Applying deep learning approach for brain tumor detection

Ankur Gupta [a], Apurv Verma [b], Dushyant Kaushik [a], Muskan Garg [a]

[a] Department of CSE, Vaish College of Engineering, Rohtak, Haryana, India
[b] Department of CSE, School of Engineering and I.T., MATS University, Raipur, India

ARTICLE INFO

ABSTRACT

In this work, a technique which is used for the purpose of picture extraction has been applied in the health sector. This technique extracts images depending upon its content. It is used for the identification of tumor. The deep learning based work which has been carried out here is practically implemented by integration of ANN and edge detection mechanism. For the fulfilment of research goal two different techniques are employed. The main intention behind this research work is to examine the techniques which are used in the extraction of clinical pictures. On the basis of this examination a new method was formed. This method is used for the purpose of pictures organization, selection and removal of picture qualities. Efficiency of this method was assessed and authorized in this work. Here this method contains different phases. In the beginning, size of previously treated pictures is adjusted by applying RGB2 grey conversion. After this, method related to edge detection applies. Depending upon the qualities which are removed out of pictures probability of tumor determined. In next phase for the identification of tumors artificial neural network is used. In the end, the consequences of this research are compared with earlier work in support of assessment.

© 2021 Elsevier Ltd. All rights reserved.
Selection and peer-review under responsibility of the scientific committee of the Emerging Trends in Materials Science, Technology and Engineering.

1. Introduction

A deep neural network (DNN) is an ANN with multiple hidden layers between the input and output layers. Similar to shallow ANNs, DNNs can model complex non-linear relationships. The main purpose of a neural network is to receive a set of inputs, perform progressively complex calculations on them, and give output to solve real world problems like classification. We restrict ourselves to feed forward neural networks. ANN has been used in Brain tumor detection. Such type of method becomes famous in the form of content based. It becomes famous in this form because during the period of probing and they simply examined authentic matter of picture in comparison to wasteful information of the image are assessed at the time of. It is also known in the form of query by image content (QBIC). In situations where the paper work is very huge computerized pictures are identified by such method when they employ the techniques which are related to computerized concept. Content of a picture represent its structural qualities, qualities related to its colour and other important information of pictures. Gateways present across the network search pictures on the basis of extra details. This becomes the basic reason due to

which such type of methods gets more attraction. It means they create lot of unauthentic matter, in addition to authentic matter. Brain of each person considered a complicated part of his physique. Information are recalled, gathered and assessed by brain. It development is abnormal. Within the brain cells circulate in an uncontrolled and controlled manner. Inside a brain two different types of cells are present. Out of these two cells, one develops in brain and the other cells arrived to this point at the time of transitional stage. It is possible that cells which develop in brain are harm full and harmless. These cells do not move in the direction of other parts. The cells which come out from other parts stay harmful. Dimension of human mind is restricted. A human brain feels heaviness whenever its size expands. In situations where a human brain feels heaviness, simply indicates, healthy part of human brain gets injured. In the diagnosis of neoplasm when it is in its early stage different type of scanning techniques are applied. In early stage, doctors start diagnosis depending upon MRI results. In situations where it becomes necessary to examine a digital picture under a computerized application, a significant contribution is done by the tissue assessment in the separation of picture and in its understanding.

A. Gupta, A. Verma, D. Kaushik et al.

2. Edge detection

We are residing in an environment where lifestyle of human beings is very contemporary. Due to this reason detection of pictures edges becomes very important. In addition to criminal laboratory area in which this technique gets more significance is defence force. It suggests, complete understanding in relation to such methods becomes necessary. A significant contribution is done by this method in situations where a picture required treatment. Whenever a picture point or its level of brightness modifies in a rough manner then this modification can be easily predicted through this method. Up to this point in time, different forms of this method are available in market. In the treatment of picture this method gives a significant contribution. It has many applications like deformation of image, identification of sample, partition of image and its removal. Edge delivers maximum details in the direction of pictures. Therefore A significant contribution is done by this method in situations where a picture required treatment. It provides the dimension of a picture is supplied by it. In normal circumstances, in an image edges are represented in different forms. These forms are

- Step edge
- Ramp edge
- Roof edge
- Line edge

Lots of research work is already done in the field of edge detection method. Due to this work, different methods are developed. All these methods are organized either in Gradient Based and or Laplacian Based method depending upon their order of derivative.

Canny edge detector- From past couple of years methods related to canny edge detection are continuously implemented between various edge detection algorithms. From past couple of years, all the details related to pictures are gathered through image processing method. The pictures taken at a crime a scene contains different information.

2.1. Canny edge detection algorithm

Such type of algorithm is used in the identification of edges. In this method digital rules are employed. These rules work in different phases. Inside a picture edges are identified by this method. It identified best possible edge detection algorithm is the only plan of this method. A detecting device becomes finest when it detects in a very superior way. Authentic edges become understandable when this method is bringing in to use. When labelled edge and edge related to existent picture becomes comparable its location becomes good. In presence of other methods, this method becomes optimal. The principles which are required in the company of this method become as:-

1. **Maximum Accuracy**: Identification of all edges becomes very important because it will ensure maximum accuracy.
2. **Premium Tracing**: The gap identified through detecting device in between picture point and genuine edge must be the minimum.
3. **Restricted Reaction**: It represents, specified edge inside a picture becomes detectable on occasion where it is feasible. The algorithm mainly has five steps in it.

Algorithm works in different steps –

1. **Levelling**: For removing sound, by using median filtering impression of picture is made vague.
2. **Finding Gradients**: Edges are prepared in understandable form where the development related to pictures is large.
3. **Least Domination**: Exactly represents, some degree of maxima becomes measured in the form of edges.
4. **Double Thresholding**: Used in identification of proper edges.
5. **Identification of Edge through Output Interval**: For the identification of eventual edges it becomes necessary to eliminate those edges which maintain no relation with a convinced edge.

2.2. Development

In conditions, where flat and flexible pictures becomes compulsion models related to canny edge detection shows poor performance. For the resolution of this problem, requirement of superior method comes in to existence. For this purpose lot of work has been carried with grey pictures. In support of this goal two conditions are kept in mind. In one situation noise is considered and in other situation noise is not considered. It has been bring in to notice, that for getting further edge information customized operators eliminating noise in a very useful way. It is highly stable edge detection, and can detect the edge detail of the image in a very useful way. Resultants, which are carried out with respect to flexible image shows that the recent algorithmic programme has several benefits. These benefits are reduced computational complication and time.

2.3. Variables

Variables present within canny method are not stiff. As a result, it effects computation time and utility of the algorithm.

2.4. Gaussian filter size

Consequences of this method are highly affected by the filter in initial stage. These filters carried out the work of levelling. Small size filters becomes indistinguishable. It permits detection of small, sharp lines. Large size filters brings vague impression. Consequence of one pixel is put by them on the large part of picture. In the identification of plane picture radius of vague impression should be large. E.g. edge of a rainbow.

2.5. Thresholds

When single threshold approach is compared with two thresholds method which has been used in the company of hysteresis, it has been come in to notice that the latter will provide more elasticity. However, the general problems of threshold method will remain unaffected. It means in situation where the location of threshold is too high it pay no attention to some useful information and in situation where the location of threshold is too low it recognize wrong information such as noise. It is impossible to form a threshold which can fit on all images. Up to this point in time no tried and tested approach to this problem yet exists.

2.6. Social applications of edge detection

By considering the manner in which this detection technique has been used in Macao society the popularity of this detection technique in public demand is displayed.

2.7. License plate detection

In the present world, cars are used everywhere. Therefore it is certain that intelligent traffic control will become a trend in future.

Therefore, we will discuss here the manner in which this detection technique is used for the identification of license plate. The technology of license plate detection is commonly applied at the gates of toll plaza, in car park areas. It has been found, this technology will provide some useful significance if some modification is done. 1) Sample image grey scaling and QDPA operator edge detection. 2) Detection of hidden information in medical images. A comparison is made between phase based detection methods and usual edge detection methods. From this comparison it has been found that the basic difference in the middle of these methods is that in addition to edges of object, some furtive information of test object are also detected which cannot be identified by conventional methods. Conventional methods are not able to identify this information because the colour of these details and their immediate area are almost similar.

2.8. Strong points

1. This method is responsive.
2. In company of various qualities it makes changes for the identification of edges.
3. Deliver consistent finding.
4. It becomes superlative in the identification of edge detection for the reason that it satisfies each and every requirement of edge detection. It is possible to use them effectively.

2.9. Weak points

1. In conditions where smoothing qualities are required in three dimensional form models related to canny edge detection shows slow performance.
2. Such conditions, where flat and flexible pictures become compulsion models related to canny edge detection shows poor performance.

3. Literature review

In 2020, C. Chen et al. [1] implemented an examination on Urine Raman spectroscopy. This work was done in order to deliver cost effective diagnose of constant renal failure (CRF). In order to obtain necessary requirement different type of categorization methods has been implemented by them. Warning indication deliver by damaged kidney indicates the failure of Chronic renal. If patient does not get timely diagnosis it becomes worse and converts into uraemia. As a result, patient overall life spam reduced. On the other hand, awareness regarding the existing screening method, like routine check-up of blood and medical image is very poor.

In 2020, A. Sadiq, I. F. Nizami et al. [2] assessed level related to Blind pictures. In order to obtain necessary requirement, information related to regular image of fixed wavelet transform was used. Human beings are the final user of picture. As a result, assessment of picture level from the prospective of human beings becomes important. Process in which level of pictures are assessed through human is a very time consuming process. As a result, it becomes necessary to use computational models for the examination of image quality using objective metrics.

In 2020, J. Liu et al. [3] demonstrate the function of FT-IR spectroscopy where it is used in presence of SVM. In this situation it works as transmission device. It was done for the determination of constant canaliculus carcinoma in breast cancer. Consequences of this work brings in to limelight that when serum FT-IR spectroscopy and multivariate statistical analysis has considerable are used in integrated form then viewing of IDC in breast cancer becomes very easy. It is possible to implement such method in the development of moveable, fast viewing device in support of discriminating healthy patients.

In 2020, A. Shakarami et al. [4] delivered computer aided design. The basic intention behind this design invention is the diagnosis of Alzheimer's disease. For its treatment, two dimensional slices and better Alex Net-SVM method was bring in to use. It is disease which is related to human mind. With the implementation of this method, near about ninety six percent exact-ness has been achieved. It decrease number of evaluation data.

In 2020, Z. Yan et al. [5] recognized a tumor which was very dangerous. The most important point is that it was recognized in a very speedy way. For the fulfillers of their goal in addition to serum Raman spectroscopy they use organization methods. Patient which are suffering from this type of disease their lifetime entirely based on its type. Lifetime of patient increased when he gets diagnose in early stages. The work which has been presented here becomes very useful in the diagnosis of this disease.

In 2020, Z. Karapinar Senturk et al. [6] give suitable cure in the direction of paralysis. In order to achieve desired treatment machine learning methods were implemented by them. The work which has been presented here delivered a method of diagnosis in the support of this disease. This method was derived on machine learning technique. Process of qualities collection and its sorting are included in this method. Logical feature removal methods and features value were considered for doing the work of feature selection. When support vector machines are used in the company of logical feature removal method they perform better in comparison to other methods. With the help of this method, near about ninety six percent exact-ness was achieved in the diagnosis of paralysis.

In 2020, R. Arora et al. [7] applied Deep feature based automatic classification of mammograms. It has been noticed that the women who died because of breast cancer comes in second place. Due to anonymous factors, prevention in early stages of disease is almost impossible. But, the images of breast which are taken on the basis of distinctive signs like huge mass of breast and microscopic wounds can provide a good assistance in the better treatment of women.

In 2020, D. Giveki et al. [8] proposed on Scene classification using a new radial basis function classifier and integrated SIFT–LBP features. From the computer points of view description of an incident is a very complicated and important work. The efficiency of the organizer which was present by them was compared with the efficiency of a multi-way SVM oorganizer. From the practical outputs, it has been found that the organizer which was proposed here is superior as comparison to latest records.

4. Methodology used

The methodology used in research has been represented below:

Upload a picture.
Size of previously treated pictures is adjusted by applying RGB2 grey conversion.
Method related to edge detection applies.
Depending upon the qualities which are removed out of pictures probability of tumor determined.
For the identification of tumors artificial neural network is used.
Consequences are compared.

5. Proposed work and implementation

The work which has been presented here considered two MRI pictures of human brains. In one picture human is suffering from tumor and in second picture human is not suffering with tumor. The work which has been presented here concludes in four steps.
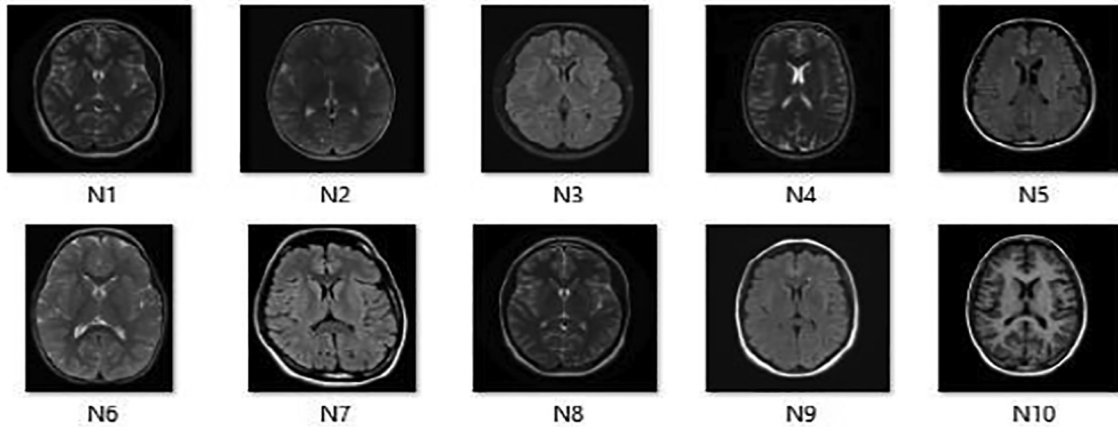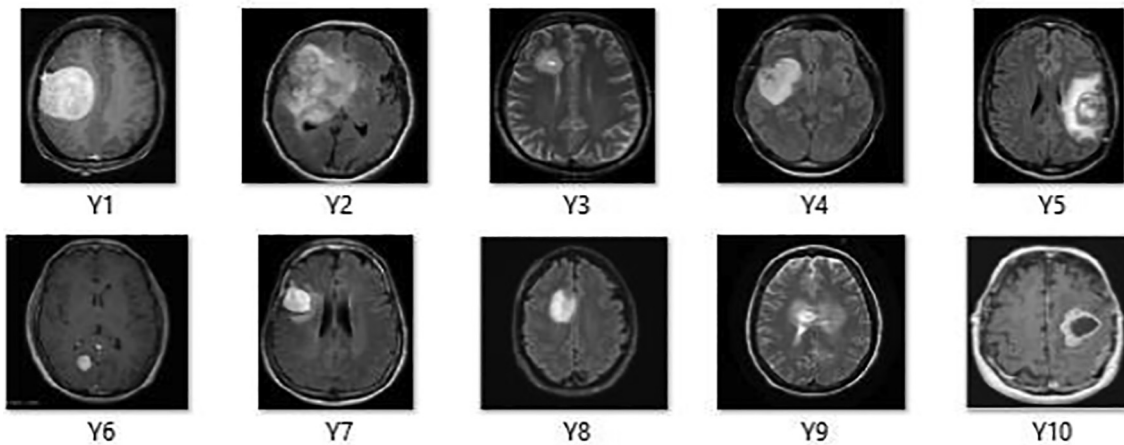
Fig. 1. Brain MRI without Tumor.

Fig. 2. Brain MRI having Tumor.

Step 1: In this step, as soon as pictures are taken out of records, RGB2GREY has been implemented on these pictures. After that canny edge detecting devices are used for the removal of pictures out of the sets of MRI pictures dataset. Records of picture with tumor and without tumor are displayed in the subsequent figures respectively (Figs. 1 and 2).

At the time of primary face by applying RGB2GREY edges becomes recognized. Pictures which are formed after the application of these techniques follow Brain MRI are generated (Figs. 3 and 4):

Step 2: After matching score is get by classification using neural network.

5.1. Classification using artificial neural network

The work which has been presented here applies ANN after applying edge detection and extracting features using GLCM. In the setting of matrix laboratory its achievements are determined. For this purpose ANN classifier was used. Duration of sorting process is also kept in mind. Following charts are representing the comparison of time taken and score when ANN is applied directly to MRI Brain sample and ANN is applied on edge detected sample. During this face the classifier is applied in order to get the score. The method which has been used for the extraction of score is separated in three parts:-

Part 1: Getting Time and Score of Brain MRI using ANN Classifier

1. Choose fifteen samples of brain MRI in a proper way for obtaining achievement by means of neural network classifier
2. Take each sample separately up to last step.
3. Initiate point in timer
4. place net is equal to google net to confirm score
5. Place input Size is equal to net .Layers(1).Input Size(1:2)
6. Place image im is equal to image(lopp) from brain MRI data set where tumor exists
7. Change the size of picture depending upon the size of input
8. Get [label, score] using classify(net, im) function available in deep learning box in MATLAB
9. Set mya(lopp) = max(score)
10. Bring timer into a standstill and get time in time1(lopp)

Part 2: Getting Time and Score of Edge Based Brain MRI using ANN Classifier

1. Choose fifteen samples of brain MRI in a proper way for obtaining achievement by means of neural network classifier
2. Take each sample separately up to last step
3. Initiate point in timer

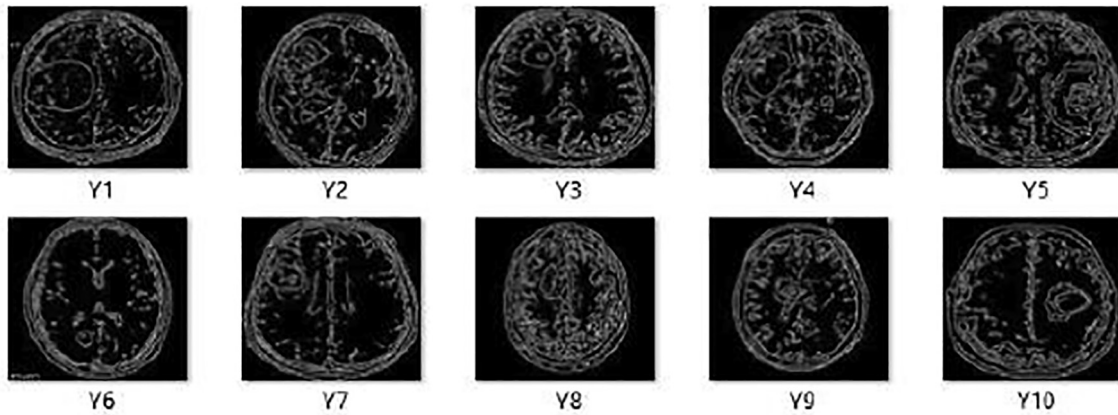A. Gupta, A. Verma, D. Kaushik et al.

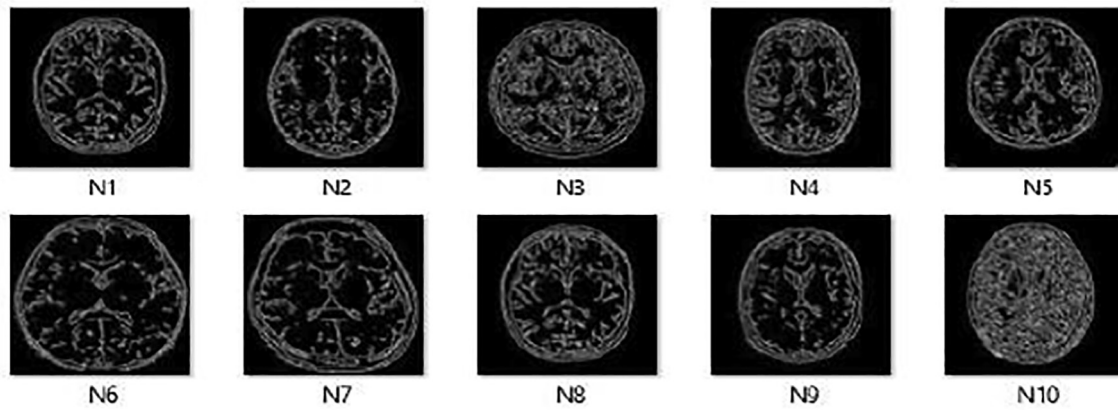Fig. 3. Edge based Brain MRI with Tumor.

Fig. 4. Edge based Brain MRI without Tumor.

4. Place net is equal to google net to confirm scoring PSet input Size is equal to net. Layers(1).Input Size(1:2)
5. Place image im is equal to mage(lopp) out of edge based brain MRI record where tumor exists
6. Change the size of picture depend ending upon the size of input
7. Get[label, score] using classify(net, im) function available in deep learning box in MATLAB
8. Set myData1(lopp) = max(score)
9. Bring timer into a standstill and get time in in time2(lopp)

Part 3: Saving Time and Score in Text Files and Plotting Results

1. Open score.txt file in append mode
2. Write image,myData,myData1 columns in score.txt
3. Open time.txt file in append mode

4. Write image,time1,time2 columns in time.txt
5. Plot the comparative chart representing score in both cases
6. Plot the comparative chart representing time in both cases

Time required in the identification of score is displayed in the next table. In this table both Time required in case of usual pictures and in case of edge based images are displayed. It is observed that the time consumption is less when score is taken from edge based brain MRI (Table 1).

5.2. Following chart has been plotted considering the above results

Identified score when ANN is used has been displayed in the next table for both cases (Fig. 5). This table brings in to limelight that score remain constant in case of edge based brain MRI (Table 2; Fig. 6).

Table1
Time in Case of Normal Brain MRI and Edge Based Brain MRI.

Image Name	Time in Case of Normal Images	Time in Case of Edge Based Images
1	3.011	0.707
2	1.045	0.750
3	0.890	0.964
4	0.886	0.767
6	1.056	0.706
7	0.749	0.805
8	0.795	0.716
9	0.797	0.703
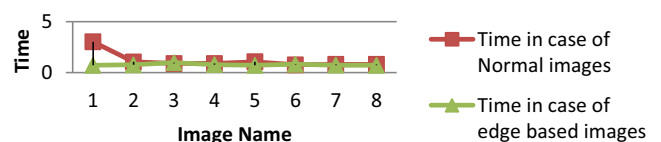
Fig. 5. Time Taken to Get Score Case of Normal Images and Edge Based Images.

A. Gupta, A. Verma, D. Kaushik et al.

Table 2
Score in Case of Normal and Edge Based Brain MRI.

Image Name	Score in Case of Brain MRI	Score in Case of Edge Based Brain MRI
1	0.432	0.291
2	0.522	0.291
3	0.594	0.291
4	0.761	0.291
6	0.672	0.291
7	0.403	0.291
8	0.237	0.291
9	0.361	0.291

Table 3
Score and Time Table.

Image	Shape	Score	Time
1	0	0.322	4.099
2	1	0.432	1.251
3	0	0.300	1.030
4	1	0.522	0.887
5	0	0.531	1.157
6	1	0.594	0.864
7	0	0.639	0.883
8	1	0.761	0.951
9	0	0.388	0.836
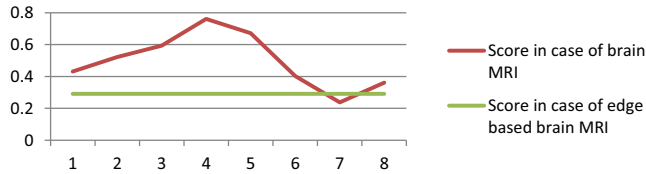
Fig. 6. Relative Examination in the Middle of Score in usual Brain MRI and Edge Based Brain MRI.

For the execution of organization process combination of brain samples are kept in mind by neural network.

Algorithmic program implemented in order to create shape, score and time related catalogue is described below:-

Step 1: Establish a loop in support of pictures where lopp = 1 and increment lopp by one until it is not reached to twenty nine to step ten.

Step 2: initiate clock

Step 3: attach in the direction of google net and acquire layers in net

Step 4: acquire input dimension out of net by receiving input dimension (1:2) out of layers

Step 5: study image im out of mix usual list

Step 6: Change the size of picture depending upon the size of input

Step 7: acquire tag and score using classy by passing input parameter im to net [label, score] = classify(net, im)

Step 8: save optimal score in myData(lopp)

Step 9: if label is' Petri dish' then set label1(lopp) is equal to one or else place labelone (lopp) = 0

Step 10: discontinue clock and save the duration of organization functioning in time one(lopp)

Step 11: Write the label1(lopp), myData(lopp), time1(lopp) in "neuraloutput1.txt" file

The MatLab script has produced following Table 3.

6. Conclusion

It has been concluded from consequences, when neural network are implemented for the removal of pictures qualities a new way of picture sorting comes in to existence. At the time of sorting lesser amount of time is taken by the pictures which are depends upon the edge. Confidential pictures which contain their achievement, in addition to sorting period, formed at the time of matrix laboratory simulation. The work which has been carried out here becomes very important in situations when pictures related to health care sector required treatment. Here, a very responsive method was put in to place by the researcher for the very first time in support of sorting and form revealing. Study makes the efficiency of form exposure better. When neural network is implemented in the company of edge detecting device makes the assessment of picture form speedy. The work which has been carried out here becomes very valuable in situations where graphed pictures are exposed and recognized on regular bases.

CRediT authorship contribution statement

Ankur Gupta: Data curation, Writing - original draft. **Apurv Verma:** Software, Validation, Writing - review & editing. **Dushyant Kaushik:** Visualization, Investigation, Supervision. **Muskan Garg:** Conceptualization, Methodology, Software.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] C. Chen, L. Yang, J. Zhao, Y. Yuan, C. Chen, J. Tang, H. Yang, Z. Yan, H. Wang, X. Lv, Urine Raman spectroscopy for rapid and inexpensive diagnosis of chronic renal failure (CRF) using multiple classification algorithms, Optik 203 (2020) 164043, https://doi.org/10.1016/j.ijleo.2019.164043.

[2] A. Sadiq, I.F. Nizami, S.M. Anwar, M. Majid, Blind image quality assessment using natural scene statistics of stationary wavelet transform, Optik 205 (2020) 164189, https://doi.org/10.1016/j.ijleo.2020.164189.

[3] J. Liu, H. Cheng, X. Lv, Z. Zhang, X. Zheng, G. Wu, J. Tang, X. Ma, X. Yue, Use of FT-IR spectroscopy combined with SVM as a screening tool to identify invasive ductal carcinoma in breast cancer, Optik 204 (2020) 164225, https://doi.org/10.1016/j.ijleo.2020.164225.

[4] A. Shakarami, H. Tarrah, A. Mahdavi-Hormat, A CAD system for diagnosing Alzheimer's disease using 2D slices and an improved AlexNet-SVM method, Optik 212 (2020) 164237, https://doi.org/10.1016/j.ijleo.2020.164237.

[5] Z. Yan, C. Ma, J. Mo, W. Han, X. Lv, C. Chen, C. Chen, X. Nie, Rapid identification of benign and malignant pancreatic tumors using serum Raman spectroscopy combined with classification algorithms, Optik 208 (2020) 164473, https://doi.org/10.1016/j.ijleo.2020.164473.

[6] Z. Karapinar Senturk, Early diagnosis of Parkinson's disease using machine learning algorithms, Med. Hypotheses 138 (2020) 109603, https://doi.org/10.1016/j.mehy.2020.109603.

[7] R. Arora, P.K. Rai, B. Raman, Deep feature–based automatic classification of mammograms, Med. Biol. Eng. Comput. 58 (6) (2020) 1199–1211.

[8] D. Giveki, M. Karami, Scene classification using a new radial basis function classifier and integrated SIFT–LBP features, Pattern Anal. Applic. 23 (3) (2020) 1071–1084.