

IBM PROJECT - 6217-1658824745
Classification of Arrhythmia by Using Deep Learning with 2-D ECG
Spectral ImageRepresentation

TEAM DETAILS: TEAM ID:PNT2022TMID34108

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Introduction

1.1project overview

This project is design and implementation of detection of arrhythmia 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 utilised in a wide range of health care related applications and dat a sets,manyarrhythmia classifiers using deeplearning methods have be en 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

Literature Survey

1. Arrhythmia Classification Techniques Using Deep Neural Network (2021):

Description:

The automated screening of arrhythmia classification using ECG beats is developed for ages. The deep learning based automated arrhythmia classification techniques are developed with high accuracy. The primary concerns that affect the success of the developed arrhythmia detection systems are (i) manual features selection, (ii) techniques used for features extraction, and (iii) algorithm used for classification and the most important is the use of imbalanced data for classification.

Result:

The major concerns that affect the success of the developed arrhythmia detection systems are (i) manual features selection, (ii) techniques used for features extraction, and (iii) algorithm used for classification and the most important is the use of imbalanced data for classification.

Future works:

The automated arrhythmia detection required the feature extraction of ECG images that required domain knowledge. Further, the balanced dataset used for classification methods is required to avoid overfitting.

Authors:

Ali Haider Khan, Muzammil Hussain and Muhammad Kamran Malik.

2 Classification of Arrhythmia in Heartbeat Detection Using Deep Learning (2021):

Description:

Aims to apply deep learning techniques on the publicly available dataset to classify arrhythmia. The system combines three different types of information: RR intervals, signal morphology, and higher-level statistical data. It is concluded that fuzzy-based technology is successful in the analysis of computerised ECG but needs more research.

Result:

It has the ability to produce very accurate predictions with a 99.12 percent accuracy rate for the CNN model, 99.3 percent accuracy for the CNN + LSTM model, and 99.29 percent accuracy for CNN + LSTM + Attention Model.

Future works:

This study should be conducted in binding domains like cloud and mobile systems. It is also vital to develop wearable technologies with integrated low-power consumption wearable technologies.

Authors:

Wusat Ullah, Imran Siddique, Rana Muhammad Zulqarnain, Mohammad Mahtab Alam, Irfan Ahmad and Usman Ahmad Raza.

3 Classification of Arrhythmia by Using Deep Learning with 2-D ECG Spectral Image Representation (2020):**Description:**

Proposal of two-dimensional (2-D) convolutional neural network (CNN) model for the classification of ECG signals into eight classes; namely, normal beat, premature ventricular contraction beat, paced beat, right bundle branch block beat, left bundle branch block beat, atrial premature contraction beat, ventricular flutter wave beat, and ventricular escape beat.

The one-dimensional ECG time series signals are transformed into 2-D spectrograms through short-time Fourier transform. The 2-D CNN model consisting of four convolutional layers and four pooling layers is designed for extracting robust features from the input spectrograms.

Result:

We achieved a state-of-the-art average classification accuracy of 99.11%, which is better than those of recently reported results in classifying similar types of arrhythmias. The performance is significant in other indices as well, including sensitivity and specificity, which indicates the success of the proposed method.

Future work:

The proposed model has attained the highest sensitivity among all the compared CNN algorithms. It is pertinent to note that detecting these cardiac arrhythmias is a labour-intensive task, where a clinical expert needs to carefully observe recordings that can go for up to hours. With such automated methods, the artificially intelligent system could augment the performance of clinical experts by detecting these patterns and directing the observer to look more closely at regions of more significance. This would ultimately improve the clinical diagnosis and treatment of some of the major CVDs.

Authors:

Amin Ullah, Syed Anwar, Muhammad Bilal, Raja Majid Mehmood.

4 Cardiac arrhythmia detection using deep learning (2017):

Description:

An electrocardiogram is an important diagnostic tool for the assessment of cardiac arrhythmias in clinical routine. A deep learning framework previously trained on a general image data set is transferred to carry out automatic ECG arrhythmia diagnostics by classifying patient ECGs into

corresponding cardiac conditions. Transferred deep convolutional neural network is used as a feature extractor and the extracted features are fed into a simple back propagation neural network to carry out the final classification.

Result:

We observed that ECG Data obtained from the MIT-BIH database are pre-processed, QRS complexes are detected and features in R-T intervals are extracted. When all of the tested networks are evaluated, it is found that networks based on transferred deep learning feature extraction obtained almost 100% recognition rates and accuracies above 96% in the training phase.

Future works:

It won't be too surprising to see state-of-the-art performances from deep learning applications not only in medical signals and imaging diagnostics but also in other popular subfields of biomedical imaging and signals.

Authors:

Ali Isina, Selen Ozdalili.

5 A deep convolutional neural network model to classify heartbeats (2017):

Description:

The basis of arrhythmia diagnosis is the identification of normal versus abnormal individual heart beats, and their correct classification into different diagnoses, based on ECG morphology. Heartbeats can be subdivided into five categories namely non-ectopic, supraventricular ectopic, ventricular ectopic, fusion, and unknown beats. It is challenging and time-consuming to distinguish these heartbeats on ECG as these

signals are typically corrupted by noise. We developed a 9-layer deep convolutional neural network (CNN) to automatically identify 5 different categories of heartbeats in ECG signals. Our experiment was conducted in original and noise attenuated sets of ECG signals derived from a publicly available database.

Result:

This set was artificially augmented to even out the number of instances of the 5 classes of heartbeats and filtered to remove high-frequency noise. The CNN was trained using the augmented data and achieved an accuracy of 94.03% and 93.47% in the diagnostic classification of heartbeats in original and noise free ECGs, respectively. When the CNN was trained with highly imbalanced data (original dataset), the accuracy of the CNN reduced to 89.07%% and 89.3% in noisy and noise- free ECGs. When properly trained, the proposed CNN model can serve as a tool for screening of ECG to quickly identify different types and frequency of arrhythmic heartbeats.

Future works:

In the future studies, the authors would like to extend the proposed model by training a CNN to recognize temporal sequences of ECG heartbeat signals. The occurrence, sequential patterns and persistence of the five classes (N, S, V, F, and Q) of ECG heartbeats considered in this work can be grouped under three main categories of green, yellow, and red, which represents normal, abnormal, and potentially life-threatening conditions of heart electrical activity, respectively. The authors plan to discuss the performance of the CNN model using de-skewed data and data with added different levels of noise in the future studies.

Authors:

U. Rajendra Acharya, Shu Lih Oh, Yuki Hagiwara, Jen Hong Tan, Muhammad Adam.

2.1 EXISTING PROBLEM

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) heart beat 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 modelling 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 utilising 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

2.2 References

1. Kachuee, Mohammad, Shayan Fazeli, and Majid Sarrafzadeh. "Ecg heart beat classification: A deep transferable representation." 2018 IEEE international conference on healthcare informatics (ICHI). IEEE, 2018
2. S.Zhang, W.Wang, J.Ford, and F.Makedon, “Learning from incomplete ratings using non-negative matrix factorization,” in Proc. 6th SIAM Int. Conf. Data Mining, 2006, pp.549–553.
3. T.Hofmann and J.Puzicha, “Latent class models for collaborative filtering,” in Proc. 6th Int. Joint Conf. Artif. Intell., 1999, pp. 688–693.
4. B. M. Sarwar, G. Karypis, J. A. Konstan, and J. Reidl,

“Item-based collaborative filtering recommendation algorithms,”in Proc.10thInt. WorldWideWeb Conf.,2001,pp. 285–295 5.T. George and S. Merugu, “A scalable collaborative filtering framework based on co -clustering,”in Proc. 5th IEEEInt. Conf. DataMining,2005, pp. 625–628

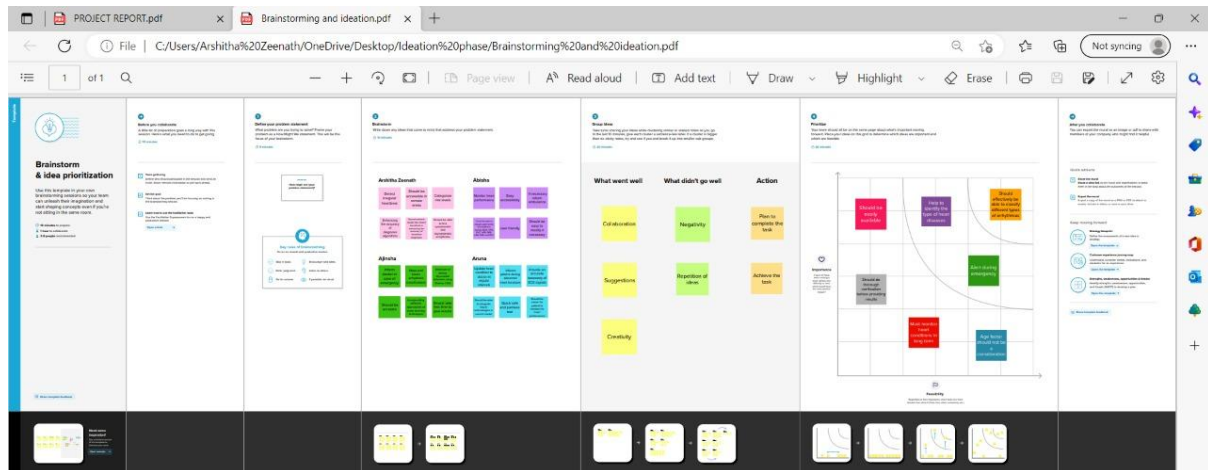
2.3 Problem Statement Definition

Cardiologists by using various values which occurred during the ECG recording decide whether the heartbeat is normal or not. Since observation of these values are not always clear, the existence of an 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 (2020):103866

3. Ideation And Proposed Solution empathy map Canva



Ideation and brainstorm



3.1 Proposed solutions

Deep learning based using to 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 (Moody and Mark, 2001) 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 recemented into heartbeats which are transformed into 2D grayscale images. Afterward, the images are used as input for training a new CNN architecture to classify heart beats

3.2 Problem Solution fit

Project Title:		Project Design Phase-I - Solution Fit Template		Team ID: PNT2022TMDXXXXX	
Define CS, fit into CC	1. CUSTOMER SEGMENT(S) <small>Who is your customer? i.e. working parents of 0-5 yrs. kids</small>	6. CUSTOMER CONSTRAINTS <small>What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices</small>	5. AVAILABLE SOLUTIONS <small>Which solutions are available to the customers when they face the problem? If need to get the job done? What have they tried in the past? What price & costs do these solutions have? i.e. pen and paper is an alternative to digital monitoring</small>	Explore AS, differentiate	
	1. People who are suffering from arrhythmia 2. Medical professionals 3. Elderly 4. People with severe heart problems	1. Budget constrains 2. Doubt on accuracy 3. Fear on getting started with technology 4. Malfunction of device	1. Direct diagnosis with doctor and waiting for results for much longer time 2. ECG/Holler monitor- portable ECG device 3. Echocardiogram 4. Implantable loop recorder - used in cases of infrequent conditions		
Focus on J&P, fit into BE, understand RC	2. JOBS-TO-BE-DONE / PROBLEMS <small>Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one, explore different sides.</small>	9. PROBLEM ROOT CAUSE <small>What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations.</small>	7. BEHAVIOUR <small>What does your customer do to address the problem and get the job done? If directly related: find the right solar panel installer, calculate usage and benefits, indirectly associated: customers spend free time on volunteering work (i.e. overspace)</small>	Focus on J&P, fit into BE, understand RC	
	1. Difficulty in visiting the hospital often 2. Unable to monitor heart asynchronous heart rhythm 3. Inability to know the heart rate	Users are not available at all the time to visit the doctors due to personal commitments, health issues, longer distance between their place and hospitals and unavailability of medical appointments	1. Users expect heart pulse to be perfectly analyzed 2. Accurate prediction of the condition 3. Expectation of accurate results 4. Ease of informing immediate relatives and medical professionals during arrhythmic attacks		
Identify strong TR & EM	3. TRIGGERS <small>What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.</small>	10. YOUR SOLUTION <small>If you are working on an existing business, write down your current solution first, tell in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.</small>	8. CHANNELS of BEHAVIOUR 8.1 ONLINE <small>What kind of actions do customers take online? Extract online channels from #7</small> 8.2 OFFLINE <small>What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.</small>	Identify strong TR & EM	
	1. Easy access to know the condition 2. Immediate results	An application which can predict the presence of arrhythmia by just feeding in the ECG tests or by measuring heart rate. The user feeds in the test and the application predicts an accurate output and produce the test results	Offline: > Customers can introduce this technology and share their experience to people with similar conditions and medical professionals Online: > Customers can access this through browsers or apps		
4. EMOTIONS: BEFORE / AFTER <small>How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure - confident, in control - use it in your communication strategy & design.</small>					

Functional and Non-functional requirements:

Proposed Solution Template:

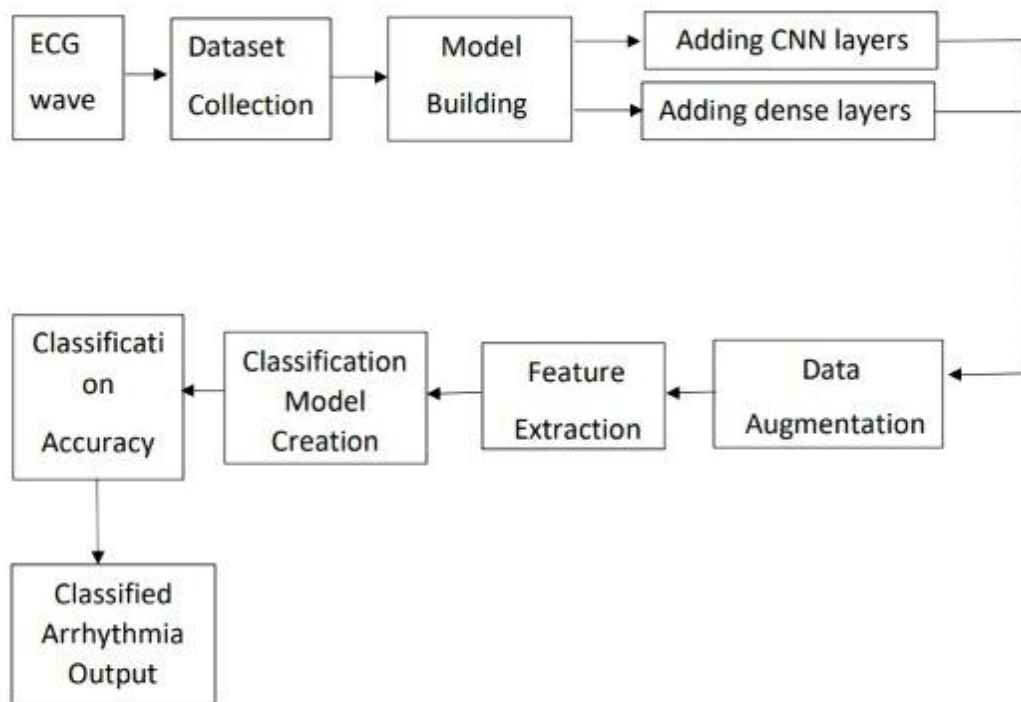
S.No.	Parameter	Description
-------	-----------	-------------

1.	<p>Problem Statement (Problem to be solved)</p>	<p>Arrhythmia is a condition in which the heart beat with an irregular or abnormal rhythm.</p> <p>There are several types of arrhythmias including atrial fibrillation, premature contraction, ventricular fibrillation, and tachycardia.</p> <p>While most arrhythmias are harmless, some can be serious and life threatening.</p>
2.	<p>Idea / Solution description</p>	<p>Create a 2D CNN (Convolutional Neural Network) based classification model for automatic classification of arrhythmias using ECG signals</p> <p>Training the model using more dataset to classify the waveforms and produce the result accurately</p> <p>Providing accurate results to detect and prevent cardio vascular diseases</p>

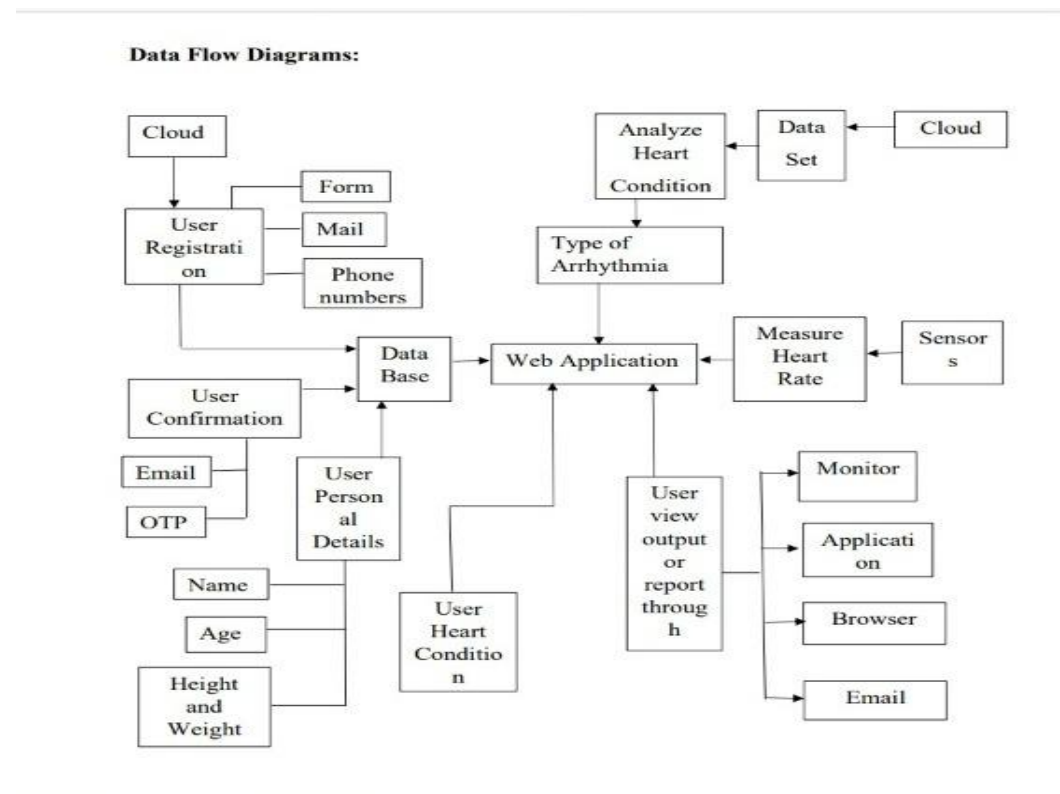
<p>3.</p>	<p>Novelty / Uniqueness</p>	<p>Providing flexibility in terms of data augmentations</p> <p>2D CNN model can learn data variations and augmentations helping in increasing the amount of data available for training</p> <p>Automatic classification of arrhythmias using ECG signal</p>
<p>4.</p>	<p>Social Impact / Customer Satisfaction</p>	<p>Ease of accessibility</p> <p>Can be done anywhere and at any time</p> <p>Have high accuracy thus provide accurate results</p> <p>Since the model has already been trained with several datasets it can classify the type of arrhythmias</p> <p>Can be easily viewed with the help of applications or browsers</p>

<p>5.</p>	<p>Business Model (Revenue Model)</p>	<p>It can be easily integrated to devices like smart watches and mobile</p> <p>It could also be integrated with medical electronic devices like Electrocardiogram, Echocardiogram, Holter monitor and Pacemaker</p> <p>The main motive of this project is not profit oriented but user satisfaction. This should be priced in a range affordable by all common people</p>
<p>6.</p>	<p>Scalability of the Solution</p>	<p>The web application will be made scalable and will be made to work with any amount of data provided</p> <p>It will be designed in a way to incorporate existing models and new models</p>

Solution Architecture:



Data Flow Diagram:



7.Coding

```
import numpy as np
import pandas as pd
from path lib import Pathimportos.
path
importtensorflowastf
dir = Path('../input/ecg-image-data/ECG_Image_data/train')
filepaths= list(dir.glob(r'**/*.png'))
labels=list(map(lambdax:os.path.split(os.path.split(x)[0])[1],filepaths))
filepaths=pd.Series(filepaths,name='Filepath').astype(str)labels=pd.Series(l
abels,na me='Label')
dataframe=pd.concat([filepaths,labels],axis=1)dataframe
dataframe['Label'].value_counts()dataframe['Label'].unique()

samples=[]
forcategoryin['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(lambdax:os.path.split(os.path.split(x)[0])[1],filepaths))
filepaths=pd.Series(filepaths,name='Filepath').astype(str)labels=pd.Series(l
abels,na me='Label')
F = pd.concat([filepaths , labels] , axis=1)F %%%time
dir=Path('../input/ecg-image-data/ECG_Image_data/test')
filepaths=list(dir.glob(r'**/*.png'))
labels=list(map(lambdax:os.path.split(os.path.split(x)[0])[1],filepaths))
filepaths=pd.Series(filepaths,name='Filepath').astype(str)labels=pd.Series(l
abels,na me='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_t
rain,
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_t
est, 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,cla ss_mode='categorical',batch_size
=batch_size,shuffle=True, seed=42,subset='training' )

```

```

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

```

```

test_images=test_generator.flow_from_dataframe(dataframe=dataframe_t
est, x_col='Filepath',y_col='Label', target_size=(size, size),
color_mode=color_mode, class_mode='categorical', batch_size
=batch_size,shuffle=False )

```

```

importkeras
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='a dam',
loss='categorical_crossentropy',metrics=['accuracy'] )

```

```

importmatplotlib.pyplotasplt
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 http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width,
initial-scale=1.0">

```

```

    <link rel="shortcut icon" href="{{url_for('static',
filename='images/fevicon.png' )}}" type="image/x-icon">

    <title>HealthDoc - About Us</title>

    <link rel="stylesheet" href="{{url_for('static',
filename='css/about.css')}}">

    <link rel="stylesheet" href="{{url_for('static',
filename='css/style.css')}}">

    <link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/aos/2.3.1/aos.css" />

    <link
href="https://fonts.googleapis.com/css2?family=Playfair+Display:wght@60
0&display=swap" rel="stylesheet" />

    <link
href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.10.0/css/all.min.css" rel="stylesheet">
</head>
<style>
    .footer {
        margin-bottom: 20px;
    }

    h1 {
        margin: 21.44px 0px;
    }
</style>

<body>
    <div class="wrapper">
        <!--Navigation Bar-->
        <div class="nav">
            <div class="logo">
                <a href="/"></a>
            </div>
            <div class="links">
                <a href="/">Home</a>
                <a href="/info">Info</a>
                <a href="/about" class="mainLink">About Us</a>
                <a href="/contact">Contact Us</a>
                <a href="/upload" class="btn1">Predict</a>
            </div>
        </div>
        <div class="landing">

```

```

        <div class="landingText" data-aos="fade-up"
data-aos-duration="1000">
            <h1>
                We are a team of
                <span style="color: #e0501b; font-size:
4vw">Arrhythmia Prediction</span>
            </h1>
            <h3>
                In this project, we build an effective
electrocardiogram (ECG) arrhythmia classification method
                using a convolutional
                neural network (CNN), in which we classify ECG into
seven categories, one being normal and the other
                six being different
                types of arrhythmia using deep two-dimensional CNN
with grayscale ECG images. We are creating a web
                application where
                the user selects the image which is to be
classified. The image is fed into the model that is
                trained and the cited
                class will be displayed on the webpage.
            </h3>
        </div>
        <div class="landingImage" data-aos="fade-down"
data-aos-duration="2000">
            
        </div>
    </div>
    <div class="main">
        <div class="profile-card">
            <div class="img">
                
            </div>
            <div class="caption">
                <h3>Arshitha Zeenath A</h3>
                <p>Professional Deep Learning Engineer, Back End
Developer</p>
                <div class="social-links">
                    <a href="#"><i class="fab fa-facebook"></i></a>
                    <a href="#"><i class="fab
fa-instagram"></i></a>
                    <a href="#"><i class="fab fa-twitter"></i></a>
                </div>
            </div>
        </div>
    </div>

```

```

        </div>
    </div>
</div>
<div class="profile-card">
    <div class="img">
        
    </div>
    <div class="caption">
        <h3>Ajinsha R</h3>
        <p>Full Stack Developer, Web Designer, Deep
Learning Engineer</p>
        <div class="social-links">
            <a href="#"><i class="fab fa-facebook"></i></a>
            <a
href="https://www.instagram.com/the_._._champ/"><i class="fab
fa-instagram"></i></a>
            <a href="#"><i class="fab fa-twitter"></i></a>
        </div>
    </div>
</div>
<div class="profile-card">
    <div class="img">
        
    </div>
    <div class="caption">
        <h3>Abisha R</h3>
        <p>Back End Developer</p>
        <div class="social-links">
            <a href="#"><i class="fab fa-facebook"></i></a>
            <a href="#"><i class="fab
fa-instagram"></i></a>
            <a href="#"><i class="fab fa-twitter"></i></a>
        </div>
    </div>
</div>
<div class="profile-card">
    <div class="img">
        
    </div>
    <div class="caption">
        <h3>Aruna D</h3>
        <p>Front End Developer</p>
        <div class="social-links">

```

```

        <a href="#"><i class="fab fa-facebook"></i></a>
        <a href="#"><i class="fab
fa-instagram"></i></a>
        <a href="#"><i class="fab fa-twitter"></i></a>
    </div>
</div>
</div>
</div>
<div class="footer">
    <h1>HealthDoc</h1>
    <div class="footerlinks">
        <a href="/home">Home</a>
        <a href="/info">Info</a>
        <a href="/about">About Us</a>
        <a href="/contact">Contact Us</a>
    </div>
</div>
</div>
<script
src="https://cdnjs.cloudflare.com/ajax/libs/aos/2.3.1/aos.js"></script>
<script>
    AOS.init();
</script>
</body>

</html>

```

```

<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
    <meta name="viewport" content="width=device-width,
initial-scale=1.0">
    <link rel="shortcut icon" href="{{url_for('static',
filename='images/fevicon.png' }}" type="image/x-icon">
    <link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/aos/2.3.1/aos.css" />

```

```

    <link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.15.3/css/all.min.css" />
    <link
href="https://fonts.googleapis.com/css2?family=Playfair+Display:wght@600&display=swap" rel="stylesheet" />
    <link rel="stylesheet" href="{{url_for('static',
filename='css/contact.css' )}}" />
    <link rel="stylesheet" href="{{url_for('static',
filename='css/style.css' )}}" />
    <title>Life Care - Contact US</title>
</head>

<body>
    <div class="wrapper">
        <div class="nav">
            <div class="logo">
                <a href="/">
                    
                </a>
            </div>
            <div class="links">
                <a href="/home" class="mainLink">Home</a>
                <a href="/info">Info</a>
                <a href="/about">About Us</a>
                <a href="/contact">Contact Us</a>
                <a href="/upload" class="btn1">Predict</a>
            </div>
        </div>
        <div class="container" data-aos="fade-down"
data-aos-duration="1000">
            <div class="image" data-aos="fade-right"
data-aos-duration="6000">
                
            </div>
            <div class="form-area">
                <h2>Contact US</h2>
                <form action="">
                    <input type="text" placeholder="Full Name">
                    <input type="email" placeholder="Email">
                    <input type="text" placeholder="Subject">

```

```

        <textarea cols="30" rows="3" placeholder="Your
Message"></textarea>
        <button type="submit">Send Message</button>
    </form>
</div>
</div>
</div>
<script
src="https://cdnjs.cloudflare.com/ajax/libs/aos/2.3.1/aos.js"></script>
    <script>
        AOS.init();
    </script>
</body>

</html>

```

```

<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="UTF-8" />
    <meta http-equiv="X-UA-Compatible" content="IE=edge" />
    <meta name="viewport" content="width=device-width, initial-scale=1.0"
/>
    <title>HealthDoc - Heart Prediction Online</title>
    <link rel="shortcut icon" href="{{url_for('static',
filename='images/fevicon.png' )}}" type="image/x-icon">
    <link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/aos/2.3.1/aos.css" />
    <link
href="https://fonts.googleapis.com/css2?family=Playfair+Display:wght@60
0&display=swap" rel="stylesheet" />
    <link rel="stylesheet" href="{{url_for('static',
filename='css/style.css' )}}" />
    <script src="https://kit.fontawesome.com/64d58efce2.js"
crossorigin="anonymous">
    </script>
</head>

<body>
    <div class="wrapper">
        <!--Navigation Bar-->
        <div class="nav">

```



```

<div class="logo">
  <a href="/">
    
  </a>
</div>
<div class="links">
  <a href="/home" class="mainLink">Home</a>
  <a href="/info">Info</a>
  <a href="/about">About Us</a>
  <a href="/contact">Contact Us</a>
  <a href="/upload" class="btn1">Predict</a>
</div>
</div>
<!--Landing Page-->
<div class="landing">
  <div class="landingText" data-aos="fade-up"
data-aos-duration="1000">
    <h1>
      Classification of Arrhythmia
      <span style="color: #e0501b; font-size:
4vw">Prediction</span>
    </h1>
    <h3>
      According to the World Health Organization (WHO),
cardiovascular diseases (CVDs) are the number one cause of
      death today. Over 17.7 million people died from CVDs in the
      year 2017 all over the world which...
    </h3>
    <div class="btn2"><a href="/info">Read more</a>
    </div>
  </div>
  <div class="landingImage" data-aos="fade-down"
data-aos-duration="2000">
    
  </div>
</div>
<!--Service Section-->
<div class="about">
  <div class="aboutText" data-aos="fade-up"
data-aos-duration="1000">

```

```

        <h1 style="margin: 20px;">
            Our Patients Are at Centre
            <span style="color: #2f8be0; font-size: 3vw">of Every We
Do</span>
        </h1>
        <div class="image-container">
            </img>
        </div>
    </div>
    <div class="aboutList" data-aos="fade-left"
data-aos-duration="1000">
        <ol>
            <li>
                <span>01</span>
                <p>99.8% accurate result.</p>
            </li>
            <li>
                <span>02</span>
                <p>No need to go hospital.</p>
            </li>
            <li>
                <span>03</span>
                <p>No need to login</p>
            </li>
            <li>
                <span>04</span>
                <p>24/7 Support.</p>
            </li>
        </ol>
    </div>
</div>

<!--Info Section-->
<div class="infoSection">
    <div class="infoHeader" data-aos="fade-up"
data-aos-duration="1000">
        <h1>
            We Analyse Youe Health states <br /><span style="color:
#e0501b">In Order to Top Service.</span>
        </h1>
    </div>

```

```

<div class="infoCards">
  <div class="card one" data-aos="fade-up"
data-aos-duration="1000">
    
    <div class="cardbgone"></div>
    <div class="cardContent">
      <h2>Health State</h2>
      <p>
        Easy to know Health state
      </p>
      <a href="/">
        <div class="cardBtn">
          
        </div>
      </a>
    </div>
  <div class="card two" data-aos="fade-up"
data-aos-duration="1300">
    
    <div class="cardbgtwo"></div>
    <div class="cardContent">
      <h2>User Friendly</h2>
      <p>
        Easy for people to use, prediction
      </p>
      <a href="/">
        <div class="cardBtn">
          
        </div>
      </a>
    </div>
  <div class="card three" data-aos="fade-up"
data-aos-duration="1600">
    
    </div class="cardbgthree"></div>
    <div class="cardContent">
        <h2>Classification of Arrhythmia</h2>
        <p>
            Prediction Classification of Arrhythmia
        </p>
        <a href="/upload">
            <div class="cardBtn">
                
            </div>
        </a>
    </div>
</div>
</div>

<!--Banner And Footer-->
<div class="banner">
    <div class="bannerText" data-aos="fade-right"
data-aos-duration="1000">
        <h1>
            Download the HealthDoc App Today <br /><span
style="font-size: 1.6vw; font-weight: normal"
            class="bannerInnerText">Stay Updated and get all your
medical needs taken care of!</span>
        </h1>
        <a href="/"></a>
        <a href="/"></a>
    </div>
    <div class="bannerImg" data-aos="fade-up"
data-aos-duration="1000">
        
    </div>
</div>

<div class="footer">
    <h1>HealthDoc</h1>
    <div class="footerlinks">
        <a href="/home" class="mainLink">Home</a>
        <a href="/info">Info</a>
    </div>
</div>

```

```

        <a href="/about">About Us</a>
        <a href="/contact">Contact Us</a>
    </div>
</div>
</div>
<script
src="https://cdnjs.cloudflare.com/ajax/libs/aos/2.3.1/aos.js"></script>
<script>
    AOS.init();
</script>
</body>

</html>

```

```

<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="UTF-8" />
    <meta http-equiv="X-UA-Compatible" content="IE=edge" />
    <meta name="viewport" content="width=device-width,
initial-scale=1.0" />
    <title>HealthDoc - About Classification of Arrhythmia</title>
    <link rel="shortcut icon" href="{url_for('static',
filename='images/fevicon.png' )}" type="image/x-icon">
    <link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/aos/2.3.1/aos.css" />
    <link
href="https://fonts.googleapis.com/css2?family=Playfair+Display:wght@60
0&display=swap" rel="stylesheet" />
    <link rel="stylesheet" href="{url_for('static',
filename='css/style.css' )}" />
    <script src="https://kit.fontawesome.com/64d58efce2.js"
crossorigin="anonymous">
    </script>
    <style>
        .banner {
            margin: 60px;
            width: auto;
            height: 300px;
            /* Setup */
            background-color: #fff;
            box-shadow: rgba(0, 0, 0, 0.15) 2.4px 2.4px 3.2px;

```

```

        display: flex;
        flex-direction: row;
        padding: 50px;
    }

    .bannerText h1 {
        font-size: 3vw;
        color: #007bff;
        font-weight: 600;
    }

    .bannerText p {
        text-indent: 50px;
        color: #777777;
        font-size: 1.2vw;
        font-weight: normal
    }

    .bannerText img {
        width: 10vw;
        margin-right: 20px;
    }

    .bannerImg img {
        margin-left: 90px;
        width: 350px;
    }
</style>
</head>

<body>
    <div class="wrapper">
        <!--Navigation Bar-->
        <div class="nav">
            <div class="logo">
                <a href="/"></a>
            </div>
            <div class="links">
                <a href="/home">Home</a>
                <a href="/info" class="mainLink">info</a>
                <a href="/about">About Us</a>
                <a href="/contact">Contact Us</a>
            </div>
        </div>
    </div>

```

```

        <a href="/upload" class="btn1">Predict</a>
    </div>
</div>
<!--Landing Page-->
<div class="landing">
    <div class="landingText" data-aos="fade-up"
data-aos-duration="1000">
        <h1>
            Classification of Arrhythmia
            <span style="color: #e0501b; font-size:
4vw">Prediction</span>
        </h1>
        <h3>
            According to the World Health Organization (WHO),
cardiovascular diseases (CVDs) are the number one
            cause of death
            today. Over 17.7 million people died from CVDs in
the year 2017 all over the world which is about
            31% of all deaths, and
            over 75% of these deaths occur in low and
middle-income countries. Arrhythmia is a representative
            type of CVD that
            refers to any irregular change from the normal
heart rhythms. There are several types of arrhythmia
            including atrial
            fibrillation, premature contraction, ventricular
fibrillation, and tachycardia. Although a single
            arrhythmia heartbeat
            may not have a serious impact on life, continuous
arrhythmia beats can result in fatal
            circumstances.
        </h3>
    </div>
    <div class="landingImage" data-aos="fade-down"
data-aos-duration="2000">
        
    </div>
</div>
<div class="banner">
    <div class="bannerText" data-aos="fade-right"
data-aos-duration="1000">
        <h1>

```

Left Bundle Branch

</h1>

<p>A delay blockage of electrical impulses to the left of the heart. Left bundle brach block

sometimes

makes it harder for the heart to pump blood efficiently through the circulatory system.</p>

<p>Most people don't have symptoms. If syntoms occur, they inlcude fainting or a slow heart rate.</p>

<p>If there's an underlying condition, such as heart disease, that condition needs treatment. In patients with heart failure, a pacemaker can also relieve symptoms as well as prevent death.</p>

</div>

<div class="bannerImg" data-aos="fade-up"

data-aos-duration="1000">

</div>

</div>

<div class="banner">

<div class="bannerText" data-aos="fade-right"

data-aos-duration="1000">

<h1>

Normal

</h1>

<p>Note that the heart is beating in a regular sinus rhythm between 60-100 beats per minute (specifically 82 bpm).</p>

<p>All the important intervals on this recording are within normal ranges.</p>

<p>The normal ECG patterns seen in children differ considerably from those in adults.</p>

</div>

<div class="bannerImg" data-aos="fade-up"

data-aos-duration="1000">


```

        </div>
    </div>
    <div class="banner">
        <div class="bannerText" data-aos="fade-right"
data-aos-duration="1000">
            <h1>
                Premature Atrial Contraction
            </h1>
            <p>usually, premature artial contraction have
                no clear cause and no health risks. In most
                cases, premature artrial contractions aren't a
                sign of heart disease and just happen
                naturally.</p>
            <p>But some people who have PACs turn out to
                have related heart conditions, such as
                Cardiomyopathy (a weakend heart muscle)
                Caronary heart disease (fatty deposits in you blood
vessels)</p>
        </div>
        <div class="bannerImg" data-aos="fade-up"
data-aos-duration="1000">
            
        </div>
    </div>
    <div class="banner">
        <div class="bannerText" data-aos="fade-right"
data-aos-duration="1000">
            <h1>
                Premature Ventricular Contractions
            </h1>
            <p>Extra, abnorma heartbeats that begininone of the
                Heart's two lower chambers.</p>
            <p>Premature ventricular contractions (PVCs) occur
                in most people at some point. Causes may include
certain
                medication, alcohol, some illegal drugs, caffeine,
                tobacco, excercise or anxiety.</p>
            <p>
                PVCs often cause no sytoms. When symptoms do
                occur, they feel like a flip-flop or skipped-beat
                sensation in the chest.
            </p>
            <p>Most people with isolated PVCs and an otherwise

```

```

        normal heart don't need treatment. PVCs occurring
        continuously serious cardiac than 30 seconds is a
        potentially serious cardiac condition known as
        ventricular tachycardia.</p>
    </div>
    <div class="bannerImg" data-aos="fade-up"
data-aos-duration="1000">
        
    </div>
</div>
<div class="banner">
    <div class="bannerText" data-aos="fade-right"
data-aos-duration="1000">
        <h1>
            Right Bundle Branch
        </h1>
        <p>Right bundle branch block is associated with
            structural changes from stretch or ischemia to
            the myocardium. It can also occur
            idiopathically from certain common cardiac
            procedures, such as right heart
catheterization.</p>
        <p>Although there is no significant association
            with cardiovascular risk factors, the presence
            with cardiovascular risk factors, the presence
            of a right bundle branch block is a predictor of
            mortality in myocardial infarction, heart
            failure, and certain heart blocks.</p>
        <p>In asymptomatic patients, isolated right bundle
            branch block typically does not need further
            evaluation.</p>
    </div>
    <div class="bannerImg" data-aos="fade-up"
data-aos-duration="1000">
        
    </div>
</div>
<div class="banner">
    <div class="bannerText" data-aos="fade-right"
data-aos-duration="1000">
        <h1>
            Ventricular Fibrillation
        </h1>

```

```

        <p>A life-threatening heart rhythm that results in a
            rapid, inadequate heartbeat.</p>
        <p>Ventricular fibrillation (VF) is a rapid,
            Life-threatening heart rhythm starting in the
bottom
            chambers of the heart. It can be triggered by a
heart attack.</p>
        <p>Because the heart doesn't pump adequately during
            ventricular fibrillation, sustained VF can cause
            low blood pressure, loss of consciousness of
death.</p>
        <p>Emergency treatment includes immediate
            defibrillation with an automated external
            defibrillator (AED) and cardiopulmonary
            resuscitation (CPR). Long-term therapy includes
            implantable defibrillators and medications to
            prevent recurrence.</p>
    </div>
    <div class="bannerImg" data-aos="fade-up"
data-aos-duration="1000">
        
    </div>
</div>
<div class="footer">
    <h1>LifeCare</h1>
    <div class="footerlinks">
        <a href="/home">Home</a>
        <a href="/info" class="mainLink">Info</a>
        <a href="/about">About Us</a>
        <a href="/contact">Contact Us</a>
    </div>
</div>
</div>
<script
src="https://cdnjs.cloudflare.com/ajax/libs/aos/2.3.1/aos.js"></script>
    <script>
        AOS.init();
    </script>
</body>

</html>

```

```
{% extends "predict_base.html" %} {% block content %}
```

```

<center>
  <h2 style="font-size: 40px;">
    ECG Arrhythmia
    <span style="color: #2f8be0; font-size:
3vw">Classification</span>
  </h2>
</center>

<div>
  <form id="upload-file" method="post" enctype="multipart/form-data">
    <center> <label for="imageUpload" class="upload-label">
      Choose...
    </label>
    <input type="file" name="file" id="imageUpload"
accept=".png, .jpg, .jpeg">
    </center>
  </form>

  <center>
    <div class="image-section" style="display:none;">
      <div class="img-preview">
        <div id="imagePreview">
        </div>
      </div>
    </div>
  </center>
</div>
<center>
  <div class="btn3" id="btn-predict"
    style="padding: 8px 34px; width: 120px; margin-top: 30px;
padding: 14px 20px 12px 20px; background-color: #007bff; border-radius:
45px; text-align: center; color: #fff; cursor: pointer;">
    Predict</div>
  <div class="loader" style="display:none;"></div>
</center>

<h3 style="color:Black" id="result">
  <span> </span>
</h3>

</div>

```

```
</div>
```

```
{% endblock %}
```

```
<!DOCTYPE html>
```

```
<html lang="en">
```

```
<head>
```

```
    <meta charset="UTF-8" />
```

```
    <meta http-equiv="X-UA-Compatible" content="IE=edge" />
```

```
    <meta name="viewport" content="width=device-width,  
initial-scale=1.0" />
```

```
    <title>HealthDoc - Heart Prediction Online</title>
```

```
    <link rel="shortcut icon" href="{{url_for('static',  
filename='images/fevicon.png' )}}" type="image/x-icon">
```

```
    <link rel="stylesheet"
```

```
href="https://cdnjs.cloudflare.com/ajax/libs/aos/2.3.1/aos.css" />
```

```
    <link
```

```
href="https://fonts.googleapis.com/css2?family=Playfair+Display:wght@60  
0&display=swap" rel="stylesheet" />
```

```
    <script
```

```
src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></scri  
pt>
```

```
    <script
```

```
src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
```

```
    <script
```

```
src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></scr  
ipt>
```

```
    <link href="{{ url_for('static', filename='css/main.css') }}"
```

```
rel="stylesheet">
```

```
    <link rel="stylesheet" href="{{url_for('static',
```

```
filename='css/style.css' )}}" />
```

```
    <script src="https://kit.fontawesome.com/64d58efce2.js"
```

```
crossorigin="anonymous">
```

```
    </script>
```

```
</head>
```

```
<body>
```

```
    <div class="wrapper">
```

```

<!--Navigation Bar-->
<div class="nav">
    <div class="logo">
        <a href="/">
            
        </a>
    </div>
    <div class="links">
        <a href="/">Home</a>
        <a href="/info">Info</a>
        <a href="/about">About Us</a>
        <a href="/contact">Contact Us</a>
        <a href="/upload" class="btn1">Predict</a>
    </div>
</div>
<!--Landing Page-->
<div class="landing">
    <div class="landingText" data-aos="fade-up"
data-aos-duration="10000">
        <h1>
            Classification of Arrhythmia
            <span style="color: #e0501b; font-size:
4vw">Prediction</span>
        </h1>
        <h3>
            According to the World Health Organization (WHO),
cardiovascular diseases (CVDs) are the number one
            cause of
            death today. Over 17.7 million people died from
CVDs in the
            year 2017 all over the world which...
        </h3>
        <div class="btn2"><a href="/info">Read more</a>
        </div>
    </div>
    <div class="landingImage" data-aos="fade-down"
data-aos-duration="2000">
        
    </div>
</div>

```

```

        <div class="about">
            <div class="aboutText" data-aos="fade-up"
data-aos-duration="1000">
                {% block content %}{% endblock %}
            </div>
        </div>

        <div class="footer">
            <h1>LifeCare</h1>
            <div class="footerlinks">
                <a href="/home">Home</a>
                <a href="/info">Info</a>
                <a href="/about">About Us</a>
                <a href="/contact">Contact Us</a>
            </div>
        </div>

        <script
src="https://cdnjs.cloudflare.com/ajax/libs/aos/2.3.1/aos.js"></script>
        <script>
            AOS.init();
        </script>
</body>
<footer>
    <script src="{% url_for('static', filename='js/main.js') %}"
type="text/javascript"></script>
</footer>

</html>

```

7. SYSTEM 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.

Output

Local Deployment:

```
C:\Windows\System32\cmd.exe - python app.py
Microsoft Windows [Version 10.0.22000.1958]
(c) Microsoft Corporation. All rights reserved.

2022-11-09 18:53:43.875379: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'cudart64_110.dll'; dlerror: cudart64_110.dll not found
2022-11-09 18:53:43.875930: I tensorflow/stream_executor/cuda/cudart_stub.cc:29] Ignore above cudart dlerror if you do not have a GPU set up on your machine.
Check
2022-11-09 18:55:26.667248: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'nvcuda.dll'; dlerror: nvcuda.dll not found
2022-11-09 18:55:26.688214: W tensorflow/stream_executor/cuda/cuda_driver.cc:283] failed call to cubinit: 10056000 (ERROR 383)
2022-11-09 18:55:26.704461: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:189] retrieving CUDA diagnostic information for host: DESKTOP-4VCEC33
2022-11-09 18:55:26.704904: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:176] hostname: DESKTOP-4VCEC33
2022-11-09 18:55:26.778357: I tensorflow/core/platform/cpu_feature_guard.cc:193] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library (oneDNN) to use the following CPU instructions in performance-critical operations: AVX AVX2
To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
* Serving Flask app "app" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

(Running App! – Flask)

[Home](#) [Info](#) [Predict](#)

ECG arrhythmia classification using CNN

According to the World Health Organization (WHO), cardiovascular diseases (CVDs) are the number one cause of death today. Over 17.7 million people died from CVDs in the year 2017 all over the world which is about 31% of all deaths, and over 75% of these deaths occur in low and middle income countries. Arrhythmia is a representative type of CVD that refers to any irregular change from the normal heart rhythms. There are several types of arrhythmia including atrial fibrillation, premature contraction, ventricular fibrillation, and tachycardia. Although single arrhythmia heartbeat may not have a serious impact on life, continuous arrhythmia beats can result in fatal circumstances. Electrocardiogram (ECG) is a non-invasive medical tool that displays the rhythm and status of the heart. Therefore, automatic detection of irregular heart rhythms from ECG signals is a significant task in the field of cardiology.

Start checking your heart's health today and avoid the dangers of undiagnosed atrial fibrillation.

we offer heart care that doesn't miss a beat.

Why you should check your heart rhythm regularly

- 1 in 4 of adults develop arrhythmias in their life
- 4.25 million strokes each year because of arrhythmias
- 75% of these strokes can be prevented

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ECG

NORMAL

Note that the heart is beating in a regular sinus rhythm between 60 - 100 beats per minute (specifically 82 bpm). All the important intervals on this recording are within normal ranges.

The normal ECG patterns seen in children differ considerably from those in adults.




VENTRICULAR FIBRILLATION

A life-threatening heart rhythm that results in a rapid, inadequate heartbeat.

Ventricular fibrillation (VF) is a rapid, life-threatening heart rhythm starting in the bottom chambers of the heart. It can be triggered by a heart attack.

Because the heart doesn't pump adequately during ventricular fibrillation, sustained VF can cause low blood pressure, loss of consciousness or death.

Emergency treatment includes immediate defibrillation with an automated external defibrillator (AED) and cardiopulmonary resuscitation (CPR). Long-term therapy includes implantable defibrillators and medications to prevent recurrence.




PREMATURE ATRIAL CONTRACTION

Usually, premature atrial contractions have no clear cause and no health risks. In most cases, premature atrial contractions aren't a sign of heart disease and just happen naturally.

But some people who have PACs turn out to have related heart conditions, such as:

- *Cardiomyopathy (a weakened heart muscle)
- *Coronary heart disease (fatty deposits in your blood vessels)




PREMATURE VENTRICULAR CONTRACTIONS

Extra, abnormal heartbeats that begin in one of the heart's two lower chambers.

Premature ventricular contractions (PVCs) occur in most people at some point. Causes may include certain medication, alcohol, some illegal drugs, caffeine, tobacco, exercise or anxiety.

PVCs often cause no symptoms. When symptoms do occur, they feel like a flip flop or skipped beat sensation in the chest.

Most people with isolated PVCs and an otherwise



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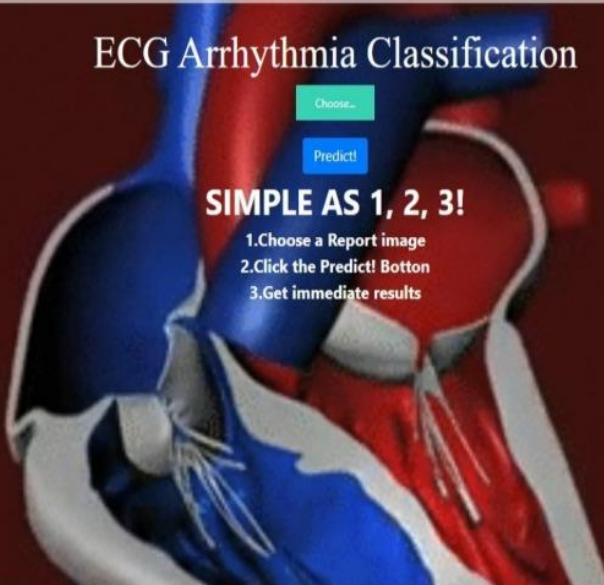
ECG Arrhythmia Classification

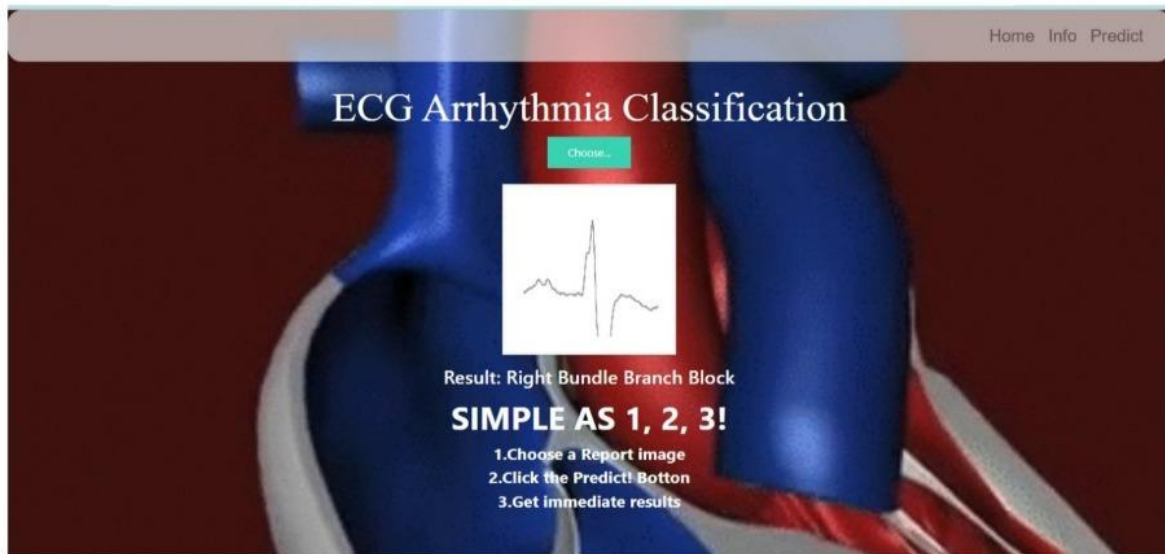
Choose...

Predict!

SIMPLE AS 1, 2, 3!

- 1.Choose a Report image
- 2.Click the Predict! Button
- 3.Get immediate results





(TheUploadedImagesStoredIn!!)

9. Advantages and disadvantages

1. High accuracy
2. High reliability
3. Reduced loss

10. Conclusions

This project is designed In using the MIT-BIH arrhythmia database, we haveproposedasystemfortheautomaticprocessingoftheECGforthe classificati on 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 theECG 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 supra ventricular ectopic beat class, the accuracy rate is 93.2% and the sensitivity evaluation is 81.

11. futurework

In future work we designed real time implementation of process or design of arrhythmia classification

12. JIRA Results

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TO DO
+ Create issue

IN PROGRESS

DONE 17 ISSUES ✓

- Download data set
✓ AC-1 ✓
- Import image data library
✓ AC-2 ✓
- Configure image data class
✓ AC-3 ✓
- Apply image data generator to functionality to trainset and testset
✓ AC-4 ✓

GROUP BY: None

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TO DO

IN PROGRESS

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- Build a python code
✓ AC-14 ✓
- Run the app
✓ AC-15 ✓
- Register for IBM Cloud
✓ AC-16 ✓
- Train the model on IBM Watson
✓ AC-17 ✓

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