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Thalavapalayam, Karur – 639 113.

A Project Report

on

CLASSIFICATION OF ARRHYTHMIA BY USING DEEP WITH 2D ECG SPECTRALIMAGE REPRESENTATION

Submitted in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

Under the Guidance of

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Submitted by

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INTRODUCTION

1.1 PROJECT OVERVIEW

This project is design and implementation of detection of arrythmia detection using deep learning models Electrocardiogram (ECG) is a simple non-invasive measure to identify heart-related issues such as irregular heartbeats known as arrhythmias Deep CNN based algorithm is implemented for train the model , artificial intelligence and machine learning is being utilized in a wide range of healthcare related applications and datasets, many arrhythmia classifiers using deep learning methods have been proposed in recent years. However, sizes of the available datasets from which to build and assess machine learning models is often very small and the lack of well-annotated public ECG datasets is evident. In this paper, we propose a deep transfer learning framework that is aimed to perform classification on a small size training dataset. The proposed method is to fine-tune a general-purpose image classifier ResNet-18 with MIT-BIH arrhythmia dataset in accordance with the AAMI EC57 standard. This paper further investigates many existing deep learning models that have failed to avoid data leakage against AAMI recommendations.

1.2 PURPOSE

The purpose of the project is design and implementation of deeplearning model deployed for detection of heart disease and prediction.

CHAPTER-2

LITERATURE SURVEY

2.1 EXISTING SYSTEM

In existing system machine learning based algorithm has been implemented in existing system machine learning algorithm has been implemented in existing system In the literature, the ECG analysis generally consists of the following steps: 1) ECG signal preprocessing and noise attenuation, 2) heartbeat segmentation, 3) feature extraction, and 4) learning/classification.

Machine learning models are widely used for arrhythmia classification in the literature [2,3,5,7,8,13,14,15]. Mi Hye Song et al. proposed a support vector machine-based classifier with reduced features derived by linear discriminant analysis [5]. Inspired by the success of Hidden Markov Model (HMM) in modeling speech waveforms for automatic speech recognition, D A Coast et al. applied HMM method in ECG arrhythmia analysis. The model can combine the temporal information and statistical knowledge of the ECG signal in one single parametric model [15]. Awni Y. Hannun et al. proposed an end-to-end deep learning approach which directly takes raw ECG signal as input and produces classifications without feature engineering or feature selection [8]. Mousavi, Sajad et al. proposed an automatic ECG-based heartbeat classification approach by utilizing a sequence-to-sequence deep learning method to automatically extract temporal and statistical features of the ECG signals

Our work differs from the studies in 2-fold: 1) it leverages the Short-term Fourier Transform (STFT) to convert 1D ECG signal into 2D time-frequency domain data. Therefore, it is feasible to apply pre-trained 2D Convolution Neural Network in arrhythmia analysis; 2) it is evaluated using MIT-BIH dataset with “inter-patient” training/testing split paradigm detailed.

1. Arrhythmia Classification with ECG signals based on the Optimization-Enabled Deep Convolutional Neural Network:

Arrhythmia classification is the need of the hour as the world is reporting a higher death troll as a cause of cardiac diseases. Most of the existing methods developed for arrhythmia classification face a hectic challenge of classification accuracy and they raised the challenge of automatic monitoring and classification methods.Accordingly, the paper proposes the automatic arrhythmia classification strategy using the optimization-based deep convolutional neural network (deep CNN). The optimization algorithm named, Bat-Rider optimization algorithm (BaROA) is newly developed using the multi-objective bat algorithm (MOBA) and Rider Optimization Algorithm (ROA).At first, the wave and gab or features are extracted from the ECG signals in such a way that these features represent the individual ECG features. Finally, the signals are provided to the BaROA-based DCNN classifier that identifies conditions of the individual as arrhythmia and no-arrhythmia from the ECG signals. The methods are analyzed using the MIT-BIH Arrhythmia Database and the analysis is performed based on the evaluation parameters, like accuracy, specificity, and sensitivity, which are found to be 93.19 %, 95 %, and 93.98 %, respectively.

2. ECG arrhythmia recognition via a neuro-SVM–KNN hybrid classifier with virtual QRS image-based geometrical features:

In this study, a new supervised noise-artifact-robust heart arrhythmia fusion classification solution, is introduced. Proposed method consists of structurally diverse classifiers with a new QRS complex geometrical feature extraction technique. the events of the electrocardiogram (ECG) signal are detected and delineated using a robust wavelet-based

algorithm. Then, each QRS region and also its corresponding discrete wavelet transform (DWT) are supposed as virtual images and each of them is divided into eight polar sectors. Next, the curve length of each excerpted segment is calculated and is used as the element of the feature space. Discrimination power of proposed classifier in isolation of different Gold standard beats was assessed with accuracy 98.20%. Also, proposed learning machine was applied to 7 arrhythmias belonging to 15 different records and accuracy 98.06% was achieved. Comparisons with peer-reviewed studies prove a marginal progress in computerized heart arrhythmia recognition technologies.

3. An effective LSTM recurrent network to detect arrhythmia on imbalanced ECG dataset:

To reduce the high mortality rate from cardiovascular disease (CVD), the electrocardiogram (ECG) beat plays a significant role in computer-aided arrhythmia diagnosis systems. However, the complex variations and imbalance of ECG beats make this a challenging issue. Since ECG beat data exist in heavily imbalanced category, an effective long short-term memory (LSTM) recurrence network model with focal loss (FL) is proposed. For this purpose, the LSTM network can disentangle the timing features in complex ECG signals, while the FL is used to resolve the category imbalance by downweighing easily identified normal ECG examples. The advantages of the proposed network have been verified in the MIT-BIH arrhythmia database. Experimental results show that the LSTM network with FL achieved a reliable solution to the problem of imbalanced datasets in ECG beat classification and was not sensitive to quality of ECG signals.The proposed method can be deployed in telemedicine scenarios to assist cardiologists into more accurately and objectively diagnosing ECG signals.

4. Real-time patient-specific ECG classification by 1-D convolutional neural networks:

This paper presents a fast and accurate patient-specific electrocardiogram (ECG) classification and monitoring system. Methods: An adaptive implementation of 1-D convolutional neural networks (CNNs) is inherently used to fuse the two major blocks of the ECG classification into a single learning body: feature extraction and classification. Therefore, for each patient, an individual and simple CNN will be trained by using relatively small common and patient-specific training data, and thus, such patient-specific feature extraction ability can further improve the classification performance. Since this also negates the necessity to extract hand-crafted manual features, once a dedicated CNN is trained for a particular patient, it can solely be used to classify possibly long ECG data stream in a fast and accurate manner or alternatively, such a solution can conveniently be used for real-time ECG monitoring and early alert system on a light-weight wearable device.

5. Medical image classification with convolutional neural network:

Image patch classification is an important task in many different medical imaging applications. In this work, we have designed a customized Convolutional Neural Networks (CNN) with shallow convolution layer to classify lung image patches with interstitial lung disease (ILD). While many feature descriptors have been proposed over the past years, they can be quite complicated and domain-specific. Our customized CNN framework can, on the other hand, automatically and efficiently learn the intrinsic image features from lung image patches that are most suitable for the classification purpose. The same architecture can be generalized to perform other medical image or texture classification tasks

2.2 REFERENCES

1. Kachuee, Mohammad, Shayan Fazeli, and Majid Sarrafzadeh. "Ecg heartbeat classification: A deep transferable representation." 2018 IEEE international conference on healthcare informatics (ICHI). IEEE, 2018

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4. B. M. Sarwar, G. Karypis, J. A. Konstan, and J. Reidl, “Item-based collaborative filtering recommendation algorithms,” in Proc. 10th Int. World Wide Web Conf., 2001, pp. 285–295

5. T. George and S. Merugu, “A scalable collaborative filtering framework based on co-clustering,” in Proc. 5th IEEE Int. Conf. Data Mining, 2005, pp. 625–628.

2.3 PROBLEM STATEMENT DEFINITION

Cardiologists by using various values which occurred during the ECG recording can decide whether the heart beat is normal or not. Since observation of these values are not always clear, existence of automatic ECG detection system is required Luz, Eduardo José da S., et al. "ECG-based heartbeat classification for arrhythmia detection: A survey." Computer methods and programs in biomedicine 127 (2016): 144-164.Romdhane, Taissir Fekih, and Mohamed Atri Pr. "Electrocardiogram heartbeat classification based on a deep convolutional neural network and focal loss." Computers in Biology and Medicine 123 (2020): 103866.

CHAPTER-3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

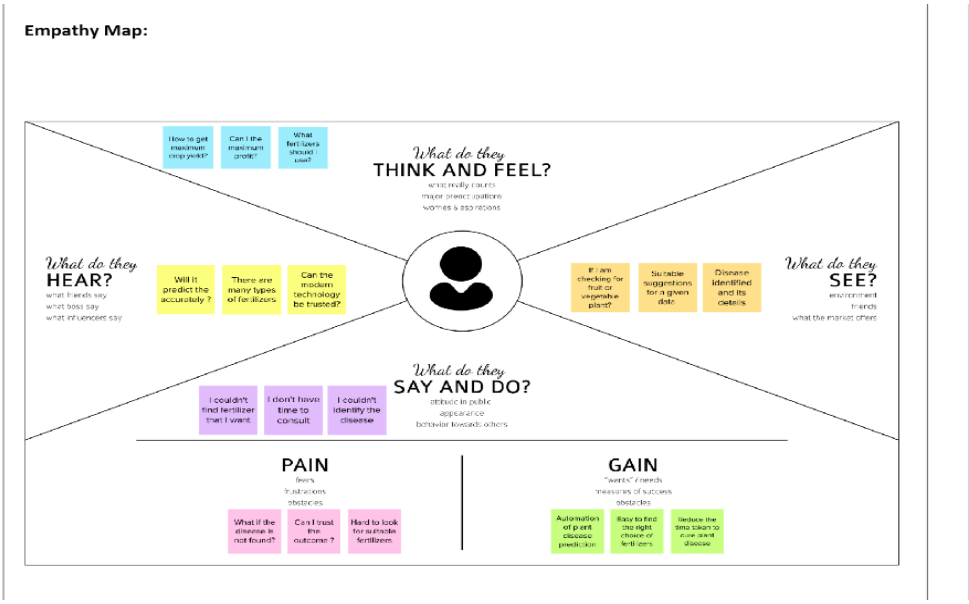

Figure 3.1: Empathy Map Canvas

An empathy map canvas helps brands provide a better experience for users by helping teams understand the perspectives and mindset of their customers. Using a template to create an empathy map canvas reduces the preparation time and standardizes the process so you create empathy map canvases of similar quality.

3.2 BRAINSTORM & IDEA PRIORITIZATION

Step 1: Team Gathering, Collaboration and Select the Problem statement

Figure 3.2: Team Gathering, Collaboration and Select the Problem statement

A problem statement is a concise description of the problem or issues a project seeks to address. The problem statement identifies the current state, the desired future state and any gaps between the two.

3.3 PROPOSED SOLUTION

Deep learning based using for train the image The MIT-BIH database, an ECG database provided by the Massachusetts Institute of Technology and based on international standards and annotated information by multiple experts is used in this study. The MIT-BIH database has been frequently used by the academic community in research for the detection and classification of arrhythmic heartbeats. The MIT-BIH database contains 48 ECG recordings, each recording

time is 30 min, the sampling frequency is 360 Hz, and each ECG record is composed of two leads. MIT-BIH database can make adjustments and corrections based on the information annotated by experts and optimization algorithms. Furthermore, it learns from existing solutions for self-optimization.

This paper proposes a novel deep learning approach to identify arrhythmias in ECG signals. The proposed approach identifies arrhythmia classes using Convolutional Neural Network (CNN) trained by two-dimensional (2D) ECG beat images. Firstly, ECG signals, which consist of 5 different arrhythmias, are segmented into heartbeats which are transformed into 2D grayscale images. Afterward, the images are used as input for training a new CNN architecture to classify heartbeats.

3.4 PROBLEM SOLUTION FIT

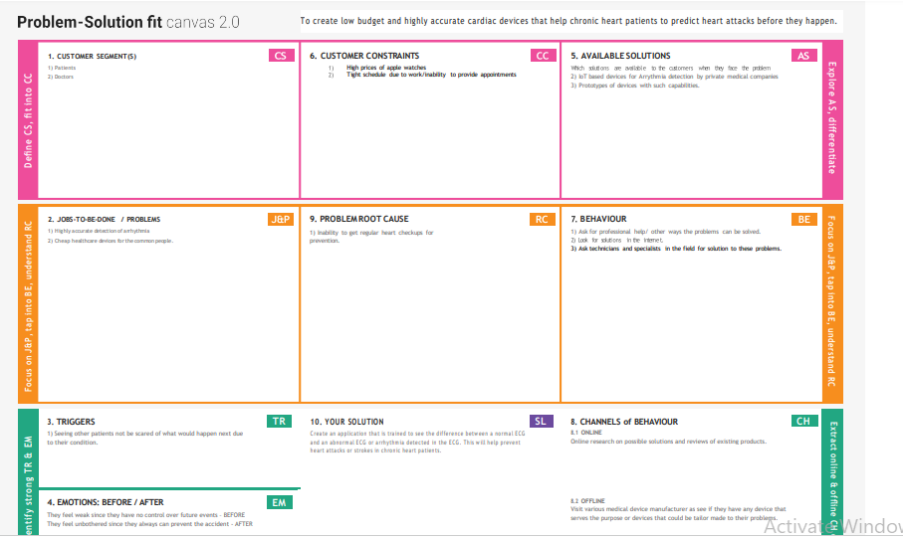

Figure 3.3 : Problem Solution Fit

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem.

CHAPTER-4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

Following are the functional requirements of the proposed solution.

FR.NO	Functional Requirement	Sub requirement (story/subtask)
FR-1	User Registration	Registration through form Registration through Gmail
FR-2	User Confirmation	Confirmation via OTP Confirmation via Email
FR-3	Get User Input	Upload image as jpeg, Upload image as png
FR-4	Save Image	Images are saved in the upload folder
FR-5	Chat with Doctor	Consult with Doctor
FR-6	Report Generation	Get complete Report

Table 4.1 Functional Requirement

4.2 NON-FUNCTIONAL REQUIREMENTS

Following are the non-functional requirement of the proposed solution

NFR.NO	Non-Functional Requirement	Description
NFR-1	Usability	Classification of Arrhythmia with the help of AI.
NFR-2	Security	User's data cannot be accessed unauthorized people.
NFR-3	Reliability	The system performs withoutfailure.
NFR-4	Performance	High accuracy.
NFR-5	Availability	Anyone who is Authorized.
NFR-6	Scalability	Does not affect the performance even though

Table 4.2 Non Functional Requirements

CHAPTER-5

PROJECT DESIGN

5.1.DATA FLOW DIAGRAM

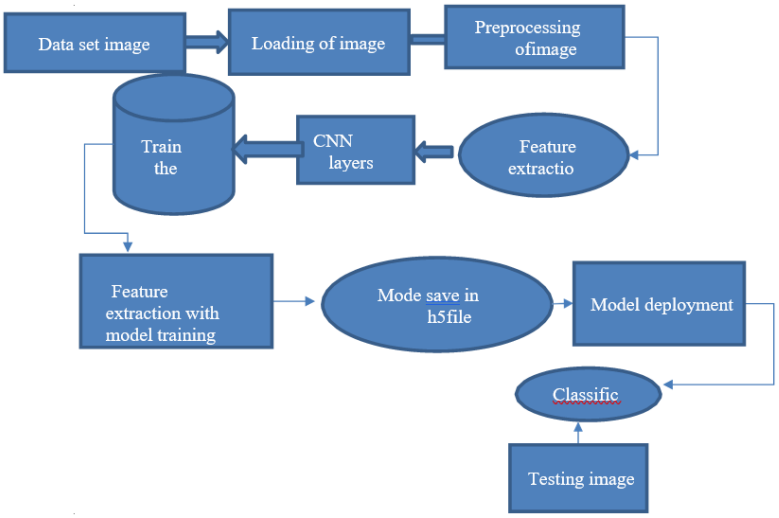

Figure 5.1 : Data Flow Diagram

A data flow diagram (DFD) is a graphical or visual representation using a standardized set of symbols and notations to describe a business's operations through data movement. They are often elements of a formal methodology such as Structured Systems Analysis and Design Method (SSADM).

5.2 SOLUTION & TECHNICAL ARCHITECTURE

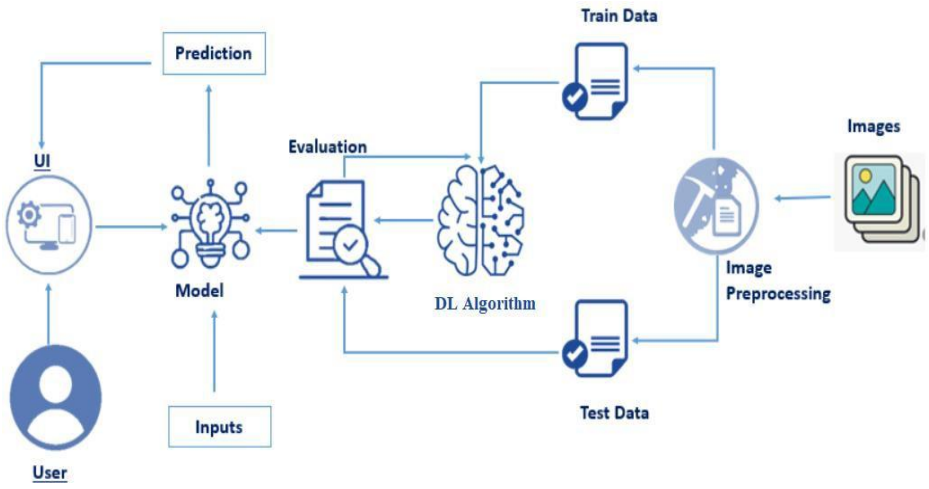

Figure 5.2 : Technical Architecture

Technical Architecture (TA) is a form of IT architecture that is used to design computer systems. It involves the development of a technical blueprint with regard to the arrangement, interaction, and interdependence of all elements so that system-relevant requirements are met.

5.3.USER STORIES

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Login	USN-1	Login into the application by entering My email &password	I can access the UI and obtain the necessary results	Medium	Sprint-1
	Interactive UI	USN-2	As a user, I can easily understand and use the application	I can access the UI and obtain the necessary results	High	Sprint-1
	Arrhythmia	USN-3	As a user, I can separately upload the image for type of arrhythmia prediction	I can upload and access the application through a separate UI	High	Sprint-2

	Layout	USN-4	As a user, I can log out of the application	I can end my session in the application by logged off	Medium	Sprint-1

Table 5.1 User Stories

CHAPTER-6

PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

Milestones	Activities
Project development phase	Delivery of sprint- 1,2,3,4
Create and configure and IBM cloud services	Create IBM Watson
Create and access deep learning	Create v1 to interact with app deploy
	Create IBM and connect with python
Create & database in cloud and DB	Launch the cloudant DB and Create database
Develop the python flask	Install the python software
	Develop python code
Create the web application	Develop the web application

Table 6.1 Sprint planning & Estimation

Sprint planning is an event in the Scrum framework where the team determines the product backlog items they will work on during that sprint and discusses their initial plan for completing those product backlog items.

6.2 SPRINT DELIVERY SCHEDULE

Milestones	Activities	Description
Ideation phase	literature	Literature survey on the selected project & information gathering
	Empathy Map	Prepare empathy map to capture the user pains & gains, prepare list of problem statement
	Ideation	Organizing the brainstorming session and priorities the top 3 ideas based on feasibility & importance

Table 6.2 Sprint delivery schedule

The deliverables of a sprint aren't as predictable as they are for other projects. Sprint participants have produced sketches and drawings, writing, photographs, comic strips, videos and fully coded working prototypes.

CHAPTER-7

TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub-assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

7.1 TYPES OF TESTS

7.1.1 Unit testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

7.1.2 Integration testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

7.1.3 Functional test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input : identified classes of valid input must be accepted.

Invalid Input : identified classes of invalid input must be rejected.

Functions : identified functions must be exercised.

Output : identified classes of application outputs must be exercised.

Systems/Procedures: interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

7.1.4 System Test

System testing ensures that the entire integrated software system meets requirements. It

tests a configuration to ensure known and predictable results. An example of system testing is the configuration-oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

7.1.5 White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

7.1.6 Black Box Testing

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot “see” into it. The test provides inputs and responds to outputs without considering how the software works.

7.2 Unit Testing:

Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases.

7.2.1 Test strategy and approach

Field testing will be performed manually and functional tests will be written in detail.

7.2.2 Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

7.2.3 Features to be tested

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

7.3 Integration Testing

Software integration testing is the incremental integration testing of two or more integrated software components on a single platform to produce failures caused by interface defects. The task of the integration test is to check that components or software applications, e.g. components in a software system or – one step up – software applications at the company level – interact without error.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

7.4 Acceptance Testing

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

CHAPTER-8

RESULT

8.1 Testing image

Figure 8.1 Testing image

Tools & algorithms to assist in automatically recognizing and deducing information about people in consumer digital images. This project proposes to investigate and test a number of image processing techniques that enhance the identification of persons in consumer digital images.

8.2 Confusion matrix

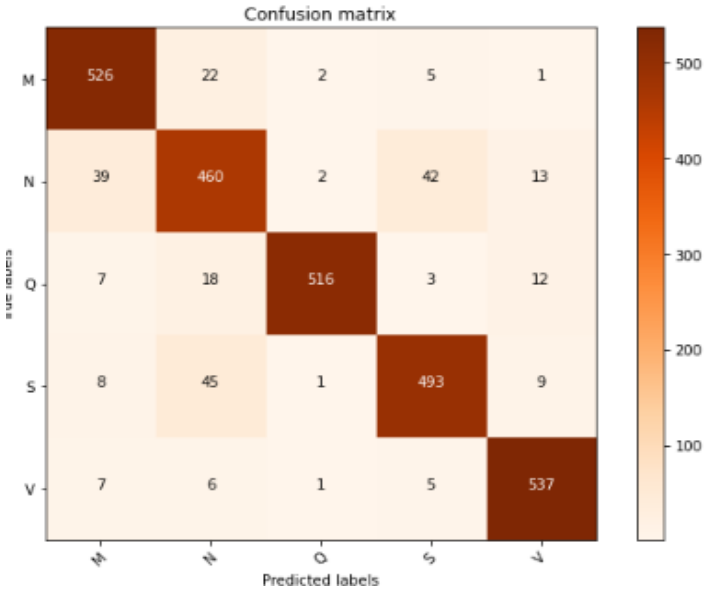

Figure 8.2 Confusion matrix

A confusion matrix is a table that is used to define the performance of a classification algorithm. A confusion matrix visualizes and summarizes the performance of a classification algorithm.

8.3 Training and validation losses

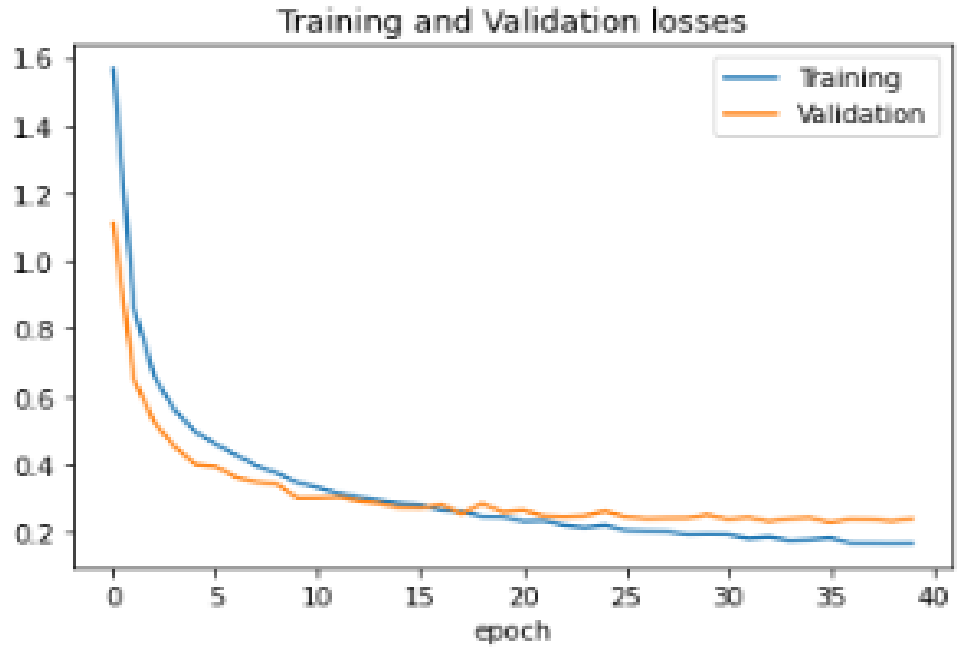

Figure 8.3 Training and validation losses

The training loss indicates how well the model is fitting the training data, while the validation loss indicates how well the model fits new data. Another common practice is to have multiple metrics in the same chart as well as those metrics for different models.

8.4 Training and testing accuracy

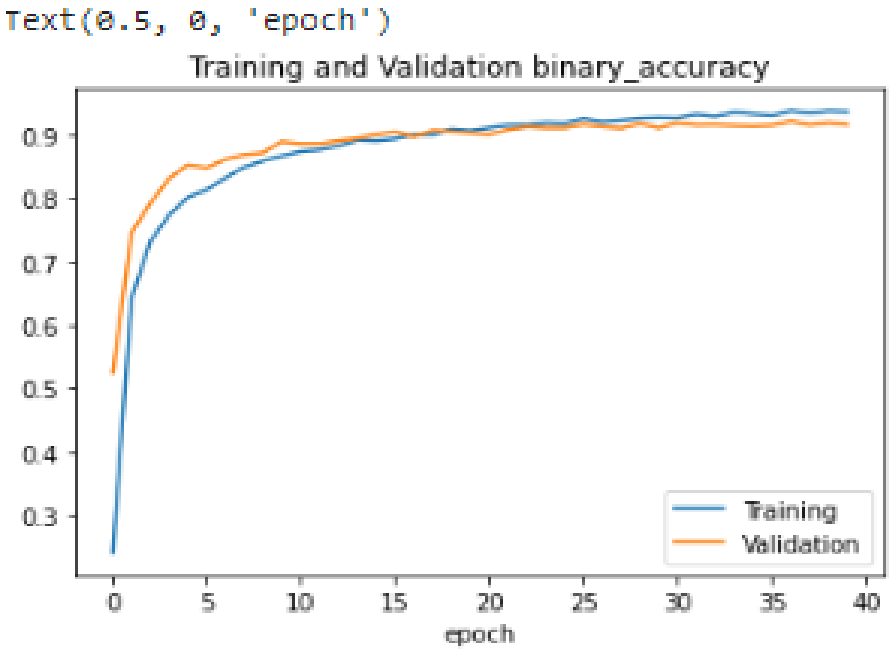

Figure 8.4 Training and testing accuracy

Training accuracy means that identical images are used both for training and testing, while test accuracy represents that the trained model identifies independent images that were not used in training.

CHAPTER-9

ADVANTAGES

1. CNN framework can, on the other hand, automatically and efficiently learn the intrinsic image features from lung image patches that are most suitable for the classification purpose.
2. The results the database demonstrate that the proposed solution achieves a superior classification performance than most of the state-of-the-art methods for the detection of ventricular ectopic beats and supraventricular ectopic beats.
3. The proposed method can be deployed in telemedicine scenarios to assist cardiologists into more accurately and objectively diagnosing ECG signals.

CHAPTER-10

CONCLUSION

This project is designed the In using the MIT-BIH arrhythmia database, we have proposed a system for the automatic processing of the ECG for the classification of arrhythmia images. The database of MIT-BIH is processed visually and a waveform detection method is proposed for detecting the QRS waveform. A CNN model was built to train and classify the ECG images. Experimental results show that according to the ANSI/AAMI EC57 evaluation criteria, The accuracy rate of ventricular ectopic beat can reach 95.9% and the sensitivity evaluation is 93.0%. For the supraventricular ectopic beat class, the accuracy rate is 93.2% and the sensitivity evaluation is 81.3%

CHAPTER-11

FUTURE SCOPE

In future work we designed real time implementation of processor design of arrythmia classification.Future advances in arrhythmia management will include improvements in catheter design and energy sources for ablation, and greater monitoring capacity of implantable devices.

CHAPTER-12

APPENDIX

GitHub Link : https://github.com/IBM-EPBL/IBM-Project-21338-1659778172

Demo Link : https://drive.google.com/file/d/1Sqm6q8yG68jdvi5-yklQMYz94xZmLRPW/view?usp=drivesdk

12.1 SOURCE CODE:

```
import numpy as np
import pandas as pd
from pathlib import Path
import os.path
import tensorflow as tf
dir = Path('../input/ecg-image-data/ECG_Image_data/train')
filepaths = list(dir.glob(r'**/*.png'))
labels = list(map(lambda x: os.path.split(os.path.split(x)[0])[1], filepaths))

filepaths = pd.Series(filepaths, name='Filepath').astype(str)
labels = pd.Series(labels, name='Label')

dataframe = pd.concat([filepaths , labels] , axis=1)
dataframe
dataframe['Label'].value_counts()
dataframe['Label'].unique()
samples = []
for category in ['N', 'M', 'Q', 'S', 'V']:
category_slice = dataframe.query("Label == @category")
```

```
samples.append(category_slice.sample(2223, random_state=1)

dataframe_train = pd.concat(samples, axis=0).sample(frac=1.0,
random_state=1).reset_index(drop=True)
dataframe_train['Label'].value_counts()
dir = Path('../input/ecg-image-data/ECG_Image_data/train')

filepaths = list(dir.glob(r'F/*.png'))
labels = list(map(lambda x: os.path.split(os.path.split(x)[0])[1], filepaths))

filepaths = pd.Series(filepaths, name='Filepath').astype(str)

labels = pd.Series(labels, name='Label')
F = pd.concat([filepaths , labels] , axis=1)
%%time
dir = Path('../input/ecg-image-data/ECG_Image_data/test')

filepaths = list(dir.glob(r'**/*.png'))
labels = list(map(lambda x: os.path.split(os.path.split(x)[0])[1], filepaths))

filepaths = pd.Series(filepaths, name='Filepath').astype(str)
labels = pd.Series(labels, name='Label')

dataframe_test = pd.concat([filepaths , labels] , axis=1)
dataframe_test
```

preprocessing of code

```
size=64
color_mode='grayscale'
```

```
batch_size=32
train_images = train_generator.flow_from_dataframe(
dataframe=dataframe_train,
x_col='Filepath',
y_col='Label',
target_size=(size, size),
color_mode=color_mode,
class_mode='categorical',
batch_size=batch_size,
shuffle=True,
seed=42,
subset='training'
)

val_images = train_generator.flow_from_dataframe(
dataframe=dataframe_train,
x_col='Filepath',
y_col='Label',
target_size=(size, size),
color_mode=color_mode,
class_mode='categorical',
batch_size=batch_size,
shuffle=True,
seed=42,
subset='validation'
)

test_images = test_generator.flow_from_dataframe(
dataframe=dataframe_test,
```

```
x_col='Filepath',

y_col='Label',

target_size=(size, size),
color_mode=color_mode,
class_mode='categorical',
batch_size=batch_size,
shuffle=False
)
```

Model summary

```
size=64
color_mode='grayscale'
batch_size=32
train_images = train_generator.flow_from_dataframe(
dataframe=dataframe_train,
x_col='Filepath',
y_col='Label',
target_size=(size, size),
color_mode=color_mode,
class_mode='categorical',
batch_size=batch_size,
shuffle=True,
seed=42,
subset='training'
)
```

```
val_images = train_generator.flow_from_dataframe(
dataframe=dataframe_train,
x_col='Filepath',
y_col='Label',
target_size=(size, size),
color_mode=color_mode,
class_mode='categorical',
batch_size=batch_size,
shuffle=True,
seed=42,
subset='validation'
)

test_images = test_generator.flow_from_dataframe(
dataframe=dataframe_test,
x_col='Filepath',
y_col='Label',
target_size=(size, size),
color_mode=color_mode,
class_mode='categorical',

batch_size=batch_size,

shuffle=False
)

import keras
checkpoint = keras.callbacks.ModelCheckpoint(
filepath='best_model.h5',
```

```
save_weights_only=False,
monitor='val_accuracy',
mode='max',
save_best_only=True,
verbose=1)

model.compile(
optimizer='adam',
loss='categorical_crossentropy',
metrics=['accuracy']
)

import matplotlib.pyplot as plt

plt.plot(result.history['loss'])
plt.plot(result.history['val_loss'])
plt.legend(['Training', 'Validation'])
plt.title('Training and Validation losses')
plt.xlabel('epoch')
```

Html coding

```
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<meta http-equiv="X-UA-Compatible" content="ie=edge">
<title>Aroma Shop - Home</title>
```

```
<link rel="icon" href="static/img/Fevicon.png" type="image/png">
<link rel="stylesheet" href="static/vendors/bootstrap/bootstrap.min.css">
<link rel="stylesheet" href="static/vendors/fontawesome/css/all.min.css">
<link rel="stylesheet" href="static/vendors/themify-icons/themify-icons.css">
<link rel="stylesheet" href="static/vendors/nice-select/nice-select.css">
<link rel="stylesheet" href="static/vendors/owl-carousel/owl.theme.default.min.css">
<link rel="stylesheet" href="static/vendors/owl-carousel/owl.carousel.min.css">

<link rel="stylesheet" href="static/css/style.css">
</head>

<body>
<!--================ Start Header Menu Area =================-->
<header class="header_area">
<div class="main_menu">
<nav class="navbar navbar-expand-lg navbar-light">

<div class="container">
<a class="navbar-brand logo_h" href="index.html"><img src="static/img/logo.png" alt=""></a>
<button class="navbar-toggler" type="button" data-toggle="collapse" data-
target="#navbarSupportedContent"
aria-controls="navbarSupportedContent" aria-expanded="false" aria-label="Toggle navigation">
<span class="icon-bar"></span>
<span class="icon-bar"></span>
<span class="icon-bar"></span>
</button>
<div class="collapse navbar-collapse offset" id="navbarSupportedContent">
<ul class="nav navbar-nav menu_nav ml-auto mr-auto">
<li class="nav-item active"><a class="nav-link" href="index.html">Home</a></li>
```

```
<li class="nav-item submenu dropdown">
<a href="#" class="nav-link dropdown-toggle" data-toggle="dropdown" role="button" aria-haspopup="true"
aria-expanded="false">Shop</a>
<ul class="dropdown-menu">
<li class="nav-item"><a class="nav-link" href="category.html">Shop Category</a></li>
<li class="nav-item"><a class="nav-link" href="single-product.html">Product Details</a></li>
<li class="nav-item"><a class="nav-link" href="checkout.html">Product Checkout</a></li>
<li class="nav-item"><a class="nav-link" href="confirmation.html">Confirmation</a></li>
<li class="nav-item"><a class="nav-link" href="cart.html">Shopping Cart</a></li>
</ul>
</li>
<li class="nav-item submenu dropdown">
<a href="#" class="nav-link dropdown-toggle" data-toggle="dropdown" role="button" aria-haspopup="true"
aria-expanded="false">Blog</a>
<ul class="dropdown-menu">
<li class="nav-item"><a class="nav-link" href="blog.html">Blog</a></li>
<li class="nav-item"><a class="nav-link" href="single-blog.html">Blog Details</a></li>
</ul>
</li>
<li class="nav-item submenu dropdown">
<a href="#" class="nav-link dropdown-toggle" data-toggle="dropdown" role="button" aria-haspopup="true"
aria-expanded="false">Pages</a>
<ul class="dropdown-menu">
<li class="nav-item"><a class="nav-link" href="sign.html">Login</a></li>
<li class="nav-item"><a class="nav-link" href="/register">Register</a></li>
<li class="nav-item"><a class="nav-link" href="tracking-order.html">Tracking</a></li>
```

```
</ul>
</li>
<li class="nav-item"><a class="nav-link" href="contact.html">Contact</a></li>
</ul>

<ul class="nav-shop">
<li class="nav-item"><button><i class="ti-search"></i></button></li>
<li class="nav-item"><button><i class="ti-shopping-cart"></i><span class="nav-
shop__circle">3</span></button> </li>
<li class="nav-item"><a class="button button-header" href="#">Buy Now</a></li>


</ul>
</div>
</div>
</nav>
</div>
</header>
<!--================ End Header Menu Area =================-->

<main class="site-main">

<!--================ Hero banner start =================-->
<section class="hero-banner">
<div class="container">
<div class="row no-gutters align-items-center pt-60px">
<div class="col-5 d-none d-sm-block">
<div class="hero-banner__img">
<img class="img-fluid" src="static/img/home/hero-banner.png" alt="">
```

```
</div>
</div>
<div class="col-sm-7 col-lg-6 offset-lg-1 pl-4 pl-md-5 pl-lg-0">
<div class="hero-banner__content">
<h4>Shop is fun</h4>
<h1>Browse Our Premium Product</h1>
<p>Us which over of signs divide dominion deep fill bring they're meat beho upon own earth without morning over third. Their male dry. They are great appear whose land fly grass.</p>
<a class="button button-hero" href="#">Browse Now</a>
</div>
</div>
</div>
</div>
</section>
<!--================= Hero banner start =================-->

<!--================= Hero Carousel start =================-->
<section class="section-margin mt-0">
<div class="owl-carousel owl-theme hero-carousel">
<div class="hero-carousel__slide">
<img src="img/home/hero-slide1.png" alt="" class="img-fluid">
<a href="#" class="hero-carousel__slideOverlay">
<h3>Wireless Headphone</h3>
<p>Accessories Item</p>
</a>
</div>
<div class="hero-carousel__slide">
<img src="static/img/home/hero-slide2.png" alt="" class="img-fluid">
<a href="#" class="hero-carousel__slideOverlay">
```

```
<h3>Wireless Headphone</h3>
<p>Accessories Item</p>
</a>
</div>
<div class="hero-carousel__slide">
<img src="static/img/home/hero-slide3.png" alt="" class="img-fluid">
<a href="#" class="hero-carousel__slideOverlay">
<h3>Wireless Headphone</h3>

<p>Accessories Item</p>
</a>
</div>
</div>
</section>
<!--================= Hero Carousel end ==================-->

<!-- ================ trending product section start ================= -->

<section class="section-margin calc-60px">
<div class="container">
<div class="section-intro pb-60px">
<p>Popular Item in the market</p>
<h2>Trending <span class="section-intro__style">Product</span></h2>
</div>
<div class="row">
<div class="col-md-6 col-lg-4 col-xl-3">
<div class="card text-center card-product">
<div class="card-product__img">
<img class="card-img" src="static/img/product/product1.png" alt="">
```

```
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Accessories</p>
<h4 class="card-product__title"><a href="single-product.html">Quartz Belt Watch</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>
</div>
<div class="col-md-6 col-lg-4 col-xl-3">
<div class="card text-center card-product">
<div class="card-product__img">
<img class="card-img" src="static/img/product/product2.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Beauty</p>
<h4 class="card-product__title"><a href="single-product.html">Women Freshwash</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>
```

```
</div>
<div class="col-md-6 col-lg-4 col-xl-3">
<div class="card text-center card-product">
<div class="card-product__img">
<img class="card-img" src="static/img/product/product3.png" alt="">

<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Decor</p>
<h4 class="card-product__title"><a href="single-product.html">Room Flash Light</a></h4>

<p class="card-product__price">$150.00</p>
</div>
</div>
</div>
<div class="col-md-6 col-lg-4 col-xl-3">
<div class="card text-center card-product">
<div class="card-product__img">
<img class="card-img" src="static/img/product/product4.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
```

```
</div>
<div class="card-body">
<p>Decor</p>
<h4 class="card-product__title"><a href="single-product.html">Room Flash Light</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>
</div>
<div class="col-md-6 col-lg-4 col-xl-3">
<div class="card text-center card-product">
<div class="card-product__img">
<img class="card-img" src="static/img/product/product5.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Accessories</p>
<h4 class="card-product__title"><a href="single-product.html">Man Office Bag</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>
</div>
<div class="col-md-6 col-lg-4 col-xl-3">
<div class="card text-center card-product">
<div class="card-product__img">
<img class="card-img" src="static/img/product/product6.png" alt="">
```

```
<ul class="card-product__imgOverlay">


<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Kids Toy</p>
<h4 class="card-product__title"><a href="single-product.html">Charging Car</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>

</div>
<div class="col-md-6 col-lg-4 col-xl-3">
<div class="card text-center card-product">
<div class="card-product__img">
<img class="card-img" src="static/img/product/product7.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Accessories</p>
<h4 class="card-product__title"><a href="single-product.html">Blutooth Speaker</a></h4>
```

```
<p class="card-product__price">$150.00</p>
</div>
</div>
</div>
<div class="col-md-6 col-lg-4 col-xl-3">
<div class="card text-center card-product">
<div class="card-product__img">
<img class="card-img" src="static/img/product/product8.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Kids Toy</p>
<h4 class="card-product__title"><a href="#">Charging Car</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>
</div>
</div>
</div>
</section>
<!-- ================ trending product section end ================ -->

<!-- ================ offer section start ================ -->

<section class="offer" id="parallax-1" data-anchor-target="#parallax-1" data-300-
```

```
top="background-position: 20px 30px" data-top-bottom="background-position: 0 20px">
<div class="container">
<div class="row">
<div class="col-xl-5">
<div class="offer__content text-center">
<h3>Up To 50% Off</h3>
<h4>Winter Sale</h4>
<p>Him she'd let them sixth saw light</p>
<a class="button button--active mt-3 mt-xl-4" href="#">Shop Now</a>
</div>



</div>
</div>
</div>
</section>
<!-- ================ offer section end ================= -->

<!-- ================ Best Selling item  carousel ================= -->
<section class="section-margin calc-60px">
<div class="container">
<div class="section-intro pb-60px">
<p>Popular Item in the market</p>
<h2>Best <span class="section-intro__style">Sellers</span></h2>
</div>
<div class="owl-carousel owl-theme" id="bestSellerCarousel">
<div class="card text-center card-product">
<div class="card-product__img">
<img class="img-fluid" src="static/img/product/product1.png" alt="">
```

```
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Accessories</p>
<h4 class="card-product__title"><a href="single-product.html">Quartz Belt Watch</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>

<div class="card text-center card-product">
<div class="card-product__img">
<img class="img-fluid" src="static/img/product/product2.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Beauty</p>

<h4 class="card-product__title"><a href="single-product.html">Women Freshwash</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>
```

```
<div class="card text-center card-product">
<div class="card-product__img">
<img class="img-fluid" src="static/img/product/product3.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>


</ul>
</div>
<div class="card-body">
<p>Decor</p>
<h4 class="card-product__title"><a href="single-product.html">Room Flash Light</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>

<div class="card text-center card-product">
<div class="card-product__img">
<img class="img-fluid" src="static/img/product/product4.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
```

```
<p>Decor</p>
<h4 class="card-product__title"><a href="single-product.html">Room Flash Light</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>

<div class="card text-center card-product">
<div class="card-product__img">
<img class="img-fluid" src="static/img/product/product1.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Accessories</p>
<h4 class="card-product__title"><a href="single-product.html">Quartz Belt Watch</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>

<div class="card text-center card-product">
<div class="card-product__img">
<img class="img-fluid" src="static/img/product/product2.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
```

```
</ul>
</div>
<div class="card-body">
<p>Beauty</p>

<h4 class="card-product__title"><a href="single-product.html">Women Freshwash</a></h4>
<p class="card-product__price">$150.00</p>

</div>
</div>

<div class="card text-center card-product">
<div class="card-product__img">
<img class="img-fluid" src="static/img/product/product3.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Decor</p>
<h4 class="card-product__title"><a href="single-product.html">Room Flash Light</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>

<div class="card text-center card-product">
<div class="card-product__img">
```

```
<img class="img-fluid" src="static/img/product/product4.png" alt="">
<ul class="card-product__imgOverlay">
<li><button><i class="ti-search"></i></button></li>
<li><button><i class="ti-shopping-cart"></i></button></li>
<li><button><i class="ti-heart"></i></button></li>
</ul>
</div>
<div class="card-body">
<p>Decor</p>
<h4 class="card-product__title"><a href="single-product.html">Room Flash Light</a></h4>
<p class="card-product__price">$150.00</p>
</div>
</div>
</div>
</div>
</section>
<!-- ================ Best Selling item  carousel end ================= -->


<!-- ================ Blog section start ================= -->
<section class="blog">
<div class="container">
<div class="section-intro pb-60px">
<p>Popular Item in the market</p>
<h2>Latest <span class="section-intro__style">News</span></h2>
</div>

<div class="row">
<div class="col-md-6 col-lg-4 mb-4 mb-lg-0">
```

```
<div class="card card-blog">
<div class="card-blog__img">
<img class="card-img rounded-0" src="static/img/blog/blog1.png" alt="">
</div>
<div class="card-body">

<ul class="card-blog__info">
<li><a href="#">By Admin</a></li>
<li><a href="#"><i class="ti-comments-smiley"></i> 2 Comments</a></li>
</ul>
<h4 class="card-blog__title"><a href="single-blog.html">The Richland Center Shooping News and weekly shooper</a></h4>
<p>Let one fifth i bring fly to divided face for bearing divide unto seed. Winged divided light Forth.</p>
<a class="card-blog__link" href="#">Read More <i class="ti-arrow-right"></i></a>
</div>
</div>
</div>

<div class="col-md-6 col-lg-4 mb-4 mb-lg-0">
<div class="card card-blog">
<div class="card-blog__img">
<img class="card-img rounded-0" src="static/img/blog/blog2.png" alt="">
</div>
<div class="card-body">
<ul class="card-blog__info">
<li><a href="#">By Admin</a></li>
<li><a href="#"><i class="ti-comments-smiley"></i> 2 Comments</a></li>
</ul>
```

<h4 class="card-blog__title">The Shopping News also offers top-quality printing services</h4>
Let one fifth i bring fly to divided face for bearing divide unto seed. Winged divided light Forth.
Read More

<img class="card-img rounded-0" src="static/img/blog/blog3.png" alt="">

<ul class="card-blog__info">
By Admin

 2 Comments

<h4 class="card-blog__title">Professional design staff and efficient equipment you'll find we offer</h4>
Let one fifth i bring fly to divided face for bearing divide unto seed. Winged divided light Forth.
Read More

```
</div>
</div>
</section>
<!-- ================ Blog section end ================= -->


<!-- ================ Subscribe section start ================= -->
<section class="subscribe-position">

<div class="container">
<div class="subscribe text-center">
<h3 class="subscribe__title">Get Update From Anywhere</h3>
<p>Bearing Void gathering light light his eavening unto dont afraid</p>
<div id="mc_embed_signup">
<form target="_blank" action="https://spondonit.us12.list-
manage.com/subscribe/post?u=1462626880ade1ac87bd9c93a&amp;id=92a4423d01"
method="get" class="subscribe-form form-inline mt-5 pt-1">
<div class="form-group ml-sm-auto">
<input class="form-control mb-1" type="email" name="EMAIL" placeholder="Enter your
email" onfocus="this.placeholder = "" onblur="this.placeholder = 'Your Email Address '" >
<div class="info"></div>
</div>
<button class="button button-subscribe mr-auto mb-1" type="submit">Subscribe Now</button>
<div style="position: absolute; left: -5000px;">
<input name="b_36c4fd991d266f23781ded980_aefe40901a" tabindex="-1" value=""
type="text">
</div>

</form>
```

```
</div>


</div>
</div>
</section>
<!-- ================ Subscribe section end ================ -->
</main>
<!--================ Start footer Area  ================-->
<footer class="footer">
<div class="footer-area">
<div class="container">
<div class="row section_gap">
<div class="col-lg-3 col-md-6 col-sm-6">
<div class="single-footer-widget tp_widgets">
<h4 class="footer_title large_title">Our Mission</h4>
<p>
So seed seed green that winged cattle in. Gathering thing made fly you're no
divided deep moved us lan Gathering thing us land years living.
</p>
<p>
So seed seed green that winged cattle in. Gathering thing made fly you're no divided deep moved
</p>
</div>
</div>
<div class="offset-lg-1 col-lg-2 col-md-6 col-sm-6">
<div class="single-footer-widget tp_widgets">
<h4 class="footer_title">Quick Links</h4>
<ul class="list">
<li><a href="#">Home</a></li>
```

```
<li><a href="#">Shop</a></li>
<li><a href="#">Blog</a></li>
<li><a href="#">Product</a></li>
<li><a href="#">Brand</a></li>
<li><a href="#">Contact</a></li>
</ul>
</div>
</div>
<div class="col-lg-2 col-md-6 col-sm-6">
<div class="single-footer-widget instafeed">
<h4 class="footer_title">Gallery</h4>
<ul class="list instafeed d-flex flex-wrap">
<li><img src="static/img/gallery/r1.jpg" alt=""></li>
<li><img src="static/img/gallery/r2.jpg" alt=""></li>
<li><img src="static/img/gallery/r3.jpg" alt=""></li>
<li><img src="static/img/gallery/r5.jpg" alt=""></li>
<li><img src="static/img/gallery/r7.jpg" alt=""></li>
<li><img src="static/mg/gallery/r8.jpg" alt=""></li>
</ul>
</div>
</div>
<div class="offset-lg-1 col-lg-3 col-md-6 col-sm-6">
<div class="single-footer-widget tp_widgets">
<h4 class="footer_title">Contact Us</h4>
<div class="ml-40">
<p class="sm-head">
<span class="fa fa-location-arrow"></span>
Head Office
</p>
```

```
<p>123, Main Street, Your City</p>

<p class="sm-head">
<span class="fa fa-phone"></span>


Phone Number
</p>
<p>
+123 456 7890 <br>
+123 456 7890
</p>

<p class="sm-head">
<span class="fa fa-envelope"></span>
Email
</p>
<p>
free@infoexample.com <br>
www.infoexample.com
</p>
</div>
</div>
</div>
</div>
</div>
</div>

<div class="footer-bottom">
```

```
<div class="container">
<div class="row d-flex">
<p class="col-lg-12 footer-text text-center">
<!-- Link back to Colorlib can't be removed. Template is licensed under CC BY 3.0. -->
Copyright &copy;<script>document.write(new Date().getFullYear());</script> All rights reserved | This template is made with <i class="fa fa-heart" aria-hidden="true"></i> by <a href="https://colorlib.com" target="_blank">Colorlib</a>
<!-- Link back to Colorlib can't be removed. Template is licensed under CC BY 3.0. --></p>
</div>
</div>
</div>
</footer>
<!--================ End footer Area  ================-
<script src="static/vendors/jquery/jquery-3.2.1.min.js"></script>
<script src="static/vendors/bootstrap/bootstrap.bundle.min.js"></script>
<script src="static/vendors/skrollr.min.js"></script>
<script src="static/vendors/owl-carousel/owl.carousel.min.js"></script>
<script src="static/vendors/nice-select/jquery.nice-select.min.js"></script>
<script src="static/vendors/jquery.ajaxchimp.min.js"></script>
<script src="static/vendors/mail-script.js"></script>
<script src="static/js/main.js"></script>
</body>
</html>
```