DETECTING HEART DISEASES BY USING ECG IMAGES AND CNN

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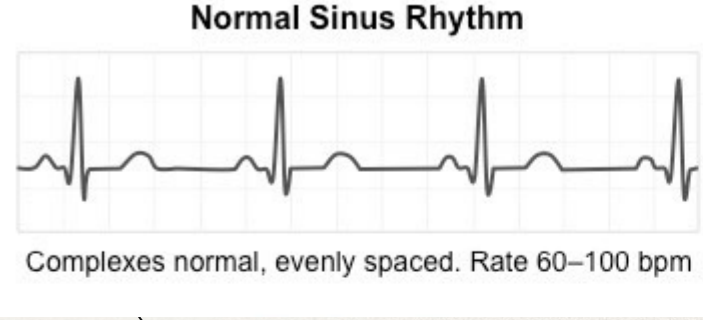
INTRODUCTION

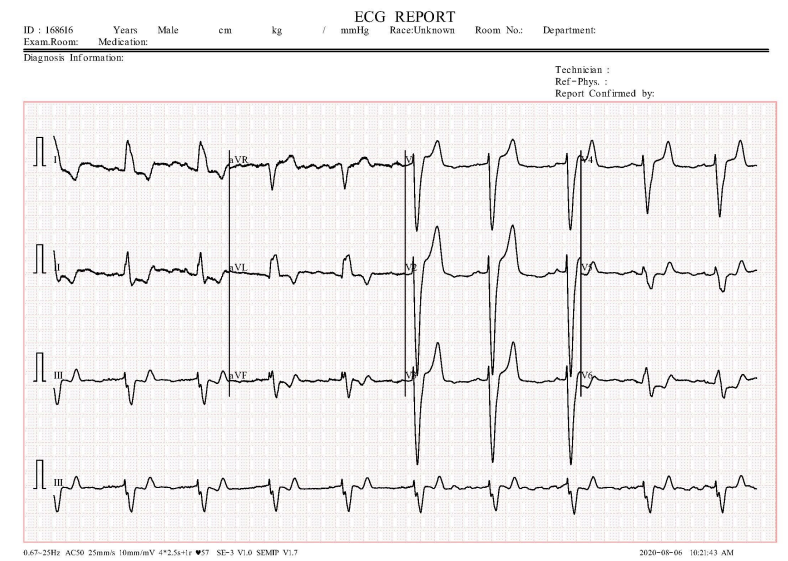
Cardiovascular diseases (CVDs) are the leading cause of death globally. An estimated 17.9 million people died from CVDs in 2019, representing 32% of all global deaths. Of these deaths, 85% were due to heart attack and stroke. Some examples of CVDs include Arrhythmia, Myocardial Infarction, Coronary artery disease, Deep Vein Thrombosis, and Pulmonary Embolism.



01

ABOUT THE DATASET

1687 ECG Reports



4 Classes

- **Normal**
- **Abnormal**
- **Myocardial Infarction (MI)**
- **History of MI**

**Collected ECG Images were reviewed by several medical professors using Telehealth ECG diagnostic systemce between Earth and the Moon

02

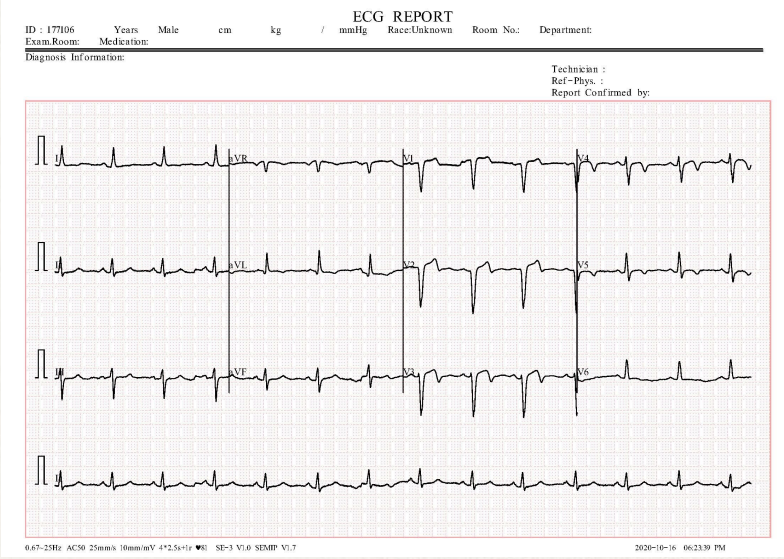
IMAGE PRE-PROCESSING

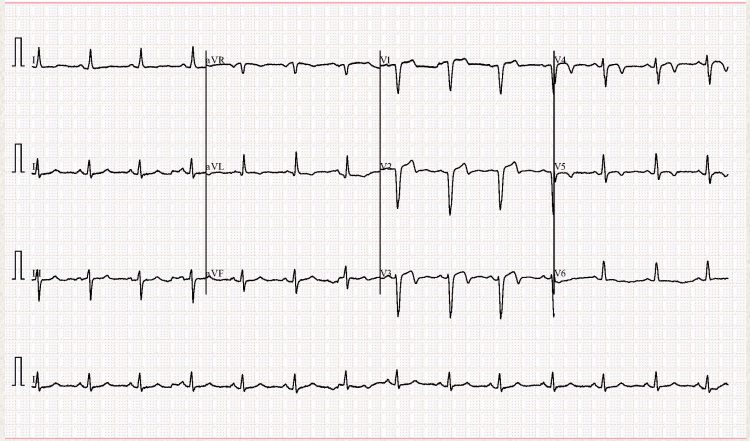
Reducing the noise

IMAGE PRE-PROCESSING

01	CROPPING	Using Numpy (Slicing)
02	THRESHOLDING	Using Numpy
03	AUGMENTATION	Using OpenCV (cv2)
3.1	FLIPPING	
3.2	SHADING	

CROPPING

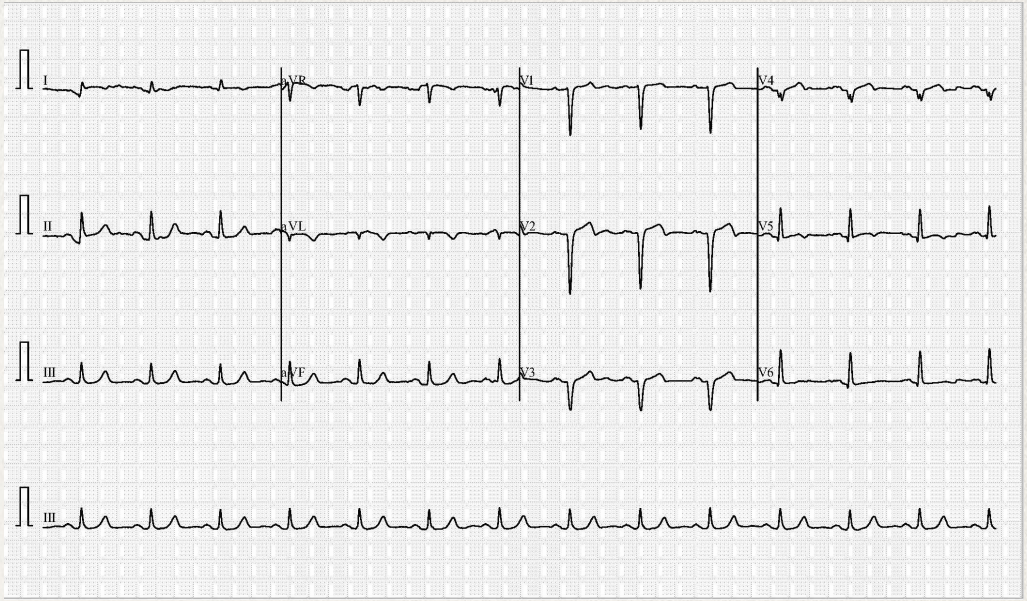

ECG REPORT
ID : 177106 Years Male cm kg / mmHg Race:Unknown Room No.: Department:
Exam.Room: Medication:
Diagnosis Information:
Technician :
Ref-Phys. :
Report Confirmed by:
aVR
V1
V4
aVL
V2
V5
aVF
V3
V6
0.67-25Hz AC50 25mm/s 10mm/mV 4*2.5s+1r SE-3 V1.0 SEMP V1.7
2020-10-16 06:23:39 PM


aVR
V1
V4
aVL
V2
V5
aVF
V3
V6

THRESHOLDING

The original picture has a grid background which is not considered as key information but as noise

Therefore, histogram thresholding has been used to set a threshold of which only frequency lines of relevant information are retained

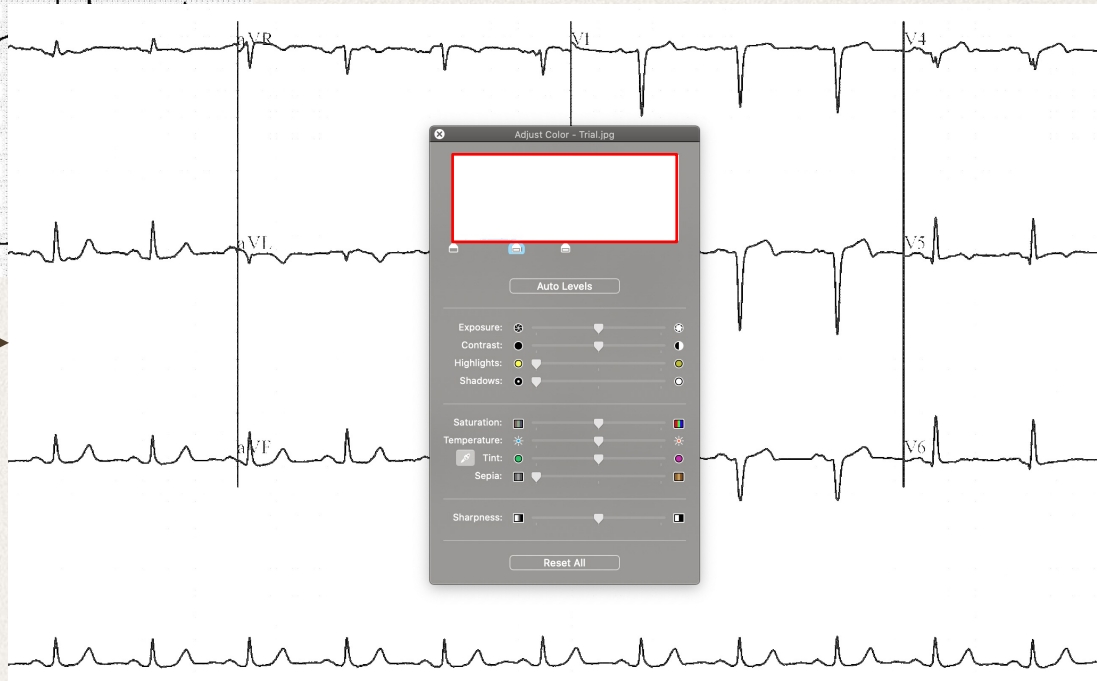


THRESHOLDING

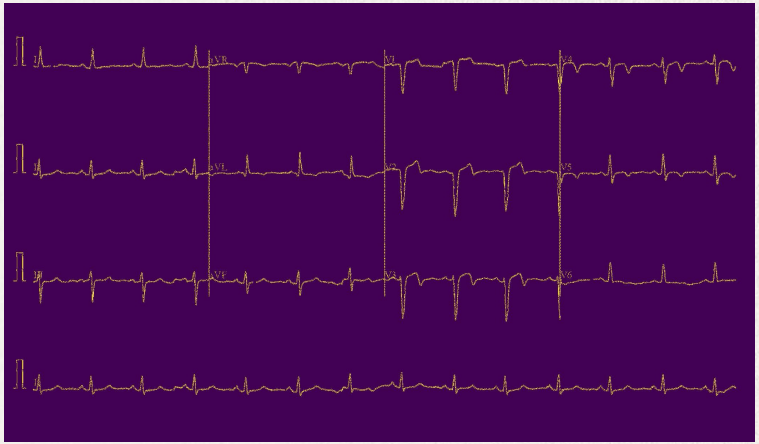
A digital image processing used for segmentation and edge detection which uses a number of techniques to detect edges or segment objects in an image

Histogram thresholding is done based on image intensity probability distribution where certain statistical features are analyzed in the image's histogram

Intensity values associated with the grid background are removed by setting the threshold to a suitable value

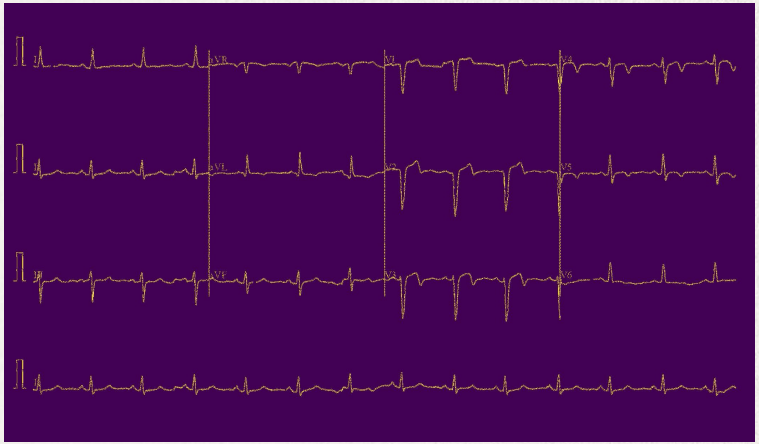


AUGMENTATION : Flipping



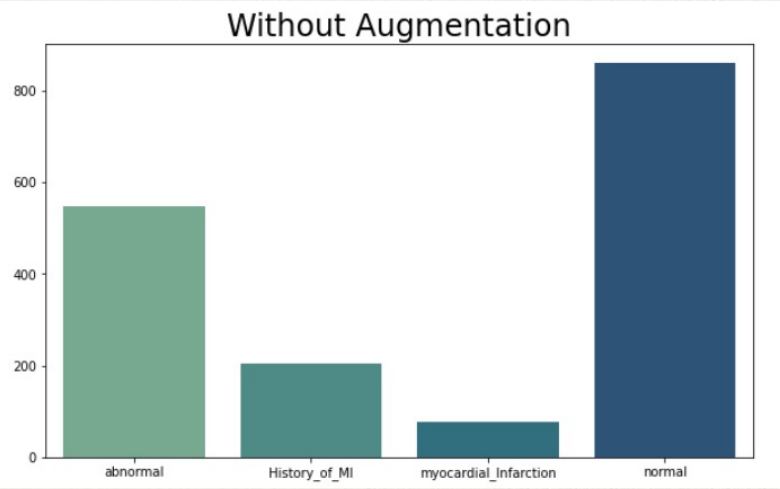
New Image

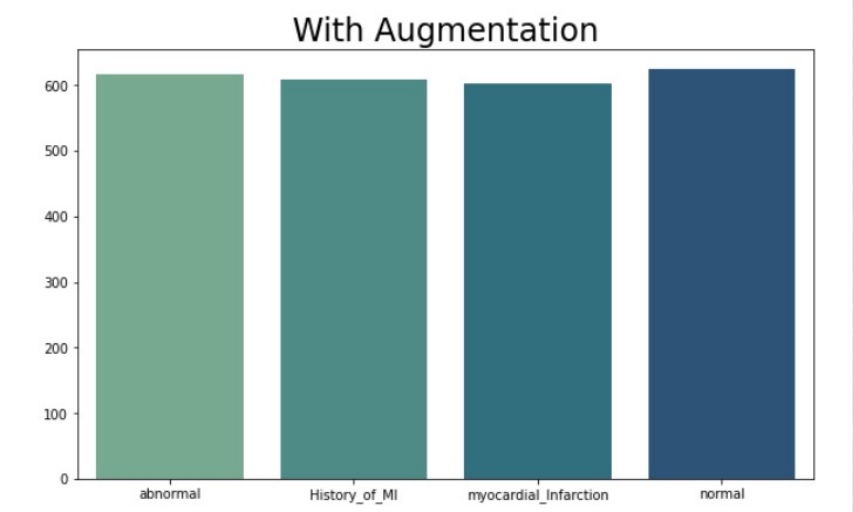
AUGMENTATION : Shading



New Image

AUGMENTATION RESULTS

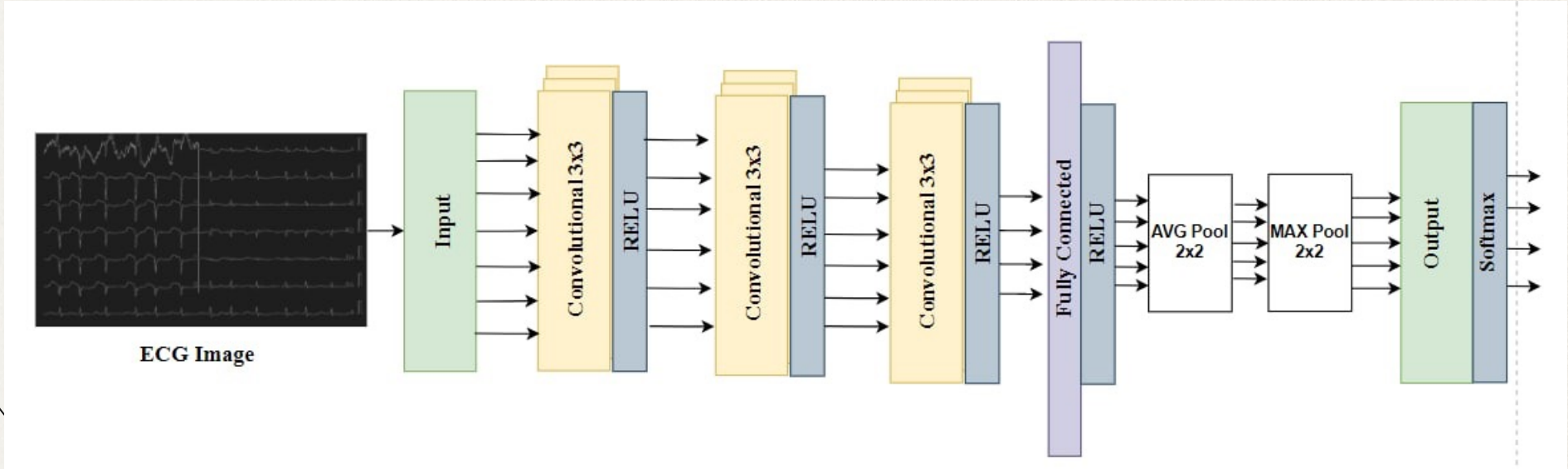




03

CONVOLUTIONAL NEURAL NETWORKS

CNN STRUCTURE



CNN RESULTS: Accuracy

TRAINING ACCURACY	82.46%
VALIDATION ACCURACY	78.54%
TESTING ACCURACY	75.69%

CNN RESULTS: Recall

	Recall
Arrythmia	60.56%
History of MI	86.95%
Myocardial Infarction (MI)	98.03%
Healthy	73.50%

CNN RESULTS: Precision

	PRECISION
Arrythmia	71.66%
History of MI	64.51%
Myocardial Infarction (MI)	87.71%
Healthy	64.66%

CNN RESULTS: ROC_AUC

	ROC_AUC
Arrythmia	75.41%
History of MI	87.96%
Myocardial Infarction (MI)	97.22%
Healthy	80.46%

CONCLUSION & SUGGESTIONS

- The model was able to generalize over certain classes more than others.
- The model's performance can be improved by:
  - Increasing the size of the dataset.
  - Applying a peak segmentation detection algorithm to capture more peak specific features and increase the separability of the model.
  - Using composite ECG images instead of an image containing the four sub-signals comprising the composite ECG signal.

THANK YOU FOR LISTENING!