVM (Mohapatra, Chakravarty, and Dash 2016). The intrusion prevention system techniques have been used in the detection of large data sets of images. Machine learning algorithm is based on the innovative colorectal cancer detection. It is improved to decrease and increase the detection rate (Mohapatra, Chakravarty, and Dash 2016; Ahmad et al. 2018). The computing method is introduced using the prediction model in the SVM algorithm. Precipitation has been undertaken to evaluate the changes of statistical indices to numerous variability and development. The wide application field in machine learning algorithms were applied in computing the classification and regression analysis in adaptive inference systems. The optimization algorithm has the genetic algorithm to support vector regression (Gocic et al. 2016). Among all this research the best article proposes that the image enhancement was performed with SVM in a machine learning algorithm and it applied in the classification method of RBF in multiclasses. It is proposed in the classification data to implement and develop the support vector machine in multiclass with parameters (Adyanti, Novitasari, and Fanani 2018).Our team has extensive knowledge and research experience that has translate into high quality publications(Bhansali et al. 2021; Jayanth et al. 2021; Sudhakar, Ravel, and Perumal 2021; Sathiyamoorthi et al. 2021; Deepanraj et al. 2021; Raju et al. 2021; Arun Prakash et al. 2020; Kamath et al. 2020; Shanmugam et al. 2021; Rajasekaran et al. 2020; Adhinarayanan et al. 2020; Rajesh et al. 2020; Aurtherson et al. 2021)

In the research , improving the accuracy in colorectal cancer of SVM-RBF algorithm. The study is to develop a machine learning algorithm SVM-RBF and to predict colorectal cancer more accurately than the existing algorithm CNN.

MATERIALS & METHODS

The study was conducted in the machine learning laboratory in the Biomedical Engineering, Saveetha School of Engineering,Saveetha Institute of Medical and Technical Sciences, Chennai. In this research there is no ethical approval required since we are not working in a human sample. The number of groups used for comparison is two. Group 1 refers to the SVM-RBF algorithm and Group 2 refers to the CNN algorithm. The sample size for group 1 and 2 is 20. The total number of sample sizes is 40. The pretest analysis of sample size is done through clinical.cal.com. The pretest probability was done by keeping G-power at 80% , Threshold at 0.05% , confidence interval at 95% and enrollment ratio is 1. Spatial and hierarchical clustering methods are applied in reflectivity data for grouping. The statistical features are derived in its centroid position from the cluster reflectivity. The feature extraction process is defined by the properties and applied in the binary classification method in the innovative colorectal cancer detection to be used as the inputs (Lee et al. 2016).

The sample preparation of group 1 and 2 is 20 and taken from the website kaggle.com. The testing setup was done through the Matlab R2021a software and the testing procedure as the data are taken from the website and preprocessed. The testing data are 20 % and 80 % training is fed into the matlab software. Run the algorithm and output is noted. The data for the input images of group 1 and 2 were collected from kaggle.com. The input is given to the algorithm and output is noted.

Statistical Analysis

The statistical software program used in the research study work in SPSS used to calculate the mean, standard deviation and significance difference of the results. Efficient techniques are proposed in statistical analysis. Data analysis and data management can be explored by basic statistics through SPSS (Denis 2018). The evaluation of this study work is carried out using Independent samples T-test .Which is used to evaluate accuracy produced through SVM-RBF and CNN algorithms.

RESULTS

The accuracy for various samples are recorded using artificial neural networks. Group statistics for SVM-RBF and CNN have been recorded. The Independent ‘t’ test has been calculated between the innovative

colorectal cancer detection SVM-RBF algorithm and the comparative CNN algorithm. The comparison of accuracy values for SVM-RBF and CNN algorithm is shown in Table 1.

From Table 1, it is observed that the SVM-RBF algorithm has higher accuracy values for different input images when compared to CNN algorithm. The SVM-RBF algorithm is found to be 93.90% and CNN algorithm has a value of 91.40%. Comparatively, it can be concluded that SVM-RBF results have higher accuracy than existing CNN algorithms.

From Table 2, it is observed that the mean value of SVM-RBF is found to be 91% and the standard deviation is 2.63079 and standard error mean is 0.32153. The mean value of CNN is found to be 89% and the standard deviation is 2.15926 and standard error mean is 0.48282.

From Table 3, it is observed that the significant value of SVM-RBF algorithm is p=0.013, in comparison with the standard significance value of 0.05.

Figure 1 shows the simulated results. The original image shown in Fig.1a is segmented and preprocessed which are depicted in Fig.1b and Fig.1c. Then the image is simulated by both the algorithms.The simulated images are shown in Fig .1d and Fig.1e.

The performance analysis of SVM-RBF and CNN algorithm is shown in Fig.2. The graph clearly depicts that the accuracy of the SVM-RBF algorithm is higher than the CNN algorithm. Figure 3 shows that the SPSS graph compares the mean accuracy values of SVM-RBF and CNN algorithms. Based on the accuracy, it is inferred that the SVM-RBF algorithm is more efficient when compared to CNN algorithm. The mean accuracy of SVM-RBF is found to be 91% and the mean accuracy of CNN is found to be 89%.

When performing the statistical analysis for twenty samples from both SVM-RBF and CNN algorithm, the SVM-RBF algorithm obtained 2.63079 standard deviations with 0.32153 standard mean error. CNN algorithm obtained 2.15926 standard deviations with .48282 standard mean error. However, The significance value of p=0.013 which is lower than the p=0.05, showed that our work holds significantly good.

An independent sample t-test was used to compare the accuracy levels for both SVM-RBF and CNN algorithm, and a statistically significant difference was noticed. The SVM-RBF algorithm obtained 91% accuracy shown in Fig.3. Compared with the other algorithms, the performance of the proposed SVM-RBF technique achieved better performance than CNN algorithm in colorectal cancer detection.

DISCUSSION

In this study it observed that the proposed algorithm provides better accuracy than existing algorithms. In this research the proposed algorithm has better significance than the existing algorithms. This work gives p value less than 0.05 where p=0.013.

Support Vector Machine (SVM) and Radial Basis Function (RBF) is to detect colorectal cancer. The quality of image during detection and reconstruction should be high for better algorithms. The proposed algorithm provides better accuracy than all these algorithms. Similar findings of this study, SVM has the learning classification by innovation detection model through different features and diagnosed by the frequency, machine learning classifier approaches by extracting the features in SVM RBF and it is predicted in colorectal cancer (Hussain et al. 2018). The artificial intelligence algorithm has been exploited by the SVM classifier. It has a variable intrusion detection system in data volumes. The combination of existing technologies are constructed and based on the innovative detection system. It is enhanced by the default SVM classifier and approaches performance measures in terms of accuracy (Rathore, Hussain, and Khan 2015; Enache and Sgârciu 2014). The performance was evaluated by inspecificity, sensitivity and predictive values. The features are extracted by the diagnostic system in cancer stage and detection accuracy obtained in the textured features of machine learning algorithms (Hussain et al. 2019). The standard diagnosis has various cancers that demonstrate low specificity and sensitivity in image density upon increasing techniques. The machine learning classifiers are broadly used in monitoring and prognosis by extracting the features (Rodrigues et al. 2021). Opposing findings are found to be in SVM classification has the better discrimination in colon cancer in innovative colorectal cancer detection (Mukhopadhyay et al. 2016). The CNN identified the cancer cells and obtained them by the digitized sample. The comparison of deep learning ability models is improving cancer detection through the support vector machine. The CNN representation of architecture is trained and detects cancers by the machine learning algorithm (Kwak and Hewitt 2017).

The limitations of this research is to implement the more sample size may increase significant values by predicting in accuracy than the existing algorithm. The future scope is to enforce and to evolve more samples in innovative colorectal cancer detection by colorectal cancer based on CNN. Existing limitations and future directions for enhancing the diagnostic potential of SVM and RBF are also proposed.

CONCLUSION

It has been concluded that the proposed innovative colorectal cancer detection algorithm significantly provides better accuracy than the existing algorithm. The SVM and RBF algorithm is comparatively shown to be 91% accurate, which is more significant with a value of p=0.013 than CNN algorithm.

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DECLARATIONS

Conflict of interests
No conflict of interest in this manuscript.

Authors Contributions:
Author MK was involved in data collection, data analysis, manuscript writing. Author PN was involved in conceptualization, data validation, and critical review of the manuscript.

Acknowledgments:
The authors would like to express their gratitude towards Saveetha School of Engineering, Saveetha Institute of Medical and Technical sciences (formerly known as Saveetha University) for providing the necessary infrastructure to carry out this work successfully.

Funding:
We thank the following organizations for providing financial support that enabled us to complete the study.
1. Sunrise Fiberglass LLC, Bengaluru..
2. Saveetha University.
3. Saveetha Institute of Medical and Technical Sciences.
4. Saveetha School of Engineering.

TABLES AND FIGURES

Table 1. Comparison between SVM-RBF and CNN algorithm with N=20 samples of the dataset with the highest accuracy of respectively 91% and 89%. The table shows different accuracy values for different input images for both SVM-RBF and CNN algorithms.

No.of. Samples	**ACCURACY RATE**

	SVM-RBF	**CNN**
1.	89.80	88.40
2.	88.10	87.10
3.	89.90	87.30
4.	90.90	88.50
5.	86.10	84.70
6.	84.20	83.90
7.	91.10	90.80
8.	93.50	91.00
9.	93.90	91.10
10.	93.20	91.40
11.	89.10	88.50
12.	93.70	91.10
13.	92.10	88.60

14.	93.60	88.30
15.	91.80	90.20
16.	91.50	90.30
17.	92.50	91.20
18.	91.10	91.30
19.	90.10	88.40
20.	93.80	88.20

Table 2. Statistical results of SVM-RBF and CNN algorithms. Mean accuracy value, Standard deviation and Standard Error Mean for SVM-RBF and CNN algorithms are obtained for 20 images. It is observed that the SVM-RBF algorithm performed better than the CNN algorithm.

ACCURACY	**GROUP STATISTICS**				
	GROUP	**N**	**MEAN**	**Std. Deviation**	**std.Error Mean**
	1(SVM-RBF)	20	91.0000	2.63079	.32153
	2(CNN)	20	89.0150	2.15926	.48282

Table 3. Comparison of Independent sample test for SVM-RBF and CNN algorithm. The significant 2-tailed value is found to be P=0.013, which is less than normal significant value 0.05. SVM-RBF algorithm provides better significant value than CNN algorithm.

	EST

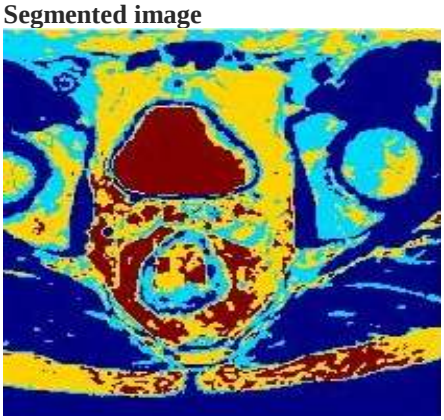
		LEVENE'S TEST FOR EQUALITY OF VARIANCE		T-test for equality of Means					95% confidence interval of the difference	
ACCURACY	**Equal Variance assumed**	**F**	**Sig.**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**Lower**	**Upper**
		.298	.589	2.608	38	.013	1.98500	.76103	.44437	3.52563
	Equal Variances Not assumed			2.608	36.608	.013	1.98500	.76103	.44244	3.52756

Original image

(a)

Preprocess image

Segmented image



(b)

SVM-RBF

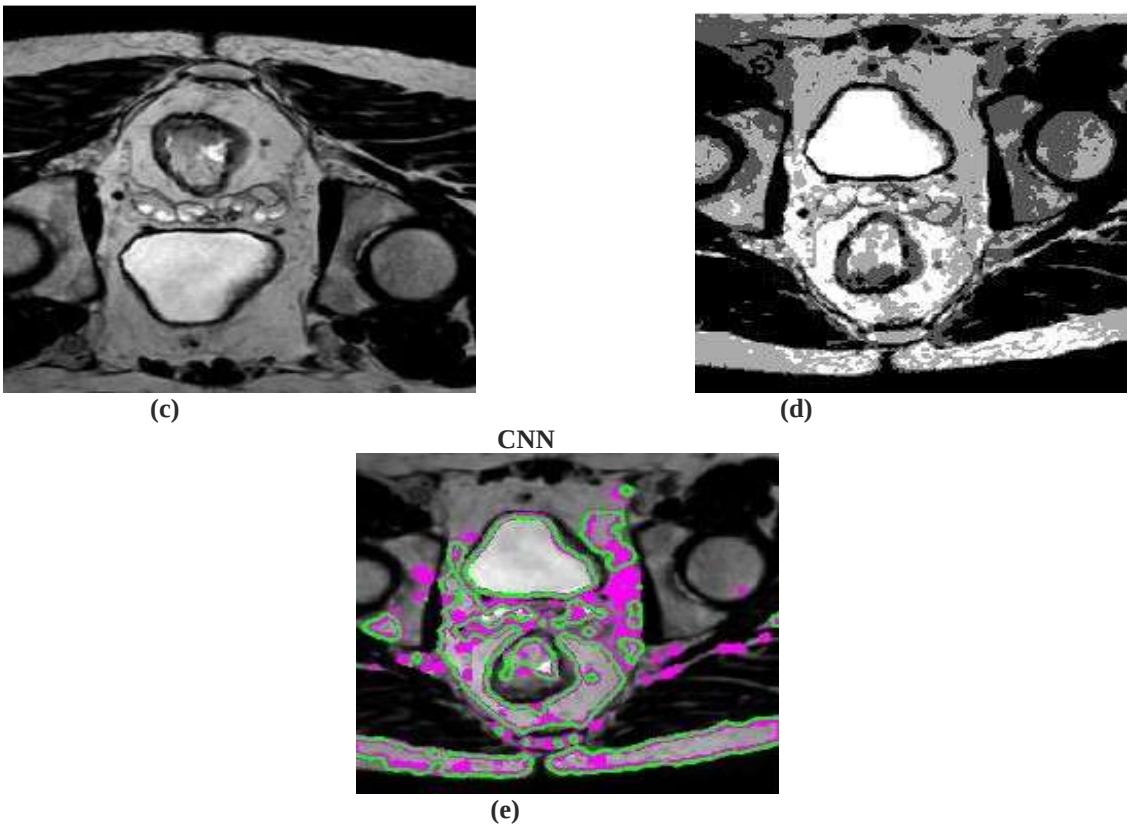


Fig. 1. Simulated results (a) Sampled original image (b) Segmented image (c) Preprocess image (d) Simulation for SVM-RBF algorithm (e) CNN algorithm.

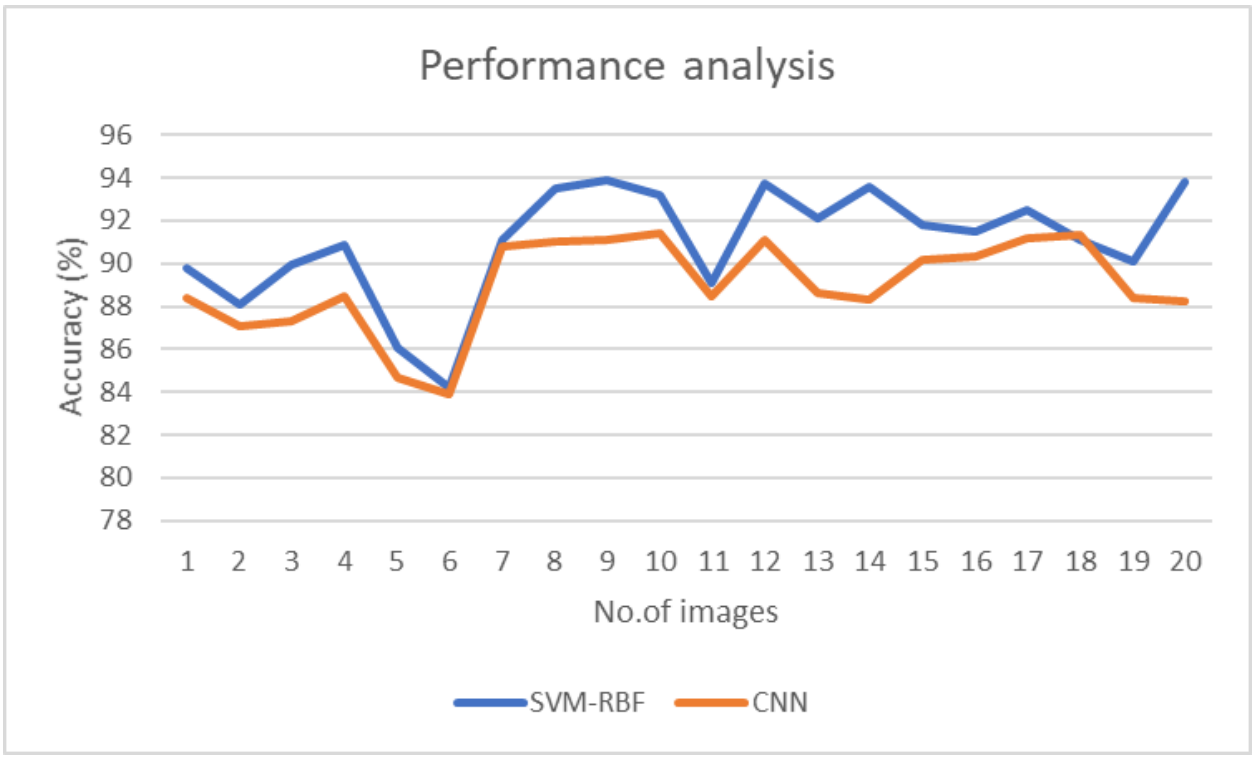


Fig. 2. The performance analysis of an SVM-RBF and CNN which is denoted by its Accuracy and number of Images. The performance analysis compares the mean accuracy values of SVM-RBF and CNN algorithm of its accuracy and number of images.

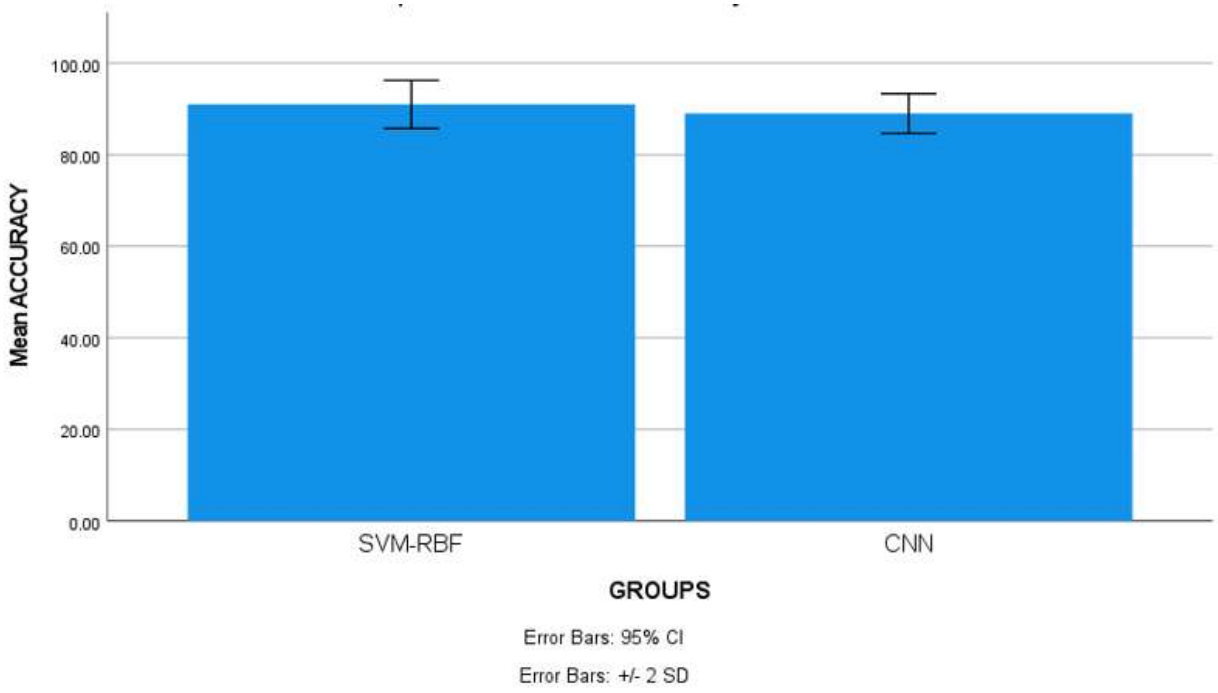


Fig. 3. The simple bar graph compares the mean accuracy values of SVM-RBF and CNN algorithm. Based on the mean accuracy, it is said that the SVM-RBF algorithm is more efficient when compared to CNN algorithm. The mean accuracy of XGboost is denoted as 91, and the mean accuracy of CNN is denoted as 89. X- axis: SVM-RBF vs CNN algorithm. Y-axis: Mean accuracy of detection +/- 2SD.