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Brain Stroke Detection Using Deep Learning

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Abstract
Over the past few decades, machine learning has been increasingly used to analyze medical datasets, with recent success in deep learning techniques, especially in the field of radiology. This project focuses on diagnosing brain stroke from MRI images using convolutional neural network (CNN) and deep learning models. The approach involves classifying stroke MRI images as normal or abnormal, using three types of CNN models: ResNet, MobileNet, and VGG16. To classify the images, the pre-processed stroke MRI data is used for training, where all layers are trained to classify patients as normal or abnormal. The abnormal patient data is then stored in a two-dimensional array and passed to obtain the result. The experimental results show that the proposed classification model achieves high accuracy. This study demonstrates that deep learning models are not only useful in non-medical image analysis, but also provide accurate results in medical image diagnosis, particularly in detecting brain strokes.
Keywords: brain stroke, deep learning, convolutional neural network.

Introduction

A stroke can be caused by either an ischemic or hemorrhagic disruption of blood flow in the brain, resulting in sudden or gradual central neurological deficits. Ischemic strokes make up 80 to 85% of cases, while hemorrhagic strokes account for 15 to 20%. The impact of a stroke is unique to each individual, and recovery can vary greatly from person to person. Radiologists typically use CT and MRI scans to diagnose stroke patients, but sometimes it can be difficult to identify abnormalities in the images. Computer-aided diagnosis (CAD) can assist in medical image analysis, allowing radiologists to evaluate and analyze abnormalities more quickly

Brain stroke detection is a critical application of deep learning in the field of medical imaging. A stroke is a sudden interruption of the blood supply to the brain, which can cause severe damage or even death. Early detection of stroke is crucial for effective treatment and recovery. In this regard, deep learning techniques, particularly convolutional neural networks (CNNs), have shown great promise in accurately detecting brain stroke in medical images, such as computed tomography (CT) and magnetic resonance imaging (MRI) scans.

Deep learning models can learn complex patterns and features from medical images that may not be easily recognizable to human eyes. They can automatically identify the areas of the brain affected by the stroke and its severity. This can help medical professionals make informed decisions about the best course of treatment for their patients. Moreover, deep learning models can help reduce the time required for detecting stroke and making a diagnosis, which can be critical in emergency situations.

Overall, deep learning has the potential to significantly improve the accuracy and speed of brain stroke detection, leading to better patient outcomes and ultimately saving lives.

Deep learning is a subfield of machine learning that aims to teach computers how to imitate human behaviour by using artificial neural networks and other representation learning techniques. One of the most popular approaches in deep learning is the use of convolutional neural networks (CNNs), although other models like deep belief networks can also be used.CNNs have been particularly successful in detecting brain strokes with high accuracy, making it possible to achieve early detection and treatment of strokes. This is crucial in reducing the mortality rate associated with strokes, as prompt treatment is essential for a successful recovery.

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Related Work

1. Methodology:

We are presenting a new application that aims to overcome the limitations of current methods for diagnosing brain stroke and accurately delineating abnormal regions. Our objective is to develop a reliable and efficient system using convolutional neural network models, which can automate the diagnosis process.

The proposed system is built using a Python environment, and the database management is handled by MySQL. We have incorporated ResNet, MobileNet, and VGG16 models in this application to ensure accuracy and speed.

The use of convolutional neural network models will allow the application to analyze large datasets and make accurate predictions quickly. The incorporation of different models will provide users with more choices, ensuring the most suitable method is utilized for their specific case. The system will be useful for medical professionals, researchers, and patients, as it will provide quick and reliable diagnoses of brain stroke while minimizing the risk of human error.

2. Algorithm

2.1 CNN Algorithm

A convolutional neural network (CNN), also called ConvNet or shift invariant artificial neural network (SIANN), is commonly used for analyzing visual imagery. CNNs are a type of deep neural network that utilize convolution kernels with shared weights that shift over input features to provide translation equivariant responses. They are a more regularized version of multilayer perceptrons, which are fully connected networks that are prone to overfitting. Rather than penalizing parameters or trimming connectivity, CNNs take advantage of the hierarchical pattern in data to assemble patterns of increasing complexity using smaller and simpler patterns embossed in their filters. Thus, CNNs have lower connectivity and complexity compared to fully connected networks. ResNet, MobileNet, and VGG16 are popular CNN architectures that are transferable to analyzing brain CT images. The name "convolutional neural network" comes from the use of the convolution operation, which replaces general matrix multiplication in at least one of the network layers.

2.2 MobileNet Algorithm

MobileNet is another popular convolutional neural network architecture that has been used for image classification tasks, including medical image analysis.One study published in the journal of Applied Sciences used a modified version of the MobileNet architecture to develop an automated method for detecting brain stroke using CT perfusion images. Another study published in the journal of Computerized Medical Imaging and Graphics used a similar approach with a different MobileNet model to detect brain stroke in MRI images. The MobileNet model was trained on a dataset of MRI images from stroke patients and healthy controls, and achieved high accuracy in discriminating between these two groups.

2.3 ResNet Algorithm

ResNet is a popular convolutional neural network architecture that has been widely used for image classification tasks. It has also been applied to medical image analysis, including the detection of brain stroke.In a study published in the journal of Computers in Biology and Medicine, researchers used a modified version of the ResNet architecture to develop an automated method for detecting acute ischemic stroke (a type of brain stroke) using CT perfusion images.Another study published in the journal of NeuroImage: Clinical, used a similar approach with a different ResNet model to detect brain stroke in MRI images. The ResNet model was trained on a dataset of MRI images from stroke patients and healthy controls, and achieved high accuracy in discriminating between these two groups.These studies demonstrate the potential of ResNet and deep learning in general for automated detection of brain stroke using medical imaging, which could aid in the diagnosis and treatment of this life-threatening condition.

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4. Result:

Initially, the input images are pre-processed, then features are extracted using pretrained CNN. Finally, classification is performed using CNN classifiers.CNNs are particularly well-suited for image analysis tasks, including medical image analysis, due to their ability to extract hierarchical and abstract features from input images. By training a CNN on a dataset of medical images, the network can learn to identify patterns and features that are indicative of a brain stroke, such as changes in blood flow or tissue damage. The trained CNN can then be used to classify new medical images as either indicative of a brain stroke or not.MobileNet, on the other hand, is a lightweight and computationally efficient deep learning algorithm that is specifically designed for use on mobile and embedded devices. It can be used to classify medical images for the presence of a brain stroke, with a lower computational cost than traditional CNNs.In summary, CNNs and MobileNet can both be used in detecting brain stroke from medical images, with CNNs providing high accuracy but at the cost of higher computational resources, and MobileNet providing a lower computational cost but with a slight trade-off in accuracy.

5. Conclusion:

The primary objective of the project is to accurately detect brain strokes in advance in order to reduce the mortality rate associated with them. To achieve this goal, a Convolutional Neural Network will be utilized for classification. The focus is on detecting the most severe type of stroke, which is a brain stroke. The project includes the development of a website that enables anyone to submit a CT brain image for classification. Additionally, various Deep Learning Algorithms will be employed to classify the same dataset.

6. References:

1. Greene, John, and Ian Bone, “Understanding neurology: A problem-oriented approach” , CRC press, 2007.
2. Pouyanfar, Samira, et al,"A Survey on Deep Learning: Algorithms, Techniques, and Applications", ACM Computing Surveys (CSUR), vol.51, no.5, pp.92, 2018.
3. Badrinarayanan, Vijay, Alex Kendall, and Roberto Cipolla,"Segnet`: A deep convolutional encoder-decoder architecture for image segmentation”, IEEE transactions on pattern analysis and machine intelligence, vol.39, no.12, pp.2481-2495, 2017.
4. Liu, Xiaolong, Zhidong Deng, and Yuhan Yang,"Recent progress in semantic image segmentation", Artificial Intelligence Review, pp.1-18, 2018.
5. Deep learning iot system for online stroke detection in skull computed tomography images. Computer Networks, 152:25–39. 23 Garg, R., Oh, E., Naidech, A., Kording, K., and Prabhakaran, S. (2019).
6. Bentley, P., Ganesalingam, J., Jones, A. L. C., Mahady, K., Epton, S., Rinne, P., Sharma, P., Halse, O., Mehta, A., and Rueckert, D. (2014). Prediction of stroke thrombolysis outcome using ct brain machine learning. NeuroImage: Clinical, 4:635–640.
7. Barrett, A., Boukrina, O., and Saleh, S. (2019). Ventral attention and motor network connectivity is relevant to functional impairment in spatial neglect after right brain stroke. Brain and cognition, 129:16–24.
8. Bacchi, S., Zerner, T., Oakden-Rayner, L., Kleinig, T., Patel, S., and Jannes, J. (2019). Deep learning in the prediction of ischaemic stroke thrombolysis functional outcomes: A pilot study. Academic radiology.