An Industrial Mini Project Report

on

EVALUATION OF MACHINE LEARNING ALGORITHMS FOR THE DETECTION OF FAKE BANK CURRENCY

Submitted By

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Under the Esteemed Guidance of

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to

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

In partial fulfilment of the requirements for award of degree of

BACHELOR OF TECHNOLOGY

IN

INFORMATION TECHNOLOGY

DEPARTMENT OF INFORMATION TECHNOLOGY

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(Sponsored by Malla Reddy Educational Society)

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Affiliated to JNTU, Hyderabad, Accredited by NBA & NAAC with 'A' Grade
Estd : 2007

Department of Information Technology

CERTIFICATE

This is to certify that this is the certificate of an industrial oriented mini project report titled "**EVALUATION OF MACHINE LEARNING ALGORITHMS FOR THE DETECTION OF FAKE BANK CURRENCY**" is submitted by **DOMMATA SAI TEJA REDDY (20W91A1212) , KARRI DILIP KUMAR (20W91A1218) , CHILUKOORI AKHIL (20W91A1209) , PAIRALA SATHISH (20W91A1238) , VARAGANTI VARSHINI (20W91A1255)** of B. Tech in the partial fulfilment of requirement for the degree of Bachelor of Technology in Information Technology, Department of Information Technology and this has not been submitted for award of any other degree of this institution.

Internal Examiner **Head of the Department**

External Examiner

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DECLARATION

We hereby declare that the Mini Project report entitled "**EVALUATION OF MACHINE LEARNING ALGORITHMS FOR THE DETECTION OF FAKE BANK CURRENCY**" submitted to Malla Reddy Institute of Engineering and technology (Autonomous), affiliated to Jawaharlal Nehru Technological University Hyderabad (JNTUH), for the award of the degree of Bachelor of Technology in Information Technology is a result of original industrial oriented mini project done by us. It is further declared that the project report or any part there of not been previously submitted to any University or Institute for the award of degree of diploma.

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ABSTRACT

The one important asset of our country is Bank currency and to create discrepancies of money miscreants introduce the fake notes which resembles to original note in the financial market. During demonetization time it is seen that so much of fake currency is floating in market. In general, by a human being, it is very difficult to identify forged note from the genuine not instead of various parameters designed for identification as many features of forged note are similar to original one. To discriminate between fake bank currency and original note is a challenging task. So, there must be an automated system that will be available in banks or in ATM machines.

To design such an automated system there is need to design an efficient algorithm which is able to predict weather the banknote is genuine or forged bank currency as fake notes are designed with high precision. In this proposed system six supervised machine learning algorithms are applied on dataset available on UCI machine learning repository for detection of Bank currency authentication. To implement this, we have applied Support Vector machine, Random Forest, Logistic Regression, Naïve Bayes, Decision Tree, K- Nearest Neighbor by considering three train test ratio 80:20, 70:30 and 60:40 and measured their performance on the basis various quantitative analysis parameter like Precision, Accuracy, Recall, MCC, F1-Score and others. And some of SML algorithm are giving 100 % accuracy for particular train test ratio**.**

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CHAPTER 1

INTRODUCTION

Many people conduct financial transactions every second, and one of our country's most important assets is its currency, the bank note. Fake notes are introduced into the market to create financial market discrepancies, even if they look like the real thing. For the most part, they are illegally created to perform various tasks. As in the late 19th century, forgery has been on the rise dramatically in 1990. The advancement of technology in the twentieth century has made it easier for fraudsters to create counterfeit money that looks exactly like the real thing, making it nearly impossible to tell the difference. An economic collapse is inevitable as a result. Falsified bank currency must be protected in order to stop this and ensure smooth transaction circulation. A human being is unable to tell the difference between genuine bank currency and counterfeit currency. We can tell if a banknote is genuine by looking for certain characteristics on it. Fraudsters, on the other hand, produce counterfeit notes that have nearly identical features to the real thing, making it nearly impossible to tell the two apart. It is now mandatory that ATMs and banks have systems in place to distinguish forged notes from genuine ones. Artificial intelligence (AI) and machine learning (ML) can play an important role in the design of a system that can distinguish between a forged banknote and the genuine article.

1.1 MOTIVATION

The motivation behind the evolution of machine learning in identifying fake bank currency notes is to combat financial fraud and ensure the integrity of our monetary systems. By leveraging advanced algorithms and data analysis, machine learning helps in accurately detecting counterfeit currency, protecting individuals and businesses from financial losses, and maintaining trust in the banking system. It's all about making our financial transactions safer and more secure.

1.2 PROBLEM STATEMENT

Forgery was not a major issue in 1990, but as in the late nineteenth century, it has skyrocketed in recent years. As technology advances in the twenty-first century, fraudsters will be able to create counterfeit money that looks and feels exactly like the real thing, making it nearly impossible to tell the difference. An economic collapse is inevitable as a result. Falsified bank currency must be protected in order to put a stop to this and ensure smooth transaction circulation. A human being is unable to tell the difference between genuine bank currency and counterfeit currency. There are some features on the government-issued banknotes that allow us to verify their authenticity. False notes with nearly identical features are being produced by fraudsters with increasing precision, making it increasingly difficult to distinguish between a fake and a real note. It is our goal to develop a model that can tell whether Currency is fake or real by looking at a variety of variables.

1.3 OBJECTIVES

The main objective is Machine learning has indeed been used to develop algorithms for identifying fake bank currency notes. By analyzing various features and patterns, these algorithms can detect counterfeit notes with high accuracy.

CHAPTER 2

LITERATURE SURVEY

EVALUATION OF MACHINE LEARNING ALGORITHMS FOR THE DETECTION OF FAKE BANK CURRENCY

AUTHOR: Tarun Jain; Vivek Kumar Verma

Abstract:

The one important asset of our country is Bank currency and to create discrepancies of money miscreants introduce the fake notes which resembles to original note in the financial market. During demonetization time it is seen that so much of fake currency is floating in market. In general by a human being it is very difficult to identify forged note from the genuine not instead of various parameters designed for identification as many features of forged note are similar to original one. To discriminate between fake bank currency and original note is a challenging task. So, there must be an automated system that will be available in banks or in ATM machines. To design such an automated system there is need to design an efficient algorithm which is able topredict weather the banknote is genuine or forged bank currency as fake notes are designed with high precision. In this paper six supervised machine learning algorithms are applied on dataset available on UCI machine learning repository for detection of Bank currency authentication. To implement this, we have applied Support Vector machine, Random Forest, Logistic Regression, Naïve Bayes, Decision Tree, K- Nearest Neighbor by considering three train test ratio 80:20, 70:30 and 60:40 and measured theirperformance on the basis various quantitative analysis parameter like Precision, Accuracy, Recall, MCC, F1-Score and others. And some of SML algorithm are giving 100 % accuracy for particular train test ratio.

L. Latha in market fake currency is the most important problem that speaks a lot. Due to the growth of technology, the fake currency production has been increased which degraded the economy of our country. Here the suggested method uses OpenCV to recognize whether the given note is original or fake. It consists of machine learning techniques that are carried out using suitable mechanisms. A fake currency detection method is introduced which uses the edge detection to detect the lines accurately and

also accurately detect curves of acceptable notes. Here we use a detector that is trained with the help of stored information which is similar to the one that is to be tested or compared later; within those modules, anchor lines are defined that are further depicted in subsequent test patterns. In order to provide training for the detector in offline a microprocessor is programmed. This is done with an sample currency obtained by scanning given note into our proposed method, here a frame like design is obtained by training image format. Then, notes similar to obtained frame are to be identified. Inside the template, the microprocessor determines anchor lines that are further depicted in that test format; it spins and moves the design before it matches to the training format, so that anchor lines which corresponds to the line can be identified in that trained dataset i.e. the pattern designed; and compares them with the test format to know if those anchor lines lies inside that test format. The system is proposed in a way that it shows if the currency is fake or it is original. We all know that Currency occupies an important place in our existence and hence it is very important for us to check its uniqueness. This system is useful in India because they use the paper currencies more.

Akanksha Upadhyaya Counterfeit currency is one of the threats which creates vice to nation's economy and hence impacts the growth worldwide. Producing forge currency or fabricating fake features in the currency considered to be a crime. Currency crime comes under the criminal law and known to be as Economical crime. Over the past few years many researchers have proposed various techniques to identify and detect forged currency. The serious problem has been come up with variety of solutions in terms of hardware related techniques, Image processing and machine learning methods. Advancements in printing and scanning technology, trading of material are some of the problems in germinating counterfeit currency. The study presents various fake currency detection techniques proposed by various researchers. The review highlighted the methodology implemented on particular characteristics feature with success rate of each method to detect counterfeited currency. Moreover, the study includes the analysis of widely acceptable statistical classification technique for currency authentication. The comparative analysis of Logistic Regression and Linear Discriminant Analysis (LDA) was performed to realize the better model for currency authentication. It has been found that classification Model using Logistic regression shows better accuracy of 99% then LDA. The study will benefit the reader in identifying most feasible technique to be implemented based on the accuracy rate.

P. Ashok Babu in this paper, we propose a system for currency recognition system and the detection of fake currency banknotes using image processing techniques. It is hard for people to perceive monetary forms from various nations. Our point is to help individuals with taking care of this issue. In any case, money acknowledgement frameworks that are in light of picture investigation are entirely not adequate. Our framework depends on picture handling and makes the procedure programmed and vigorous. Our aim to assist those folks that are not ready to recognize which country's currency note was. We use banknotes which are currency, may differ the size, texture, color. Our system helps in currency identification, which is a fake currency or not. In India,' currency' is Transaction, so there is more value for currency in our social and economic development. We have used MATLAB software to recognize other country currencies and fake currency. Modernization within the money-related framework ensures financial improvement, and nowadays, the government has become cognizant about this. Hence, Rs 1000 and Rs 500 notes' demonetization is the foremost upto-date case of it. However, we have Rs 2000 as another benefit showcase. In light of the top elevated worth note, quite possibly degenerate individuals will try to make it a fake. The real target of this project is to contemplate distinctive key highlights of recent certifiable money and utilize such systems to acknowledge and confirm new cash circled by India's depository institution. There are different strategies which are utilized to acknowledge fake notes and certifiable one. By utilizing various parts of Digital Image handling, such as picture preparing, Image Segmentation, feature extraction, and viewing pictures, we will then remove the highlights of certified notes. It is a problematic errand for recognizing counterfeit money.

Neeru Rathe Fake currency detection is a serious issue worldwide, affecting the economy of almost every country including India. The possible solutions are to use either chemical properties of the currency or to use its physical appearance. The approach presented in this paper is based upon physical appearance of the currency. Image processing algorithms have been adopted to extract the features such as security thread, intaglio printing (RBI logo) and identification mark, which have been adopted as security features of currency. To make the system more robust and accurate, the decisive score of all the three features has been fused to differentiate between real and fake currencies. The fake currency detection accuracy of the proposed system is 100%. Another parameter used to measure the performance of the proposed system is mean

square error, which is approximately 1%. It may be adopted by the common people as well, who quite often face the problem of differentiating between real and fake currencies.

Anju Yadav The one important asset of our country is Bank currency and to create discrepancies of money miscreants introduce the fake notes which resembles to original note in the financial market. During demonetization time it is seen that so much of fake currency is floating in market. In general by a human being it is very difficult to identify forged note from the genuine not instead of various parameters designed for identification as many features of forged note are similar to original one. To discriminate between fake bank currency and original note is a challenging task. So, there must be an automated system that will be available in banks or in ATM machines. To design such an automated system there is need to design an efficient algorithm which is able topredict weather the banknote is genuine or forged bank currency as fake notes are designed with high precision. In this paper six supervised machine learning algorithms are applied on dataset available on UCI machine learning repository for detection of Bank currency authentication. To implement this we have applied Support Vector machine, Random Forest, Logistic Regression, Naïve Bayes, Decision Tree, K- Nearest Neighbor by considering three train test ratio 80:20, 70:30 and 60:40 and measured theirperformance on the basis various quantitative analysis parameter like Precision, Accuracy, Recall, MCC, F1-Score and others. And some of SML algorithm is giving 100 % accuracy for particular train test rat

Rencita Maria Colaco Now a days due to the development in color printing technology the rate of counterfeit notes production and distribution is increasing. This is a massive problem, faced by almost all the countries. It affects the economy, sine it compromises the security of the real economy. Such counterfeit currencies are used to fuel nefarious motives, usually involving terrorist activities. According to the research, developing countries like India have been impacted by this very negatively. Even after the steps taken in 2016 to remove the counterfeits, by executing the demonetization of 500- and 1000-rupees bank notes in India the counterfeits of the new notes have begun circulating. This is due to the highly advanced technology adopted by the counterfeiters which makes the tracking of these counterfeit notes hard. This has become a very critical issue and the negative impact due to the counterfeit currency keeps rising. The only one solution for this problem for a common man is to detect the fake currency, by using the

fake currency detector machine. These machines are used in banks and large-scale business, but for a small business or for a common man these machines are not affordable. This paper gives the complete methodology of fake note detector machine, which is affordable even for a common man. By implementing the applications of image processing techniques, we can find out whether the currency notes are fake or not. Image processing technique consists of a number of operations that can be performed on an image, some of which include image segmentation, edge detection, gray scale conversion etc. The proposed system will have advantages like simplicity, reliability and costs less.

Aman Bhatia This paper deals with the matter of identifying the currency that if the given sample of currency is fake. Different traditional strategies and methods are available for fake currency identification based on the colors, width, and serial numbers mentioned. In the advanced age of Computer science and high computational methods, various machine learning algorithms are proposed by image processing that gives 99.9% accuracy for the fake identity of the currency. Detection and recognition methods over the algorithms include entities like color, shape, paper width, image filtering on the note. This paper proposes a method for fake currency recognition using K-Nearest Neighbors followed by image processing. KNN has a high accuracy for small data sets making it desirable to be used for the computer vision task. In this, the banknote authentication dataset has been created with the high computational and mathematical strategies, which give the correct data and information regarding the entities and features related to the currency. Data processing and data Extraction is performed by implementing machine learning algorithms and image processing to acquire the final result and accuracy.

CHAPTER 3

SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

It is a SML model that may be used for classification as well as regression problems of prediction but mainly in industry it is used for classification problems. KNN is lazy algorithm means it learns very slowly as its training is very slow due to the consideration of whole dataset for classification. And it is also known as parametric learning algorithm as it will not consider any information form the underlying data. Basically, KNN uses the concept of feature similarity to find out the new data point values [9] i.e., the value assigned to the new data point is based on the matching of its value to the points of training set [9]. KNN is applied on dataset by considering three different train test ratios (80:20, 60:40, and 70:30) to predict whether the bank currency is forged or genuine. For train test ratio 80:20 ROC curve and learning curves are drawn see Fig. 5(a). Accuracy of SVM is observed around

3.2 EXISTING SYSTEM DISADVANTAGES

1.Less Accuracy

2. Low Efficiency

3.3 PROPOSED SYSTEM

Probabilistic NN method is used for classification of bank currency and in LVQ classifier is used for detecting note authentication. Both the papers authors applied above approaches on US Dollars data set. Recognition of euro banknotes has been proposed by using perceptron of three layer and to classify bank currency into a particular class by considering input as an image of bank currency. The back propagation method is used to train the model. Further for validation radial basis function is used to discard the invalid data.

3.4 PROPOSED SYSTEM ADVANTAGES

1.High Accuracy

2. High Efficiency

3.5 ALGORITHMS

Support Vector Machine

It is a supervised machine learning algorithm known as SVM (Support Vector Machine). In the short and medium term, this model outperforms other models in terms of accuracy. In order to learn patterns and make predictions, every algorithm has a different approach. By analysing the weekly NIKKEI 225 index trend, the SVM model can predict the financial trend. With a line or hyperplane, SVM is the boundary that best separates two classes of data from one another. Equation establishes the decision threshold. Kernel functions such as linear, non-linear, sigmoid, radial basis function (RBF), and polynomial are used by SVMs to separate classes that were previously indistinguishable.

Logistic Regression

Hypothesis states that the cost function should be restricted to a value between 0 and 1 It is possible to use logistic regression as a classifier for observations. The logistic sigmoid function is used to transform the algorithm's output into a probability value, and the target is predicted using this probability value. Unlike linear regression, which uses a simple logistic function, the Logistic Regression model makes use of the more complex sigmoid function. Logistic regressions.

KNN (K-Nearest Neighbor) Algorithm

A non-parametric algorithm, lazy learning, and a lack of assumptions about underlying data distribution are typical properties of KNN. To find targets, the method follows a series of steps:

Step 1: The first step is to begin.

Step 2: Separate the dataset into training and testing samples.

Step 3: Decide which distance function to use by selecting the value of K.

Step 4: Choosing a sample from the test data is the fourth step.

Step 5: Put an end to it.

Decision Tree

The goal is to build a model that can predict a target value by learning simple decision rules derived from the data features. Using this method has the advantage of being simple to interpret and comprehend, as well as being able to solve problems involving multiple outputs. For both regression and classification problems, Decision Trees are a common supervised learning technique used. Its goal is to predict a target using simple decision rules derived from the dataset and its related features. An advantage of using this model is its ability to solve problems with varying outputs; on the other hand, overfitting is a typical disadvantage of using this model.

Random forest

As a result, this model is comprised of three distinct concepts: randomizing the training data used to build trees, selecting some subsets of features to split nodes, and considering only a subset of all features for each simple decision tree. In a random forest, each tree receives training data from a random subset of the data points. A random forest model is made up of a large number of decision trees. A forest is created by averaging the predicted outcomes of trees in the model. When forming trees, the algorithm uses three random ideas: picking training data randomly, selecting some subsets of variables when dividing nodes, and selecting only one subset of all variables for splitting every node in the basic tree. During the random forest training process, each basic tree gains knowledge from a randomly selected sample of the dataset. When compared to more complex algorithms, the Naive Bayes classifier can be extremely fast. Class distributions can be evaluated as one-dimensional distributions because of the separation of the distributions. The dimensionality curse can be alleviated in this way. Classifiers based on Bayes' theorem with strong independence assumptions between features given the class variable are known as naive Bayes classifiers. This is a set of algorithms for supervised learning.

3.6 SYSTEM ARCHITECTURE

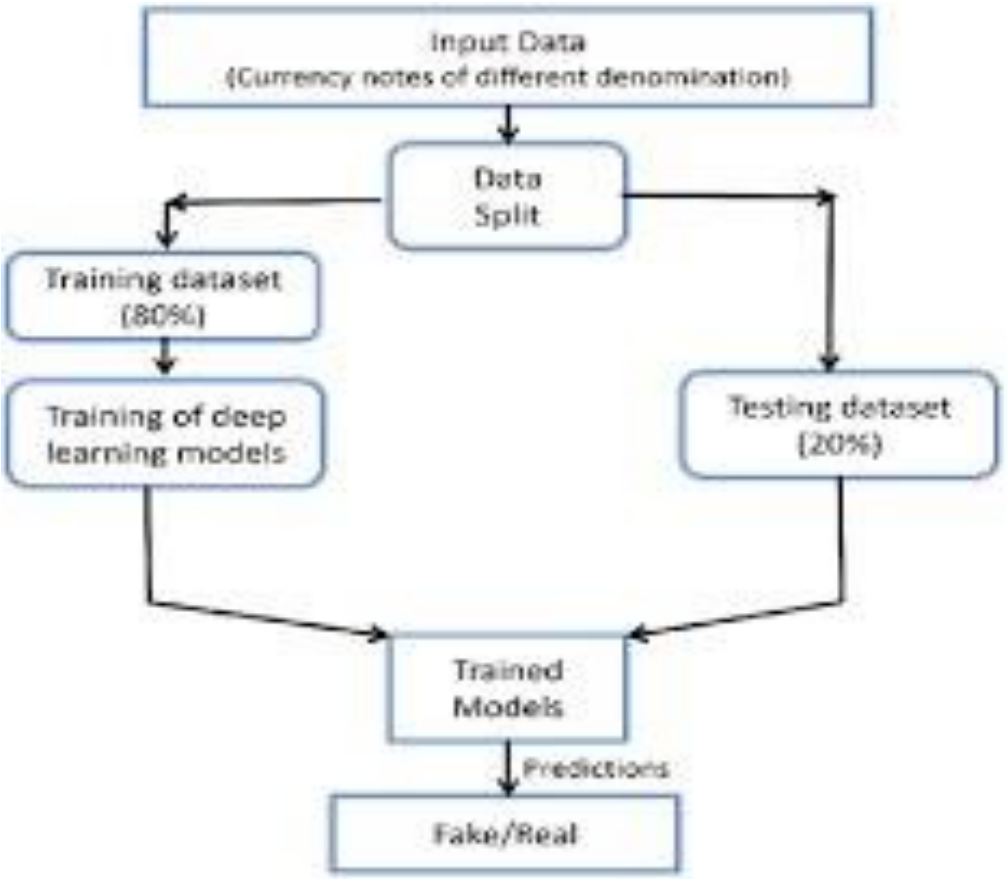


Fig 3.6 System Architecture

CHAPTER 4

SYSTEM REQUIREMENTS

REQUIREMENTS SPECIFICATION

used to implement the proposed system. The following are the hardware and software requirements that have

4.1 HARDWARE REQUIREMENTS

- System : i3 or above.
- RAM : 4 GB.
- Hard Disk : 40 GB.

4.2 SOFTWARE REQUIREMENTS

- Operating system : Windows8 or Above.
- Coding Language : python

4.3 FUNCTIONAL REQUIREMENTS

- System should automatically detect Input Image.
- System should automatically classify the input image.
- System should automatically detect the currency note.
- System should automatically classify the Fake currency.

4.4 NON-FUNCTIONAL REQUIREMENTS

- **Usability**

  Easy Interface for capture of image and alert the concerned person in case of fake currency**.**

- **Reliability**

  Currency detection

FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

Three key considerations involved in the feasibility analysis are:

- Economic feasibility
- Technical feasibility
- Social feasibility

ECONOMICAL FEASIBILITY

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

TECHNICAL FEASIBILITY

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on theavailable technical resources. This will lead to high demands on the available technicalresources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required to use the for implementing this system.

SOCIAL FEASIBILITY

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance

by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

CHAPTER 5

SYSTEM DESIGN

5.1 MODULES

- User
- System

User

In this module, user has to give the retina image as input.

System

In this module, system has to preprocess the image, Run the CNN algorithm, predict retinopathy and show the accuracy.

5.2 DESIGN REPRESENTATION

UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, and was created by, the Object Management Group.

The goal is for UML to become a common language for creating models of object oriented computer software. In its current form UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML.The Unified Modeling Language is a standard language for specifying, Visualization, Constructing and documenting the artifacts of software system, as well as for business modeling and other non-software systems.The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems.

The UML is a very important part of developing objects oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects.

GOALS:

The Primary goals in the design of the UML are as follows:

1. Provide users a ready-to-use, expressive visual modeling Language so that they can develop and exchange meaningful models.
2. Provide extensibility and specialization mechanisms to extend the core concepts.
3. Be independent of particular programming languages and development process.
4. Provide a formal basis for understanding the modeling language.
5. Encourage the growth of object oriented tools market.
6. Support higher level development concepts such as collaborations, frameworks, patterns and components.

5.3 USE CASE DIAGRAM

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

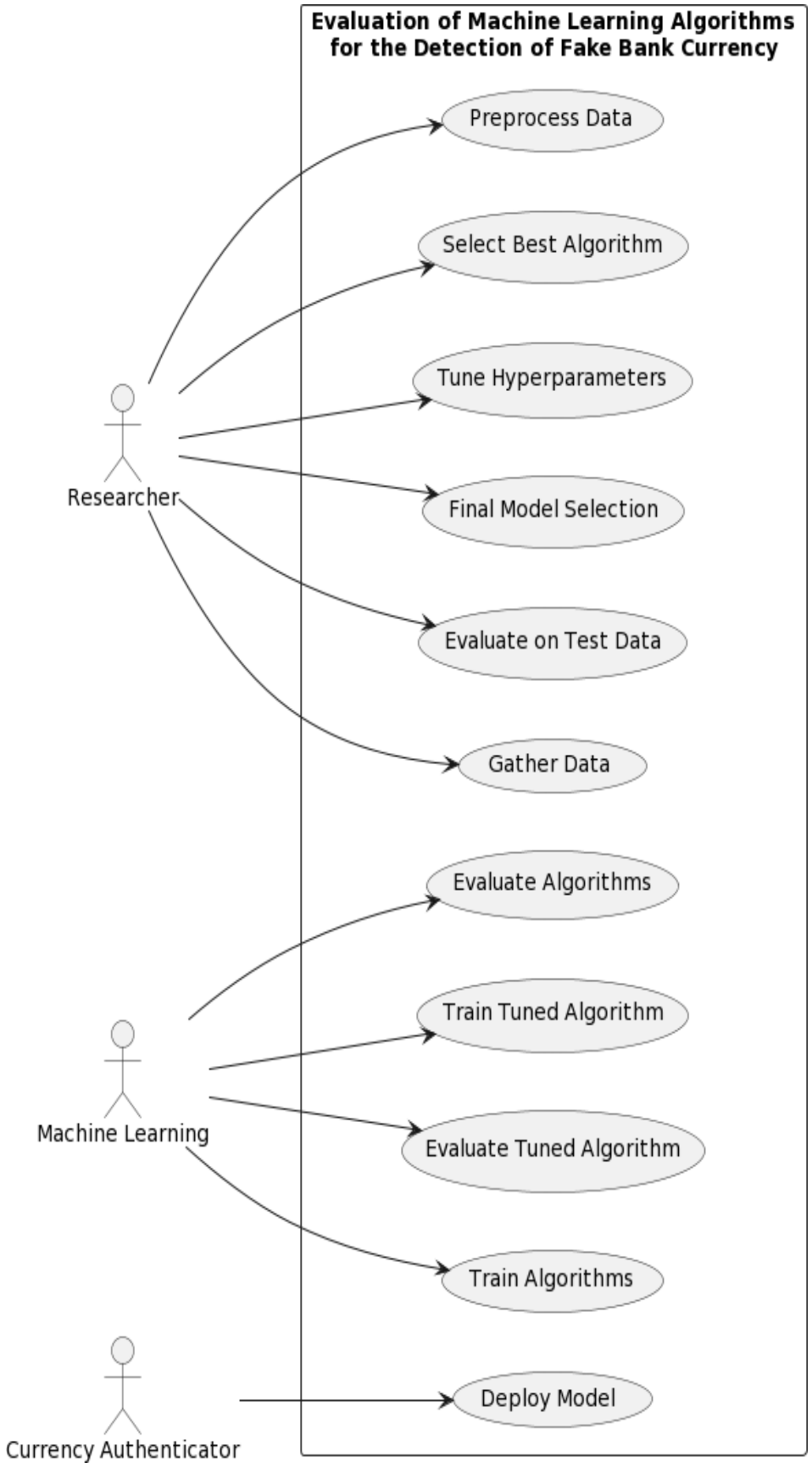


Fig 5.3**:** Use case diagram

5.4 CLASS DIAGRAM

In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes.

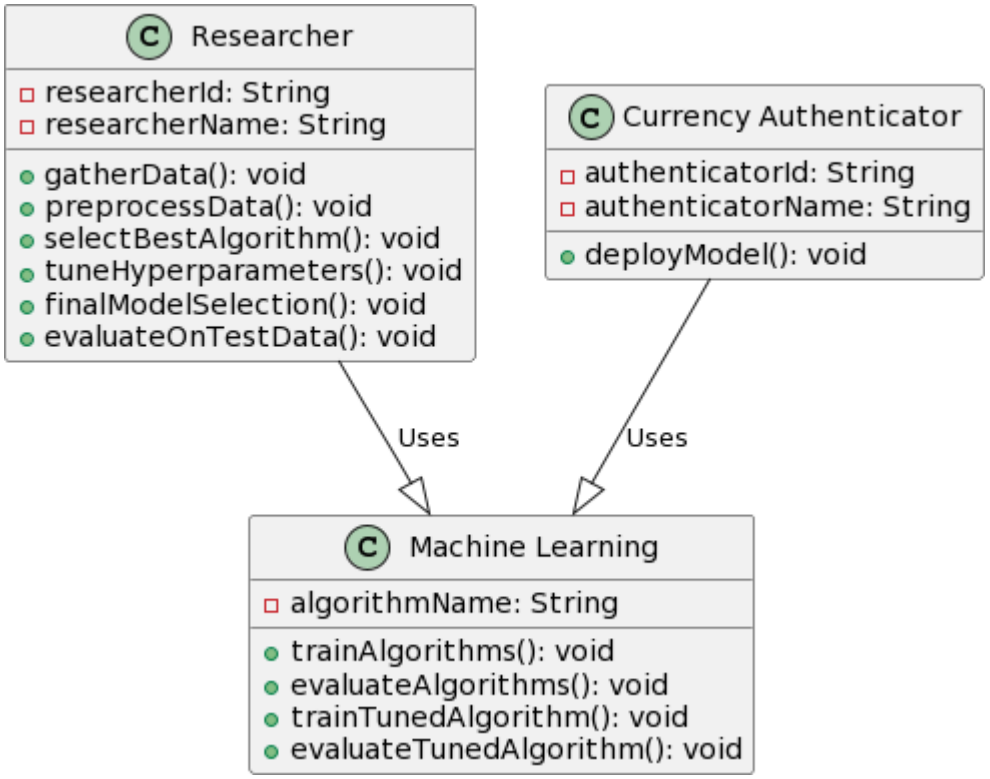


Fig 5.4: Class diagram

5.5 SEQUENCE DIAGRAM

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

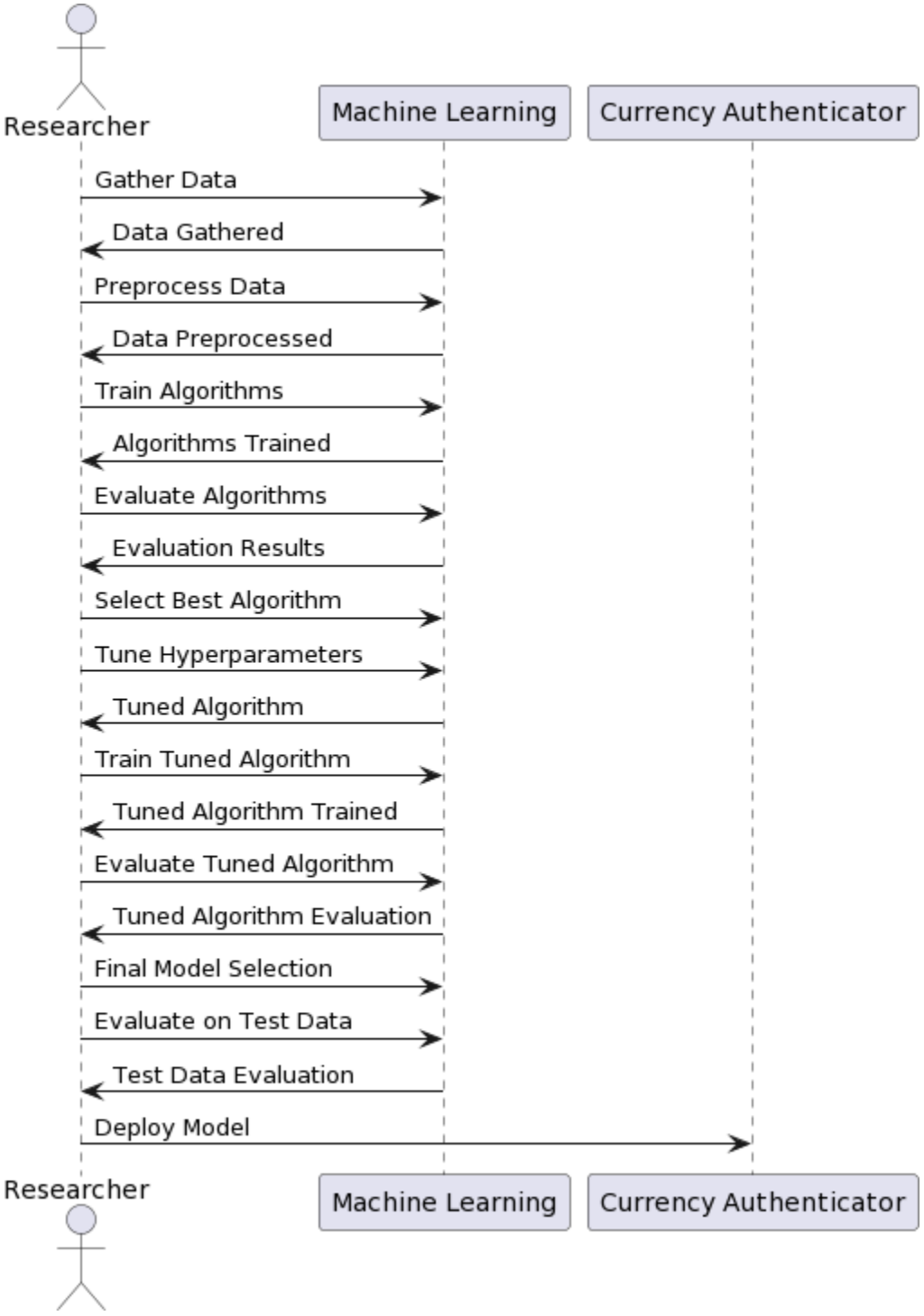


Fig 5.5**:** Sequence diagram

5.6 ACTIVITY DIAGRAM

Activity diagram is another important behavioral diagram in UMLdiagram to describe dynamic aspects of the system. Activity diagram is essentially an advanced version of flow chart that modeling the flow from one activity to another activity.

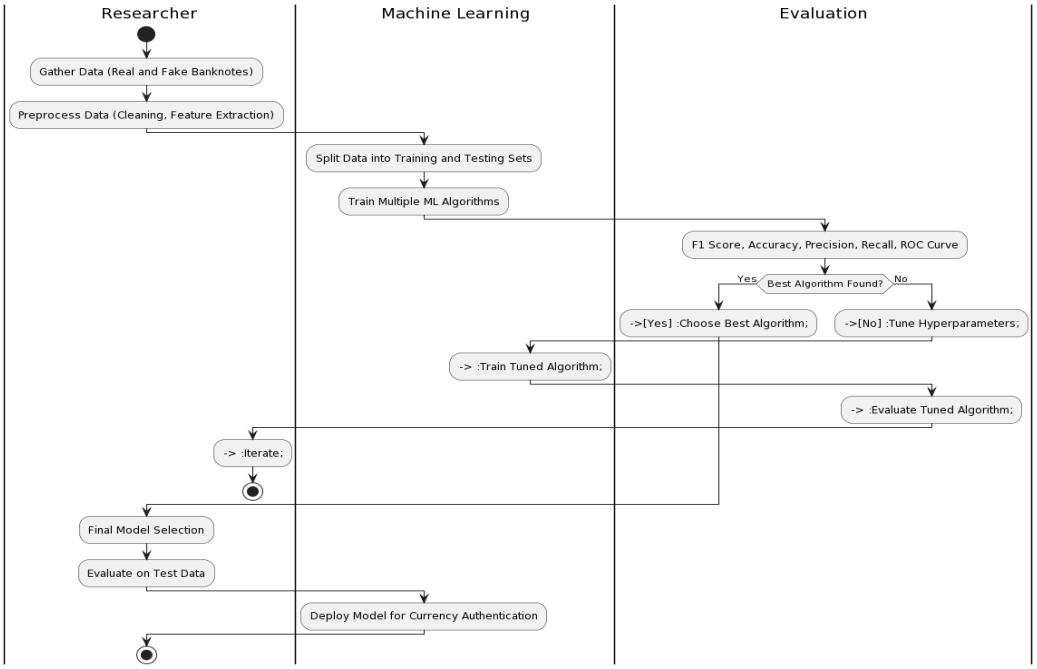


Fig 5.6**:** Activity diagram

5.7 MODULES DESCRIPTION

- **Data collection**
- **Pre-Processing**
- **Feature Extraction**
- **Detect Fake Currency**

to further processing. It includes image adjusting and image smoothening. After these two pre-processing steps, the images of the currency were applied for feature 31 extraction.

Data Collection Module:

The different categories of Indian currencies differs in value estimation and color usage, separated from the quality of printing ,material used for printing and other which makes for simple visual distinguishing proof. In any case, for the visually disabled person, the content and color will not give the assistance at all and measure can lead to disarray since of the comparable measurements of the different coins.

1. Pre-Processing Module:

In pre-processing the operations normally initial to main data analysis and extraction of information. In this unwanted distortion are suppressed and enhance some image features that are important.

2. Feature Extraction:

Feature extraction employs the selection and extraction of some of the Effective and important features, among the largest data set of the features which are extremely important for the recognition of fake currency. Some Features of an image are Latent image and Identification Mark. We first create a database of a number of authentic Indian notes and then extract their features. The extracted features are used for detection of fake currency.

3. Detect Fake Currency Module:

In this work six supervised machine learning algorithms are applied on dataset available on UCI machine learning repository for detection of Bank currency authentication. To implement this we have applied machine learning algorithms are measured their performance on the basis various quantitative analysis parameter. And some of ML algorithm are giving better accuracy for particular train test ratio.

Conclusion:

In this work, we have discussed that how our proposed system detects the fake bank currency using machine learning algorithms. The proposed system is also scalable for detecting the whether the currency is fake or not by image processing. The system is not having complex process to detect the whether the data contains fake bank currency like the existing system. Proposed system gives genuine and fast result than existing system.

CHAPTER 6

IMPLEMENTATION

6.1 INTRODUCTION

Implementation is the stage where the theoretical design is turned into a working system. The most crucial stage in achieving a new successful system and in giving confidence on the new system for the users that it will work efficiently and effectively. The system can be implemented only after through testing is done and if it is found to work according to the specification. It involves careful planning, investigation of the current system and its constraints on implementation, design of methods to achieve the changeover and an evaluation of change over methods a part from planning. Two major tasks of preparing the implementation are education and training of the users and testing of the system. The more complex the system being implemented, the more involved will be the system analysis and design effort required just for implementation. The implementation phase comprises of several activities. The required hardware and software acquisition is carried out. The system may require some software to be developed. For this. Programs are written and tested. The user then changes over to his new fully tested system and the old system is discontinued.

6.2 MACHINE LEARNING

Machine Learning is the most popular technique of predicting or classifying information to help people in making necessary decisions. Machine Learning algorithms are trained over instances or examples through which they learn from past experiences and analysis the historical data. Simply building models is not enough. You must also optimize and tune the model appropriately so that it provides you with accurate results. Optimization techniques involve tuning the hyperparameters to reach an optimum result. As it trains over the examples, again and again, it is able to identify patterns in order to make decisions more accurately. Whenever any new input is introduced to the ML model, it applies its learned patterns over the new data to make future predictions. Based on the final accuracy, one can optimize their models using various standardized approaches. In this way, Machine Learning model learns to adapt to new examples and produce better results.

Types of Machine Learning Algorithms can be classified into 3 types as follows:

1. Supervised learning
2. Unsupervised Learning
3. Reinforcement Learning

6.3 SUPERVISED LEARNING

Supervised learning is the most popular paradigm for machine learning. It is the easiest to understand and the simplest to implement. It is the task of learning a function that maps an input to an output based on example input-output pairs. It infers a function from labelled training data consisting of a set of training examples. In supervised learning, each example is a pair consisting of an input object (typically a vector) and a desired output value (also called the supervisory signal). A supervised learning algorithm analyses the training data and produces an inferred function, which can be used for mapping new examples. Supervised Learning is very similar to teaching a child with the given data and that data is in the form of examples with labels, we can feed a learning algorithm with these example-label pairs one by one, allowing the algorithm to predict the right answer or not. Over time, the algorithm will learn to approximate the exact nature of the relationship between examples and their labels. When fully trained, the supervised learning algorithm will be able to observe a new, never-before-seen example and predict a good label for it. Most of the practical machine learning uses supervised learning.

Supervised learning is where you have input variable (x) and an output variable (Y) and you use an algorithm to learn the mapping function from the input to the output. $Y = f(x)$ The goal is to approximate the mapping function so well that when you have new input data (x) that you can predict the output variables (Y) for the data. It is called supervised learning because the process of an algorithm learning from the training dataset can be thought of as a teacher supervising the learning process. Supervised learning is often described as task oriented. It is highly focused on a singular task, feeding more and more examples to the algorithm until it can accurately perform on that task. 4 This is the learning type that you will most likely encounter, as it is exhibited in many of the common applications like Advertisement Popularity, Spam Classification, face recognition.

Two types of Supervised Learning are

1. Regression

Regression models a target prediction value based on independent variables. It is mostly used for finding out the relationship between variables and forecasting. Regression can be used to estimate/ predict continuous values (Real valued output). For example, given a picture of a person then we have to predict the age on the basis of the given picture.

2. Classification

Classification means to group the output into a class. If the data is discrete or categorical then it is a classification problem. For example, given data about the sizes of houses in the real estate market, making our output about whether the house "sells for more or less than the asking price" i.e., Classifying houses into two discrete categories.

6.4 UNSUPERVISED LEARNING

Unsupervised Learning is a machine learning technique, where you do not need to supervise the model. Instead, you need to allow the model to work on its own to discover information. It mainly deals with the unlabeled data and looks for previously undetected patterns in a data set with no pre-existing labels and with a minimum of human supervision. In contrast to supervised learning that usually makes use of unlabeled data, unsupervised learning, also known as self-organization, allows for modelling of probability densities over inputs.

reference to known, or labelled outcomes. It is the training of machine using information that is neither classified nor labelled and allowing the algorithm to act on that information without guidance. Here the task of machine is to group unsorted information according to similarities, patterns, and differences Unsupervised machine learning algorithms infer patterns from a dataset without any prior training of data. Unlike supervised learning, no teacher is provided that means no training will be given 5 to the machine. Therefore, machine is restricted to find the hidden structure in unlabeled data by our-self. For example, if we provide some pictures of dogs and cats

to the machine to categorized, then initially the machine has no idea about the features of dogs and cats so it categorizes them according to their similarities, patterns and differences. The Unsupervised Learning algorithms allows you to perform more complex processing tasks compared to supervised learning. Although, unsupervised learning can be more unpredictable compared with other natural learning methods.

Unsupervised learning problems are classified into two categories of algorithms:

• **Clustering**: A clustering problem is where you want to discover the inherent groupings in the data, such as grouping customers by purchasing behavior.

• **Association**: An association rule learning problem is where you want to discover rules that describe large portions of your data, such as people that buy X also tend to buy Y.

6.5 REINFORCEMENT LEARNING

Reinforcement Learning (RL) is a type of machine learning technique that enables an agent to learn in an interactive environment by trial and error using feedback from its own actions and experiences. Machine mainly learns from past experiences and tries to perform best possible solution to a certain problem. It is the training of machine learning models to make a sequence of decisions. Though both supervised and reinforcement learning use mapping between input and output, unlike supervised learning where the feedback provided to the agent is correct set of actions for performing a task, reinforcement learning uses rewards and punishments as signals for positive and negative behavior. Reinforcement learning is currently the most effective way to hint machine's creativity.

6.6 NEURAL NETWORKS

Neural Network (or Artificial Neural Network) has the ability to learn by examples. ANN is an information processing model inspired by the biological neuron system. ANN biologically inspired simulations that are performed on the computer to do a certain specific set of tasks like clustering, classification, pattern recognition etc. It is composed of a large number of highly interconnected processing elements known as

the neuron to solve problems. It follows the non-linear path and process information in parallel throughout the nodes. A neural network is a complex adaptive system. Adaptive means it has the ability to change its internal structure by adjusting weights of inputs.

Artificial Neural Networks can be best viewed as weighted directed graphs, where the nodes are formed by the artificial neurons and the connection between the neuron outputs and neuron inputs can be represented by the directed edges with weights. The ANN receives the input signal from the external world in the form of a pattern and image in the form of a vector. These inputs are then mathematically designated by the notations x(n) for every n number of inputs. Each of the input is then multiplied by its corresponding weights (these weights are the details used by the artificial neural networks to solve a certain problem). These weights typically represent the strength of the interconnection amongst neurons inside the artificial neural network. All the weighted inputs are summed up inside the computing unit (yet another artificial neuron).

If the weighted sum equates to zero, a bias is added to make the output non-zero or else to scale up to the system's response. Bias has the weight and the input to it is always equal to 1. Here the sum of weighted inputs can be in the range of 0 to positive infinity. To keep the response in the limits of the desired values, a certain threshold value is benchmarked. And then the sum of weighted inputs is passed through the activation function. The activation function is the set of transfer functions used to get the desired output of it. There are various flavors of the activation function, but mainlyeither linear or non-linear set of functions. Some of the most commonly used set of activation functions are the Binary, Sigmoid (linear) and Tan hyperbolic sigmoidal (non-linear) activation functions.

The Artificial Neural Network contains three layers

1. Input Layer: The input layers contain those artificial neurons (termed as units) which are to receive input from the outside world. This is where the actual learning on the network happens or corresponding happens else it will process.

2. Hidden Layer: The hidden layers are mentioned hidden in between input and the output layers. The only job of a hidden layer is to transform the input into something meaningful that the output layer/unit can use in some way. Most of the artificial neural networks are all interconnected, which means that each of the hidden layers is

individually connected to the neurons in its input layer and also to its output layer leaving nothing to hang in the air.

3. Output Layer: The output layers contain units that respond to the information that is fed into the system and also whether it learned any task or not.

6.7 METHOD OF IMPLEMENTATION

SOURCE CODE

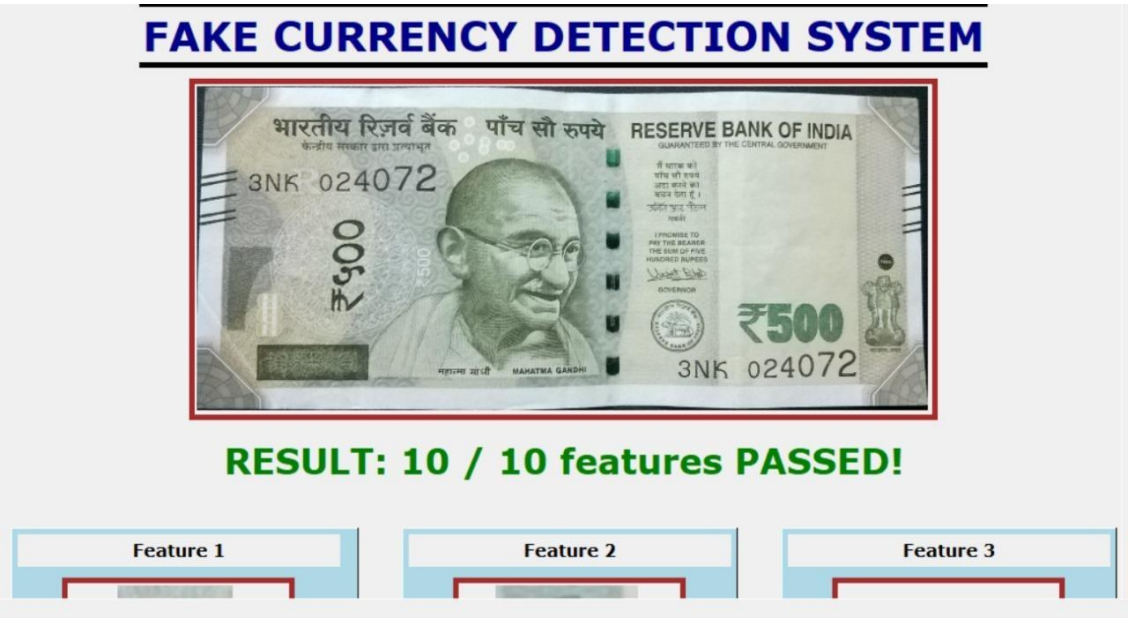
```
# Importing important libraries

import cv2

import numpy as np

import matplotlib. pyplot as plt

from skimage. metrics import structural similarity as ssim

#Resizing the Plots

plt. rcParams["figure.figsize"] = (12, 12)

%store -z # Deleting all pre- stored variables

# Running gui_1. ipynb

%Run ./gui_1.ipynb

# The GUI file produces and then stores the variables path and option

# Reading the stored variables

%store -r selectedImage

%store -r path

%store -r option

print ('Image selected: ', selectedImage)

print ('Path: ', path)

print ('Currency type: ', option)
```

```
Image selected:  True
if selectedImage == True:
    if option == 1:                    # For 500 currency note
        %Run ./500_Testing.ipynb
    elif option == 2:                  # For 2000 currency note
        %Run ./2000_Testing.ipynb
if selectedImage == True:
    # The above file produces and stores result_list variable
    # Reading the variable
    %store -r result_list
 # Showing the results
    # The result list variable is a list of lists and each list conatins details about each feature
    for x in result_list:
        if x [0] is not None:
            plt. imshow (x [0]) # Showing images
            plt. show ()
if selectedImage == True:
# Show output in GUI
   %Run ./gui_2.ipynb
%store -z # Deleting all pre- stored variables
```

6.8 OUTPUT SCREENS

Currency Note detection screen

To test this application, we are using below images



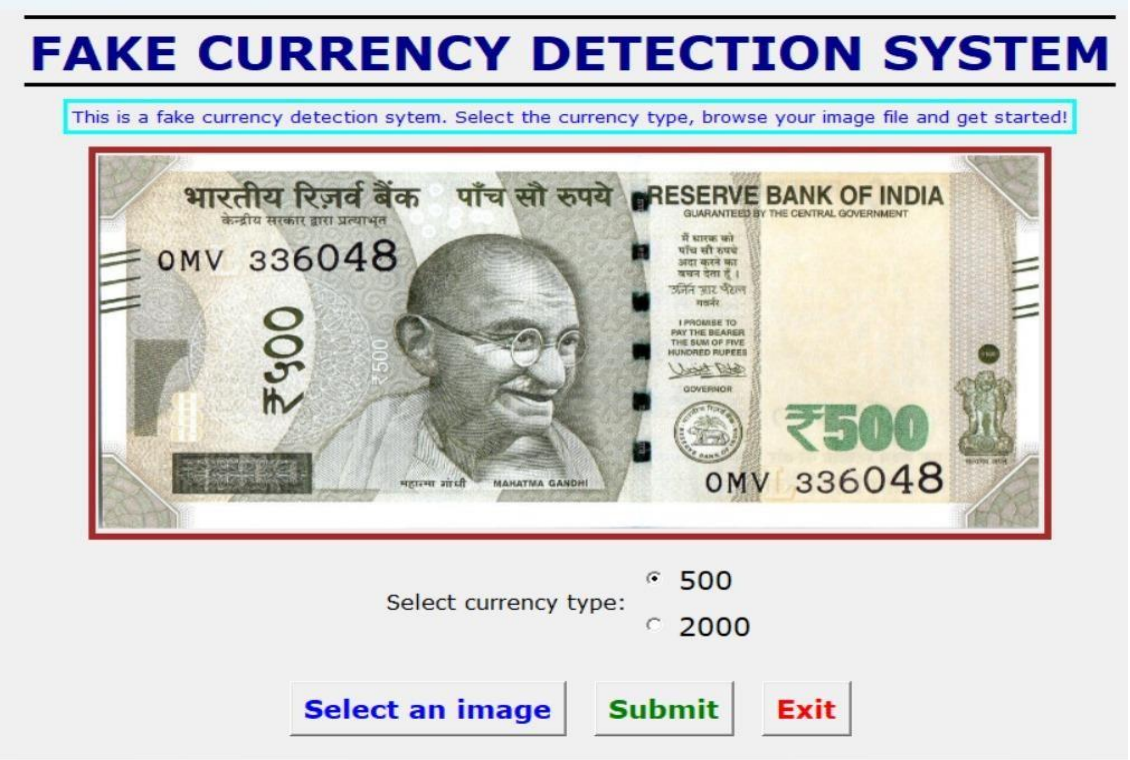
Screenshot 6.8: Currency Note

In above screen we can observe currency note So, by uploading this image to application we can identify whether the note is fake or genuine.

6.9 SCREEN SHOTS

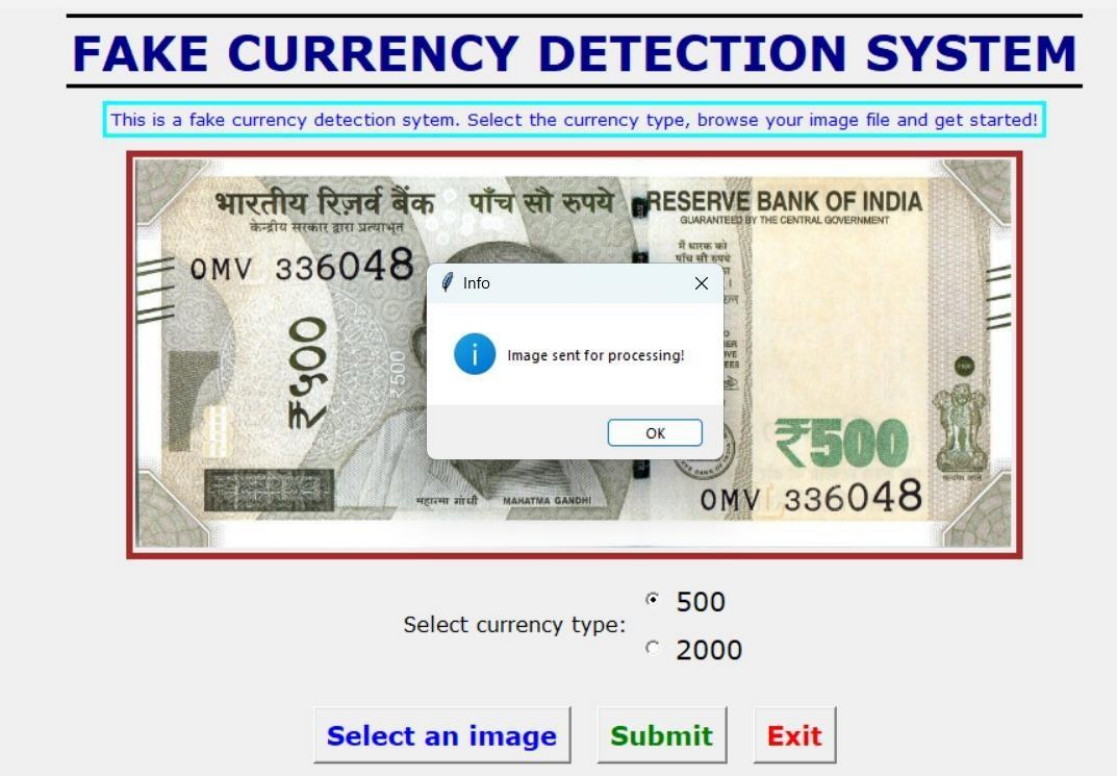
To run code double click on ‘run.bat’ file to get below screen

In below screen click on ‘select an Image’ button to upload currency note image



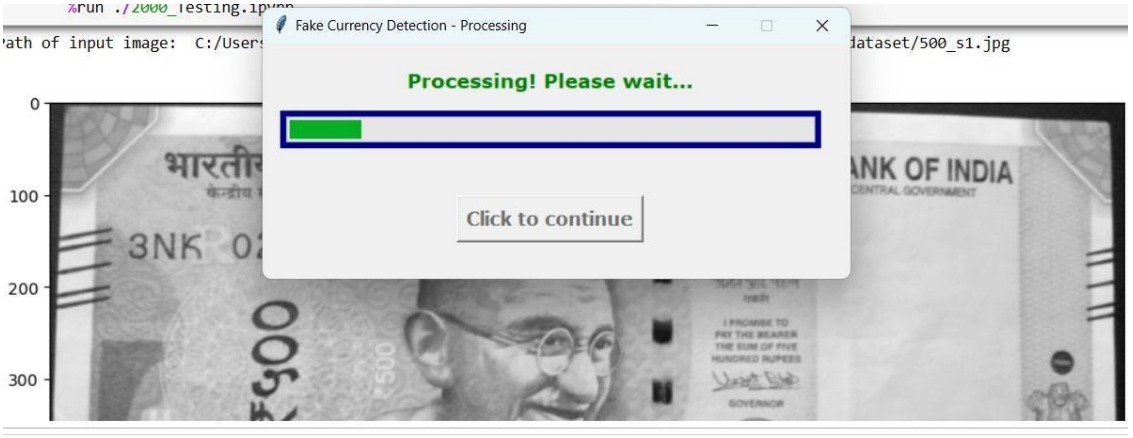
Screenshot 6.9: selecting and uploading 457.png file

In above screen we are uploading one image of currency note called ‘457.jpg’. After upload will get below screen



Screenshot 6.9: uploading image

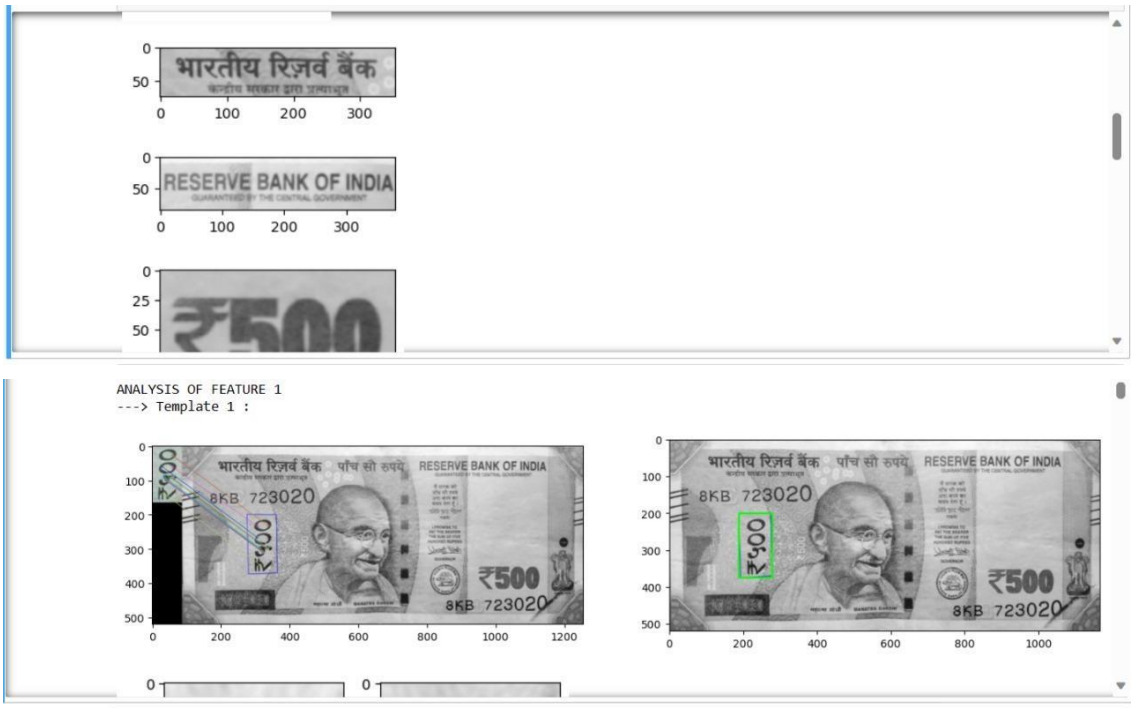
Now click on ok button to continue the processing! As shown in the below figure



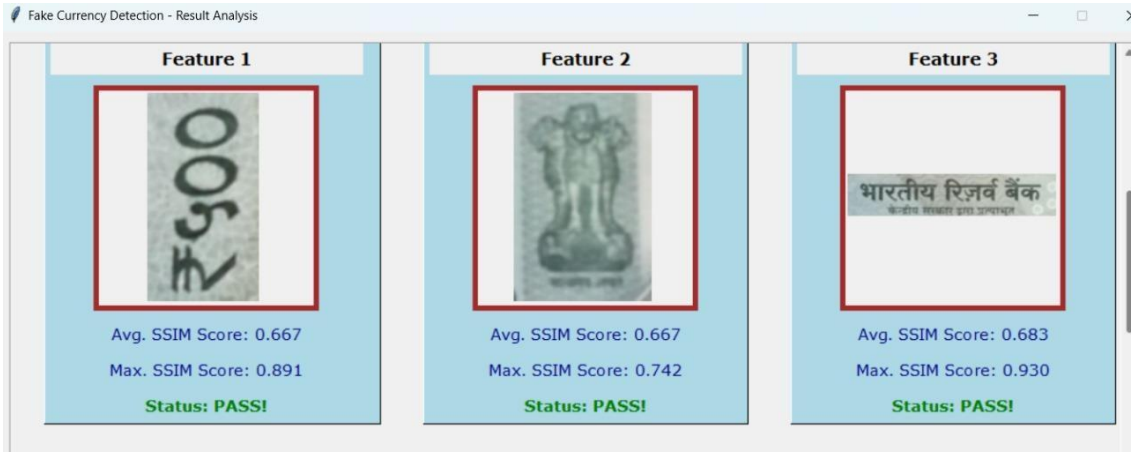
Screenshot 6.9: uploading currency image


भारतीय रिज़र्व बैंक
RESERVE BANK OF INDIA

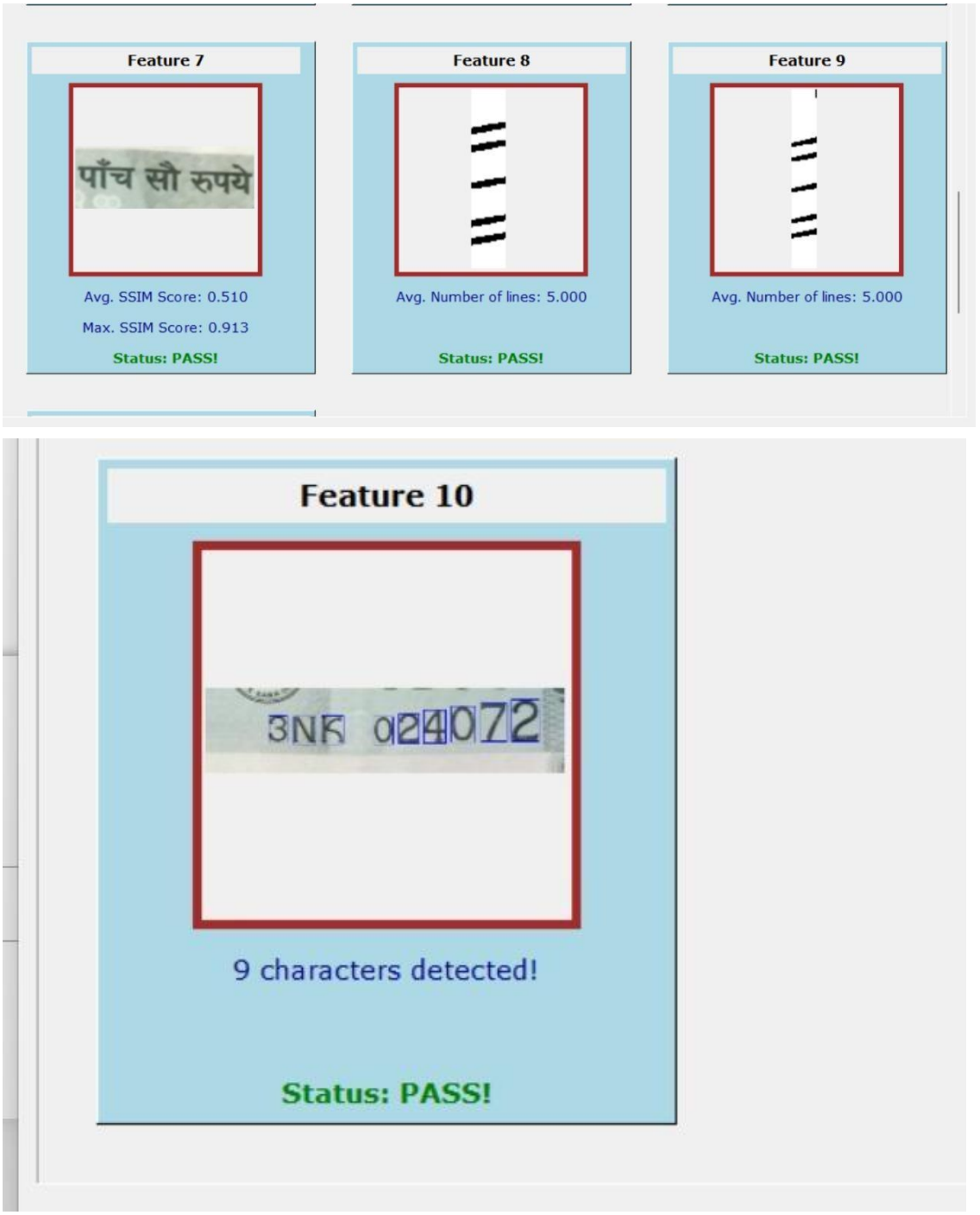

8KB 723020



The above images are templets of the currency notes. Now again click on Run button.



Screenshot 6.9: parameters



In above screen we can observe 10 parametes . And we can observe the parameters status have passed.so we can consider the above currency note is an original.

CHAPTER 7

TESTING & VALIDATION

7.1 INTRODUCTION

Software testing is a critical element of software quality assurance and represents the ultimate review of specification, design and coding. In fact, testing is the one step in the software engineering process that could be viewed as destructive rather than constructive. A strategy for software testing integrates software test case design methods into a well-planned series of steps that result in the successful construction of software. Testing is the set of activities that can be planned in advanceand conducted systematically. The underlying motivation of program testing is to affirm software quality with methods that can economically and effectively apply to both strategic to both large and small-scale systems.

7.2 SOFTWARE TESTING

Software testing is the process of validating and verifying that a software application meets the technical requirements which are involved in its design and development. It is also used to uncover any defects/bugs that exist in the application. It assures the quality of the software. There are many types of testing software viz., manual testing, unit testing, black box testing, performance testing, stress testing, regression testing, white box testing etc. Among these performance testing and load testing are the most important one for an android application and next sections deal with some of these types.

7.3 BLACK BOX TESTING

Black box testing treats the software as a "black box"—without any knowledge of internal implementation. Black box testing methods include equivalence partitioning, boundary value analysis, all-pairs testing, fuzz testing, model-based testing, traceability matrix, exploratory testing, and specification-based testing.

7.4 WHITE BOX TESTING

White box testing is when the tester has access to the internal data structures and algorithms including the code that implement these.

7.5 PERFORMANCE TESTING

Performance testing is executed to determine how fast a system or sub-system performs under a particular workload. It can also serve to validate and verify other quality attributes of the system such as scalability, reliability and resource usage.

7.6 LOAD TESTING

under specific load, whether that Load testing is primarily concerned with testing that can continue to operate is large quantities of data or a large number of users.

7.7 MANUAL TESTING

Manual Testing is the process of manually testing software for defects. Functionality of this application is manually tested to ensure the correctness. Few examples of test case for Manual Testing are discussed later in this chapter.

7.8 TEST CASES

Test Case	**Description**
Data cleaning	Verify handling of missing values, outliers, and inconsistencies.
Feature scaling	Normalize or standardize features.
Algorithm comparison	Evaluate performance of different algorithms.
Feature selection	Assess most crucial features for detection
Cross validation	Check model’s generalizability and reduce overfitting.
Accuracy metrics	Measure accuracy, precision, recall, and F1-score.
Robustness testing	Evaluate performance on new, unseen data.

Table 7.8

CHAPTER 8

CONCLUSION AND FUTURE SCOPE

8.1 PROJECT CONCLUSION

The project "Fake currency detection using machine learning" provides an in-depth analysis of the proposed approach for detecting counterfeit notes. The report details the methodology used for data collection, pre-processing, and feature extraction. It also provides a comprehensive overview of CNN architecture and implementation and its model's performance. The project's results demonstrate that the use of CNNs in fake currency detection can be highly effective in accurately identifying counterfeit notes. The CNN model trained on the dataset achieved high accuracy, demonstrating its potential as a reliable tool for detecting fake currency. Project emphasizes its potential to prevent financial losses and illegal activities related to counterfeit notes. The proposed approach can be highly beneficial for banks, businesses, and individuals in detecting fake currency, preventing further distribution, and ensuring financial securityand also provides valuable insights into the development of a robust and effective system for detecting counterfeit notes. The use of CNNs in fake currency detection cansignificantly improve the accuracy and reliability of the system, making it an essential tool for financial institutions and businesses. Overall, the outcomes can pave the way for further research and development in this area, ultimately leading to improved financial security and stability.

8.2 FUTURE SCOPE:

The future of machine learning for fake bank currency detection is promising. Advancements in deep learning, feature engineering, and sensor integration will improve accuracy. Real-time processing is crucial for applications like ATMs. Transfer learning can reduce the need for extensive training data. Mobile and IoT devices will make counterfeit detection accessible to a broader audience. Collaboration with central banks is essential for effective solutions. Ongoing adaptation is necessary to stay ahead of counterfeiters.The field will continue to evolve to meet the challenges of ever-sophisticated counterfeit.

CHAPTER 9

REFERENCES

1. T. Agasti, G. Burand, P. Wade, P. Chitra, Fake currency detection using image processing, ICSET-2017. IOP Conf. Ser. Mater. Sci. Eng. 263, 052047 (2017).

2. S. Gothe, K. Naik, V. Joshi, Fake currency detection using image processing and machine learning (2018).

3.T. Kumar, T. Subhash, D. Regan, Fake currency recognition system for Indian notes using image processing techniques (2019).

4. (6S) (2019). ISSN: 2277-3878 7. M. Laavanya, V. Vijayaraghavan, Real time fake currency note detection using deep learning. Int. J. Eng. Adv. Technol. (IJEAT) 9(1S5) (2019). ISSN: 2249-8958

5. V. LalithendraNadh, G. Syam Prasad, Support vector machine in the anticipation of currency markets. Int. J. Eng. Technol. (UAE) 7(2), 66–68 (2018). 37

6.A.A. Mandankandy, K.E. Kannammal, Fake currency detection: a survey. Gedrag en Organisatie 33(4), 622–638 (2020).

7. G. Navya Krishna, G. Sai Pooja, B. Naga Sri Ram, V. Yamini Radha, P. Rajarajeswari, Recognition of fake currency note using convolutional neural networks. Int. J. Innov. Technol. Exploring Eng. 8(5), 58–63 (2019).

8. A.Singh, K. Bhoyar, A. Pandey, P. Mankani, A. Tekriwal, Detection of fake currency using image processing. Int. J. Eng. Res. Technol. (IJERT) 8(12) (2019).

9. K.D. Sudha, P. Kilaru, M.S.R. Chetty, Currency note verification and denomination recognition on Indian currency system. Int. J. Recent Technol. Eng.

10.S. Shaker, M.G. Alawan, Paper currency detection based image processing techniques: a review paper .

11.A.Upadhyaya, V. Shokeen, G. Srivastava, Analysis of counterfeit currency detection techniques for classification model (2018).

12.Vidhate, Y. Shah, R. Biyani, H. Keshri, R. Nikhare, Fake currency detection application. Int. Res. J. Eng. Technol. (IRJET) 08(05) (2021). e-ISSN: 2395-0056.