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A NOVEL ALGORITHM USING DEEP LEARNING TECHNOLOGY FOR DETECTING SIX DIFFERENT TYPES OF THYROID DISEASE

Mrs. K. Arulmozhi, Assistant Professor, Dhanalakshmi Srinivasan College of Engineering and Technology
Mrs. S. Jenitha, Assistant Professor, Dhanalakshmi Srinivasan College of Engineering and Technology
Ms. D. Sharmila :, Student, Dhanalakshmi Srinivasan College of Engineering and Technology

ABSTRACT Thyroid is arguably one of the most important parts of your body. As part of the endocrine system, this small gland in your neck secretes thyroid hormone, which is responsible for directing all your metabolic functions that means controlling everything from digestion to mood to energy. Early detection of thyroid diseases is the top priority for saving the lives of many. Typically, visual examination and manual techniques are used for these types of a thyroid disease's diagnosis. This manual interpretation of medical images demands high time consumption and is highly prone to mistakes. This leads to earlier prediction of the presence of the disease and allows us to take prior actions immediately to avoid further consequences in an effective and cheap manner avoiding human error rate.

1. INTRODUCTION

These are all the most common thyroid disorders and what we know (and don't know) about the causes of each. If you think you may have one of the conditions below, voice your concerns to your doctor so you can be appropriately screened and get your condition under control. Hypothyroidism is also referred to as underactive thyroid. In this situation, your thyroid doesn't make enough of the thyroid hormone, therefore, all of your body's important processes get slowed down. Weight gain, decreased appetite, fatigue, dry skin, and heavy periods are all hallmark symptoms of hypothyroidism, as your body's cells are unable to work at their normal level of efficiency.

The most common cause of an underactive thyroid is Thyroiditis, swelling of the thyroid gland (see below), according to the National Institutes of Health. Thyroiditis is essentially thyroid inflammation. Thyroiditis can cause pain in the thyroid, or lead it to produce too much or too little thyroid hormone. Some may start to develop symptoms over time, after the inflammation has been impactingthe thyroid for a while. The most common cause of thyroiditis is an autoimmune disease, which causes the immune system to mistakenly send antibodies to attack the thyroid gland. The specific one most frequently associated with thyroiditis (and that then causes hypothyroidism) is called Hashimoto's disease. Hashimoto's is more common in women, Baker says, and it tends to be inherited. Having another autoimmune disease can also increase your chances of developing Hashimoto's.

Having a viral or bacterial infection can also cause antibodies to attack the thyroid, similarly to Hashimoto's. Some medications, like the heart medication amiodarone, can also cause thyroiditis. Hyperthyroidism is when your thyroid is overactive and releasing too many hormones. Weight loss, increase in appetite, diarrhea, anxiety, and rapid heartbeat are all signs of hyperthyroidism.

The most common cause of hyperthyroidism is an autoimmune disease called Graves

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disease, where the body attacks the thyroid and causes it to overproduce thyroid hormones. Postpartum thyroiditis can also cause hyperthyroidism, as can thyroiditis caused by an infection in the body.

Goiter is simply a catch-all name for an enlarged thyroid, Baker says. Both hyper- and hypothyroidism can cause the thyroid to swell. Several nodules clumped together can also cause a goiter, as can thyroiditis, thyroid cancer, and even hormonal fluctuations during pregnancy.

According to the National Cancer Institute, there were an estimated 62,450new cases of thyroid cancer in 2014. The rate has been increasing in recent years, 51 which experts estimate is partly because new technologies have made it easier to detect. The full reason for this increase, though, is not yet known. The good news is that thyroid cancer is usually very treatable, and the survival rates are high. Thyroid cancer often presents without symptoms and just causes a goiter or nodules that usually will not impact the thyroid's function or cause any pain in the early stages. As it progresses and cancerous nodules grow, you may experience pain in the neck, difficulty swallowing, or a hoarse voice.

2. MATERIALS & METHODS

Deep learning is a computer software that mimics the network of neurons in a brain. It is a subset of machine learning and is called deep learning because it makes use of deep neural networks.

Deep learning algorithms are constructed with connected layers

A. The first layer is called the Input Layer.

B. The last layer is called the Output Layer.

C. All layers in between are called Hidden Layers. The word deep means the network join neurons in more than two layers.

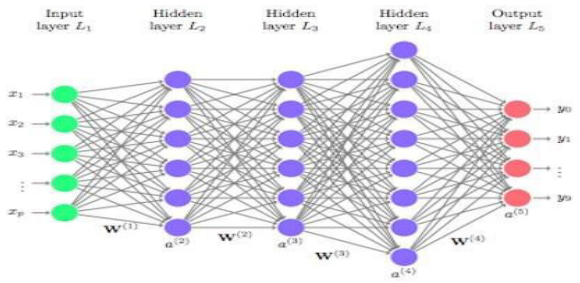

FIG 1. Deep Learning Layers

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Each Hidden layer is composed of neurons. The neurons are connected to each other. The

neuron will process and then propagate the input signal it receives the layer above it. The strength of the signal given the neuron in the next layer depends on the weight, bias and activation function. The network consumes large amounts of input data and operates them through multiple layers; the network can learn increasingly complex features of the data at each layer. Deep learning is a powerful tool to make prediction an actionable result. Deep learning excels in pattern discovery (unsupervised learning) and knowledge based prediction. Big data is the fuel for deep learning. When both are combined, an organization can reap unprecedented results in term of productivity, sales, management, and innovation. 51 Deep learning can outperform traditional method. For instance, deep learning algorithms are 41% more accurate than machine learning algorithm in image classification, 27 % more accurate in facial recognition and 25% in voice recognition.

A deep neural network provides state-of-the-art accuracy in many tasks, from object detection to speech recognition. They can learn automatically, without predefined knowledge explicitly coded by the programmers.

FIG 2. Deep Learning Process

To grasp the idea of deep learning, imagine a family, with an infant and parents. The toddler points objects with his little finger and always says the word's cat.' As its parents are concerned about his education, they keep telling him 'Yes, that is a cat' or 'No, that is not a cat. The infant persists in pointing objects but becomes more accurate with cats. The little kid, deep down, does not know why he can say it is a cat or not. He has just learned how to hierarchy complex features coming up with a cat by looking at the pet overall and continue to focus on details such as the tails or the nose before to make up his mind. A neural network works quite the same. Each layer represents a deeper level of knowledge, i.e., the hierarchy of knowledge. A neural network with four layers will learn more complex feature than with that with two layers.

The following shows survey did for thyroid. The most popular of the existing techniques is been discussed as follows.

We aimed to propose a highly automatic and objective model named online transfer learning (OTL) for the differential diagnosis of benign and malignant thyroid nodules from ultrasound (US) images. Methods: The OTL method combined the strategy of transfer learning and online learning. Two datasets (1750thyroid nodules with 1078 benign and 672 malignant nodules, and 3852 thyroid nodules with 3213 benign and 639 malignant nodules) were collected

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to develop the model. The diagnostic accuracy was also compared with VGG-16basedtransfer learning model and different input images based model. Analysis of receiver operating characteristic (ROC) curves were performed to calculate optimal area under it (AUC) for benign and malignant nodules. Results: AUC, sensitivity and specificity of OTL were 0.98 (95% confidence interval [CI]: 0.97-0.99), 98.7%(95% confidence interval [CI]: 97.8%-99.6%) and 98.8% (95% confidence interval[CI]: 97.9%-99.7%) in the final online learning step, which was significantly better than other deep learning models ($P < 0.01$).OTL achieved the most accurate 51 differential diagnosis of benign and malignant thyroid nodules comparing with transfer learning and multi-ROI based model.

A. Pros: OTL achieved the most accurate differential diagnosis of benign and malignant thyroid nodules comparing with transfer learning and multi-ROI based model.

B. Cons: Only benign and malignant form of thyroid presence is detected in the existing system.

Age-specific thyroid phantoms corresponding to 5, 10, 15 years-old and the adult case have been designed and manufactured with a 3D printer. Reference measurements of the counting efficiency have been carried out for thyroid in vivo monitoring of 131 I with all these phantoms. These measurements where performed for the emergency mobile units of IRSN. The full efficiency curve, between 29 and 1000 keV, was then obtained by Monte-Carlo calculations and validated by comparison of a large set of measurements. The obtained efficiency curves are consistent and show that the relative difference in efficiency between the adult and the children case are energy dependent. The developed thyroid phantoms enabled to obtain age specific calibration factors for emergency in vivo monitoring of children. Taking into account the size of thyroid for up take measurement might be also useful in nuclear medicine department. Indeed, the 51 treatment of benign thyroid disease, like Grave's disease, requires a personalized do simetry and hence personalized thyroid retention function.

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[CI]: 97.9%-99.7%) in the final online learning step, which was significantly better than other deep learning models (P < 0.01).OTL achieved the most accurate differential diagnosis of benign and malignant thyroid nodules comparing with transfer learning and multi-ROI based model.

Thyroid is arguably one of the most important parts of your body. As part of the endocrine system, this small gland in your neck secretes thyroid hormone, which is responsible for directing all your metabolic functions—that means controlling everything from digestion to mood to energy. When the thyroid malfunctions, it can affect every facet of your health. Both researchers and doctors are facing the challenges of fighting with thyroid diseases. In that thyroid disease is a major cause of formation in medical diagnosis and in the prediction, onset to which it is a difficult axiom in the medical research. Thyroid gland is one of the most important organs in our body. The secretions of thyroid hormones are culpable in controlling the metabolism.

Hyperthyroidismand hypothyroidism are one of the two common diseases of the thyroid that releases thyroid hormones in regulating the rate of body's metabolism. Early detection of thyroid diseases is the top priority for saving the lives of many. Typically, visual examination and manual techniques are used for these types of a thyroid disease's diagnosis. This manual interpretation of medical images demands high time consumption and is highly prone to mistakes. This leads to earlier prediction of the presence of the disease and allows us to take prior actions immediately to avoid further consequences in an effective and cheap manner avoiding human error rate.

3.RESULTS & DISCUSSIONS

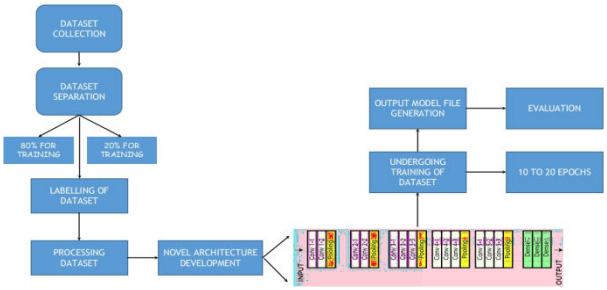

FIG 3.1 System Architecture

We will be able to determine the presence of thyroid diseases in the CT images or x-rays. So, initially the first step will be dataset collection where we will be collecting dataset such as CT images or x-rays which are used by the laborites to analysis the presence of thyroid diseases

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from various resources through internet. After that, we will be splitting those datasets into different categories that is we will be splitting the dataset into training and testing dataset. In training datasets, we will be using the dataset for training the module whereas testing dataset is used to evaluate the model when it is been completely ready. So training dataset first undergoes the process called dataset augmentation, where the dataset is multiplied into many datasets then it will undergo the process called preprocessing, which is to make all sizes into single size.

We train that datasets by extracting the features using a novel algorithm. It undergoes a process called optimization which will optimize the model and loss minimization which will reduce the noises generated during training. In the last it will be undergoing a process is called model serialization which will be evaluated after generating model using the testing dataset and predict the presence of thyroid diseases. Thus, this method provides an effective and cheap method to determine the presence of thyroid diseases than the methodologies used nowadays. A data set is a collection of data. Deep Learning has become the go-to method for solving many challenging real-world problems. It's definitely by far the best performing method for computer vision tasks. The image above show cases the power of deep learning for computer vision. With enough training, a deep network can segment and identify the "key points" of every person in the image. These deep learning machines that have been working so well need fuel lots of fuel; that fuel is data. The more labeled data available, the better our model performs. The idea of more data leading to better performance has even been explored at a large-scale by Google with a dataset of 300 Million images! When deploying a Deep Learning model in a real-world application, data must be constantly fed to continue improving its performance. And, in the deep learning era, data is very well arguably the most valuable resource. There are three steps of collecting data.

Manually finding and downloading images takes a long time simply due to the amount of human work involved. The task probably has some kind of common objects are to be detected. And so that becomes the keyword for web-scraping. It also becomes the class name for that object. From the sounds of it this is of course every easy for a task such as image classification where the images annotations are quite coarse. But to do something like instance segmentation? Every single pixel in the image is required. To get those, it's best to use some really great image annotation tools that are already out there..

Since data has become such a valuable commodity in the deep learning era, many start-ups have started to offer their own image annotation services they'll gather and label the data. Given a description of what kind of data and annotations needed. Mighty is one that has been doing self-driving car image annotation and has become pretty big in the space were at CVPR

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2018 too. Payment AI are less specialized than Mighty AI, offering image annotation for any domain. They also offer a couple more tools such as video and landmark annotations.

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To begin with, testing of the trained model, we can split our project into modules of implementation that is done. Dataset collection involves the process of collecting different thyroid diseases data set. Various datasets were collected and done example among the collected dataset can be found below

FIG 4. Dataset Collected

These datasets are then preprocessed to form an equal aspect ratio so that it can be made ready for training with the model. The datasets are separated into different categories to undergo preprocessing which can be seen in the below figure

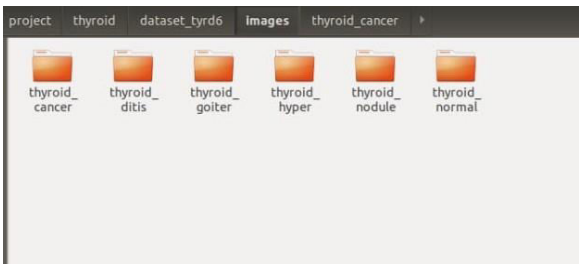

FIG 5. DATASET SEPERATION

After this the final implementation is done where the training process takes place and the results are obtained. In order to run the code, first we need to go inside the project folder and select the location to run from there such that the location of the code is the main thing to be considered. This can be seen in the following figure below

4. CONCLUSION & FUTURE REFERENCE

Here we find the presence of thyroid diseases and provide prior measures to avoid the disease. This also help in providing efficient treatment in almost cheap way and eventually reduce the time required for finding the thyroid diseases in the current state. it is done manually which consumes more time and also involves human error rate. So, reduces the time required for manual classification and eliminates the human error rate by this project.

In the coming future, we review the application of the thyroid diseases determine technology in the healthcare field and it can promote for detecting various types of cancer with more accuracy. In medical field they are more chance to develop or convert this project in many ways. Thus, this project has an efficient scope in coming future where manual predicting can be converted to computerized production in a cheap way

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