

An Identification and Classification of Thyroid Diseases Using Deep Learning Methodology

C. Shobana Nageswari¹; M.N. Vimal Kumar²; C. Raveena³; J. Sostika Sharma⁴; M. Yasodha Devi⁵

¹Associate Professor, Department of ECE, R.M.D. Engineering College, Tamil Nadu, India.

¹shobananageswari79@gmail.com

²Assistant Professor, Department of ECE, R.M.D. Engineering College, Tamil Nadu, India.

²vim19kum@gmail.com

³Assistant Professor, Department of ECE, R.M.D. Engineering College, Tamil Nadu, India.

³cjraveena@gmail.com

⁴UG Student, Department of ECE, R.M.D. Engineering College, Tamil Nadu, India.

⁵UG Student, Department of ECE, R.M.D. Engineering College, Tamil Nadu, India.

Abstract

The thyroid is one of the most important parts of our body. As part of the endocrine system, this tiny gland in our neck releases thyroid hormone, which is responsible for directing all your metabolic functions which means controlling everything from digestion to conversion to energy. When thyroid dysfunction, it can affect all aspects of our health. Both researchers and doctors face challenges in fighting thyroid disease. In that thyroid disease is a major cause of the emergence of medical diagnostics and prognosis, the beginning of which is a difficult confirmation in medical research. Thyroid hormones are suspected to regulate metabolism. Hyperthyroidism and hypothyroidism are one of the two most common thyroid diseases that release thyroid hormones to regulate the rate of digestion. Early detection of thyroid disease is a major factor in saving many lives. Frequently, visual tests and hand techniques are used for these types of diagnostic thyroid diseases. This manual interpretation of medical images requires the use of time and is highly affected by errors. This work is developed to successfully diagnose and detect the presence of five different thyroid diseases such as Hyperthyroidism, Hypothyroidism, Thyroid cancer, thyroid gland, Thyroiditis and general thyroid screening without the need for several consultations. This leads to predictable disease progression and allows us to take immediate steps to avoid further consequences in an effective and cost-effective way to avoid the human error rate. A web application will also be developed where a scanned image of the inclusion will provide the removal of the most time-consuming thyroid type and patient investment.

Key-words: Thyroid Diseases, Learning Methodology, Time-consuming.

1. Introduction

Hypothyroidism is also called an underactive thyroid. In this case, the thyroid does not make enough thyroid hormone, therefore, all the vital processes in the body are reduced. Weight gain, weight loss, fatigue, dry skin, and difficult periods are all prominent symptoms of hypothyroidism, as our immune cells are unable to regain their normal level of functioning. Thyroiditis is actually an inflammation of the thyroid gland. Thyroiditis can cause pain inside the thyroid, or lead to an overdose or insufficient hormone. Some may begin to develop symptoms over time, after the inflammation has had a temporary effect on the gut. The most common definition of thyroiditis is an autoimmune disease, which causes the system to accidentally send antibodies to invade the thyroid. Something that is often associated with thyroiditis is called Hashimoto's disease. Hypothyroidism is more common in women, and tends to be inherited. Having another autoimmune disease can also increase the chances of developing Hashimoto's. Hyperthyroidism is overactive and releases too many hormones. Weight loss, increased appetite, diarrhea, anxiety, and rapid heartbeat are all symptoms of hyperthyroidism.

The most common cause of hyperthyroidism is an autoimmune disease called Grave disease, in which the body attacks the thyroid gland and causes overproduction of thyroid hormones. Postpartum thyroiditis can also cause hyperthyroidism, as does thyroiditis caused by an infection. A nodule is simply an abnormal growth of cells, which may be solid or fluid-filled. Thyroid tumors are common. Most are dangerous, and exist without manifestation. The only way to know this is to pay attention to a lump in the neck or take it during a routine medical examination or scan. According to the National Cancer Institute, there were an estimated 62,450 cases of thyroid cancer in 2014. The rate has been increasing over the years, which is being tested by experts in part because new technologies have made it easier to find. The exact cause of this increase, however, is still unknown. Thyroid cancer is highly treatable, so survival rates are high.

2. Related Work

Online Transfer Benign and Malignant Thyroid Differential Diagnosis was studied with Ultrasound images. The diagnostic accuracy was also compared with a VGG-16-based study model with a different imaging input model. They used OTL method only to found the presence of thyroid [1] available.

Estimates of old thyroid tests in vivo monitoring uses the Monte-Carlo calculation. Effective curves available are consistent and show that the difference in efficacy between the adult and pediatric case depends on the strength. Accuracy is not satisfied [2].

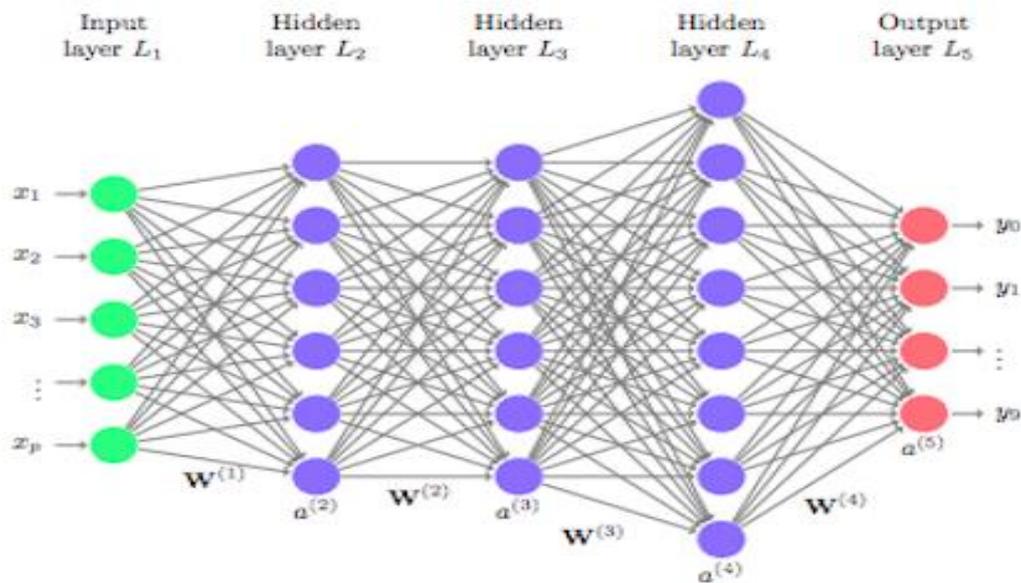
Evaluated the Standard Resolution PET-CT Scanner with an HRRT Brain Scanner for imaging small tumors within the head. Performance of HRRT is fairly poor compared to the other methods [3].

3. Methodology

The thyroid is one of the most important parts of our body. As part of the process, this tiny gland in our neck releases hormones, which are responsible for regulating all our metabolic functions which means controlling everything from digestion to conversion to energy. When the thyroid malfunctions, it can affect all aspects of our health. Both researchers and doctors face challenges in fighting thyroid disease. Thyroid disease can be a major factor in the formation of the diagnosis and within the predicament, the beginning of which is a difficult confirmation in medical research. Thyroid hormones are suspected to regulate metabolism. Hyperthyroidism and hypothyroidism are one of the two most common thyroid diseases that release thyroid hormones to regulate body speed. Early detection of thyroid disease is a major factor in saving many lives. Frequently, visual tests and hand techniques are used for these types of thyroid diagnosis. This manual interpretation of medical images requires the use of time and is highly affected by errors. Therefore, this work is developed to effectively identify the presence of five different thyroid diseases such as Hyperthyroidism, Hypothyroidism, Thyroid cancer, thyroid gland, Thyroiditis and general thyroid screening without the need to consult various physicians. This leads to predictable disease progression and allows us to take immediate steps to avoid further consequences in an effective and cost-effective way to avoid the human error rate. A web application will also be developed where a scanned image of the inclusion will provide the removal of the most time-consuming thyroid type and patient investment.

Deep learning: It is a computer software that copycats the network of neurons in a brain. It is a subclass of machine learning and is termed as deep learning because it makes use of deep neural networks. Various layers of deep learning is shown in Figure 1.

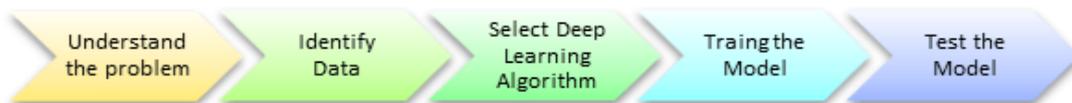
Figure 1 - Deep Learning Layers



1. The Top most layer is named as input layer
2. The bottom most layer is termed as Output Layer
3. All layers linking are called Hidden Layers. The word deep means the network connect neurons in more than two layer.

DEEP LEARNING PROCESS: The deep neural network provides the completeness of a wide range of activities, from object acquisition to speech recognition. They can read automatically, without having to rewrite the information explicitly written by the program.

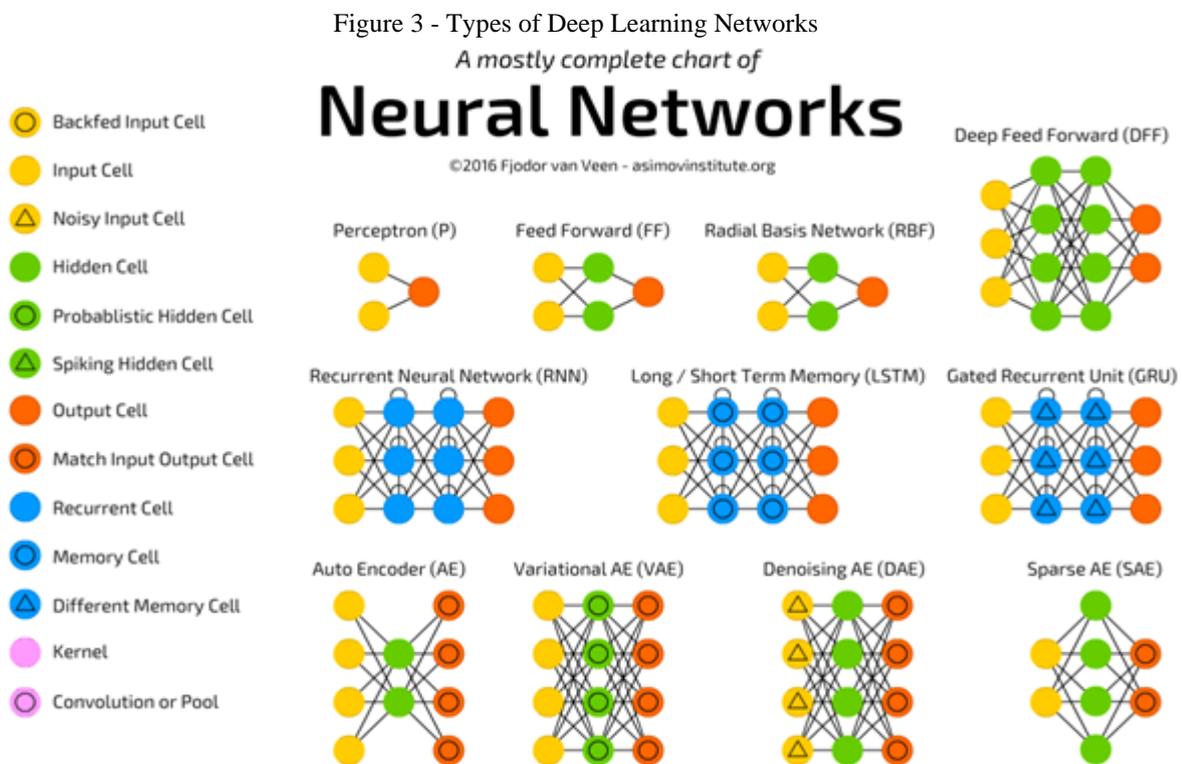
Figure 2 - Deep Learning Process



To understand the idea of deep learning, think of family, babies and parents. A small child points to objects along with his little one and often means the word 'cat.' Concerned about her education, her parents constantly told her 'Yes, that's a cat' or 'No, that's not a cat. The brain continues to point to objects but is more accurate with cats. A little child, deep down, doesn't know why he can't say whether he is a cat or not. He has just learned how to use the intricate aspects of royalty that come with a cat by looking at the whole animal and continuing to focus on details like tails or noses before making his point.

Classification of Neural Network

Deep neural network: Shallow neural network has only one hidden layer between input and output. Deep neural networks have a single layer. For example, the GoogleLeNet image recognition model counts 22 layers. Types of deep learning networks shown in Figure 3.



Feed-Forward Neural Networks: A simple type of neural implant network. With this type of structure, the data flows to one side, forward. That is, the information glide starts in the first layer, goes to the "hidden" layers, and ends in the output layer. The network does not have a loop. The details depend on the output layers.

Recurrent neural networks (RNNs): RNN can be a multi-layer network that will store data on content nodes, allowing it to detect data sequences and output variations or other sequences. In simple terms man-made network is designed for communication between neurons including traps. RNNs are compatible with processing input sequences.

Convolutional Neural Networks (CNN): CNN can be a multimedia neural network with a single structure designed to extract complex information elements in each layer in order to produce results. CNN is well-suited for visual **purposes**.

ReactJS: ReactJS is basically an ASCII library file, a JavaScript library used to build links directly to one-page applications. Used to manage the readings of network and mobile applications. React also allows the United States of America to create non-functional UI components. React was originally developed by Jordan Walke, a Facebook-based code. React allows developers to create large net programs that can change details, while not reloading the page. The main purpose of the React is to speed up and simplify. Works only on user interface in app. This is the connection that should be considered within the template. It is usually used in combination with other JavaScript libraries or frames.

4. Working

Figure 4 and Figure 5 show the system design and application development. The first step will be data collection where we will be collecting data such as CT images or x-rays used to provide the presence of thyroid diseases from various online sources. Moreover, the data set will be divided into different categories i.e. dividing the database into data training and testing. Training datasets will be used to train the module and the test dataset is used to test the model when it is completely ready. Therefore Database training begins with a process called dataset.

Figure 4 - System Architecture

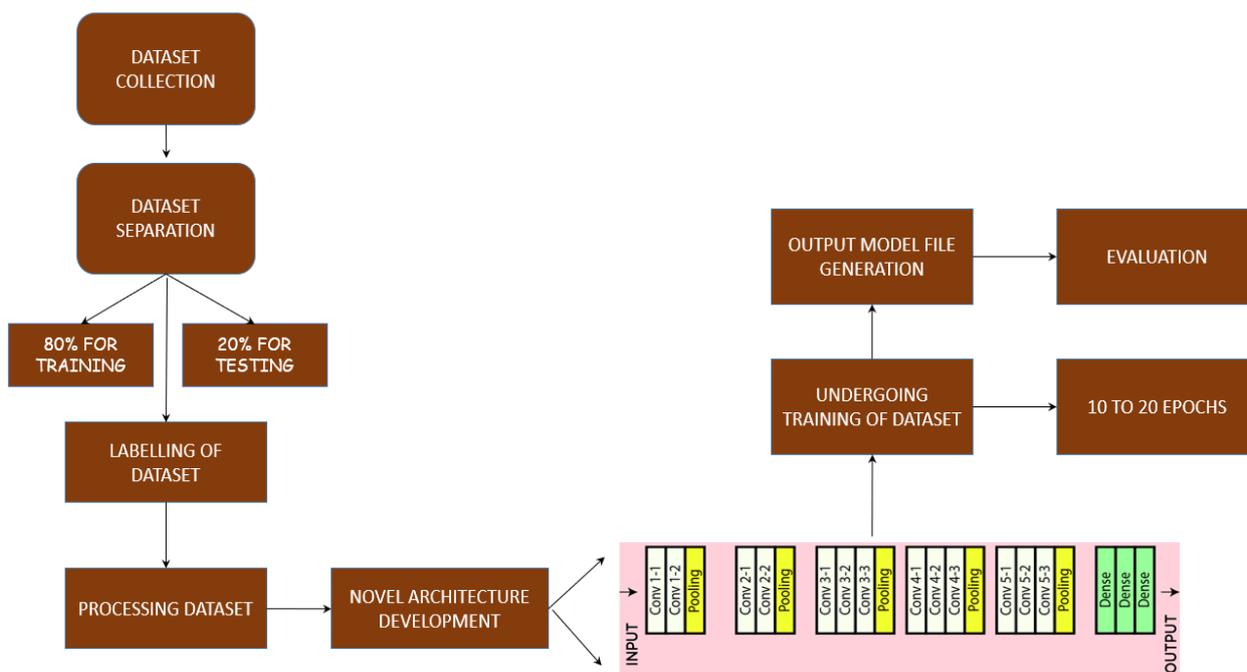
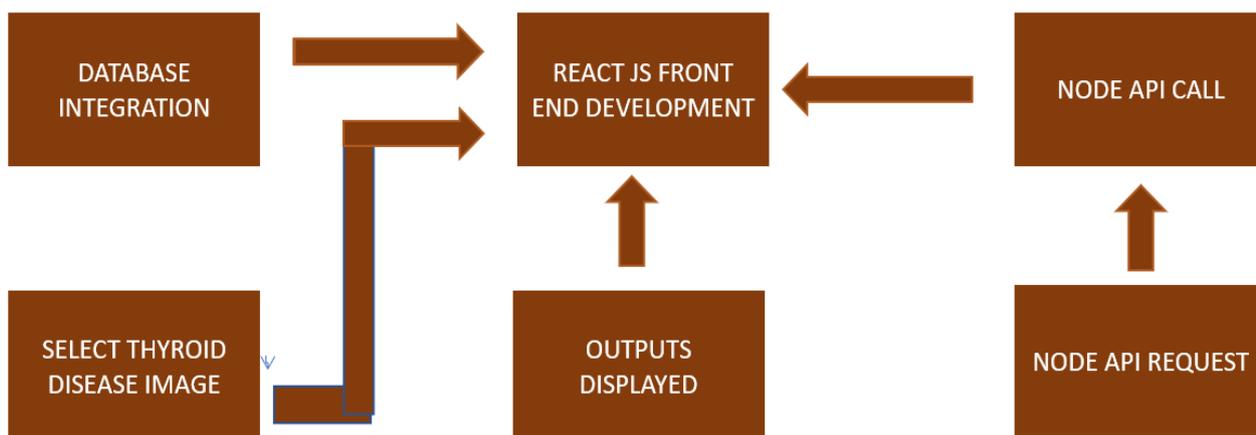


Figure 5 - Application Architecture



Augmentation, when the database is multiplied into multiple data sets then it will undergo a process called processing, which makes all sizes into one size. We train those data sets by extracting features using in-depth novel writing techniques.

It continues with a process called optimization that will extend the model and minimize losses that will reduce the noise generated during training. Eventually it will proceed with a process called model seriation that will be tested after modeling using a database to diagnose and predict the presence of thyroid diseases. A web application using a javascript framework reactJS will also be developed in which an input scanned image will give the output of the type of thyroid disease saving a lot of time and money invested by the patients. However, this method provides an effective and inexpensive way to determine the presence of thyroid diseases than the methods used these days.

5. Thyroid Prediction Using Deep Learning Architecture

Novel Architecture

Figure 3 shows the Novel Architecture. In this work a novel architecture is developed to effectively identify and detect five different types of thyroid diseases such as Hyperthyroidism, Hypothyroidism, Thyroid cancer, Thyroid nodules, Thyroiditis.

Figure 6 - Novel Architecture

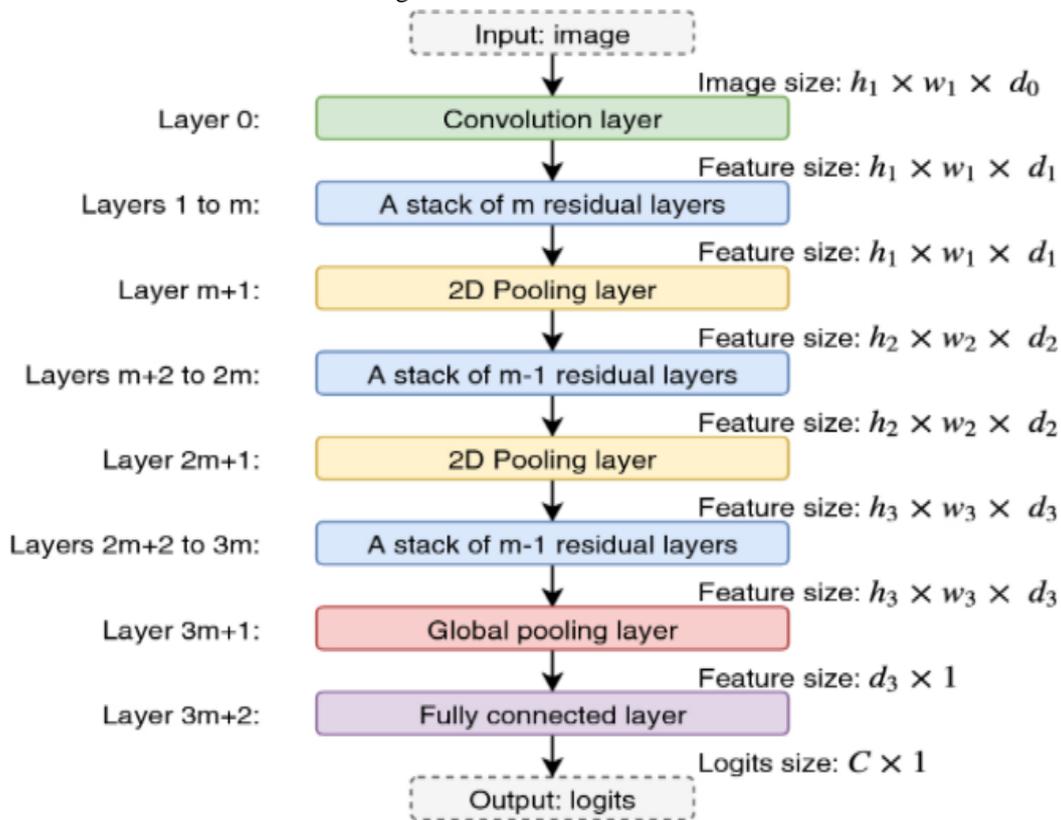


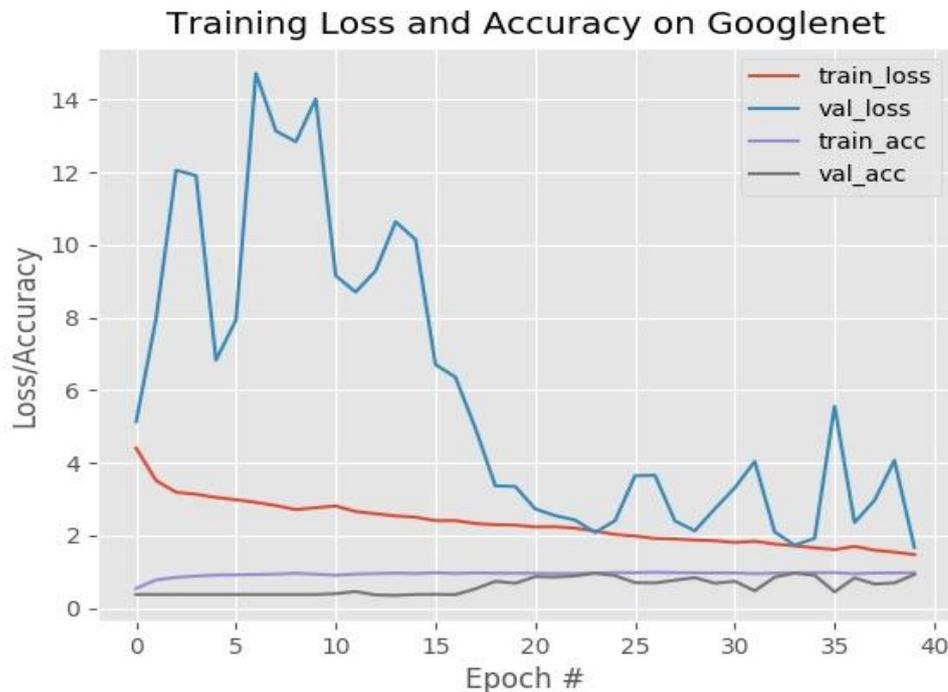
Figure 7 - Graph after the Training Process Using Novel Architecture



GOOGLNET ARCHITECTURE: GOOGLNET ARCHITECTURE: Google is a 22-layer deep convolutional neural network separate from the Inception Network, a Deep Convolutional Neural Network developed by Google researchers. The GoogLeNet architecture introduced in the ImageNet Large-Scale Visual identification Challenge 2014 (ILSVRC14) solved computer visual

functions such as image classification and object detection. Today GoogLeNet is recognized for other computer viewing activities such as face recognition and knowledge, and training.

Figure 8 - Graph Plot After the Training Process of Googlenet Architecture



6. Web Development

Microsoft Visual Studio throughout this project aims to create the use of IDE Microsoft Visual Studio associates in Nursing integrated development surroundings (IDE) from Microsoft. Visual Studio uses Microsoft software development platforms such as the Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It will keep all the traditional code and managed code. Visual Studio covers a code editor that supports IntelliSense (part of code completion) compiled as a reusable code. A separate system always works as a source level system and a machine level system. Completely different integration tools include code profile, computer programming designer, web designer, classroom designer, and information schema designer. It accepts plug-ins that improve usage at almost every level in addition to adding support for administrative applications and adding new toolsets such as domain language programmers and designers or tools for a variety of pc code development tools.

Figure 9 - Input Image Uploaded

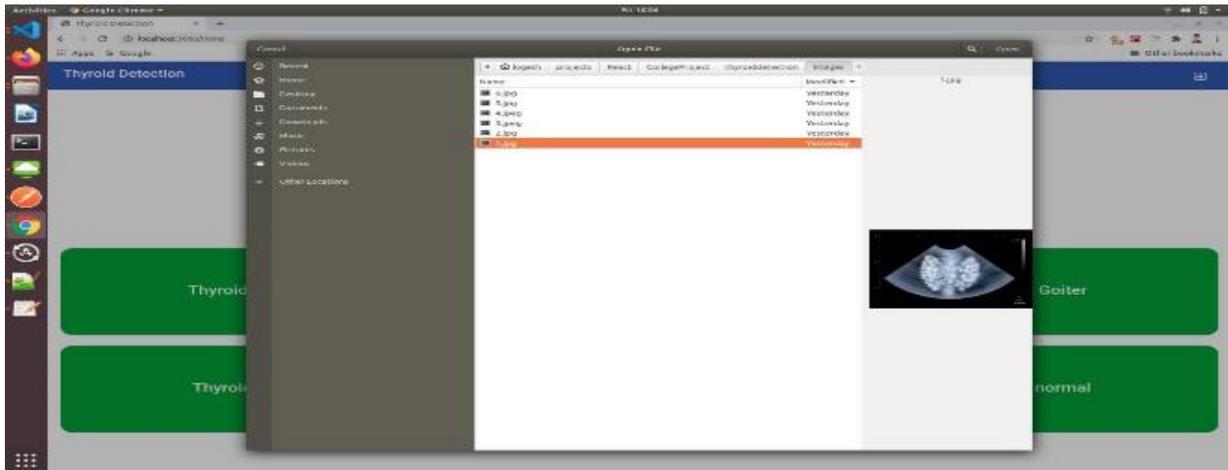


Figure 10 - Results Obtained

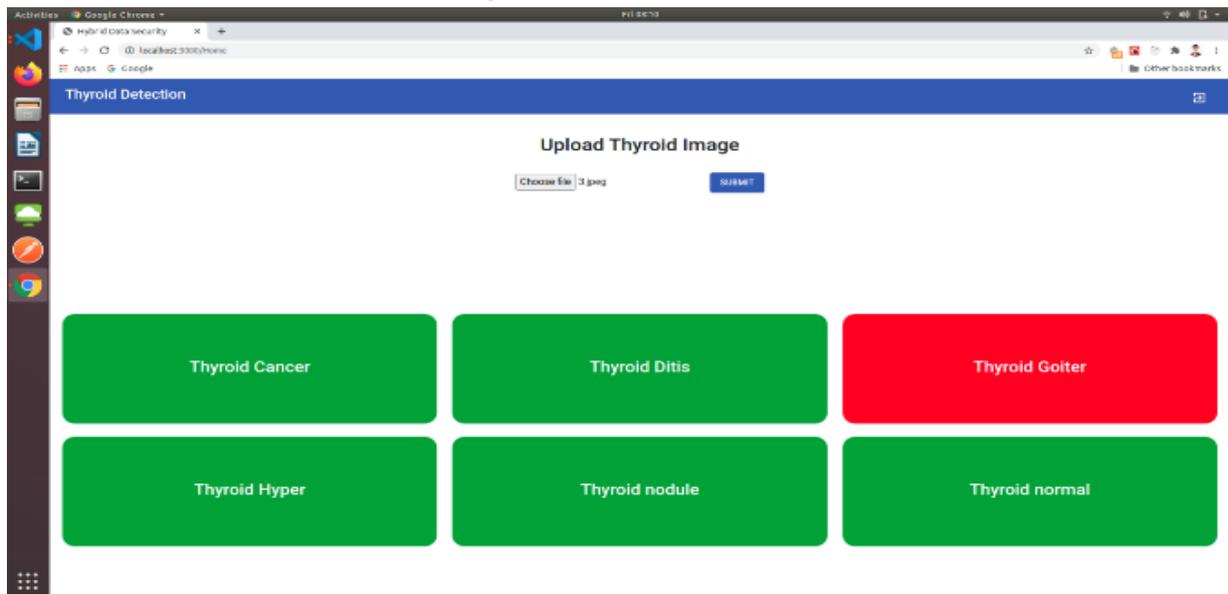


Figure 6 shows the uploaded thyroid input image. Result is shown in the figure 7 after processing. Figure 7 indicates the type of thyroid disease.

7. Conclusion

This work is used to find the presence of thyroid diseases and provide prior measures to avoid the disease, using a web application developed using react JS. This also help in providing efficient treatment in a most cheap way and eventually reduce the time required for finding the thyroid diseases in the current state. Manual identification consumes more time and also involves human error rate.

Thus this method reduces the time required for manual classification and eliminates the human error rate.

8. Future Work

This work will be promoted for detecting various types of cancer with more accuracy. In medical field they are more chance to develop or convert this work in many ways. Thus, this work has an efficient scope in coming future where manual predicting can be converted to computerized production in a cheap way.

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