# CLASSIFICATION OF ULTRASOUND IMAGES FOR THYROID DETECTION USING SVM

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***Abstract*: Nowadays the health issue is being worried a lot and so the workload of a doctor becomes comparatively huge. In current scenario, unidentified thyroid has lots of serious medical issues. So, to reduce the workload, the image segmentation and classification of thyroid ultrasound images is most necessary. In our proposed project, the thyroid ultrasound images are taken for further processing. The US images first undergo a pre-processing stage, involving processes like grayscale conversion, intensity calculation and histogram equalization. Most commonly, GLCM algorithm is being used for the segmentation of ultrasound images. The feature output that is obtained is then applied to the PCA as input. All the features extracted from each data are combined into a single matrix for classification with the help of PCA. For classification purposes, The classifier is SVM. In our proposal, classification is done by CNN because SVM is a binary classifier whereas CNN classifier is more efficient compared to SVM.**

***Keywords*: Thyroid Ulrasound Images, PCA, GLCM, SVM.**

## I. Introduction

The **thyroid**, or **thyroid gland**, is an endocrine gland in the neck consisting of two connected lobes. The lower two thirds of the lobes are connected by a thin band of tissue called the thyroid isthmus. The thyroid is located at the front of the neck, below the Adam's apple. Microscopically, the functional unit of the thyroid gland is the spherical thyroid follicle, lined with follicular cells (thyrocytes), and occasional parafollicular cells that surround a lumen containing colloid. The thyroid gland secretes three hormones: the two thyroid hormones – triiodothyronine ($T_3$) and thyroxine ($T_4$) – and a peptide hormone, calcitonin. The thyroid hormones influence the metabolic rate and protein synthesis, and in children, growth and development. Calcitonin plays a role in calcium homeostasis.[1] Secretion of the two thyroid hormones is regulated by thyroid-simuating hormone (TSH), which is secreted from the anterior pituitary gland. TSH is regulated by thyrotropin-realising hormone (TRH), which is produced by the hypothalamus. In this chapter, the introduction of entire thyroid gland is given, **Hyperthyroidism** often causes a variety of non-specific symptoms including weight loss, increased appetite, insomnia, decreased tolerance of heat, tremor, palpitations, anxiety and nervousness. In some cases it can cause chest pain, diarrhoea, hair loss and muscle weakness. Such symptoms may be managed temporarily with drugs such as beta blockers. Hypothyroidism is managed with replacement of the hormone thyroxine. This is usually given daily as an oral supplement, and may take a few weeks to become effective. Some causes of hypothyroidism, such as Postpartum thyroiditis and Subacute thyroiditis may be transient and pass over time, and other causes such as iodine deficiency may be able to be rectified with dietary supplementation.

## II. Methodology

Image pattern recognition and classification techniques for medical ultrasonic images are necessary to reduce the workload of the clinical doctor. In our work, initially the ultrasound image is preprocessed, segmented and features are extracted to diagnose the type of thyroid disorder present. Then the thyroid ultrasound images are taken into account. It undergoes a preprocessing stage, segmentation followed by feature extraction by means of Support Vector Classifier (SVC).

After that features are extracted, it is compared with the predefined datasets that are completely trained and classified by using the SVM classifier in the classification module.

Pre-Processing – (Scale Conversion, Intensity Measure, Binary Conversion)
- Diagnosis with the thyroid ultrasound sample image
- Segmentation is done by GLCM (Gray Level Co-occurrence Matrix) Features
- Feature Extraction by PCA (Principal Component Analysis)
- Classification with Support Vector Classifier (SVM)

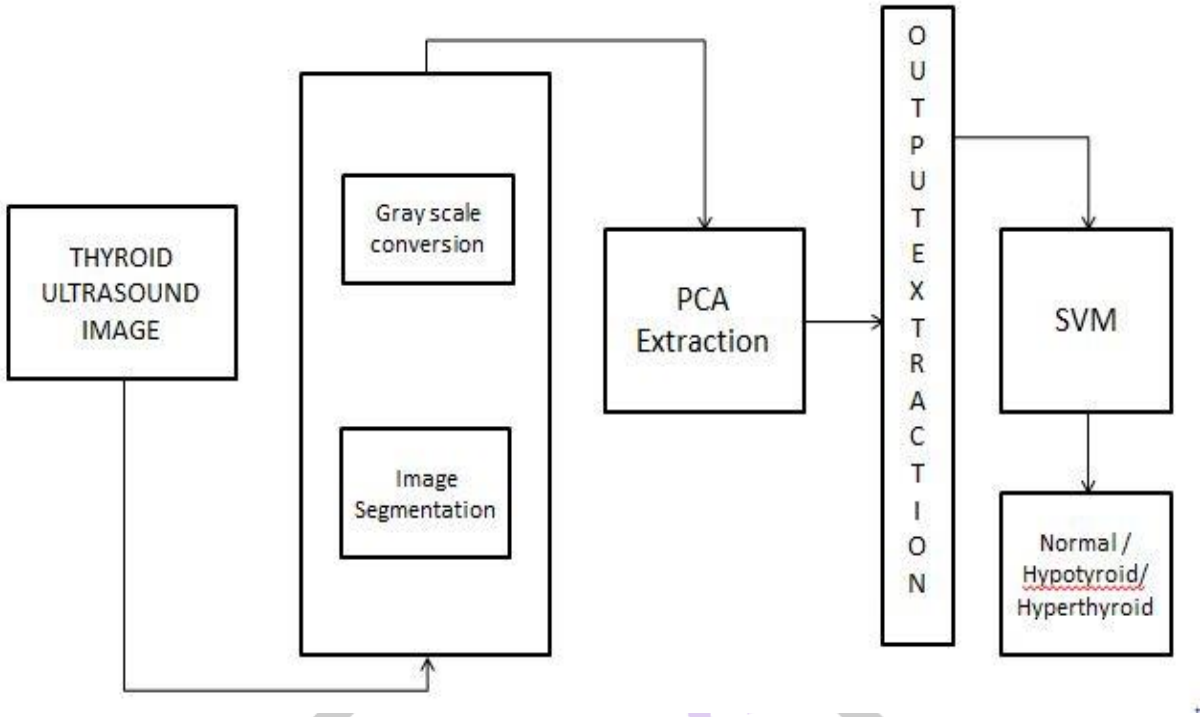


**Figure:** High level architecture diagram for Classification of Ultrasound images for Thyroid Detection using Support Vector Machine (SVM) technique.

The software components utilized in this project are as follows:
1. Thyroid ultrasound images
2. Python3.6
3. Packages
4. Computer System (from 4GB RAM)

### 2.1 PYTHON 3.6

**Python 3.6** the asyncio module is no longer provisional and its API is considered stable. A new file system path protocol has been implemented to support path-like objects. All standard library functions operating on paths have been updated to work with the new protocol. This specific software makes the easier for implementing the variables and function as well as condition. The accuracy is much considerable than other and it can be convertible to every user-friendly environment.

### 2.2 PACKAGES

The term 'PACKAGE' act as the head of the program. Each packages used in this program specifies the various functions that takes place as per the instruction of the block diagram. The packages used in this program is given as,

```
import cv2
import numpy as np
import os
import glob
from skimage import feature
from sklearn.svm import LinearSVC
import matplotlib.pyplot as plt
```

The allocation of variables, Implementation of images, Segmentation of images, Comparison of input to standard values, Displaying of images etc. These are done by these packages.

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### 2.3 GLCM

Grey Level Co-Occurrence matrix is one of the oldest techniques used for texture analysis. The Grey Level Co-Occurrence matrix has two important parameters i.e. distance and direction. In this paper various combinations of distance and directional angles used for GLCM calculation are analyzed in order to recognize certain patterned images based on their textural features.

Patterns considered in this paper are horizontally striped, vertically striped, right diagonally striped, left diagonally striped, checkered and irregular.

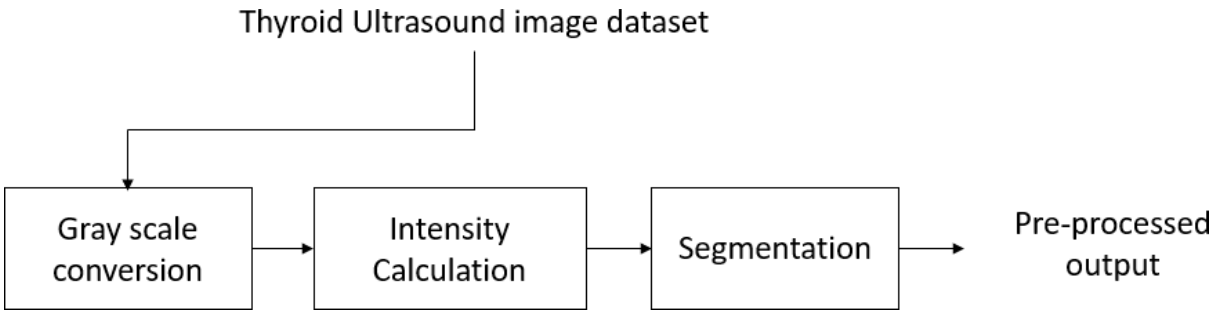


**Figure:** Pre-processing module of UL thyroid image

**2.4 SVM**

After segementation of the mage, SVM plays the vital role by comparing the dataset with the actual input values then its displays the iterations that takes place in the image and evaluated values in form of tabulation. The test database is the input that taken from the patient to check whether he/she has specific thyroid disorder. The train database is the standardized data that used for the comparison process. The final classification is done when it is processed with the model program

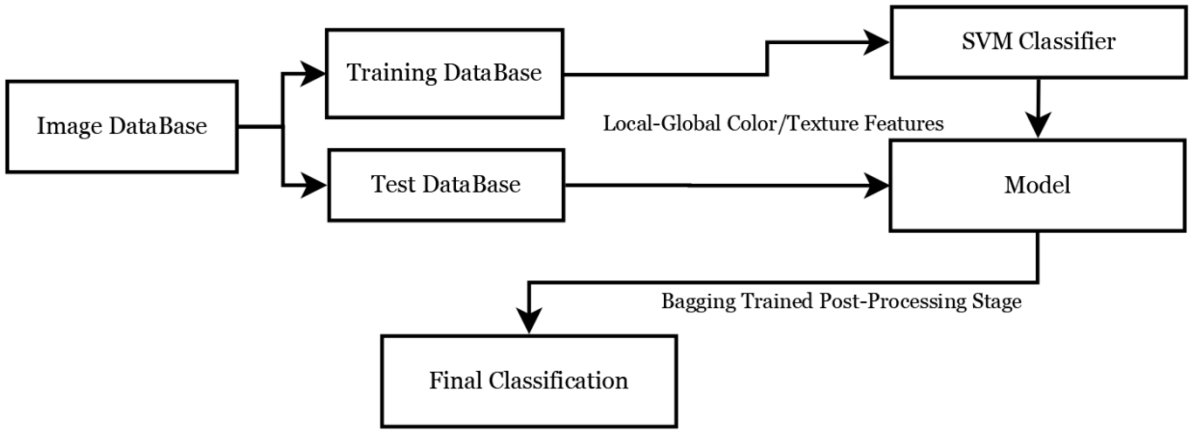


**Figure:** Feature Extraction module using SVM

**2.5 PCA**

PCA is to determine directions (or) principal components along with the variation in the data which is maximal. In other words, the process of PCA is the reduction of the dimensionality of a huge data to two or three principal components, which can be visualized graphically, with minimal loss of data.

## V. Conclusion

In this project, we have proposed a model for the classification of the thyroid by using support vector machine. The model evaluate the thyroid images and check whether the given image is of which type of image. In this process, the Gray Level Co-occurrence Matrix is used for segmentation of image increases the efficiency by reducing the time complexity and Principal Component Analysis take the values of all the outputs is taken into consideration which proves to be advantageous. We have used the SVM classifier since it is a self-learning algorithm that alters its parameters based on internal and external information that moves through the network.

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