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BRAIN STROKE IDENTIFICATION A MACHINE LEARNING BASED DIAGNOSTIC MODEL USING NEUROIMAGES

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Abstract : Stroke is one of crucial neurological emergencies impacting million worldwide that can also lead to death, if it is undiagnosed. Artificial Intelligence in healthcare in particular stroke identification is quickly growing. In recent years DL and TL has shown effective for identifying the strokes this paper provide research on applying deep learning for the identification of stroke.

IndexTerms **- Machine learning, brain stroke identification, Ct scans , Hemorrhage, classification, deep learning**

I. INTRODUCTION

Stroke is a neurological crisis that occur when flow of the blood to a part of brain is disturbed, if it left untreated, this withholding can cause permanent damage to brain, that can lead to paralysis, speech impairment, memory loss, and also this can lead to death. Strokes are systemized into ischemic stroke occur frequently nearly 87% of all cases, this happens due to a blockage in blood vessel supplying the brain. Hemorrhage strokes occur due to ruptured vessel causing bleeding within or in the surrounding of the brain tissue [1]

Early detection of stroke is necessary for opting the treatment, for ex. Tissue plasminogen activator(TPA) is helpful for ischemic stroke. Nut it is life threatening if the implemented during threatening if it implemented during the hemorrhagic event. Presently computed tomography CT, MRI are need for the identification.

II. LITERATURE REVIEW

Over past few years Artificial intelligence technique in particular deep learning techniques in particular deep learning & transfer learning have shown effective in the field of brain stroke detection . One of the highlightable work is neuro Vern framework proposed by Tanveer et al. this model utilize the power of VGG-16 CNN Precise the output using gaussian naïve bayes in combination with non -negative matrix factorization (NMF). This model provide accuracy of 99.6% and also explained the reliability of TL -based stroke for clinical deployment [1]

Chaki & Wozniak provided a detailed review on Deep learning based solutions that is applied to brain focused on different moralities such as CT, MRI, EEG and highlighting model such as RR(NN, YOLO, U-Net, and Deep residential Attention network (DRANET). They also highlighted the stroke robotic system, this utilizes AI to personalize rehabilitation therapy, greatly improving outcome of patient[2].

The author remarkable review is proposed by Karthik et al. focused on challenge and opportunities introduced by neuroimaging technique like CT & MRI , they debated that CT is faster & more widely available, although it frequently fails to detect the subtle change in early ischemic , on the other hand MRI in particular with DWI & FLAIR provide higher contact & earlier detection capability, also they focused on fully convolutional layer(FCN) and architecture like deep Sym Net earns then model explained the similarity co-efficient and area under ROC , & verifying their diagnostic utility[3]

Another important highlighted literature in the use of assemble learning and hybrid arch, for ex. Combining CNN's for feature extraction with ML classifiers like guided to enhanced transparency & reduced computational cost, this hybrid framework was authenticated in neuro-VGNB model. Where feature from VGG-16 were refined using GNB for classification, emerging accuracy & flexibility[4]

III. METHODOLOGY

The stroke identification involve pipelined structure of image acquisition, pre-processing, feature extraction. Classification & evaluation.

The first step to build the model is image acquisition image can be collected from different source. Ct or mri scan are usually used for stroke detection the next step is preprocessing this is an important step that will further more that input image are normalized & standardized in relation to other patient & imaging system, it involve skull stripping. Intensity normalization, resizing. Preprocessing will help ensure deep network can be reliably trained .to involve varying technique to include data augmentation process, rotation, flipping, cropping to increase data sample size even artificially to prevent overfitting.

Feature extraction performed using cnn which can automatically learn features, popular model such as vgg -16, resnet & u- net are often used to extracted feature for ex vgg -16 network can contain several convolutional layer with small 33 kernels several layer that are fully connected. They are used became they have lot of layers that are suitable for detecting [1]

Fully convolutional network (fcn) and encoder-decoder architecture like v -net used for segmentation, it is popular because of symmetric design that allow localization of stroke detection.

Recent model has opted for adversarial technique, such as gan to improve accuracy & reliability of stroke detection in gan there are 2 component discriminator which differentiate between real & fake data and generator that create synthetic stroke image the evaluation of these model involve various techniques, such as dice similarity co-efficient (dsc) & jaccard index, precision, recall, these metrix cases that overlap between predicted & actual lesion areas. The model sensitivity to true pos and their ability to different between classes, and additionally factored such as generalization, interference time, to different patient population robustness to imbalanced or noisy data, and interpretability for clinical decision making are also important

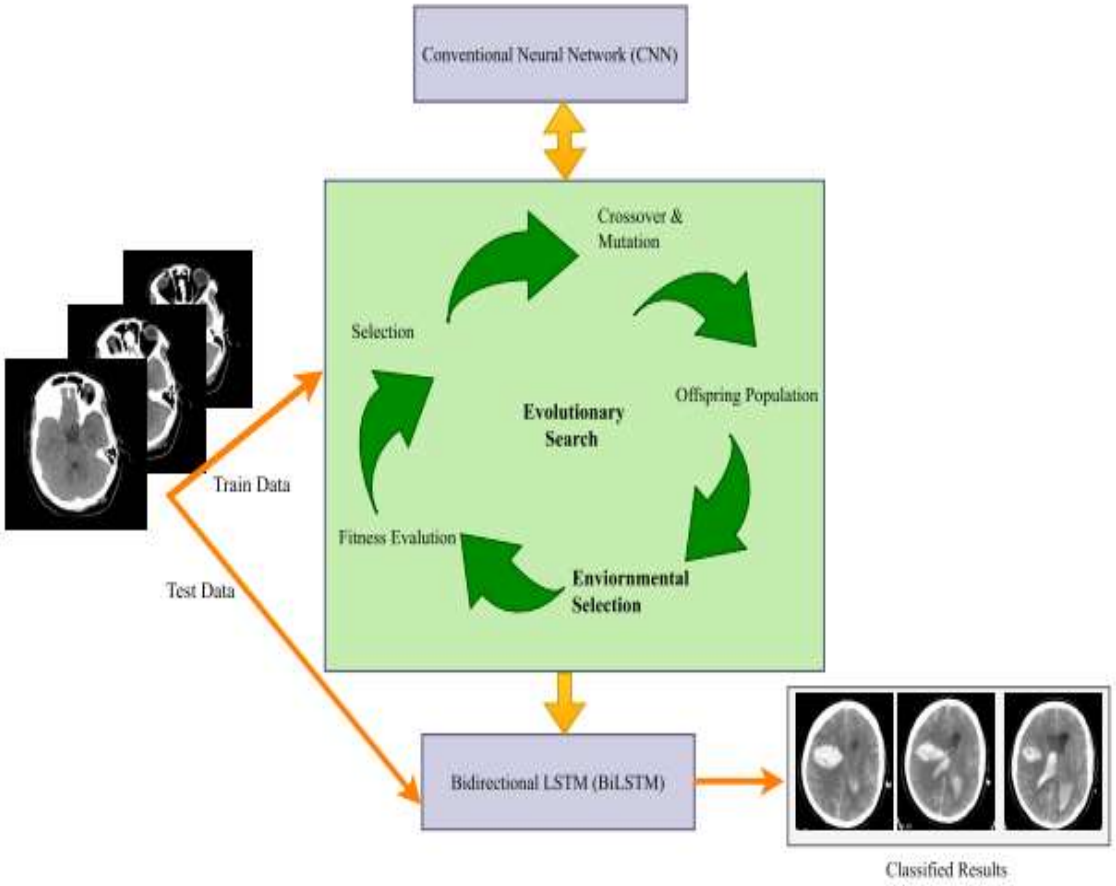

Figure 1 : methodology of the brain stroke detection.

IV. CHALLENGES AND LIMITATIONS

Regardless of significant progress in application of deep learning for identification of brain stroke, there are several challenge in the path.

Availability:- One of the challenges availability and liability of the datasets, which is resource intensive, models are trained on restricted datasets such as ISLES ATLAS are invitational data [2]

Imaging modality:- CT & MRI scan can differ significantly in resolution, contract. And noise that depend on equipment and acquisition parameter. This diversity dealing for deep learning model, even though technique such as data augmentation strategies Heep to reduce this issue, they are not trust worthy & need careful adjusting to avoid creating artificer [3].

Interpretability:- CNN & GAN offer high performance. They are considered as Blackbox model. Creating trust issue of clinically to validate their decision. In healthcare transparency of the model is severe for regulatory approval & real world deployment, many solution like maps, attention mechanism, CAM are being examined to envision decision working, but these lack clinical validation [1]

Bottleneck of Realtime – integration:- models like U -Net & Verner -16 are fast integration. And complex arch like 3D & GAN are expensive, this become obstacle for crisis where diagnosis is crucial. Ther is need of portable lightweight model that can be deployed on device or unified to existing PACS [2].

VII. Comparative analysis

The Assessment of stroke identification models is vital to understanding their clinical endpoint. Usually model are evaluated using performance metrics such as accuracy, recall, in particular precision. F1 Score, out of these DSC and AOC-ROC are valuable in medical imaging as they evaluate the overlap between précised and actual region. And also classifiers discriminative capability.

In Neuro – VGNB model proposed by Tanveer et al. the combination of VGG – 16 Gaussian Naïve Bayes improved by non-negative matrix factorization (NMF). Has provided 99.96% accuracy [1].

Chaki & Wozniak reviewed many DL model & provided report on score that range from 0.7 to 0.95 that depend upon the model and dataset they need[2].

Yang et al s 3D GAN arch a discs Co -efficient of 0.87 - outperforming conventional segmentation tools by emerging consistency between forecasted & reality [3].

Additionally arch like RES NET and deep Lab V3, utilize pyramid pooling and spatial pyramid, both have been successful in dividing complicated lesion structure in multi-model images, these framework performed effectively in ISLES & ATLAS datasets.

VIII. Future direction

Looking forward, the future of brain stroke detection using DL poses several potential direction one of them is unification of neurological data such as combining a MRI with patient records, genomics. Relative vital sign.

Alter one is associate with AI model to learn from distributed localized dataset without transferring patient record access invitation can improve model diversities wide keeping privacy.

Future records should focus on developing lightweight portable, modifiable models trained on large scale. If we work together Deep learning has soon become a trusted tool that can help or arise the work

IX. Conclusion

In overview, this review has examined the brain stroke detection using DL, &transfer learning. Stroke is one of the vital health concern and need timely diagnosis. As explained in multiple framework, Convolutional neural network transfer learning strategies, and hybrid arch provide efficient tool, to Robotic & improve stroke identification from CT & MRI scan.

Architecture such as Neuro – VGNB, which write VGC – 16 based feature extraction with gaussian naïve Bayes. Has provided outstanding accuracy & flexibility, explaining the capability of combining deep & ML approach [1]. In contract , U-Net & GAN -based network have shown good result in segmenting ischemic cores and penumbra region with high precision, which is critical for treatment precising [3].

Nevertheless obstacle version, these include restricted data availability & scanner variability, and vital need for Analysis & visibility in clinical settings. Merging these gaps will need technical innovation & also collaboration within AI researches.

In conclusion DL & transfer learning have undoubtedly transformed brain stroke detection, offering quick diagnosis, effective accuracy, & self operating system. With continued development & careful incorporation to clinical practice these technologies considerably support to reducing stroke related issue worldwide.

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