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DETECTION OF BRAIN HEMORRHAGE USING MACHINE LEARNING

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Abstract : Cerebrovascular diseases are the third leading cause of death in the world after cancer and heart diseases. Brain hemorrhage is one of the most common cerebral vascular diseases. Brain hemorrhage (Bleeding in the brain) can happen because of an accident, brain tumor, stroke, or high blood pressure caused by the bursting of a brain artery leading to bleeding and can have a fatal impact on brain function and its performance. Brain bleed can reduce oxygen delivery to the brain, creating extra pressure in the brain and killing brain cells. For diagnosis of hemorrhage medical experts suggest CT (computed tomography), CT images are used in greater ratio due to its ease of use, price constraints and high speed. The identification of cerebral hemorrhage is not known immediately. Therefore, we need a certain method that can segment the CT scan image quickly and automated. The goal is to obtain the segmentation of brain parts that are affected with hemorrhage quickly and accurately using the method of machine Learning. So, patients with cerebral hemorrhage can immediately obtain the medical treatment in accordance with their needs.

IndexTerms **– Brain hemorrhage, Brain Cells, SVM.**

I. INTRODUCTION

Brain hemorrhage is a type of stroke that is normally caused by an artery in the brain. The stroke bursts and bleeds in the surrounding tissues. The continuous bleeding from the concern tissues kills brain cells. In case of not accurately diagnosing and treated in time-sensitive procedure, then it will cause death or lifetime disability. Computerized tomography (CT) scans are examined by the radiologists to predict intracranial hemorrhage (ICH) and locate affected regions. Additionally, hemorrhage is divided into five categories based on the bleeding tissues that are intra ventricular hemorrhage, intra parenchymal hemorrhage, subarachnoid hemorrhage, epidural hemorrhage, and subdural hemorrhage. The dataset is collected from Kaggle machine learning dataset. Acquiring the dataset is the first step in data pre-processing in machine learning. To build and develop Machine Learning models, you must first acquire the relevant dataset. This dataset will be comprised of data gathered from multiple and disparate sources which are then combined in a proper format to form a dataset.
The results of the proposed Support Vector Machine classifier are shown in project. the right-side numerals represent the calculated accuracy results, while the left-side shows different brain hemorrhage types. Overall accuracy result of 90.02% is calculated for SVM.

II. PROPOSED SYSTEM

The proposed brain hemorrhage detection system presents a quality brain hemorrhage diagnosis device based on machine learning techniques. The machine learning techniques include support vector machine and neural network. This application provides a quality diagnosing facility for the brain hemorrhage patients.

- Brain hemorrhage in real-time and has the advantages of low cost, small size, high phase accuracy, and good clinical application potentiality.
- The advantages of low cost, high precision and high sensitivity endow this system with great application prospects.

III. METHODOLOGY

Acquiring the dataset is the first step in data pre-processing in machine learning. To build and develop Machine Learning models, you must first acquire the relevant dataset. This dataset will be comprised of data gathered from multiple and disparate sources which are then combined in a proper format to form a dataset.
The dataset name is “brain hemorrhage dataset” which has the following types:

- **Intraparenchymal: -**is a bleed that occurs within the brain, the profuse release of blood from a ruptured blood vessels in the brain.
- **epidural: -** This bleed happens between the skull bone and the uttermost membrane layer, the dura mater.

- **Subarachnoid: -** subarachnoid is the most caused by brain, this occurs between the brain and membrane that cover it.
- **Intraventricular:** -is a most common cause of intraventricular hemorrhage is premature birth.
- **subdural:** -This bleed happens between the dura mater and the arachnoid membrane.

It consists of 8 CT scans collected from different patients. Below Figure 2.1 shows some of the brain hemorrhage CT scan images.

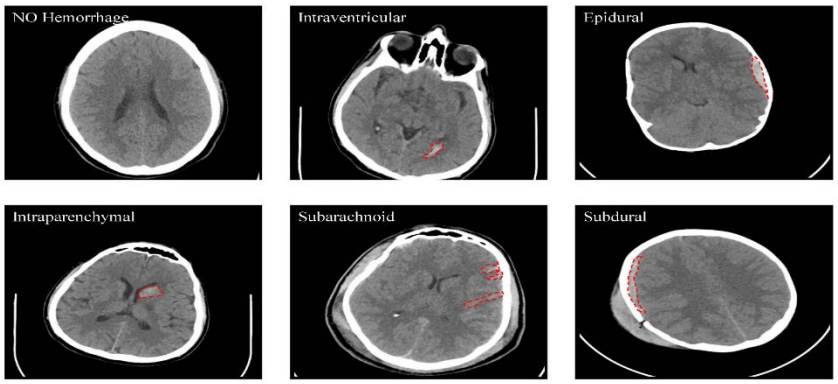
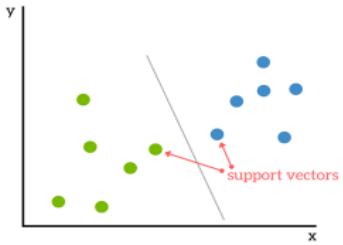


Figure 1: - Datasets (brain hemorrhage CT scan images)

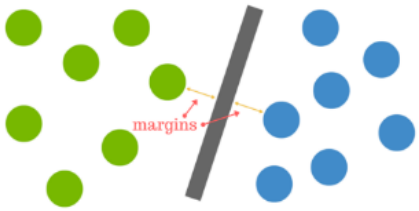
3.1 SVM (Support Vector Machine)

Support Vector Machine (SVM) is a supervised machine learning algorithm capable of performing classification, regression and even outlier detection. The linear SVM classifier works by drawing a straight line between two classes. All the data points that fall on one side of the line will be labelled as one class and all the points that fall on the other side will be labelled as the second.
In fact, the "support vector" in "support vector machine" refers to two position vectors drawn from the origin to the points which dictate the decision boundary.
SVMs are based on the idea of finding a hyperplane that best divides a dataset into two classes, as shown in the image below.



the further from the hyperplane our data points lie, the more confident we are that they have been correctly classified. We therefore want our data points to be as far away from the hyperplane as possible, while still being on the correct side of it.

So, when new testing data is added, whatever side of the hyperplane it lands will decide the class that we assign to it.



- The problem consists of five classes, namely, intraparenchymal, epidural, subarachnoid, intraventricular, and subdural. In this approach, one class is selected as a base class and the rest of the classes are compared with that, then the second one, and so on.we have followed the concept of one vs many approaches as shown on below figure:

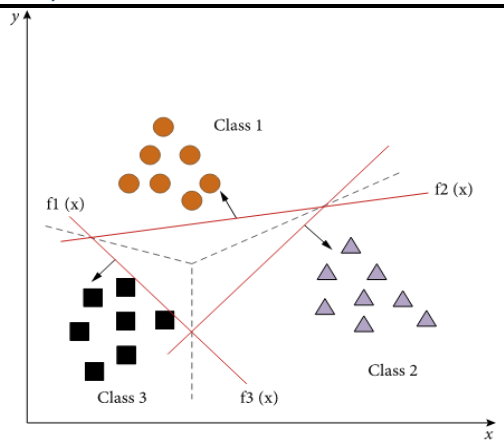
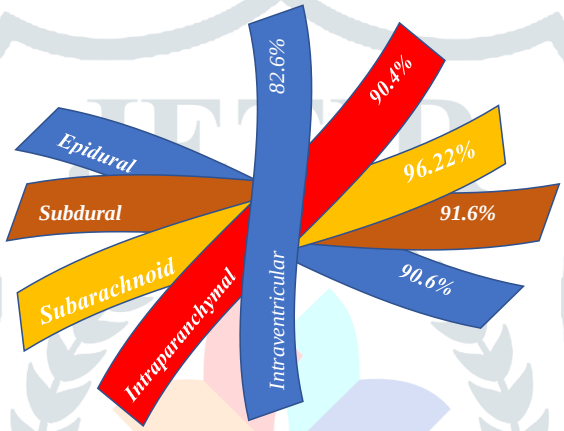


Figure 2 One vs many approaches of the SVM technique

The results of the proposed support vector machine classifier are shown in Figure,in this figure,the right-side numerals represent the calculated accuracy results, while the left-side shows different brain hemorrhage types. Overall accuracy result of 90.02% is calculated forSVM.



SVM classification result

Eventually, we have classified the different types of hemorrhage: -
The Accuracy for 5 major types of hemorrhage:

- epidural,
- subdural.
- subarachnoid,
- intraparenchymal,
- intraventricular.

- Brain hemorrhage detection is a major help to physicians to rescue patient in an early stage.
- We have tried to introduce a detection and classifications method to improve and accelerate the process of physicians.
- To achieve this purpose, first we have used simple effective method to detect and separate the hemorrhage types from other parts of the brain.

Accuracy = Number of correct predictions/Total number of predictions
Obtained 96.22% in Subarachnoid
91.6% in Subdural
90.6% in Epidural
90.4% in Intraparenchymal
82.6% in Intraventricular respectively.
Neural network:
The classification of brain hemorrhage CT scan pictures was attempted using a neural network. the designs that work on a lot of layers that aren't visible. These hidden layer neurons extract features and offer output based on recognition/classification problems automatically.
The neural networks were created using the human nervous system as a model. It is made up of neurons that take in data, process it, and then produce patterns based on the information presented to the network.

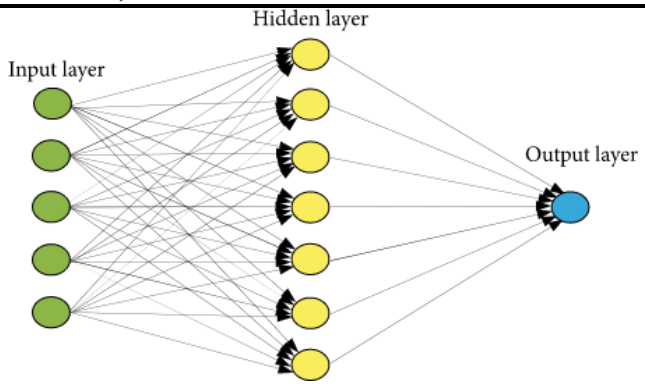


Figure 2: Generalized Neural network

The power of neural networks comes from their ability to learn the representation in your training data and how to best relate it to the output variable that you want to predict. In this sense, neural networks learn mapping. the training data, in this case, is a large dataset that contains many examples of each image class. When we say a large dataset, we really mean it.

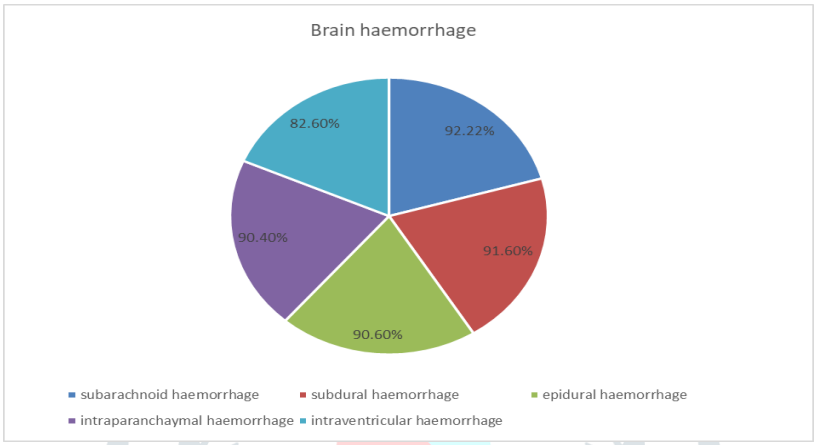


Figure 3: Pie chart

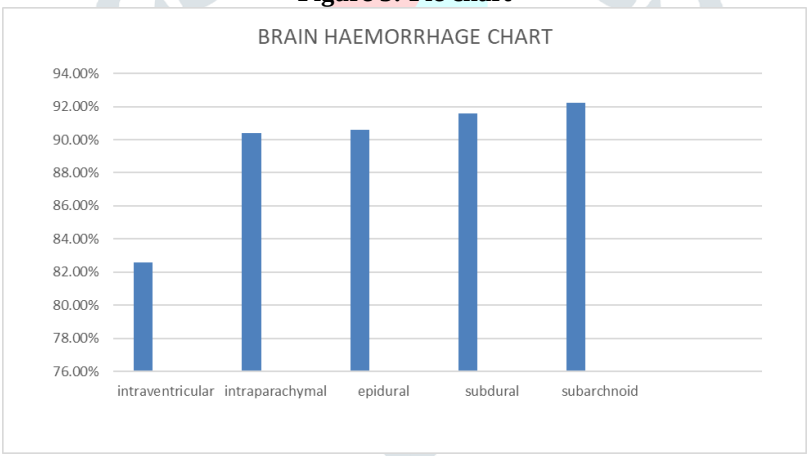


Figure 4: Histogram chart

Each layer of nodes trains on the output (feature set) produced by the previous layer. So, nodes in each successive layer can recognize more complex, detailed features – visual representations of what the image depicts. Such a "hierarchy of increasing complexity and abstraction" is known as *feature hierarchy*.

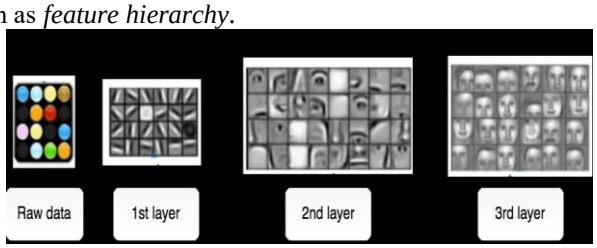


Figure 5: Example of layers

3.2 Upload scan: -

Input image will be uploaded, back-end process takes the input and predict with trained model. Depending upon the threshold value Hemorrhage and Normal Brain will be identified and displayed with this method the hemorrhage in brain can be predicted with the accuracy of 90.2% in the web development of python. Additionally, we can use method to predict the types of hemorrhage and to find the area of hemorrhage in brain to grab a better performance.

In upload scan, we will upload brain CT image which is DCM format, and after that CT scan image will be uploaded and analyzed.In analyze the image dataset is processed. Acquiring the dataset is the first step in data preprocessing in machine learning. To build and develop Machine Learning models, you must first acquire the relevant dataset. This dataset will be comprised of data gathered from multiple and disparate sources which are then combined in a proper format to form a dataset. Dataset formats differ according to use cases.

Data Processing is the task of converting raw data from a given form (CT scan images) making it more meaningful and using Machine Learning algorithms, this entire process can be automated, the output of this complete process is on images and it depending on the task we are performing and the requirements of the machine.

- **Collection:**
The first and most important step when starting with Machine Learning is to have data of good quality and accuracy. Data is collected from Kaggle.high-quality and accurate data will make the learning process of the model easier and better and at the time of testing, the model would yield state-of-the-art results.
- **Preparation:**
The collected data can be in a raw form which can't be directly fed to the machine. So, this is a process of collecting datasets from different sources, analyzing these datasets and then constructing a new dataset for further processing and exploration.
- **Input:**
Now the prepared data can be in the form that may not be machine-readable, so to convert this data to the readable form, some conversion algorithms are needed. For this task to be executed, high computation and accuracy is needed.
- **Processing:**
This is the stage where algorithms and ML techniques are required to perform the instructions provided over a large volume of data with accuracy and optimal computation.

- **Output:**
In this stage, results are procured by the machine in a meaningful manner which can be inferred easily by the user. Output can be in the form of reports, graphs, videos, etc.

- **Storage:**
This is the final step in which the obtained output and the data model data and all the useful information are saved for future use.

IV EXPERIMENTAL RESULTS

The results are coming into different type of hemorrhages, which has the following types: intraparenchymal, epidural, subarachnoid, intraventricular, and subdural. It consists number of CT scan datasets, and the datasets is collected from different patients in Kaggle. Below Figure shows some of the brain hemorrhage CT scan images.

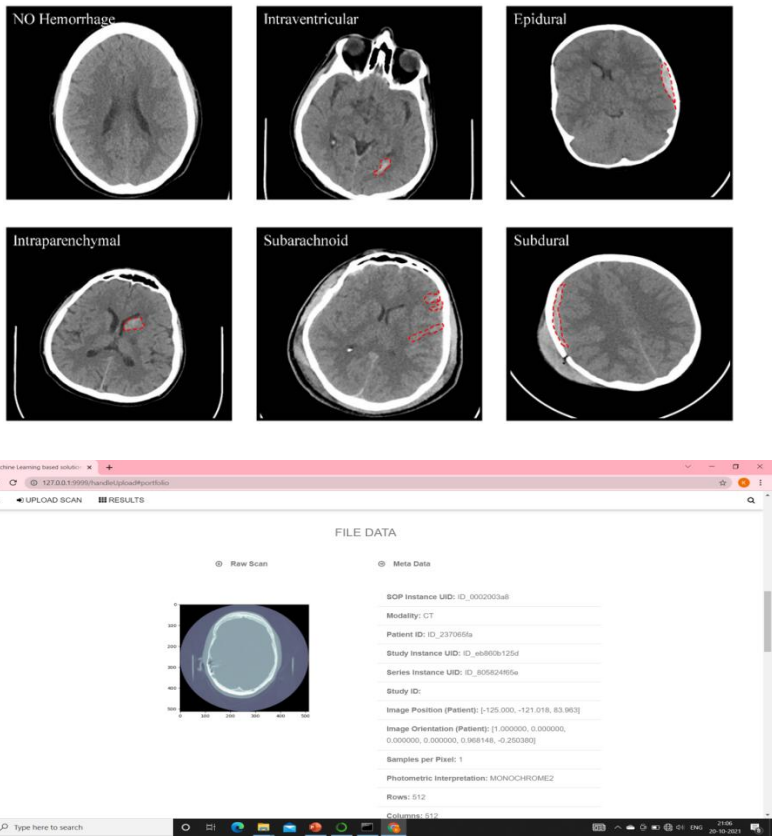


Figure 6: Results

V CONCLUSION

CNN-based method for segmentation of brain hemorrhage in CT images the results are coming into different type of hemorrhages, which has the following types: intraparenchymal, epidural, subarachnoid, intraventricular, and subdural. It consists number of CT scan datasets, and the datasets is collected from different patients in Kaggle. There are several existing of techniques are available for brain hemorrhage segmentation and classification to detect the brain hemorrhage. There are many techniques presents in my brain hemorrhage detection SVM (support vector machine) and Neural Network, propose a Convolution Neural Network (CNN) based classifier. Overall, accuracies of 90.2% the SVM and FNN, respectively, are calculated. Based on the classification results, it was determined that the feed forward neural network produces superior results in a short period of time when compared to the support vector machine. The best result is obtained by comparing the trained and test data using a CNN-based classifier.

REFERENCES

[1] Donepudi, P. K. (2021). Impact of Machine Learning in Neurosurgery: A Systematic Review of Related Literature. Malaysian Journal of Medical and Biological Research, 8(1), 13-20.

[2] Chen, H., Khan, S., Kou, B., Nazir, S., Liu, W., & Hussain, A. (2020). A smart machine learning model for the detection of brain hemorrhage diagnosis based internet of things in smart cities. Complexity, 2020.

[3] Nael, K., Gibson, E., Yang, C., Ceccaldi, P., Yoo, Y., Das, J., ... & Fayad, Z. A. (2021). Automated detection of critical findings in multi-parametric brain MRI using a system of 3D neural networks. Scientific reports, 11(1), 1-10.

[4] Cho, S. J., Sunwoo, L., Baik, S. H., Bae, Y. J., Choi, B. S., & Kim, J. H. (2021). Brain metastasis detection using machine learning: a systematic review and meta-analysis. Neuro-oncology, 23(2), 214-225.

[5] Phong, T. D., Duong, H. N., Nguyen, H. T., Trong, N. T., Nguyen, V. H., Van Hoa, T., & Snasel, V. (2017, January). Brain hemorrhage diagnosis by using deep learning. In Proceedings of the 2017 International Conference on Machine Learning and Soft Computing (pp. 34-39).

[6] Zhang, T., Song, Z., Yang, J., Zhang, X., & Wei, J. (2021). Cerebral Hemorrhage Recognition Based on Mask R-CNN Network. Sensing and Imaging, 22(1), 1-16.

[7] Bolhasani, H., Mohseni, M., & Rahmani, A. M. (2021). Deep learning applications for IoT in health care: A systematic review. Informatics in Medicine Unlocked, 100550.

[8] Huang, Y. C., Li, S. J., Chen, M., Lee, T. S., & Chien, Y. N. (2021, May). Machine-learning techniques for feature selection and prediction of mortality in elderly CABG patients. In Healthcare (Vol. 9, No. 5, p. 547). Multidisciplinary Digital Publishing Institute.

[9] Cho, J., Park, K. S., Karki, M., Lee, E., Ko, S., Kim, J. K., ... & Park, S. (2019). Improving sensitivity on identification and delineation of intracranial hemorrhage lesion using cascaded deep learning models. Journal of digital imaging, 32(3), 450-461.

[10] Koch, M., Acharjee, A., Ament, Z., Schleicher, R., Bevers, M., Stapleton, C., ... & Kimberly, W. T. (2021). Machine learning-driven metabolomic evaluation of cerebrospinal fluid: insights into poor outcomes after aneurysmal subarachnoid hemorrhage. Neurosurgery, 88(5), 1003-1011.