

# A Detection of Amblyopia using Image Processing and Machine Learning Techniques

**K. Praveen<sup>1\*</sup>, S.Lalitha<sup>2</sup>, S.Gopinath<sup>2</sup>**

<sup>1</sup>M.E. Student, <sup>2</sup>Assistant Professor

<sup>1,2</sup>Department of Computer Science & Engineering,

Gnanamani College of Technology, Namakkal, Tamil Nadu, India

**Email:** praveendebugger@gmail.com

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## Abstract

*Amblyopia is an eye disease occurred due to the failure of interconnection between the brain and the eye. It typically affects the vision of children and kids. Using image processing and machine learning techniques validate the user name and password then proceed to capture image and if it is valid then use the canny edge detection techniques to detect the amblyopia. If validation is success means test the training data using KNN Algorithm, Logistic Regression and Random Forest Classifier(RFC). Comparing to other algorithm RFC is more accurate to detect the amblyopia. It is nothing but lack of coordination between eye and brain. It could be a new visual process disorder which ends within the patient perceiving a blurred image from one in all their eyes that isn't rectifiable with glasses or contact lenses. We used SPYDER IDE, Open CV, and python programming language for image processing and machine learning algorithm. It can result from any condition that prevents from the eye from focusing clearly. The Input parameters taken as for the sample dataset are namely gender, age, cataract, myopia, hyperopia, strabismus, and class.*

**Keywords:** Amblyopia, KNN, Logistic Regression, RFC

## INTRODUCTION

Amblyopia is the exact cause of visual impairment among children, specifically 2-3% of children being affected. If it is not cleared by childhood mostly it will replicate in adulthood. It also affects the other normal eye. The brain and the eyes are coordinated to produce vision. It is also called as lazy eye [1].

## EXISTING SYSTEM

Usually the treatment of amblyopia is provided to the child to use the eye with weaker vision. The two most common solution to treat amblyopia are patching and atropine and the other methods are vision exercises, contact lenses, and by regular eye drops to the weaker vision. In olden days, amblyopia was assumed to be a retinal defect. It has now been well established through animal studies that amblyopia represents functional and

morphological effects of visual deprivation on the visual cortex (advanced methods). Based on the retina studies, we should identify the eye issues earlier [2]. A best method to analyze amblyopia in childhood by experiment the visual test initially and it should be rectified with small visual activities. When amblyopia occurred, it can be cured if adequately treated in children less than 6-7 years of age. Even in existing patients, visual improvement can be achieved with therapy. Present research is focused at developing substances and delivery modes that will allow the sensitive period of visual development to be manipulated, increasing the period during which it can develop and enhancing preventative and therapeutic measures. Research is contributing to current understanding of causes, prevention and treatment of amblyopia is discussed. At most many new

treatment methods have been tried; it still seems to be the most successful therapy [3,4].

#### Disadvantages of Existing System

- It takes more time to predict amblyopia.
- It requires new systematic approaches or methods to treat the disease.

#### PROPOSED SYSTEM

##### Implementation of Knn Algorithm using python for Detecting Amblyopia Eye Disease

- Handling the data
- Calculate the distance
- Find k nearest point
- Predict the class
- Check the accuracy

##### Implementation of Logistic Regression Algorithm using python for Detecting Amblyopia Eye Disease

##### Logistic Regression

It produces results in a binary format which is used to classify the result of a dependent input variable. It is used when the dependent variable is binary i.e., the number of dependent variable is two such as, the result of logistic regression are

- Yes and No
- True and False
- High and Low
- Pass and Fail

##### Implementation of Random Forests Classifier Algorithm using python for Detecting Amblyopia Eye Disease

It is a supervised learning algorithm. It is mainly used for classification and regression. It is more flexible and easier to use algorithm. A forest is classified into trees. It refers to more trees it has, the more robust a forest is. It creates a decision trees on randomly selected data set, gets prediction from each tree and opt the optimal solution by means of voting. It also provides accurate results (Figure 1).

It has a plenty of applications, such as recommendation engines, image classification and feature selection. It can be used to classify genuine loan applicants, identify fraudulent activities and predict diseases. It works based on the Boruta algorithm, which opt important features in a sample dataset.

##### How does the algorithm work?

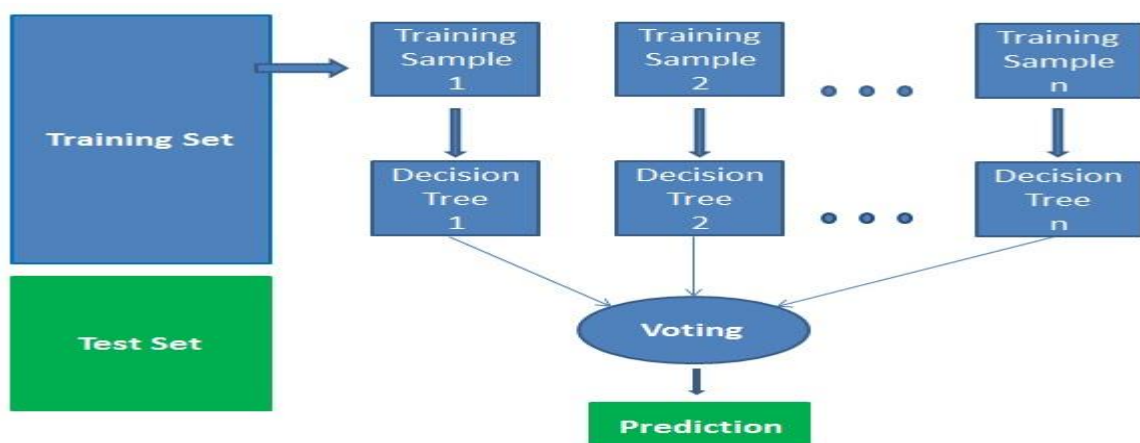
It works in four steps:

**Step1:** Select random samples from a given dataset.

**Step2:** Construct a decision tree for each sample and get a prediction result from each decision tree.

**Step 3:** Perform a vote for each predicted result.

**Step 4:** Select the prediction result with the most votes as the final prediction.



*Figure 1: Random Forests Classifier Algorithm*

## SYSTEM SPECIFICATIONS

### Hardware Requirements

- System : Pentium IV 2.4 GHz.
- Hard Disk : 40 GB.
- Monitor : 15 VGA Colour.
- Mouse : Logitech.
- Ram : 512 Mb.
- High resolution image capture device

### Software Requirements

- Operating system : Windows / MAC / LINUX
- Navigator : Anaconda
- Image processing tool: Open CV
- IDE : Spyder
- Programming language : Python

## METHODOLOGY

Methodology Method used in this project can be classified in two steps

- Image Processing and Feature Extraction
- Supervised learning

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### Image Processing and Feature Extraction

This is the most important step of the project as textures obtained will be taken as input material for neural nets which will classify the images in their respective classes.

### Image compression

We may take eye images in various perspectives and its size may vary according to quality of images. Our motto is to split them in different classes. Based on the heterogeneous dataset, image size also varies.

### Feature extraction

It is the most important step in image processing. It is classified into canny edge detection and thresholding.

Canny edge detection

In this step we proceed towards finding perimeters of all 3 layers. This is done by canny edge detection. In canny edge detection Gaussian filters are applied then using double threshold edge of intensity variation part is detected.

Thresholding

It classifies the original image into various layers. It can be done by adaptive thresholding.

### Implementation of KNN Algorithm using Python

- Handling the data
- Calculate the distance
- Find k nearest point
- Predict the class
- Check the accuracy

### Logistic Regression

It produces output in a binary format which is used to predict the result of an expected variable. It is mostly used when the required variable is binary i.e., the number of available input categories is two such as, the usual outputs of logistic regression are as follows

- Yes and No
- True and False
- High and Low
- Pass and Fail

### Random Forests Classifier

It is a type of supervised learning algorithm. It is mainly used for classification and regression. It is more flexible and easier to use algorithm. A forest is classified into trees. It refers to more trees it has, the more robust a forest is. It creates a decision trees on randomly selected data set, gets prediction from each tree and opt the optimal solution by means of voting. It also provides accurate results.

It has a plenty of applications, such as recommendation engines, image classification and feature selection. It can be used to classify genuine loan applicants,

identify fraudulent activities and predict diseases. It works based on the Boruta algorithm, which opts important features in a sample dataset.

### How does the algorithm work?

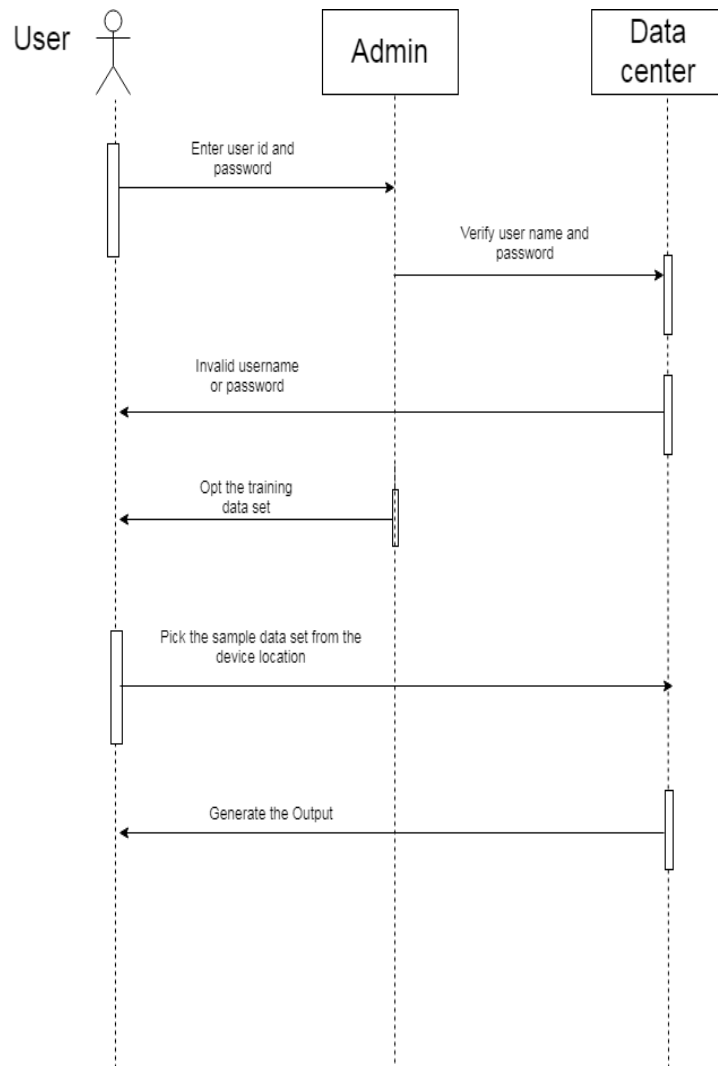
It works in four steps:

**Step1:** Select random samples from a given dataset.

**Step2:** Construct a decision tree for each sample and get a prediction result from each decision tree.

**Step 3:** Computes a vote for each predicted result.

**Step 4:** Opt the prediction result with the most votes as the final prediction.



**Figure 2:** Sequence Diagram

### RESULT

```

run file
('D:/PythonPrograms/Amblyopia/Amblyopia.py',
wdir='D:/PythonPrograms/Amblyopia')
<class 'pandas.core.frame.DataFrame'>
Int64Index: 1728 entries, 0 to 1727
Data columns (total 7 columns):
Gender 1728 non-null object
  
```

```

Age 1728 non-null object
Cataract 1728 non-null object
Myopia 1728 non-null object
Hyperopia 1728 non-null object
Strabismus 1728 non-null object
Class 1728 non-null object
dtypes : object (7)
memory usage: 60.8+ KB
['Boy' 'Girl'] 2
  
```

```
['five' 'eight' 'three' 'four' 'six' 'two' 'one'
'five' 'seven']      9
['yes' 'no']          2
['yes' 'no' '4']      3
['yes' 'no']          2
['no' 'yes']          2
['unacc' 'acc' 'vgood' 'good'] 4
Boy    1329
Girl   399
Name: Gender, dtype: int64

six440
eight415
seven412
three124
four121
two 95
one48
five48
five25
Name: Age, dtype: int64

yes929
no799
Name: Cataract, dtype: int64

yes943
no779
4      6
Name: Myopia, dtype: int64

yes 1134
no594
Name: Hyperopia, dtype: int64

yes1152
no576
Name: Strabismus, dtype: int64

unacc1210
acc384
good69
vgood65
Name: class, dtype: int64

{'C': 1, 'multi_class': 'multinomial',
'solver': 'newton-cg'}
70.96774193548387
C:\ProgramData\Anaconda3\lib\site-
packages\sklearn\metrics\classification.py:
```

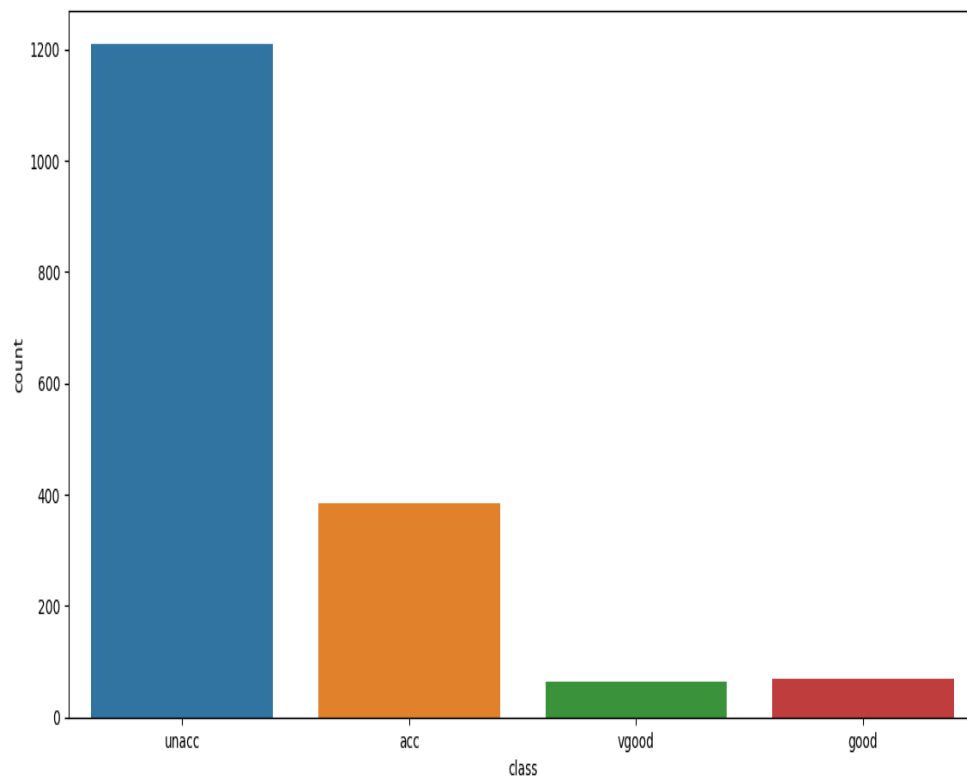
```
1143: UndefinedMetricWarning: Precision
and F-score are ill-defined and being set to
0.0 in labels with no predicted samples.
'precision', 'predicted', average, warn_for)
C:\ProgramData\Anaconda3\lib\site-
packages\sklearn\metrics\classification.py:
1143: UndefinedMetricWarning: Precision
and F-score are ill-defined and being set to
0.0 in labels with no predicted samples.
'precision', 'predicted', average, warn_for)
C:\ProgramData\Anaconda3\lib\site-
packages\sklearn\metrics\classification.py:
1143: UndefinedMetricWarning: Precision
and F-score are ill-defined and being set to
0.0 in labels with no predicted samples.
'precision', 'predicted', average, warn_for)
precision recall f1-score support

0      0.28      0.28      0.28      118
1      0.08      0.16      0.11      19
2      0.77      0.78      0.78     358
3      0.00      0.00      0.00      24

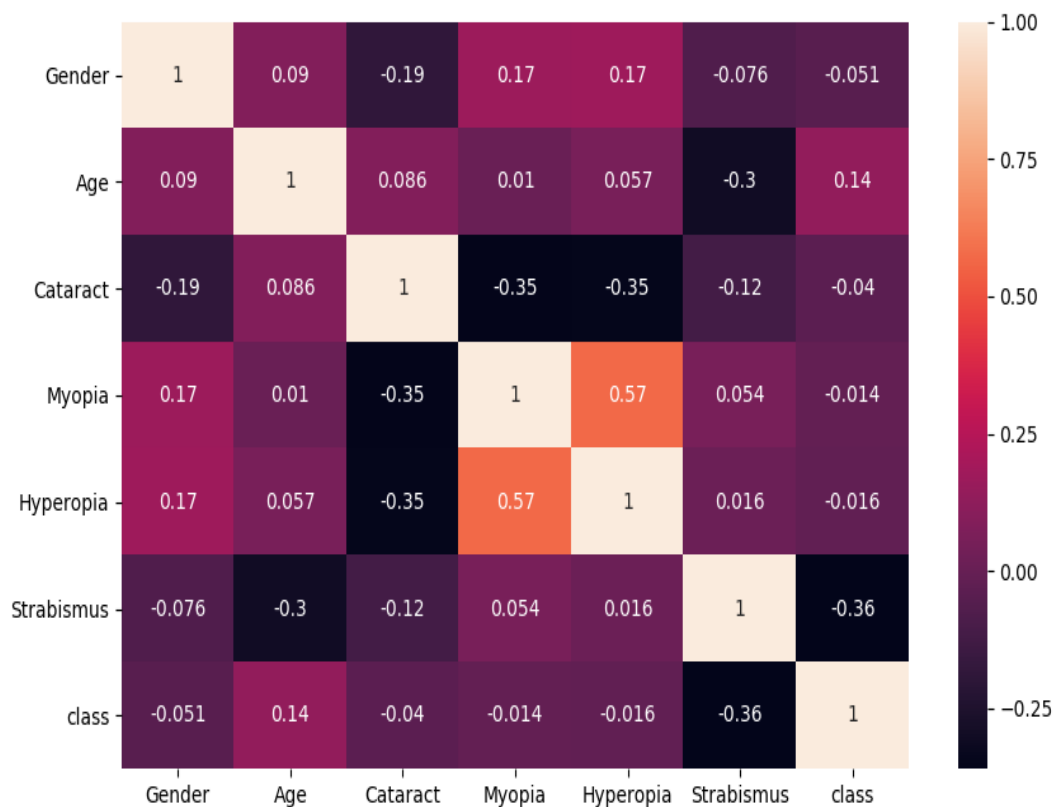
microavg      0.61      0.61      0.61     519
macroavg      0.28      0.31      0.29     519
weightedavg  0.60      0.61      0.60     519

C:\ProgramData\Anaconda3\lib\site-
packages\sklearn\ensemble\forest.py:246:
FutureWarning: The default value of
n_estimators will change from 10 in
version 0.20 to 100 in 0.22.
"10 in version 0.20 to 100 in 0.22.",
FutureWarning) 66.66666666666666
30.844463062441474
C:\ProgramData\Anaconda3\lib\site-
packages\sklearn\metrics\classification.py:
1143: UndefinedMetricWarning: F-score
is ill-defined and being set to 0.0 in labels
with no predicted samples.
'precision', 'predicted', average, warn_for)
{'criterion': 'gini', 'max_depth': 5,
'max_features': 2, 'max_leaf_nodes':
None} 71.05045492142267
Index(['Gender', 'Age', 'Cataract', 'Myopia',
'Hyperopia', 'Strabismus'], dtype='object')
[0.05331111  0.37306533  0.0817321
0.07007619 0.04430057 0.3775147 ]
67.4373795761079
```

## SCREEN SHOTS

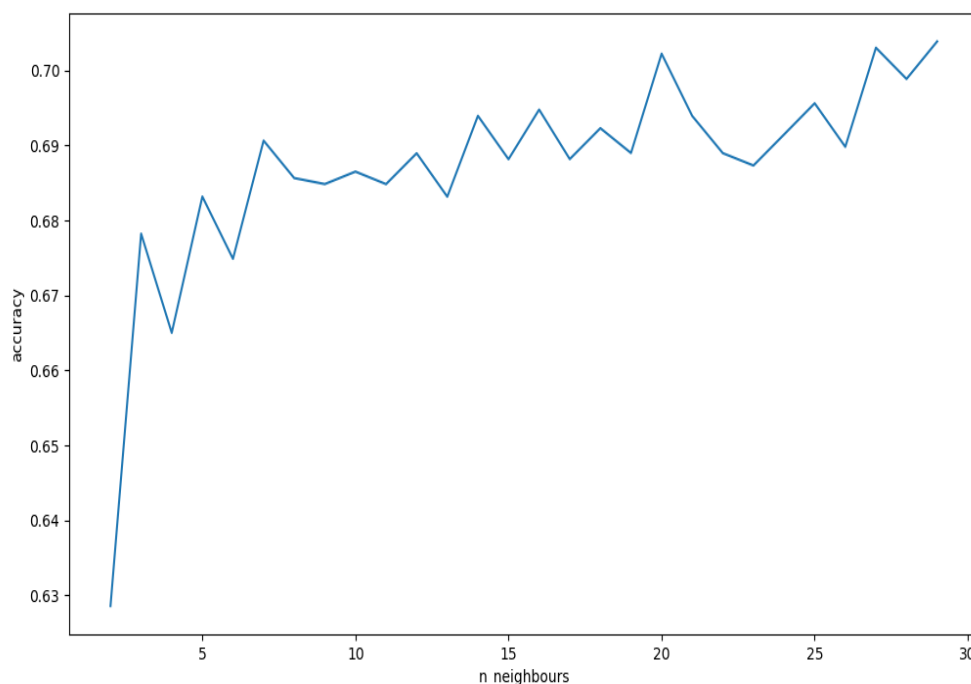


*Figure 3: Classes of input variables*



*Figure 4: Confusion matrix of input variables*





**Figure 5: Knn accuracy**

## CONCLUSION

In future, amblyopia is easily identified by using various systematic approaches. Using efficient algorithms we can able to detect the amblyopia earlier and achieve the best accuracy rate. In the forthcoming days there would be chance for getting the inputs dynamically from the patients. Surely this project could be remedy for the amblyopia affected persons.

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