Heart Diagnostics and Analytics Dashboard (H-DAD)

- ## Group Members
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- ## Category

    Machine Learning Web Application

- ## Purpose

    The web-app enables clinicians to leverage Machine Learning for assistance in making data-driven decisions in variety of diagnostics and predictions. Also, generates patient analytics using the data entered over time.

- ## Scope

    The applications is oriented towards the use by medical experts, specifically Cardiologists and clinical practitioners. Further, it can be integrated with other tele-medicine services or healthcare infrastructure in general.

- ## Introduction

    A.   ### Existing System

    - Currently, there are fewer experts in the medical domain as compared to almost 60 Million cases of Heart Diseases in India itself, further, over 17.9 million lives are lost annually due to Cardiovascular Diseases world-wide.
    - Diagnosis of Heart Diseases, Heart Failure and its type, detection of Heart Failure, etc are complex tasks which even experts struggle in making accurate decisions.
    - On-time detection and treatment is the key to saving lives but due to diminutive number of doctors, patients are not timely diagnosed.
    - Also, very few standardized assistive applications exist which can help experts in making informed decisions.

    B.   ### Proposed System

    The app aims to tackle the issues in the existing scenario assisting the cardiologists in making data-driven decisions.

- A web-app that can be used by doctors from anywhere and any device connected to internet.
- **Doctor Registration :** Allows doctors to register using secure login id and password
- **Patient Records :** Each doctor can store the record of all the patients at one place and run multiple diagnostics
- **ML Prediction Models**

    - **Congestive Heart Failure** Detection model can enables doctors to diagnose the syndrome of patients.
    - **Heart Failure Classification** Model can help doctors in making complex decision of figuring our the type of HF.
    - **Heart Disease Prediction** Model can assist doctors in predicting whether their patient can develop some kind of Heart Disease in future.
    - Over time other models can be added having more functionality at ease.

- Doctors can use predictive models on fly or run a proper recorded diagnostics for each patient.
- **Patient Analytics** : Reflects the changes in patient data and clinical test results over-time.
- **Patient Alert System** : Doctor can immediately alert the patient when they have concluded a diagnosis and send their desired message right from the app.

C. Advantages

- Helps clinicians in making quicker and accurate decisions critical for heart patients.
- Doctors can directly email the patient right away using patient alert system integrated with each patient profile.
- Assist doctors in diagnosing the complex cases which cannot be accurately handled by humans using ML models such as Prognosis of Heart Failure with Mid-Range Ejection Fraction patients.
- Easily accessible and user friendly UI for swift usage.
- Free from any hardware or software based dependency which is needed for a generic software. Doctors can access the application from their PC, mobile or laptop.
- Patient history and analytics availability with improved visualization for better understanding of patient data.

- ○ Functional Requirements
    1. Users need to sign up/Register on the web-app and a system generated username will be assigned.
    2. Users will use the system generated Doc-ID to log into the system.
    3. User can add new patients and system will generate a Patient-ID for them.
    4. User can use different models on fly without saving any data into the system.
    5. User can run diagnostics for each registered patient. Data along with results will be stored in the database.
    6. Patient diagnostics are saved and can be viewed later at any point in time.
    7. Patients list and records are also available to the user with date-time stamp, data and results.
    8. User can send a direct email to every patient using patient alert system by entering patient's email id.
    9. User can view patient analytics for different clinical test results available from past.
    10. User can delete their complete data at any time.
    11. Secure storage of patient data
    12. Secure access to the dashboard

- ○ Non-Functional Requirements

    1. Swift and user-friendly UI/UX
    2. Machine Learning Models improvement over time
    3. Patient Data Privacy

- ○ Software Tools

    1. **Database** : SQLite
    2. **Developer Tools** : Microsoft Visual Studio Code, Google Colab, Heroku, Git/Github.
    3. **Language** : Python, HTML/CSS
    4. **Framework and Libraries** : Flask, Jinja2, Sci-Kit Learn, NumPy, Pandas
    5. **Client** : Any web browser (Preferably Chrome and Firefox)

o   Deployment

1.   **IaaS Cloud** : AWS, Azure or Google Cloud

2.   **PaaS Third Party Hosting :** Heroku

3.   **IaaS platform OS :** Linux

o   Hardware Specification

1.   **For Deployment** : AWS T3 Micro specification having 1 GB memory, 2 vCPU, EBS Storage and Network Performance up to 5 Gbps is enough for web-app deployment in pilot phase. Can be scaled-out or scaled-up as per the requirement and load.

2.   **For developing and training ML models** : Google Colab compute resources are enough which offers : 12 GB Memory, 1.56 GHz GPU Memory Clock, 2.3 GHz Intel Xeon 2 core and 25-358 GB disk space.