

Stroke Disease Prediction System Using Electrography Images

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Abstract -This Project portray the prediction of stroke with the resource of the use of MRI image with tool gaining knowledge (Machine Learning Algorithm) having some set of guidelines. Stroke is a top motive of disabilities in adults and the aged that could bring about several social or monetary issues in Artificial neural networks (ANN) for stroke assessment or prediction with the resource of the use of Electromyography images. The proposed set of guidelines offer the higher accuracy and sensitivity for MRI image detection. Stroke is the second-essential motive of loss of life globally; therefore, it desires proper away remedy to forestall from the brain damage. A practical version of ANN is proposed to the useful resource of Stroke detection methods. This layout implied the use of Artificial Neural Networks (ANN) enables in forecasting the stroke disease.

KEYWORDS

Digital Image Processing, Image Processing Techniques, System Analysis, Feature Extraction, Image Segmentation, SVM Algorithm, MATLAB.

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I. INTRODUCTION

Ischemic stroke emanate due to blocked or narrowed arteries. Treatment emphasis to bring back sufficient passage of blood to the brain. Treatment go ahead with taking pills that destroy clots and avert others from forming. A Physician may afford blood thinners such as Aspirin or an injection of Tissue Plasminogen Activator (TPA). There are other line of action that surgeons can execute to decrease the risk of strokes or TIAs. A carotid endarterectomy viz. involves opening the carotid artery and detach plaque that could break and proceed to the brain. Further choice is Angioplasty. This involves a medico inflating a small balloon inside a narrowed artery by the use of catheter. Subsequently, they will place a mesh tube or a stent into the opening. This averts the artery from narrowing furthermore. Blood exuding into the brain leads a Hemorrhagic stroke. Treatment keen on restrain the bleeding and lowering the pressure in the brain and restrain the whole blood pressure, besides preventing seizures and any unforeseen constrictions of blood vessels. If a person is proceeding blood-thinning anticoagulants or antiplatelet medication like warfarin or clopidogrel, they can acquire

medications to counter the effects of blood thinners. Medicos can mend few of the problems with blood vessels that have pave way to Hemorrhagic strokes. Although an aneurysm-or a protrusion in a blood vessel that may burst-leads a hemorrhagic stroke, a medico can place

small clamps at the base of the aneurysm or occlude it with detachable coils to cease the passage of blood and lessen the aneurysm. If the hemorrhage transpired by cause of an AVM, a physician can discharge it. AVMs are connections in the middle of arteries and veins that can be at risk of bleeding.

Symptoms-If yourself or a person you are with may be afflicted by stroke, pay particular attention to the time the symptoms began. Several treatment options are most effectual when given promptly after a stroke begins. Signs and Symptoms of stroke comprise: a) Inconvenience in speaking and understanding what others are phrasing- You may be faced with scepticism, slur words, mumble, or having inconvenience in understanding speech. b) Lack of sensation (Paralysis) or numbness of the face, arm and leg- You may develop sudden numbness, weakness or lack of sense in the face, arm or leg. c) Difficulties perceiving in the eyes- You may abruptly have blurred or blackened vision in either of the eyes or you may see double. d) Cephalalgia- an abrupt severe headache, which may be go along with vomiting, dizziness or altered consciousness. e) Inconvenience in walking- You may stumble or lose your balance, having abrupt dizziness or a loss of coordination.

Rehabilitation- Stroke is a plausibly metamorphic life event that can have lasting physical and emotional effects. A victorious therapy from a stroke will often involve specific therapies and support systems comprising: a) Speech therapy- It helps with difficulties producing or understanding speech. Exercise, tranquility and changing communication style can all make communicating easier. b) Physical therapy- It can

help a person to relearn movement and coordination. It is very important to be active in this situation even though it is difficult. c) Occupational therapy- It helps a person to improve their ability skill to carry out daily routines like bathing, cooking, dressing, eating, reading and writing. d) Support groups- Attaching with a group where we have support in our difficulties. It can help a person to cope with common mental health issues that occurs after a stroke like depression. e) Support from friends and family- Family and close friends should try to make comfort and provide practical support after an occurrence of stroke. Rehabilitation plays a vital role in the stroke treatment. Accompanied by right assistance and the support of cared ones, regaining a normal life is probably possible depending on severity of stroke.

II. LITERATURE REVIEW

Owing to gain the essential knowledge about various concepts related to the present analysis, existing literature were studied. Amongst important conclusions were made through those are listed below.

2.1 Title: Management of Acute Ischemic Stroke

Author: Franziska Herpich, Fred Rincon

Year: 2020

Description: Over the past six decades, stroke mortality has been increased, as a result stroke has been considered as the second leading cause of death in United States. In this layout, they have shown the importance of early recognition and early revascularization of stroke. Relevant treatment of ischemic stroke plays a vital role in the reduction of mortality and morbidity.

2.2 Title: Identification of post-stroke EEG signal using wavelet and convolutional neural networks

Author: Esmeralda C. Djamal, Rizkia I.Ramadhan, Miranti I. Mandasari, Daswara Djajasasmita

Year: 2020

Description: Post-stroke patients demand ongoing rehabilitation to restore dysfunction caused by an attack so that a monitoring device is required. EEG signals reflect electrical activity in the brain, which reflects the recovery condition of post-stroke patient.

2.3 Title: Acute ischemic stroke lesion core segmentation in CT perfusion images using fully convolutional neural networks

Author: Albert Clerigues, Sergi Valverde, Jose Bernal, Jordi Freixenet, Arnau Oliver, Xavier Llado

Description: Computed Tomography(CT) Imaging is very useful in diagnosis of patients with stroke symptoms. In this layout, evaluation of automated deep learning tool for acute stroke lesion core segmentation from CT and CT perfusion images were presented. CT performance reaches the top ranking methods of the ISLES 2018 testing leaderboard with an average coefficient of 49%.

2.4 Title: Segmentation Stroke objects based on CT Scan Image Using Thresholding Method

Author: Tessa Badriyah, Nur Sakinah, Iwan Syarif, Daisy Rahmania Syarif

Year: 2019

Description: Brain Image Segmentation determines the characteristics of a particular stroke type and it is one of the important parts from a clinical diagnostic tool. This layout proposes an approach to Image Segmentation by separating objects from other objects in CT scan images. Thresholding method with the Binarization process is implied in this CT scan segmentation.

2.5 Title: New level set approach based on Parzen estimation for stroke segmentation in skull CT images

Author: Elizangela de S. Reboucas, Regis C.P.Marques, Alan M. Braga, Saulo A.F. Oliveira, Victor Hugo C. de Albuquerque & Pedro P. Reboucas Filho

Year: 2019

Description: This layout is focused on the Hemorrhagic type of stroke, which accounts for 40% of all stroke deaths. It uses nonparametric estimation approach based on the Parzen window to segment the stroke from cranial CT images. Results shows that this method has highest mean of accuracy with 99.84% and lowest standard deviation of 0.08%.

III. IMAGE PROCESSING

3.1 DIGITAL IMAGE PROCESSING

Digital image processing process the digital images through an algorithm and it is the usage of digital computer. Digital image processing has many beneficials over analog image processing. It process wide range of algorithms to be applied to the input data and it can avoid problems like magnifying noise and distortion during processing. In image processing, low quality image is a input while image with a improved quality is a output. The standard image processing comprise image enhancement, restoration, encoding and compression. The first and foremost successful application was the American Jet Propulsion Laboratory(JPL).In that Laboratory, they used image processing techniques such as geometric correction, gradation transformation, noise removal, etc. on the thousands of lunar photos sent back by the Space Detector Ranger 7 in 1964,taken into account the position of the sun and the environment of the moon. It creates a huge success by achieving

successful mapping of the moon's surface. However, the cost is fairly high in that era. Later that changed in 1970's, when digital image processing proliferated cheaper computers and dedicated hardware became available.

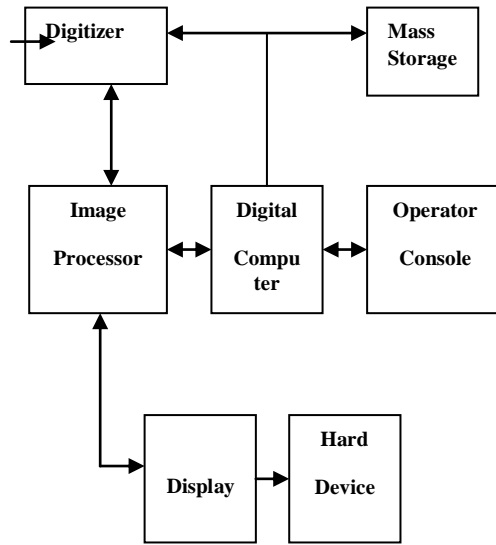


Fig 1.1 BLOCK DIAGRAM FOR IMAGE PROCESSING SYSTEM

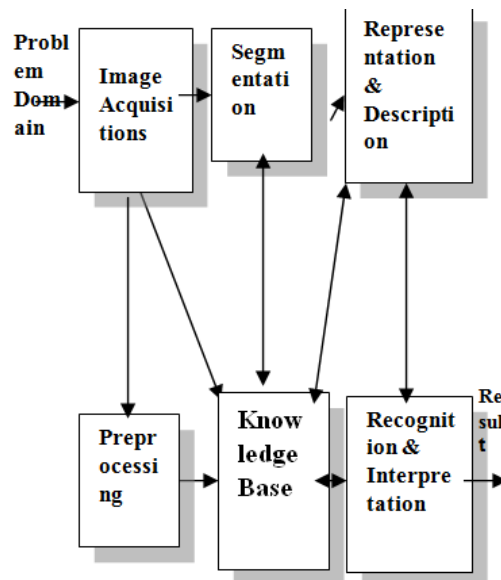
3.1.1 DIGITIZER

A digitizer transforms an image into a numerical representation suitable for input into a digital computer. Some familiar digitizers are:

1. Microdensitometer
2. Flying spot scanner
3. Image dissector
4. Videocon camera
5. Photosensitive solid-state arrays

3.1.2 IMAGE PROCESSOR

An image processor comprises of following functions like image acquisition, storage, preprocessing, segmentation, representation, recognition and interpretation and finally displays or records the resulting images. The block diagram given below implies the fundamental sequence involved in an image processing system.



The first step is the Image acquisition by an imaging sensor in conjunction with a digitizer to digitize the given image. In preprocessing, image undergoes enhancing, removing noise, isolating regions, etc. Segmentation partitions the image and its output is usually raw pixel data. Representation involves the process of changing raw pixel data into a form which is useful for subsequent processing. Description involves in features extracting. Recognition provides a label to an object based on information furnished by its descriptors. Interpretation implies assigning meaning to an ensemble of recognized objects. The knowledge base assist the operation of each processing module and it controls the interaction amongst modules. The frame rate of image processor is generally around 25 frames per second.

3.1.3 DIGITAL COMPUTER

Mathematical Processing of digitized image comprise of convolution, averaging, addition, subtraction, etc., are implemented by the computer.

3.1.4 MASS STORAGE

The secondary storage devices such as floppy disks, CD ROMs are generally used.

3.1.5 HARDCOPY DEVICE

The hard copy device helps in produce a permanent copy of the image and the storage of the software is also involved.

3.1.6 OPERATOR CONSOLE

The operator console involves equipment and arrangements for the verification for intermediate results and for alterations in the software. It is capable of checking resulting errors.

3.2 IMAGE PROCESSING TECHNIQUES

The image processing techniques comprises:

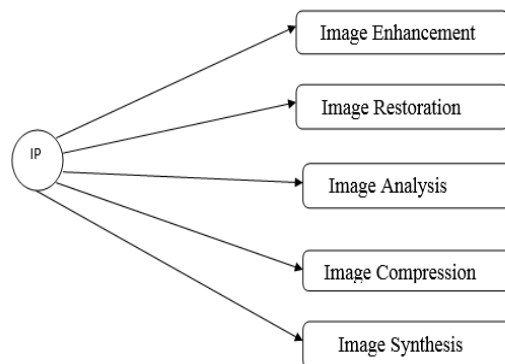


Fig 1.3 IMAGE PROCESSING TECHNIQUES

3.2.1 IMAGE ENHANCEMENT

Image enhancement operations helps in the improvement of the qualities of an image like improving image's contrast and characteristics of brightness, reducing its noise content, or sharpen the details.

3.2.2 IMAGE RESTORATION

Image restoration just like image enhancement, improves the image quality but the whole operations based on known, measured, or degradations of the original image. It helps in restore the images by correcting problems like geometric distortion, improper focus, repetitive noise and camera motion.

3.2.3 IMAGE ANALYSIS

This operation produce numerical or graphical information based on characteristics of the original image. It is mainly utilized in machine vision applications

3.2.4 IMAGE COMPRESSION

Image compression and depression involves in reduce the data content which are necessary to describe the image. Because of the compression, the size is reduced. The compressed image is decompressed when it displays.

3.2.5 IMAGE SYNTHESIS

From non- image data or other images, it creates the image for synthesis which are either physically impossible or impractical to obtain.

3.3 IMAGE TYPES

The various ways of encoding the information in an image includes:

- Binary image
- Grayscale image
- Indexed image

- True color or RGB image

3.4 APPLICATIONS OF IMAGE PROCESSING

Image processing has far-flung range of applications such as:

- Document Processing
- Medicine
- Industry
- Defense/Intelligence
- Radar Imaging System
- Agriculture

IV. SYSTEM ANALYSIS

4.1 PROPOSED SYSTEM

Image processing algorithm is enacted in the proposed system of stroke disease detection. ANN algorithm is implemented for an examine of chronic disease prediction. The features of image were extracted based on stroke disease condition. It helps in the early identification of acute stroke to reduce morbidity and mortality.

4.1.1 ANN Model

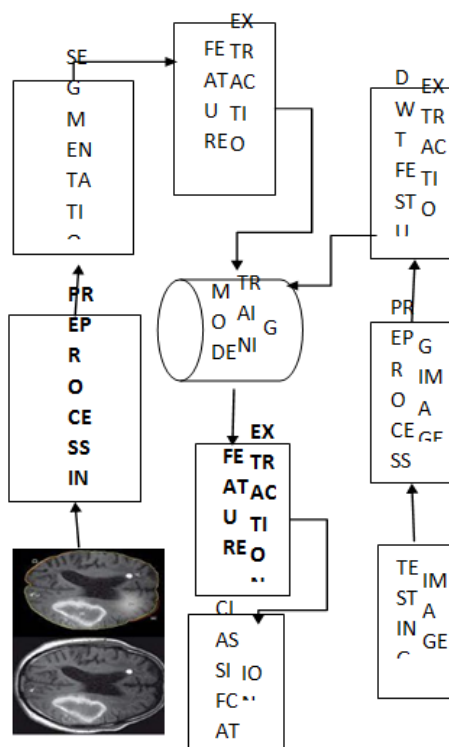
We effectuated 10 rounds of model learning in step1 and testing in step2 phases. With the help of the results of 10 model validations to compute the average error, which represents the accuracy of the model.

STEP 1 (MODEL DEVELOPMENT)-We ensued the ANN model using a package in R software named Neuralnet. The learning algorithm was entrenched on back propagation, inspired from neural back propagation, a technique generally used for training ANNs. This technique is occasionally done in combination with training where the precise result is known. We made 10 neural networks based on 10 training sets. The whole 10 training sets have equal amount of ACI and SMs (13 patients each) respectively to ensure equal representation of subjects. The model was also enhanced with a various number of hidden neurons which includes 1,4,6,8 and 12.

STEP 2 (MODEL VALIDATION)-To assess the generalizability of our analysis, we performed 10-fold cross-validation to an independent date set. The 10 constructed neural network models were evaluated using 10 testing sets. Testing set comprise of 13 randomly selected SMs and 13 randomly selected ACI respectively. In addition, we recognized the neural network with six hidden neurons to carry out finest result for this data set.

4.2 ADVANTAGE

- High accuracy
- High sensitivity



4.3 BLOCK DIAGRAM OF PROPOSED SYSTEM

FIG 1.4 BLOCK DIAGRAM OF PROPOSED SYSTEM

4.3.1 DESCRIPTION

Radiography, magnetic resonance imaging (MRI), nuclear medicine, ultrasound and infrared imaging are helps in examine imaging of brain's soft tissue. MRI's mostly helps to train ML algorithms for the identification of brain anomaly. Physicians use MRI images because it gives image annotations useful for model construction with the help of supervised machine learning algorithms and most datasets found here was annotated MRI. AI and ML algorithms helps to analyze the image types. MRI make use of powerful magnets to make detailed tomographic images.

Feature extraction- Local, regional and global were the scopes categorized in image analysis of brain's soft tissue. MRI images ranges local features of the brain from few millimeters to several centimeters.

DWT Feature extraction: Histogram equalization- The images become noisy with rotational and translational contrasts. To eliminate these contrasts, it undergoes preprocessing steps, called Image enhancement. Histogram equalization helps in image enhancement, used to amplify the pixel values to increase the perceptual information. After histogram equalization, histogram holds all the range from 0 to 255 and the visualization effect became enhanced.

Discrete Wavelet Transform (DWT)- DWT includes multiple resolution for the description of an image. Decoding can be treated consecutively from low resolution to high resolution. DWT divides the image into high and low frequency parts.

V. SYSTEM SPECIFICATION

5.1 SOFTWARE REQUIREMENTS

- MATLAB Version R2017a

5.2 FEATURES OF MATLAB

- High-level language for technical computing.
- 2-D and 2-D graphics functions for visualizing data.
- Tools for building custom graphical user interfaces.

VI. ANALYZING AND ACCESSING DATA

MATLAB assists the entire data analysis process, acquiring data from external devices and databases thru preprocessing, visualization and numerical analysis to produce quality output presentation.

6.1 DATA ANALYSIS

MATLAB comprises interactive tools and command-line functions for analyse the data operations, includes:

- Interpolating and decimating
- Thresholding and smoothing
- Matrix analysis

6.2 VISUALIZING DATA

2-D and 3-D plotting functions, 3-D volume visualization functions, tools for interactively creating plots were implied here. We can customize plots by adding latex equations, drawing shapes, multiple axes and adding annotation.

6.3 2-D PLOTTING

2-D plotting functions create:

- Line, area, bar and pie charts
- Direction and velocity plots
- Histograms

VII. RESULTS

In this segment, we portray the process and results in the prediction of stroke using ANN. Collecting the datasets and it undergoes the process of clustering, segmentation and feature extraction.

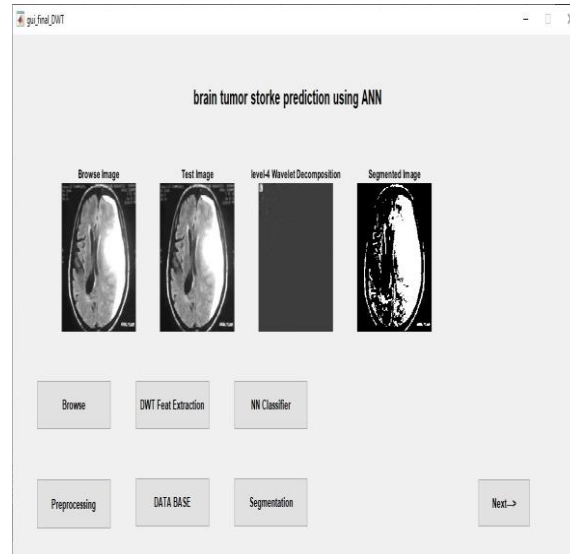


Fig 1.5 BRAIN TUMOR STROKE PREDICTION USING ANN

7.1 CLUSTERING

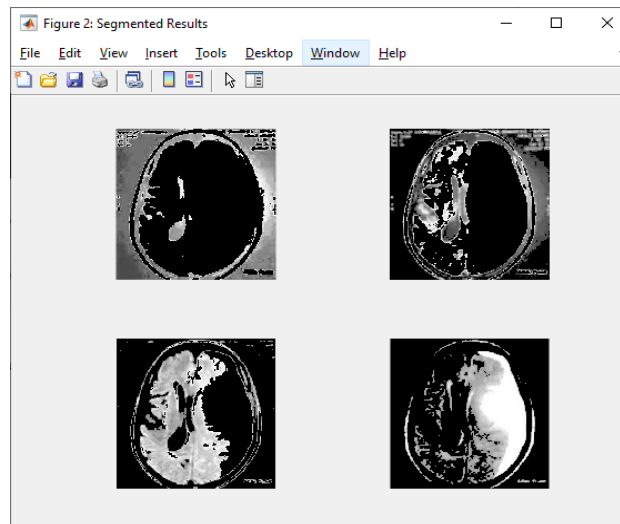


Fig 1.6 SEGMENTED RESULT

7.2 CLUSTERING RESULT

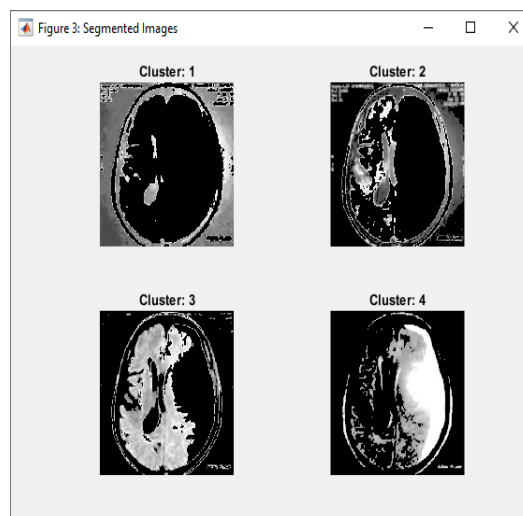


Fig 1.7 SEGMENTED IMAGES

7.3 FEATURE EXTRACTION

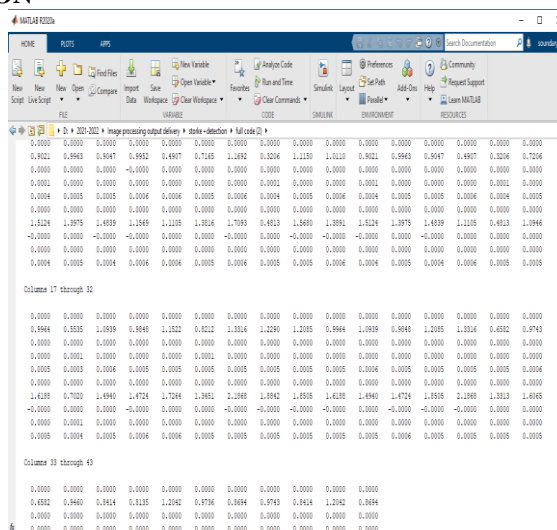


Fig 1.8 FEATURE EXTRACTION

7.4 STROKE RESULT

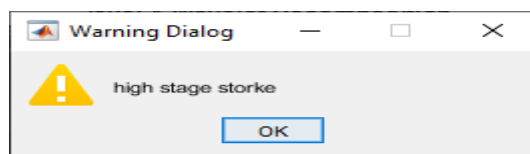


Fig 1.9 STROKE RESULT

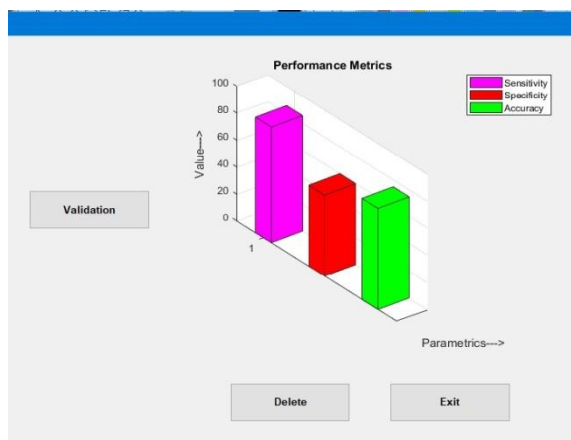


Fig 1.10 PERFORMANCE METRICS OF STROKE PREDICTION USING ANN

VIII. CONCLUSION

Neural Networks had been considered predominantly in decision making of medical applications. Yet, neural networks never replace human experts, they helps in screening and used by experts to double-check thier diagnosis. ANN model supports the physicians to make plan for better medication with early diagnosis. Eventhough AI Techniques are in their budding stage,they had been passionately applied to stroke imaging analysis, exhibit few inspired results.

9. PERCENTAGE DIFFERENCE BETWEEN EXISTING AND PROPOSED SYSTEM

PARAMETER	EXISTING SYSTEM	PROPOSED SYSTEM
SENSITIVITY	60	86
SPECIFICITY	42	60
ACCURACY	55	75

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