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Breat Cancer Prediction Using Deep Learning Technique

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ABSTRACT — to rapid advancement of machine learning and especially deep learning continues to fuel the medical imaging community's interest in applying these techniques to improve the accuracy of cancer screening. The cancer is the most dangerous diseases in the world, its mainly effective for women. So, our prime target must be curing the cancer through scientific investigation and the second main target should be early detection of cancer because the early detection of cancer can be helpful for remove the cancer completed. Breast cancer is the second leading cause of cancer deaths among U.S. women and screening mammography has been found to reduce mortality.

Index Terms — Deep Learning, Convolution neural network, Machine Leaning, Artificial Intelligence.

I. INTRODUCTION

THIS Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans: learn by example. Deep learning is a key technology behind driverless cars, enabling them to recognize a stop sign, or to distinguish a pedestrian from a lamppost. It is the key to voice control in consumer devices like phones, tablets, TVs, and hands-free speakers. Deep learning is getting lots of attention lately and for good reason. It's achieving results that were not possible before. In deep learning, a computer model learns to perform classification tasks directly from images, text, or sound. Deep learning models can achieve state-of-the-art accuracy, sometimes exceeding human-level performance. Models are trained by using a large set of labeled data and neural network architectures that contain many layers. Deep learning achieves recognition accuracy at higher levels than ever before. This helps consumer electronics meet user expectations, and it is crucial for safety-critical applications like driverless cars. Recent advances in deep learning have improved to the point where deep learning outperforms humans in some tasks like classifying objects in images. While deep learning was first theorized in the 1980s, there are two main reasons it has only recently become useful: Deep learning requires large amounts of labeled data. For example, driverless car development requires millions of images and thousands of hours of video.

II. DEEP LEARNING WORKS

2.1 Convolution Neural Network

One of the most popular types of deep neural networks is known as convolutional neural networks **(CNN** or **ConvNet)**. A CNN convolves learned features with input data, and uses 2D convolutional layers, making this architecture well suited to processing 2D data, such as images.CNNs eliminate the need for manual feature extraction, so you do not need to identify features used to classify images. The CNN works by extracting features directly from images. The relevant features are not pretrained; they are learned while the network trains on a collection of images. This automated feature extraction makes deep learning models highly accurate for computer vision tasks such as object classification.CNNs learn to detect different features of an image using tens or hundreds of hidden layers. Every hidden layer increases the complexity of the learned image features. For example, the first hidden layer could learn how to detect edges, and the last learns how to detect more complex shapes specifically catered to the shape of the object we are trying to recognize.

2.2 Training from Scratch

To train a deep network from scratch, you gather a very large labeled data set and design a network architecture that will learn the features and model. This is good for new applications, or applications that will have a large number of output categories. This is a less common approach because

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with the large amount of data and rate of learning, these networks typically take days or weeks to train.

2.3 Feature Extraction

A slightly less common, more specialized approach to deep learning is to use the network as a feature extractor. Since all the layers are tasked with learning certain features from images, we can pull these features out of the network at any time during the training process. These features can then be used as input to a machine learning model such as support vector machines (SVM).

III. SYSTEM

3.1 Exsisting System

Breast cancer is one of the most dangerous and common reproductive cancers that affect mostly women. Breast tumor is an abnormal growth of tissues in the breast, and it may be felt as a lump or nipple discharge or change of skin texture around the nipple region. Cancers are abnormal cells that divide uncontrollably and are able to invade other tissues. Cancer cells have the ability to spread to other parts of the body through the blood and lymphatic system. In today's world with the advent of personalized medicine, it increases the workload and complexity of the doctors in cancer diagnosis. Radiologic and pathology are the key players in making decision for cancer diagnosis. Based on the radiology diagnosis, the results will be submitted to pathology for further diagnosis. Machine learning (ML) comprises a broad class of statistical analysis algorithms that iteratively improve in response to training data to build models for autonomous predictions. In other words, computer program performance improves automatically with experience. ML algorithm's aim is to develop a mathematical model that fits the data. It comprises of two types of learning which are supervised and unsupervised. Supervised learning algorithm required the data to be labeled for training purposes. In existing system implement Support Vector Machine algorithm to classify the diseases and also implement Feed forward neural network (FNN) for the classification of diseases with trained databases.

3.2 Proposed System

The rapid advancement of machine learning and especially deep learning continues to fuel the medical imaging community's interest in applying these techniques to improve the accuracy of cancer screening. Detection of subclinical breast cancer on screening mammography is challenging as an image classification task because the tumors themselves occupy only a small portion of the image of the entire breast. The proposed system attempted to train neural networks using whole mammograms without relying on any annotations. However, it is hard to know if such networks were able to locate the clinically significant lesions and base predictions on the corresponding portions of the mammograms. It is well known that deep learning requires large training datasets to be most effective. Thus, it is essential to leverage both the few fully annotated datasets, as well as larger datasets labeled with only the cancer status of each image to improve the accuracy of breast cancer classification algorithms. In this project, we propose an "end-to-end" approach in which a model to classify local image patches is pre-trained using a fully annotated dataset with contour information which are extracted by snake model. The convolution neural network is used to initialize the weight parameters of the whole image classifier, which can be further fine-tuned using datasets without annotations. We used a large public digitized film mammography database with ultrasound images to develop the patch and whole image classifiers.

IV. APPLICATIONS OF DEEP LEARNING

Deep learning applications are used in industries from automated driving to medical devices.

Automated Driving: Automotive researchers are using deep learning to automatically detect objects such as stop signs and traffic lights. In addition, deep learning is used to detect pedestrians, which helps decrease accidents.

Aerospace and Defense: Deep learning is used to identify objects from satellites that locate areas of interest, and identify safe or unsafe zones for troops.

Medical Research: Cancer researchers are using deep learning to automatically detect cancer cells. Teams at UCLA built an advanced microscope that yields a high-dimensional data set used to train a deep learning application to accurately identify cancer cells.

Industrial Automation: Deep learning is helping to improve worker safety around heavy machinery by automatically detecting when people or objects are within an unsafe distance of machines.

Electronics: Deep learning is being used in automated hearing and speech translation. For example, home assistance devices that respond to your voice and know your preferences are powered by deep learning applications.

V. MACHINE LEARNING

Machine learning is a data analytics technique that teaches computers to do what comes naturally to humans and animals: learn from experience. Machine learning algorithms use computational methods to "learn" information directly from data without relying on a predetermined equation as a model. The algorithms adaptively improve their performance as the number of samples available for learning increases. Deep learning is a specialized form of machine learning.

5.1 Supervised Learning

Supervised machine learning builds a model that makes predictions based on evidence in the presence of uncertainty. A supervised learning algorithm takes a known set of input data and known responses to the data (output) and trains a model to generate reasonable predictions for the response to new data. Use supervised learning if you have known data for the output you are trying to predict. Supervised learning uses classification and regression techniques to develop predictive models.

5.2 Unsupervised Learning

Unsupervised learning finds hidden patterns or intrinsic structures in data. It is used to draw inferences from datasets consisting of input data without labeled responses.
Clustering is the most common unsupervised learning technique. It is used for exploratory data analysis to find hidden patterns or groupings in data. Applications for cluster analysis include gene sequence analysis, market research, and object recognition.

5.3 Classification Technique

Classification techniques predict discrete responses—for example, whether an email is genuine or spam, or whether a tumor is cancerous or benign. Classification models classify input data into categories. Typical applications include medical imaging, speech recognition, and credit scoring. Use classification if your data can be tagged, categorized, or separated into specific groups or classes. For example, applications for hand-writing recognition use classification to recognize letters and numbers. In image processing and computer vision, unsupervised pattern recognition techniques are used for object detection and image segmentation. Common algorithms for performing classification include support vector machine (SVM), boosted and bagged decision trees, k-nearest neighbor, Naïve Bayes, discriminant analysis, logistic regression, and neural networks.

VI. ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving.

The ideal characteristic of artificial intelligence is its ability to rationalize and take actions that have the best chance of achieving a specific goal. A subset of artificial intelligence is machine learning, which refers to the concept that computer programs can automatically learn from and adapt to new data without being assisted by humans. Deep learning techniques enable this automatic learning through the absorption of huge amounts of unstructured data such as text, images, or video.

6.1 Data Preparation

Taking raw data and making it useful for an accurate, efficient, and meaningful model is a critical step. In fact, it represents most of your AI effort. Data preparation requires domain expertise, such as experience in speech and audio signals, navigation and sensor fusion, image and video processing, and radar and lidar. Engineers in these fields are best suited to determine what the critical features of the data are, which are unimportant, and what rare events to consider. AI also involves prodigious amounts of data. Yet labeling data and images is tedious and time-consuming. Sometimes, you don't have enough data, especially for safety-critical systems. Generating accurate synthetic data can improve your data sets. In both cases, automation is critical to meeting deadlines.

6.2 Deployment

AI models need to be deployed to CPUs, GPUs, and/or FPGAs in your final product, whether part of an embedded or edge device, enterprise system, or cloud. AI models running on the embedded or edge device provide the quick results needed in the field, while AI models running in enterprise systems and the cloud provide results from data collected across many devices. Frequently, AI models are deployed to a combination of these systems. The deployment process is accelerated when you generate code from your models and target your devices. Using code generation optimization techniques and hardware-optimized libraries, you can tune the code to fit the low power profile required by embedded and edge devices or the high-performance needs of enterprise systems and the cloud.

VII. SYSTEM IMPLEMENTATION

7.1 Modules

- BREAST IMAGE ACQUISITION
- PREPROCESSING
- SEGMENTATION
- CLASSIFICATION
- DISEASE PREDICTION.

7.2 Modules Description

7.2.1 Breast Image Accusition

A breast ultrasound is most often done to find out if a problem found by a mammogram or physical exam of the breast may be a cyst filled with fluid or a solid tumor. Breast ultrasound is not usually done to screen for breast cancer. This is because it may miss some early signs of cancer. Ultrasound imaging of the breast uses sound waves to produce pictures of the internal structures of the breast. It is primarily used to help diagnose breast lumps or other abnormalities your doctor may have found during a physical exam, mammogram or breast MRI. Ultrasound is safe, noninvasive and does not use radiation. This procedure requires little to no special preparation. Leave jewelry at home and wear loose, comfortable clothing. You will be asked to undress from the waist up and to wear a gown during the procedure. A mammogram is an X-ray picture of the breast. Doctors use a mammogram to look for early signs of breast cancer. Regular mammograms are the best tests doctors have to find breast cancer early, sometimes up to three years before it can be felt. In this module, input the breast image as scan images. Images can be any type and any size.

7.2.2 Preprocessing

In this module convert the RGB image into gray scale image. The colors of leaves are always green shades and the variety of changes in atmosphere because the color features having low reliability. Therefore, to recognize various plants using their leaves, the obtained leaf image in RGB format will be converted to gray scale before preprocessing. The formula used for converting the RGB pixel value to its grey scale counterpart is given in Equation.

Gray = 0.2989 * R + 0.5870 * G + 0.1140 * B where R, G, B correspond to the color of the pixel, respectively.

Then remove the noises from images by using filter techniques. The goal of the filter is to filter out noise that has corrupted image. It is based on a statistical approach. Typical filters are designed for a desired frequency response. Filtering is a nonlinear operation often used in image processing to reduce "salt and pepper" noise. A median filter is more effective than convolution when the goal is to simultaneously reduce noise and preserve edges.

7.2.3 Segmentation

Active contour model, also called snakes, is a framework in computer. The snake's model is popular in computer vision, and snakes are widely used in applications like object tracking, shape recognition, segmentation, edge detection and stereo matching. A snake is an energy minimizing, deformable spline influenced by constraint and image forces that pull it towards object contours and internal forces that resist deformation. Snakes may be understood as a special case of the general technique of matching a deformable model to an image by means of energy minimization. In two dimensions, the active shape model represents a discrete version of this approach, taking advantage of the point distribution model to restrict the shape range to an explicit domain learnt from a training set. Snake models have been some of the most successful nature-inspired methods for image segmentation. The basic snake model that gives an elegant method to simulate an elastic material which can dynamically conform to local image features. In this module, breast scan images are segmented using snake model. A snake is an energy minimizing, deformable spline influenced by constraint and image forces that pull it towards object contours and internal forces that resist deformation. Snakes may be understood as a special case of the general technique of matching a deformable model to an image by means of energy minimization

7.2.4 Classification

Classification includes a broad range of decision-theoretic approaches to the identification of images (or parts thereof). All classification algorithms are based on the assumption that the image in question depicts one or more features (e.g., geometric parts in the case of a manufacturing classification system, or spectral regions in the case of remote sensing, as shown in the examples below) and that each of these features belongs to one of several distinct and exclusive classes. In this module, implement deep learning algorithm to predict the diseases using Convolutional neural network. Convolutional Neural Network [CNN] is a network formulation of "probability density estimation‟. It is a model based on competitive learning with a „winner takes all attitude‟ and the core concept based on multivariate probability estimation. The distinguishing feature of CNN is that the computational load in the training phase is transferred to the evaluation phase. The main advantage of CNN is that training is instantaneous, easy and faster compared to back propagation networks. The development of CNN relies on the Parzen window concept of multivariate probabilities. The CNN is a classifier version, which combines the Baye's strategy for decision-making with a nonparametric estimator for obtaining the probability density function. The CNN architecture consists of an input layer, a pattern layer, a summation layer, and an output layer.

7.2.5 Disease Prediction

Breast cancer is a type of cancer that starts in the breast. Cancer starts when cells begin to grow out of control. It's important to understand that most breast lumps are benign and not cancer (malignant). Non-cancerous breast tumors are abnormal growths, but they do not spread outside of the breast. They are not life threatening, but some types of benign breast lumps can increase a woman's risk of getting breast cancer. Any breast lump or change needs to be checked by a health care professional to determine if it is benign or malignant (cancer) and if it might affect your future cancer risk. Breast cancer disease is classified using Convolutional neural network algorithm. Cancer can be further classified as benign or malignant. Proposed system provide improved accuracy than the existing framework

VIII. CONCLUSION

Cancer is a major issue that has a great deal with the entire world. It is a fatal disease that affects the lives of numerous people and will keep on influencing the lives of some more. It is important to develop reliable and precise system for diagnosing the benign or malignant breast cancer. Breast cancer needs to be providing accuracy of diagnosis at the early stages. Mammography is one of the best methods in breast cancer detection Hence it is seen that Soft Computing methods provide solutions to biologically inspired problem of medical domain like breast cancer. In this thesis, better algorithm has been proposed to improve the detection of edges by using probabilistic neural network. This algorithm is adaptable to various environments. The weights associated with each neural network were tuned to allow good results to be obtained while extracting edges of the image, where contrast varies a lot from one region to another. During the performance tests, however, all parameters were kept constant. Experimental results show the higher quality and superiority of the extracted edges compared to the other methods in the literature such as texture, statistical and deep learning algorithm.

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