

EEG SIGNAL CLASSIFICATION FEATURES ANALYSIS FOR BRAIN DISEASES DIAGNOSIS

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ABSTRACT

The project proposes Associate in nursing automatic network for stage classification victimization artificial neural network for tumour and brain disorder detection for medical application. The detection of the tumor could be a difficult drawback, as a result of the structure of the tumor cells. The artificially created neural network are accustomed classify the stage of brain graphical record signal that's tumor case or brain disorder case or traditional. The manual analysis of the signal is time intense, inexact and needs intensive trained person to avoid diagnostic errors. Back Propagation Network with image and processing techniques was used to implement an automatic tumor classification. The higher process was performed in 2 stages: feature extraction victimization Principal element Analysis and therefore the classification victimization Back Propagation Network (BPN). The performance of the BPN classifier was evaluated in terms of coaching performance and classification accuracies. Back Propagation Network offers quick and correct classification than alternative neural networks and it's a promising tool for classification of the Tumors.

Keywords—Back Propagation Network, Feature Extraction, Principal Component Analysis (PCA), Electroencephalogram (EEG)

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I. INTRODUCTION

Electroencephalography (EEG) could be a non-invasive check for encephalopathy throughout that many electrodes are placed on a L patient's scalp to record electrical impulses from the brain (brain waves). The sometimes known as a brain wave check, used for testing patients with encephalopathy, a tumor, a brain symptom, brain trauma, meninges intumescence, meningitis, redness, stroke or noninheritable defects of the brain. It was performed by employing a device that measures the fluctuations and patterns in electrical processes at intervals the brain. The graphical record (EEG) has become a verified supply of knowledge for clinicians and researchers. Early on, encephalogram analysis was restricted to visual examination of encephalogram records. The event of electrical devices combined with the quick Fourier rework rule, bound encephalogram analysis in terms of spectral parts. Throughout the Nineteen Seventies, the introduction of micro-computer technology in medication and biology revolutionized approaches to encephalogram process. New ways of signal and knowledge analysis still as increasing powers of computing, offer improved tools to record and analyze the encephalogram. Among new computing tools, neural networks are with success utilized to method encephalogram signals so as to review brain mechanisms by victimization multiple approaches. This paper presents a spectrum of neural network applications in encephalogram process. Associate in nursing extended list is enclosed. When the brain cells send messages to

every different, they turn out small electrical signals. Your brain cells communicate via electrical impulses and are active all the time. This activity shows up as wavy lines on Associate in nursing encephalogram recording. Associate in nursing encephalogram is one among the most diagnostic tests for encephalopathy.

In Associate in nursing encephalogram check, electrodes (flat metal discs) are placed onto your scalp employing a sticky substance. These electrodes obtain the electrical signals from your brain Associate in Nursing send them to an encephalogram machine, which can record the signals as wavy lines onto paper or on a pc. The encephalogram machine records your brain's electrical activity as a series of traces, every trace corresponds to a special region of the brain. Associate in nursing graphical record (EEG) could be a painless procedure that takes thirty to forty five minutes with seldom causes of any facet effects.

II. CLASSIFICATION

Automated classification and detection of tumors in several medical signals is motivated by the requirement of high accuracy once addressing a person's life. Also, the pc help is demanded in medical establishments thanks to the very fact that it might improve the results of humans in such a site wherever the false negative cases should be at a really low rate. It has been evidenced that double reading of medical pictures could lead on to raise neoplasm detection. However the price tacit in double reading is incredibly high, that's why sensible software system to help humans in medical establishments is of nice interest today. Typical ways of watching and designation the diseases deem police investigation the presence of explicit

options by a person's observer. Thanks to sizable amount of patients in medical aid units and therefore would like for continuous observation of such conditions, many techniques for automatic diagnostic systems are developed in recent years to try to unravel this downside. Such techniques work by remodeling the largely qualitative diagnostic criteria into an additional objective quantitative feature classification downside. EEG signals involve an excellent deal of knowledge regarding perform of the brain. However classification and analysis of those signals are restricted. Since there's no definite criterion evaluated by the specialists, visual analysis of graph signals in time domain is also depleted. Routine clinical designation has to analysis of graph signals. Therefore, some automation and laptop techniques are used for this aim. Since the first days of automatic graph process, representations supported a Fourier remodel are most typically applied. This approach is predicated on earlier observations that the graph spectrum contains some characteristic waveforms that fall primarily inside four frequency bands—delta (<4 Hz), letter (4—8 Hz), alpha (8—13 Hz) and beta (13—30 Hz). Such ways have tested helpful for varied graph characterizations, however quick Fourier remodel (FFT), suffer from massive noise sensitivity. Constant quantity power spectrum estimation ways like car regressive (AR), reduces the spectral loss issues and offers higher frequency resolution. But, since the graph signals are non-stationary, the constant quantity ways don't seem to be appropriate for frequency decomposition of those signals [1, 2].

A robust methodology was projected within the late Eighties to perform time-scale analysis of signals: the moving ridge transforms (WT). This methodology provides a unified framework for various techniques.

Brain tumor is inherently serious and grievous unwellness. It builds intracranial pressure with in the brain, by shifting the brain and additionally damaging nerves and healthy brain tissues. These intracranial pressure affects and interferes with traditional brain practicality, it ends up in generation of abnormal electrical activities from brain. With recent development within the medical engineering and instruments, EEG instruments square measure able to record the brain electrical activities with high accuracy, which establishes EEG as a primary tool for designation the brain abnormalities. Analysis students and general physicians, usually face problem in understanding EEG patterns. This paper presents the EEG patterns related to brain tumor by hair care drugs theory and brain doctor expertise. Paper additionally explains the pros-cons of the EEG based mostly brain tumor identification.

III. SYMPTOMS OF BRAIN TUMOR

The brain made from neurons cells; these cells square measure liable for brain traditional functionalities. The brain usually forms new cells only they're required to interchange recent or broken ones. Most cells repair themselves by dividing to form a lot of cells. Normally, this turnover takes place in associate degree orderly and controlled manner. If, for a few reason, the method gets out of management, the cells will still divide, developing into a lump, which is termed a neoplasm [1]. They brain tumor is outlined as associate degree atypical growth of cells within the brain or skull, which might either be cancerous or non-cancerous.

The reason behind brain tumors is unknown, however folks that work with rubber and bound chemicals have a

greater-than average risk of developing them. There's no proof that head injury causes brain tumors. The researchers try to work out the link, between brain tumors and viruses, case history, and semipermanent exposure to magnetic force fields [1]. Signs and symptoms of brain neoplasms principally rely on 2 factors: neoplasm size (volume) and tumor current location. They symptoms do not sometimes seem till the neoplasm grows massive enough to displace, damage, or destroy delicate brain tissue.

Swelling or obstruction of the passage of cerebrohumour (CSF) from the brain might reason behind enlarged intracranial pressure that interprets clinically into headaches vomiting altered state of consciousness and in youngster's amendment within the diameter of the skull and bulging of the fontanelles. A lot of advanced symptoms like endocrine dysfunctions indicate potential presence brain tumors. The brain tumor causes bilateral temporal field of regard defect (due to compression of the optic chiasm) or dilatation of the people, fast onset of focal neurological symptoms, such as cognitive and behavioral impairment (including impaired judgment, state of mind, lack of recognition, spacial orientation disorders), temperament and emotional changes, hemiparesis, disability, aphasia, ataxia, field of regard impairment, impaired sense of smell, impaired hearing, facial disfunction, double vision symptoms like tremors, disfunction on one aspect of the body unilateral paralysis, or (epileptic) seizures during a patient with a negative history for brain disease.

A higher risk of developing brain tumors. Per brain doctor observation, prevalence of primary brain tumor is high within the children's with a history of previous radiation

treatment to the top for cancer; folks with bound cancers (nervous system, duct gland, colon);

Secondary brain tumors or pathologic process tumors begin growing elsewhere within the body then jaunt the brain type pathologic process brain tumors. This implies that a cancerous tumor has developed in another organ else where within the body which cancer cells have leaked from that primary tumor then entered the systema lymphaticum and blood vessels. They then flow into through the blood, and square measure deposited within the brain. There, these cells continue growing and dividing, changing into another invasive tumor of the first cancer's tissue. Secondary tumors of the brain square measure quite common within the terminal phases of patients with associate degree incurable metastasized cancer; the foremost common sorts of cancers that originate secondary tumors of the brain square measure carcinoma, breast cancer, melanoma, excretory organ cancer and carcinoma. Secondary brain tumors square measure the foremost common reason behind tumors within the bodily cavity.

IV. BRAIN TUMOR IDENTIFICATION

The brain tumor identification can begin with associate degree interrogation of the patient to urge a transparent read of his medical antecedents, and his current symptoms. Examinations during this stage might embrace the eyes, otolaryngological (or ENT) and/or electro physiological exams. Imaging trial plays a central role within the identification of brain tumors. The foremost ordinarily used imaging ways for identification square measure resonance Imaging (MRI), CT (CT), antilepton emission picturing (PET), single-photon emission CAT (SPECT), and useful tomography (fMRI)[3], [4].

With advance EEG instruments, brain abnormal electrical activities is recorded with high accuracy; this establishes EEG take a look at as a vital trial for the identification and treatment of brain diseases. EEG square measure up-and coming back as a significant methodology to suit the increasing world demand for more cost-effective and effectual clinical and attention services, with fitting interpretation ways.

EEG take a look at usually plays a vital role within the identification of brain tumors. EEG take a look at reliable in localizing lesions involving superficial parts of the cerebral hemispheres, although it's of restricted price in implanted lesions. Being a non-invasive low value procedure, the EEG may be a reliable tool for gliomas neoplasm identification (since these tumors square measure a lot of electrical active) and fewer winning in sleuthing brain stem tumors and neoplasm series (since they sometimes occur in deeper brain and fewer electrical activity). EEG is most relevant in assessing however the brain responds to brain tumor treatments (e.g. post operative).

The role of EEG in sleuthing focal cerebral disturbances has undergone a major amendment since the event of CT scan and tomography with high (<1mm) spacial resolution. these days EEG is employed primarily to enrich these studies by evaluating useful changes within the patient's condition; it demonstrates aspects of brain physiology that don't seem to be mirrored in structural neuro imaging tests. Despite restricted spacial resolution, EEG continues to be a valuable tool for analysis and identification, particularly once millisecond-range temporal resolution (not potential with CT or MRI) is needed.

Despite the very fact that EEG is a vital clinical tool for designation, observance and managing brain tumor disorders, several researchers and medical man unaware of the EEG abnormalities that indicate the presence of brain tumour. This paper highlights the foremost EEG changes that occur with different brain tumors.

V. WAVELET TRANSFORM

That are developed for varied applications. Since the WT is acceptable for analysis of non-stationary signals and this represents a serious advantage over spectral analysis, it's compatible to locating transient events, which can occur throughout epileptic seizures.

Wavelet's feature extraction and illustration properties may be wont to analyze varied transient events in biological signals. Adeli et al. [2] gave an outline of the distinct moving ridge remodel (DWT) developed for recognizing and quantifying spikes, sharp waves and spike-waves. They used moving ridge remodel to research and characterize epilepti type discharges within the sort of 3-Hz spike and wave advanced in patients with absence seizure. Through moving ridge decomposition of the graph records, transient options are accurately captured and localized in each time and frequency context. The capability of this mathematical magnifier to research totally different scales of neural rhythms is shown to e a robust tool for work small-scale oscillations of the brain signals. An improved understanding of the dynamics of the human brain through graph analysis may be obtained through additional analysis of such graph records.

This paper aims to check the standard technique of provision regression to the additional advanced neural network techniques, as mathematical tools for developing

classifiers for the detection of convulsion in multi-channel graph. With in the neural network techniques, the multilayer perceptron neural network (MLPNN) are used with back propagation and Levenberg—Marquardt coaching algorithm. The selection of this network was supported the actual fact that it's the foremost common style. In these strategies we have a tendency to used lifting-based distinct riffle remodel (LBDWT) coefficients of graph signals as associate degree input to organization with 2 distinct outputs: epileptic seizure or non-epileptic seizure. We offer quicker riffle decomposition in multi-channel EEG with none special hardware, by exploitation LBDWT in a very multi-channel graph. The accuracy of the classifiers are assessed and cross-compared, and blessings and limitations of every technique are mentioned. Wavelet's feature extraction and illustration properties is wont to analyze varied transient events in biological signals. Adeli et al. [2] gave an outline of the distinct riffle remodel (DWT) developed for recognizing and quantifying spikes, sharp waves and spike-waves. They used riffle remodel to investigate and characterize epileptic form discharges within the variety of 3-Hz spike and wave complicated in patients with absence seizure. Through riffle decomposition of the graph records, transient options area unit accurately captured and localized in each time and frequency context. The aptitude of this mathematical magnifier to investigate totally different scales of neural rhythms is shown to be a strong tool for work small-scale oscillations of the brain signals. A more robust understanding of the dynamics of the human brain through graph analysis is obtained through any analysis of such graph records. This area unit procedure tools utilizing a mixture of the many elementary process units (cell). Every unit is connected to variety of network units to method info by transfer operate. The

link between the input and also the output confirm network behavior. Contrary to traditional computing strategies, area unit 'trained' to provide desired the input-output relationship. Throughout the coaching (learning) section, samples of knowledge area unit bestowed to the network and, employing a learning rule, the parameters area unit tuned to regulate network behavior. Per offered data of the matter, and also the objective of the operator, the educational procedure utilized is either supervised or unsupervised or both. The supervised learning procedure is performed with pairs of identified input-output patterns whereas unattended learning consists of presenting coaching examples to the network input and also the network organizes itself increasingly to achieve outside separation between the present categories of examples. The principal applications of are within the space of pattern recognition. The pattern is changed into a feature vector used as input, and also the output is taken as distinguishing the input to be a member of 1 of variety of categories of attainable inputs. A very important quality of neural networks (referred to as generalization) is that after they area unit properly trained, networks will fitly method knowledge that haven't been used for coaching.

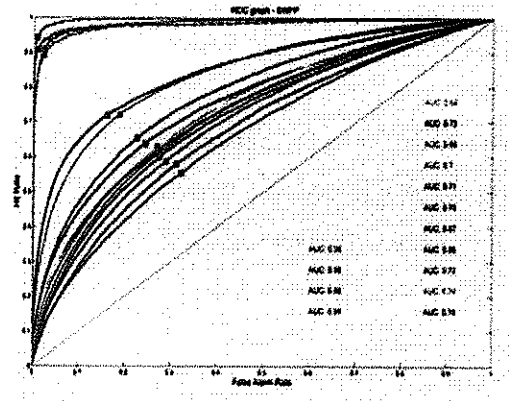
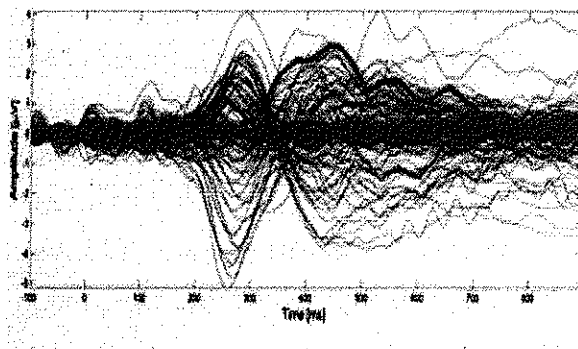


Figure 1 : EEG Signals and False Rate

Training algorithms area unit associate integral a part of model development. Associate applicable topology could still fail to grant an improved model, unless trained by an acceptable coaching algorithmic program. A decent coaching algorithmic program can shorten the coaching time, whereas achieving an improved accuracy. Therefore, coaching method is a crucial characteristic, whereby representative samples of the data area unit iteratively given to the network, so it will integrate this data at intervals its structure. There area unit variety of coaching algorithmic programs wont to train a MLPNN and an oftentimes used one is termed the rear propagation training algorithm. The rear propagation algorithmic program that relies on looking out miscalculation surface victimization gradient descent for points with minimum error is comparatively simple to implement.

However, back propagation has some issues for several applications. The algorithmic program isn't absolute to realize the world minimum of the error perform since gradient descent could grind to a halt in native minimal, wherever it should stay indefinitely. Additionally to the present, long coaching session's area unit typically needed so as to search out a suitable weight resolution

as a result of the well-known difficulties inherent in gradient descent improvement. Therefore, lots of variations to enhance the convergence of the rear propagation were planned. Improvement ways like second-order ways (conjugate gradient, quasi-Newton, Levenberg—Marquardt (L—M)) have additionally been used for coaching in recent years.

The Levenberg—Marquardt algorithmic program combines the simplest options of the Gauss—Newton technique and also the steepest-descent algorithmic program, however avoids several of their limitations. Particularly, it typically doesn't suffer from the matter of slow convergence.

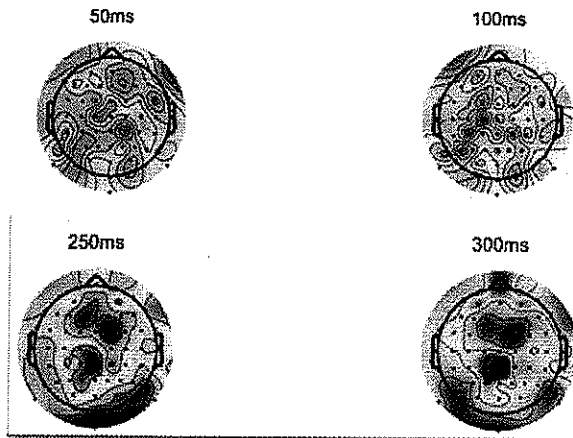


Figure 2 : Classification Weight

System Model: PCA may be a mathematical procedure that uses associate degree orthogonal transformation to convert a group of observations of probably correlate variables into a group of values of linearly unrelated variables referred to as principal parts. The amount of principal parts is a smaller amount than or capable the amount of original variables. This transformation is outlined in such how that the primary principal part has

the biggest attainable variance (that is, accounts for the maximum amount of the variability within the knowledge as possible), and every succeeding part has the very best variance attainable beneath the constraint that it's orthogonal to (i.e., unrelated with) the preceding parts. Principal parts are absolute to be freelance provided that the info set is together commonly distributed. PCA is sensitive to the relative scaling of the first variables. Reckoning on the sphere of application, it's additionally named the distinct Karhunen—Loève remodel (KLT), the Hotelling remodel or correct orthogonal decomposition (POD).

The performance of the rear Propagation network was evaluated in terms of coaching performance and classification accuracies. Back Propagation network provides quick and correct classification and may be a promising tool for classification of the tumors. Back propagation rule is finally used for classifying the pattern of malignant and nonmalignant neoplasm. The back-propagation learning rule are often wont to alter the weights and biases of networks to reduce add square error of the network.

Feed-forward:

The input x is fed into the network. The denoting functions at the nodes and their derivatives square measure evaluated at every node. The derivatives square measure keep. The constant one is fed into the output unit and therefore the network is run backwards. Incoming data to a node is additional and therefore the results increased by the worth keep within the left a part of the unit. The result's transmitted to the left of the unit. They

result will be collected at the input unit is that the by-product of the network perform with relation to x

Back Propagation:

Most people would think about the rear Propagation network to be the example neural internet. Actually, Back Propagation one, 2, 3 is that the coaching or learning algorithmic rule instead of the network itself.

Initialize the weights in the network

while stopping criterion has reached do

for all example e 2 training set do

O = actual, output(network, e); propagate forward

T = wanted output for e

Calculate error ($T - O$) at each neuron in the output layer Compute Mean Squared Error value; propagate backward Compute *deltaweightupdate* for all weights Update all the weights in the network such that the sum-squared value of

error is minimized.end forend while

VI. CONCLUSION

The BCI drawback is resolved exploitation neural network. The mental task classification is increased by many kinds of pre-processing, to get the computer file of the neural network. The soft computing techniques area unit utilized for the classification of the graphical record signals because the techniques area unit supposed to model and alter solutions to world tribulations. The chance of correct classification has been accrued by

exploitation soft computing techniques like Principal part Analysis with neural network and formal logic.

A very common practice to solve these problems is to repeat the initialization until we receive a set of good initial center vectors. In practice, after center initialization, we assign elements to the concerned clusters. If an empty cluster is found, at this early stage, a re-initialization takes place [26]. This process is repeated until all non-empty initial clusters are formed. This is, however, an ad-hoc technique. Several other methodical approach are also found, a refinement approach is proposed, where starting with a number of initial samples of the data set we can obtain a number of sets of center vectors. These center vectors then pass through a refinement stage to generate a set of so called good starting vectors. In [21], a genetically guided k-means has been proposed where possibility of generation of empty clusters is treated in the mutation stage. Several k-d-tree based methods are found in [17] and [18]. Another approach to initialize cluster centers based on values for each attribute of the data set has been proposed in [19]. These methods are time costly and may not be applicable by keeping the k mean's inherently simple structure.

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