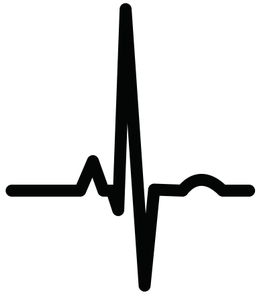

Cardiovascular Disease Prediction from ECG images

If there are no ups and downs in your life, you are dead !

Team Members

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PoojaShree NS

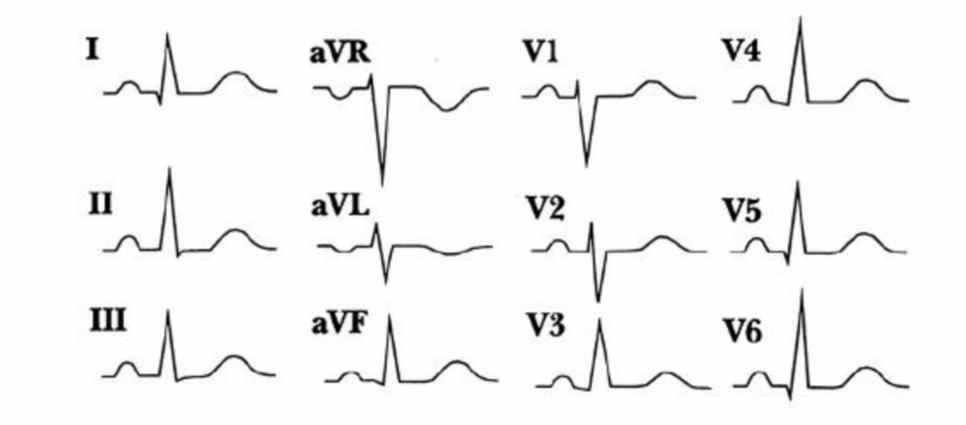
Avinash Ramesh

Github: https://github.com/rameshavinash94/Cardiovascular-Detection-using-ECG-images

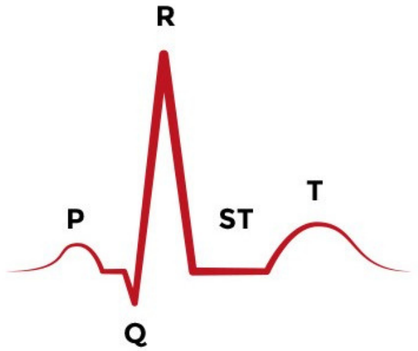
What is ECG?

An electrocardiogram (ECG) is a simple test that can be used to check your heart's rhythm and electrical activity.

12-lead Electrocardiogram (EKG)



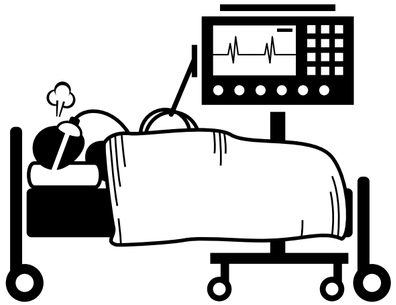
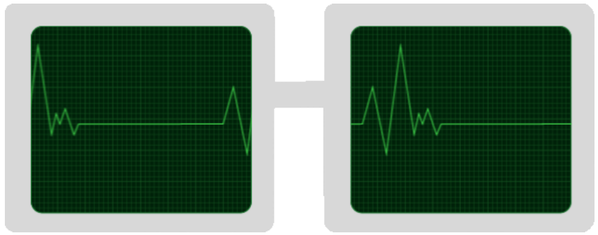
Characteristics of ECG



Why ECG Images for CVD Prediction?

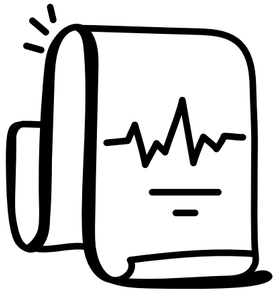
- Digital technologies have revolutionized the signal analysis and automated diagnosis
- Digitized ECG signals have advantages, such as security, easy to store, transmit, and retrieve
- It is essential to convert biomedical signals, such as electro-cardiograms (ECG) into digital form, for such computerized investigation

Existing System


Proposed System






Pros

- Without any delay, the results are instant.
- There is no need to visit a doctor just to confirm the ecg report.
- Following the initial findings, the patient may consult with a specialized doctor.
- Can be used in remote areas of the world where doctors are scarce and require long distance travel.

Cons

Every System has a Con

- Because we don't have a large image dataset to work with, the results may not be 100% correct.
- It is not intended to replace the present system; rather, it is intended to speed up the process.

Dataset

ECG images: https://data.mendeley.com/datasets/gwbz3fsgp8/2

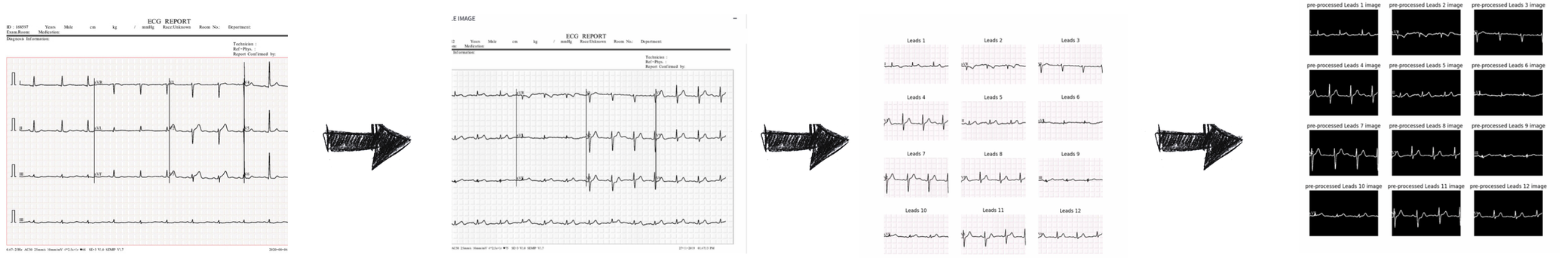
We have used 4 categories for image classification for our ECG images

- Normal
- Myocardial infarction
- Abnormal Heart beat
- History of Myocardial infarction

Data Preparation and Preprocessing

Crucial step in our project is data preparation from ECG images.

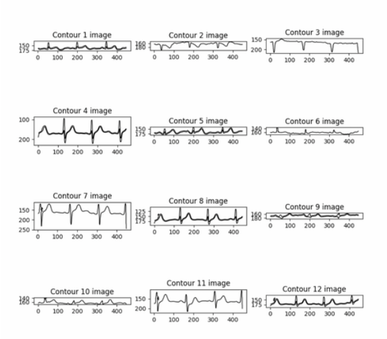
- Convert all ECG images to grayscale
- Resize image per requirements
- Divide the images into 12 sections for each image extracting 12 lead values (1-12)
- Remove Grid lines from each lead image and convert to binary image



Ecg image | Gray scale | Dividing leads | Preprocessed image without grid lines

Data feature Extraction & Data Engineering

- To trace and extract only the necessary signal from images, we used the contour technique.
- The image is converted to a one-dimensional signal.
- After that, MinMaxScaler is used to scale the image.
- For each lead(1-12) signal in all ecg image, save the 1D signal values in a.csv file.
- In a single csv file, combine all 12 lead values with the target label added.



Contour signal for each lead (1-12)

Multiple csv files with each lead values

Lead 1-12 values in seperate csv file for all images

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0.879564	0.884859	0.862624	0.863514	0.890544	0.901569	0.898292	0.889891	0.857318	0.807208	0.725240	0.660485	0.651937	0.683133	0.736857	0.794300	0.835281	0.859044	0.859421	0.887375	0.886069
1	0.823822	0.851580	0.831474	0.742423	0.640954	0.537460	0.434492	0.440666	0.544877	0.643515	0.745372	0.825819	0.837881	0.835424	0.817205	0.767469	0.722195	0.711404	0.741969	0.733074	0.711167
2	0.958192	0.950701	0.939834	0.930176	0.913602	0.891733	0.867083	0.853544	0.834577	0.793910	0.731482	0.664342	0.600220	0.588880	0.639483	0.698350	0.754684	0.798526	0.832941	0.856195	0.864262
3	0.888300	0.879925	0.878529	0.861947	0.852297	0.871318	0.862094	0.870808	0.882129	0.884130	0.873929	0.868463	0.821538	0.762281	0.697350	0.651873	0.654859	0.710441	0.755025	0.785405	0.812776
4	0.954615	0.980103	0.992674	0.990172	1.000000	0.988452	0.956340	0.938288	0.943095	0.938519	0.933057	0.941465	0.946419	0.948918	0.963104	0.957713	0.944459	0.916801	0.877561	0.880143	0.898394
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
932	0.950766	0.951138	0.959777	0.945713	0.892418	0.812866	0.725065	0.625350	0.523888	0.423925	0.341911	0.402067	0.501998	0.608696	0.703274	0.796192	0.888384	0.944552	0.934266	0.897300	0.837752
933	0.824701	0.822938	0.801757	0.786931	0.812754	0.839380	0.860231	0.863259	0.863247	0.856914	0.812937	0.788671	0.808371	0.830826	0.838839	0.857135	0.888399	0.904924	0.917800	0.670379	0.542964
934	0.769484	0.779840	0.791373	0.791596	0.784007	0.779464	0.788663	0.793205	0.756532	0.706685	0.777890	0.806670	0.801566	0.796554	0.791891	0.800136	0.793639	0.773359	0.749348	0.710003	0.655608
935	0.487099	0.493937	0.511121	0.542608	0.564591	0.572090	0.553629	0.564875	0.561722	0.525697	0.452448	0.367623	0.276643	0.292958	0.383284	0.473617	0.514193	0.487041	0.440730	0.384323	0.361199
936	0.878391	0.887723	0.922612	0.964803	1.000000	0.987336	0.956896	0.927781	0.904543	0.904928	0.913569	0.908978	0.893216	0.850000	0.786048	0.700734	0.613641	0.523914	0.432117	0.393749	0.465540

937 rows x 3060 columns

one combined csv file of 12 lead singal values for processing

ML Model

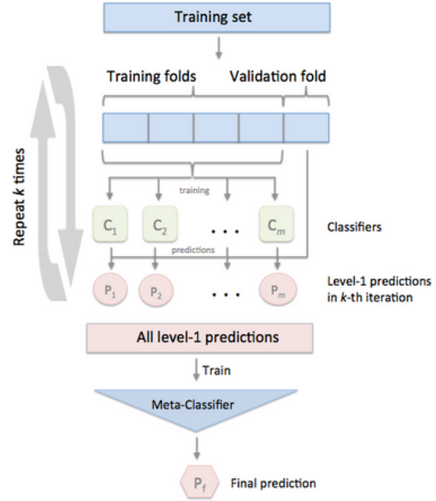
We tested various algorithms and then utilized the enseble technique to stack algorithms to enhance performance because it was a classification problem.

Algos tested

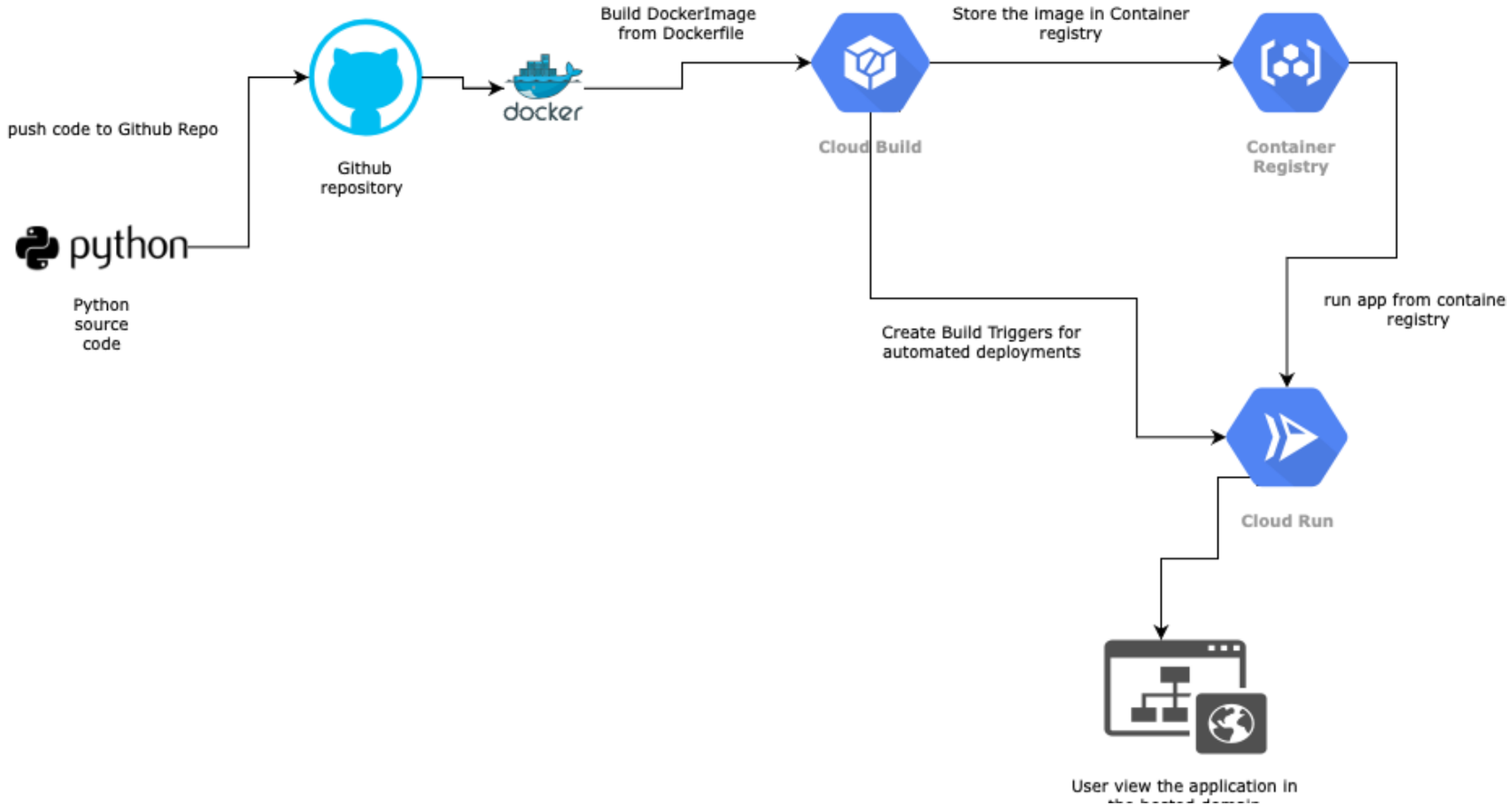
Knn
Logistic Regression
SVM
Random forest
GaussianNB
xgboost

GridSearchCv for hyperparamter tuning

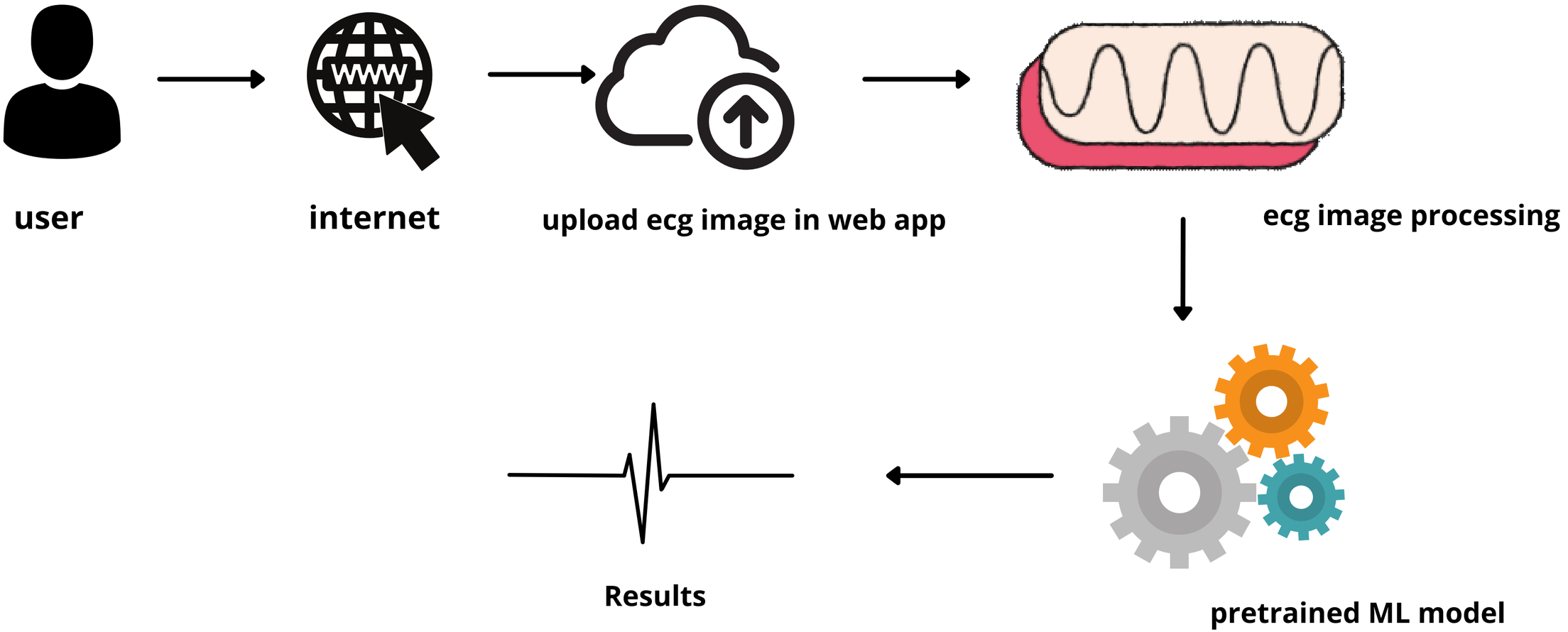
Ensemble of stacking multiple models using voting classifer



Our Deployment Architecture



High Level Architecture Diagram



Demo

https://cmpe255-project-q4uake3apq-uc.a.run.app


Thank
you