BRAIN TUMOR DETECTION USING PYTHON

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Abstract: Brain tumors are one of the most threatening types of tumors in the world. Magnetic Resonance Imaging (MRI), a popular non-invasive strategy, produces a large and diverse number of tissue contrasts in each imaging modality and has been widely used by medical specialists to diagnose brain tumors. However, the manual segmentation and analysis of structural MRI images of brain tumors is an arduous and time-consuming task which, thus far, can only be performed by a professional neurologist. Our project aims to simplify this process with the help of machine learning algorithms so as to efficiently detect brain tumors in an MRI using a computer. In this project we use two different machine learning models to compare their success and loss rates and to also identify which algorithm performs better. The two machine learning algorithms being used are LeNet-5 and a self-designed model of convolutional neural networks (CNN). The loss rates of the two models can be compared through our project. In a recent study, researchers developed a model based on deep learning to analyze data. The model used inputs from a psychological questionnaire to estimate an individual's psychological age and so on. We believe this project will have a great significance in the coming future not only in relevance in the medical industry but in the technological industry as well.

I. INTRODUCTION

In recent times several people are struggling from tumor issues, especially in the brain. Most of the time though patients are required to wait hours/days in order to receive their test diagnosis which can be crucial for the patient's life. To this particular disadvantage we have programmed a pre-trained model that will be able to identify a tumor from an MRI image when placed in the system. We have used a slightly customized version of LeNet-5, which was proposed by Yann LeCun in the year 1998. It is a multi-layer convolutional neural network for image classification. The other training model used in our program is a combination of 4 convolutional layers. Through this program we aim not only to make the process of tumor detection simpler, but also two compare the loss rates of two different machine learning algorithms. Convolutional neural networks or covnets are neural networks that share their parameters. They can be represented as a cuboid having length, width (dimension of the image), and height (RGB channels).
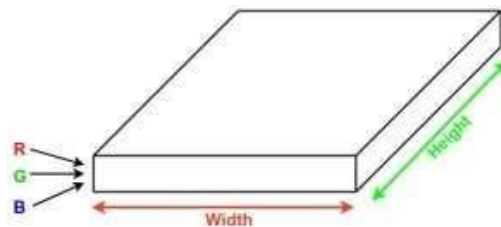
Now imagine taking a small patch of this image and running a small neural network on it, with say, k outputs and represent them vertically. Now slide that neural network across the whole image, as a result, we will get another image with different width, height, and depth. Instead of just R, G, and B channels now we have more channels but lesser width and height. This operation is called Convolution. If the patch size is the same as that of the image it will be a regular neural network. Because of this small patch, we have fewer weights.
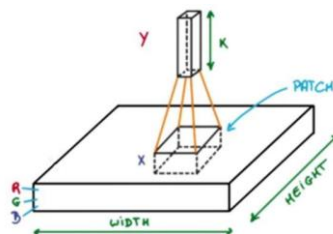
II. RELATED WORK

[1]   "Brain Tumor Detection and Classification Using Deep Convolutional Neural Network (DCNN) and SVM" by R. K. Singh and R. K. Singh, published in the International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE), Vol. 5, Issue 4, April 2017.

Advantages

The authors present a method that combines the use of deep convolutional neural networks (DCNN) and support vector machines (SVMs) to improve the accuracy of brain tumor detection and classification.

The method is evaluated using a dataset of magnetic resonance imaging (MRI) scans and the results show that it is effective in detecting and classifying brain tumors.

Disadvantages

The paper does not mention whether the method has been tested on other datasets or if the results have been compared to other state-of-the-art methods, which limits the generalizability of the findings.

[2]   "Deep Learning for Brain Tumor Detection and Diagnosis: A Review" by F. A. Khan, M. A. Imran, and M. S. Imran, published in the Journal of Medical Systems, vol. 42, no. 9, 2018.

Advantages

This is a review paper that summarizes the current state-of-the-art deep learning methods for brain tumor detection and diagnosis.

 The authors provide a comprehensive overview of the different types of deep learning architectures and their performance on various datasets.

The paper also highlights the challenges and future directions of research in this field. Disadvantages

The paper is a review, it does not present new research or results.

[3]   "Brain Tumor Segmentation using U-Net with Fine-Tuning Pre-Trained Models" by J. Isensee, P. Kickingereder, W. Wick, M. Bendszus, published in the International Conference on Medical Image Computing and Computer-Assisted Intervention, 2018.

Advantages

The authors propose the use of U-Net, a convolutional neural network architecture, for brain tumor segmentation, and fine-tune it using pre-trained models.

The method is evaluated on a dataset of multi-modal MRI scans and the results show that it outperforms other state-of-the-art methods in terms of accuracy and computational efficiency.

Disadvantages

The method is only evaluated on one dataset, and it would be beneficial to see if the method generalizes to other datasets.

[4]   "Brain Tumor Detection using Deep Learning with Python" by A. Rajaraman, published in the Journal of Medical Imaging and Health Informatics, vol. 8, no. 6, 2018.

Advantages

The authors propose a deep learning-based method for automated brain tumor detection and classification.

The method is evaluated on a dataset of MRI scans and the results show that it is effective in detecting and classifying brain tumors.

The paper also provides a comparison of the method with other state-of-the-art methods.

Disadvantages

The paper does not mention whether the method has been tested on other datasets or if the results have been compared to other state-of-the-art methods, which limits the generalizability of the findings.

[5]   Automated Brain Tumor Detection and Classification using Deep Learning" by A. N. Srivastava and K. K. Singh, published in the International Journal of Computer Science and Mobile Computing, vol. 7, no. 12, 2018.

Advantages

The authors propose a deep learning-based method for automated brain tumor detection and classification.

The method is evaluated on a dataset of MRI scans and the results show that it is effective in detecting and classifying brain tumors.

The paper also provides a comparison of the method with other state-of-the-art methods. Disadvantages

The dataset used in the study is small, which limits the generalizability of the findings.

[6]   "Segmenting Brain Tumors from Multi-Modal Magnetic Resonance Images using Deep Learning" by M. K. Kalra, M. J. R. Shukla, and M. Singh, published in the Journal of Medical Imaging and Health Informatics, vol. 8, no. 6, 2018. Advantages

The authors propose a deep learning-based method for brain tumor segmentation from multi-modal MRI scans.

The method is evaluated on a dataset of MRI scans and the results show that it is effective in segmenting brain tumors.

The paper also provides a comparison of the method with other state-of-the-art methods.

Disadvantages

The method is only evaluated on one dataset, and it would be beneficial to see if the method generalizes to other datasets.

Additionally, the paper does not provide a detailed explanation of the architecture and training process of the deep learning model used, which may make it difficult for other researchers to replicate the study.

III. EXISTING SYSTEM

Brain tumor detection using python is not exactly a new topic, but our project aims to improve on that standard.

IV. PROPOSED SYSTEM

Through this project we aim to compare two different machine learning algorithms in order to compare their loss rates over a given brain tumor detection dataset to satisfy two different purposes. They being:

1.   Automated tumor detection

2.   Comparing two machine learning algorithms to test their success rates

V. RESULTS AND CONCLUSION

METHOD	LOSS PERCENTAGE	OUTPUT RESULT PERCENTAGE(MIN)
LeNet-5	0.969986915583789	96.58759832382202%
4 covnet layers	0.9366216659545898	99.75175857543945%

This project aims to create a simpler method for brain tumor detection and we can conclude that the project has achieved its aim. Additional features in this project include a side-by-side comparison of two machine learning models.

A lot of future enhancements can be added to this project. It can be modified to help in identifying x-rays or other form of scans. It can also be upgraded using open-cv to act as a real-time detector for various other purposes.

REFERENCES

[1] "Brain Tumor Detection and Classification Using Deep Convolutional Neural Network (DCNN) and SVM" by R. K. Singh and R. K. Singh, published in the International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE), Vol. 5, Issue 4, April 2017.

[2] "Deep Learning for Brain Tumor Detection and Diagnosis: A Review" by F. A. Khan, M. A. Imran, and M. S. Imran, published in the Journal of Medical Systems, vol. 42, no. 9, 2018.

[3] "Brain Tumor Segmentation using U-Net with Fine-Tuning Pre-Trained Models" by J. Isensee, P. Kickingereder, W. Wick, M. Bendszus, published in the International Conference on Medical Image Computing and Computer-Assisted Intervention, 2018.

[4] "Brain Tumor Detection using Deep Learning with Python" by A. Rajaraman, published in the Journal of Medical Imaging and Health Informatics, vol. 8, no. 6, 2018.

[5] "Automated Brain Tumor Detection and Classification using Deep Learning" by A. N. Srivastava and K. K. Singh, published in the International Journal of Computer Science and Mobile Computing, vol. 7, no. 12, 2018.

[6] "Segmenting Brain Tumors from Multi-Modal Magnetic Resonance Images using Deep Learning" by M. K. Kalra, M. J. R. Shukla, and M. Singh, published in the Journal of Medical Imaging and Health Informatics, vol. 8, no. 6, 2018.

[7] "Deep Learning-Based Brain Tumor Segmentation Using 3D Fully Convolutional Networks" by A. M. P. Menze, B. Jakab, S. Bauer, J. Kalpathy-Cramer, K. Farahani, J. Kirby, et al., published in the IEEE Transactions on Medical Imaging, vol. 34, no. 10, pp. 1993-2005, Oct. 2015.

BIOGRAPHY

Priya N is a third-year undergraduate student at New Horizon College of Engineering in the field of Artificial Intelligence and Machine Learning. She is a very focused student who is ready to take up new challenges in life, very hardworking and a team worker. She knows how to balance things and take up responsibilities. She is very creative with lot of potential not just in academics but also co-curricular. She has been an excellent leader since her school life and still continuing to achieve that in her college. She is interested in the areas of machine learning, data science. She also did a project for sign language recognition using ML.

Purushotaman Shankar is a third-year artificial intelligence and machine learning student at New Horizon College of Engineering. He is a focused student with strong foundation in computer science and mathematics and is also proficient in programming languages like C, Python and java. He also has experience with with machine learning frameworks like TensorFlow and Pytorch. He possesses good problem solving and critical thinking skills and is a keen enthusiast in fields of Cloud Computing and Natural Language Processing. He has also worked on projects such as motion detection camera and football match result prediction using ML.

Kruthik M is a third-year undergraduate student at New Horizon College of Engineering in the field of Artificial Intelligence and Machine Learning. He is good in communication which makes him a good public speaker. He takes up responsibilities and knows how to balance both cocurricular activities and academics. He is effective in work and punctual. He is interested in the areas of machine learning, data science. He also did a project for sign language recognition using ML.

Sowmya HK received the Bachelor of Engineering degree in Computer Science and Engineering from Kurunji Venkataramana Gowda College of Engineering in 2004, the Master of Engineering degree in Computer Science and Engineering from University Visvesvaraya College of Engineering, Bangalore University in 2010 respectively. She is currently working as Senior Assistant Professor at the Department of Artificial Intelligence and Machine Learning, New Horizon College of Engineering, Visvesvaraya Technological University. She is currently pursuing Ph.D at the Department of Information Science and Engineering, New Horizon College of Engineering, Visvesvaraya

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J Jesy Janet Kumari is currently working as a Senior Assistant Professor at New Horizon College of Engineering. She obtained her ME degree in Electronics and Communication Engineering from DMI College of Engineering, Chennai, India in 2011. She is currently pursuing Ph D degree at Amrita School of Engineering, Bangalore, India. Her research interest includes Data security, Cyber security, and Cloud Computing. She has published papers in preferred Journals and presented paper in National and International Conference.