Project Report

1 INTRODUCTION

1.1 Overview

Heart Failure : A heart failure or a congestive heart failure (CHF) is a condition that occurs when your heart muscle doesn't pump blood as well as it should.

According to the official US government site for the centers dedicated to disease control and prevention, heart failures constitute a major cause for death principally in the United States of America, but also for the rest of the world. It was listed that more than 6.2 million adults in the US have heart failure. CHF was the cause for 13.4% of the total deaths in 2018, counting more than 379,800 cases. Including the cost of healthcare services, medicines to treat heart failures, and missed days of work, CHF costs the country an estimated $30.7 billion in 2012.

Heart failures can go unnoticed. Depending on how severe the condition is, CHF can only cause minor symptoms, making it almost impossible to detect. This is the main reason why people can die due to heart failure without ever being diagnosed.

A question can be then asked: Is it possible to anticipate heart failures? Is there a solution to this frequent problem? If there was, what are its limits and its possibilities? What are the methods used and exploited?

To analyze a cardiovascular breakdown, the clinical center has numerous apparatuses to depend on. A specialist will take a cautious clinical history, audit the manifestations and play out an actual assessment. The specialist will likewise check for the presence of danger factors, for example, hypertension, coronary conduit sickness or diabetes. An echocardiogram is a typical test. It gives an image of a heart utilizing ultrasound. It utilizes a test either on the chest or now and again should be possible down the throat. It helps the specialist check if there are any issues with the heart's valves and chambers, and perceive how firmly it pumps blood.

By getting access to all this information, comparing hundreds of cases, exploiting the most suitable tools and incorporating accurate results into the research, it is possible to come to a solution.

AI is quite possibly the most quickly advancing spaces of man-made brainpower. These calculations can

examine immense information from different fields, one such significant field is the clinical field. It is a substitute to routine expectation demonstrating approach utilizing a computer to acquire a comprehension of non-direct and non-linear interactions among various components by decreasing the blunders in anticipated and factual results.

Using a subset of Artificial Intelligence called Machine Learning, we can foresee somebody's likeliness of having CHF before they pass on from it. In the event that individuals know their likeliness of having this lethal sickness, this will urge them to settle on more intelligent way of life decisions. Subsequently lessening the quantity of individuals who pass on from heart failures.

The medical field comprises tremendous data of patients suffering or who have suffered from heart failure. By exploiting it using machine learning, we can develop a program capable of predicting the likeliness that a patient with certain characteristics such as age, family history, diabetes, or life habits (sports, smoking) will contract a CHF in the foreseeable future.

What is presented here is the main idea of the project treated in this report that uses the same technology as explained above.

1.2 Purpose

The purpose of this study and the present program is to understand the complex and non-linear interactions among different factors of patients to predict heart failures among individuals with different characteristics, backgrounds, and habits.

2 LITERATURE SURVEY

2.1 Existing problem

Ideally, health institutions should be able to predict heart failures among different patients to take better prevention measures. Specialists can identify the possibility of a CHF taking place within a person's body by studying and collecting specific information.

Contrariwise, heart disease is the leading cause of death for men, women, and people of most racial and ethnic groups in the world. Around half of individuals will be dead five years after they get a CHF diagnosis, presumably from unexpected heart failure. However, different intricacies are frequently ensnared. This makes the sickness as dangerous as numerous cancers. One person dies every 36 seconds in the United States from cardiovascular disease. About 655,000 Americans die from heart disease each

year—that's 1 in every 4 deaths. These tremendous numbers make the CHF disease one of the deadliest in the world.

To clarify even more the idea, let's incorporate some more numbers into the analysis. First, it is important to know that the lifetime costs for patients have been estimated to be $126.819 per patient. If health care services, medicines to treat heart failure, and missed days of work are being accounted for, this deadly disease cost the United States a tremendous $200 billion every single year.

What is even more shattering than these numbers is that heart failures cannot be cured. It can be treated, quite often with strategies to improve symptoms but prevention is the most efficient way.

This leads us to the main focus: To decrease the rate at which patients succumb to CHF, prevention must become the number one preoccupation. By improving the tools and techniques used in preventing the disease, it can have a notable positive impact on the health institute.

But, how so? In the next section of the report, the solution to this problem proposed by the project is detailed and explained.

2.2 Proposed solution

In our present world, heart failures are the leading cause of death. As discussed in the previous section, the most suitable way to fight against this disease is to improve current instruments used for prevention. It is common knowledge that prevention is a safe way to resist any type of sickness, whether it is CHF or the annual flu. It envelops all the daily life habits that a person can have that consecutively improve his health. As an example, we can talk about the benefits of sports for the heart or the benefits of adopting an equilibrated and diversified alimentary diet. These practices are even more advised to people whose hearts risk developing a CHF.

But, how to predict the possibility of developing heart failure?

By exploiting the astounding advances in technology and using a subset of Artificial Intelligence called Machine Learning, we can foresee somebody's likeliness of having CHF before they pass on from it.

Machine Learning is a type of AI whose way of functioning is to teach computers to think similarly to how people do. This means that a Machine Learning program exploits the information it has available to learn from past experiences and improve them, which is possible by exploring data, identifying patterns. The process of Machine Learning involves minimal to no human intervention. We can identify two main techniques used: Supervised Learning and Unsupervised Learning. In the case of predicting heart failures, unsupervised learning is an interesting feature. The machine's principal task is to help find all kinds of unknown patterns in the data given. With only unlabeled examples, the algorithm tries to learn some structure inherent to the data. Clustering and dimensionality reduction are two common unsupervised

learning tasks. Machine Learning algorithms can catch complex patterns that would have been overlooked by the human eye.

The solution proposed in this report depends on this particular feature of ML. This project consists of developing an algorithm that compares hundreds of cases, exploiting the most suitable tools, and incorporating accurate results into the research. What goes in the favor of the program here is that the medical field comprises tremendous data of patients suffering or who have suffered from heart failure.

To train effectively the machine for this project, eight different characteristics were taken into consideration: heartbeat, number of palpitations per day, cholesterol level, age, sex, family history, number of minutes of exercise per week, and smoking. 1,000 different cases were used for the experiment. Now, through the flask application, a person can enter his corresponding numbers and the program will communicate to him his chances of contracting the disease.

If individuals know their likeliness of having this lethal sickness, this will urge them to settle on a more intelligent way of life decisions. Subsequently lessening the number of individuals who pass on from heart failures.

3 THEORETICAL ANALYSIS

3.1 Block diagram
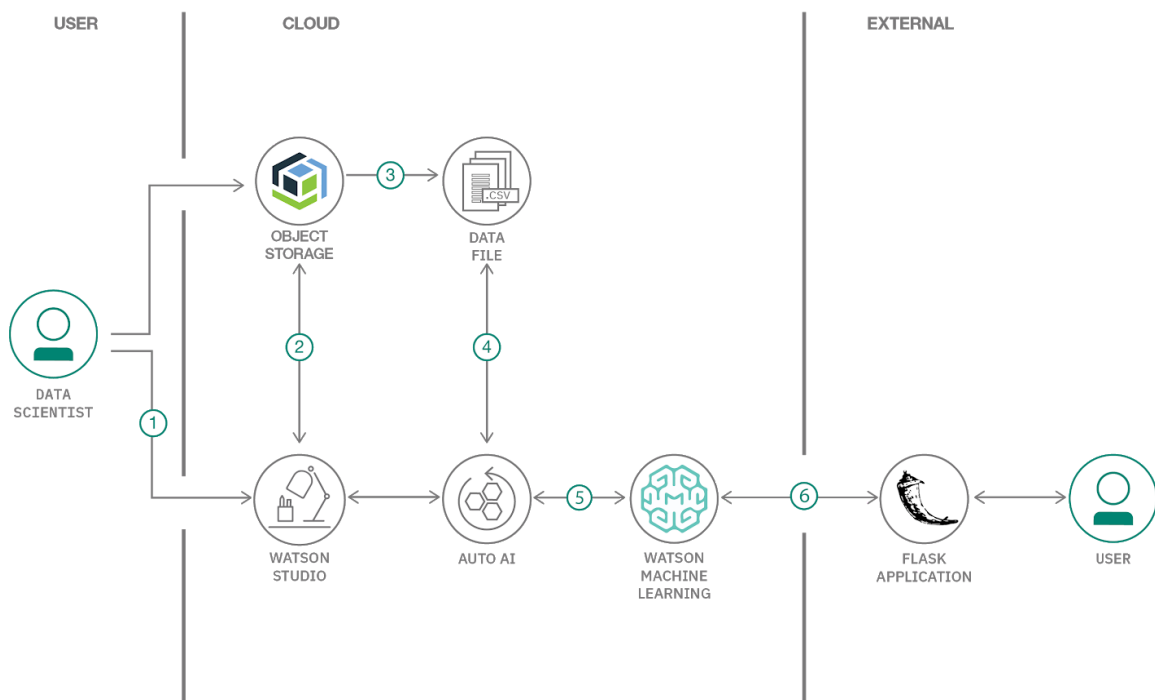
## 3.2 Hardware / Software designing

- Operating system ------ Recommended :
  - 3.5.0 (OpenShift 3.11, 4.5)
  - 3.5.1 (OpenShift 3.11, 4.5, 4.6)
- Minimum CPU or processor speed
  - 6 vCPU
- Minimum system memory (RAM)
  - 12 GB RAM
- Storage requirements:
  - 150 GB
- Supported storage types:
  - NFS
  - OpenShift Container Storage
  - Portworx
  - IBM Cloud File Storage

4 EXPERIMENTAL INVESTIGATIONS

Before starting the creation of the program, a breakdown of the problem was necessary to better understand the different parts composing it and that would, later on, form a concrete solution.

1. The problem: Heart Disease is the main cause of death in the world.
2. The solution: Prevention against the disease to decrease the number of cases.
3. The parties: The medical staff, the patients.
4. What would push the parties towards the solution? : By calculating one's risk of contracting the disease, people would be more inclined to make a change in their life.
5. Level of technology required: The program should be accessible to a majority of people and doesn't require a lot of technical knowledge.

5 FLOWCHART
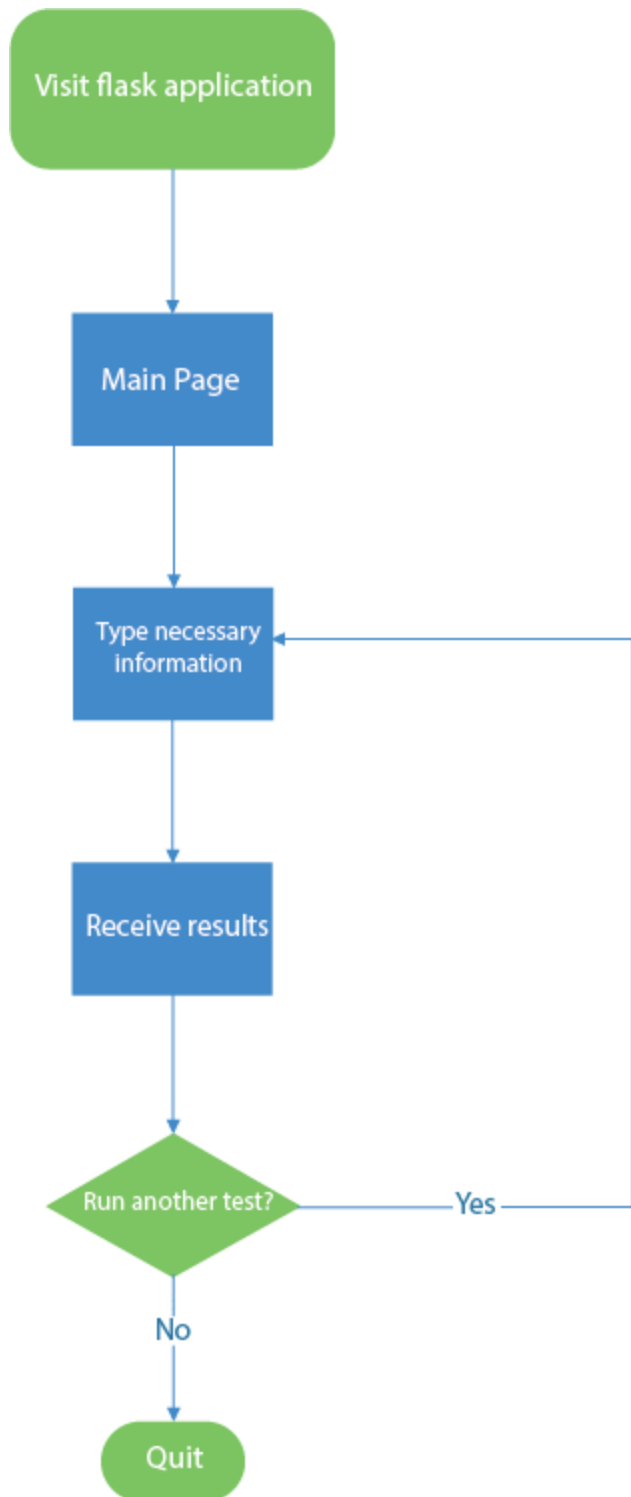
6 RESULT

Heart failure prediction

Estimation by IBM Watson Machine Learning and AutoAI.

Fill out the form to see an estimate.

Heart beat: 62

palpitations per day: 31

Cholesterol: 207

Age: 45

sex(Female=F;Male=M) F

family history(Yes=Y;NO=N) Y

Smoker in the last 5 years(Yes=Y;NO=N) Y

Exercice min per week: 101

Predict

Predicted Heart failure (N=NO ; Y=YES):

Y

Yes: 72.1%

No: 27.9%

No   27.9%   Yes   72.1%

Heart beat: 85

palpitations per day: 7

Cholesterol: 185

Age: 45

sex(Female=F;Male=M) M

family history(Yes=Y;NO=N) N

Smoker in the last 5 years(Yes=Y;NO=N) N

Exercice min per week: 145

Predict

Predicted Heart failure (N=NO ; Y=YES):

N

No: 93.6%

Yes: 6.4%

No   93.6%   Yes   6.4%

The program is developed to create a user-friendly interface. It is easily understandable and simple to use. Little to no training is needed to efficiently use the program. The external user will be able to insert accurate numbers and the program will run the information through its database to closely find a match. Using complex patterns that would have normally been overlooked by the human eye, the machine learning program can predict with a certain degree of confidence whether the patient is subject to catching CHF or not. As it is shown in the screenshots, after putting the required input. The output would be either Y or N, with a probability chart of each one of them. To be clearer, if the result shows the letter "Y", it means that the probability of contracting a heart failure in the foreseeable future is higher than the average. On the other side, if the letter "N" shows up, the probability of contracting a CHF in the foreseeable future is relatively low.

7 ADVANTAGES & DISADVANTAGES

The use of machine learning for the prediction of heart failure has multiple advantages, but also disadvantages.

Machine learning does not need human intervention. To explain why this particular point represents an asset to the project, imagine yourself entering the data one by one, and checking every minute to make sure that no anomalies occurred. Machine Learning is a time-saving process and in a field where being a second late can be fatal, it is really important to be on point, efficient, and fast. In less than a second, the program runs the information entered through hundreds and hundreds of cases to display the output; an operation that would have taken human hand hours of hard work. Machine Learning does the unwanted work and the long-hour research. It discovers information almost imperceptible to a normal person. It is particularly reliable, as long as the data keeps growing, and it allows us to think more creatively.

Even though machine learning looks particularly fitting for the problem tackled, it still has its flaws and drawbacks. For example, Diving straight into the issue means that you have blind faith in the facts. People believe the data is accurate and do not attempt to scrutinize the facts. "Many don't even ask the question "are the features appropriate to predict the outcome or involve more features. But, the basic issue here is that there are no static characteristics such as blood pressure, cholesterol, heart rhythm. They vary. A person's blood pressure varies from hour to hour, and heart beats regularly, too. There is therefore no telling whether 135 mm hg blood pressure when it comes to prediction issue was one of the factors that triggered the heart attack or was it 140, all through the data set might report 130 mm hg. Ideally, a patient needs to have several measurements for each characteristic.

In conclusion, machine learning effectively helps predict the likeliness of contracting a disease. However, the data scientist should be careful when picking the data.

8 APPLICATIONS

- Medical staff
- Personal Use

9 CONCLUSION

Heart failure is the leading cause of death in the world. Prevention is the best way possible to fight against the disease. However, it is not simple to practice prevention as it involves daily healthy practices, for example, practicing sport or taking a certain amount of protein and fiber a day. People who do not feel concerned about the issue will more likely not try to improve their lifestyle. That's why the solution proposed in this report consists of developing a program that interprets data inserted by the external user and predicts his likeliness of contracting the disease. As a whole, the project presents multiple advantages that help greatly the medical core.

10 FUTURE SCOPE

At a compound annual growth rate (CAGR) of 44.1 percent during the forecast period, the machine learning market is projected to rise from $1.03 billion in 2016 to $8.81 billion by 2022. New techniques, studies, researches, and improvements are being made every day from all around the world. As far as the human eye can perceive, Machine Learning has no bounds or limits. It can be exploited in every field or domain and multiple different ways. Even though the purposes differ, one can rest assured that Machine Learning will overcome its actual obstacles.

Concerning this particular project, multiple refinements can be made from now on. For example, adding more data is particularly beneficial to the development of the project as it increases the machine's accuracy in its predictions. Treating missing values in the data can also be an option as it improves accuracy as well. As for the algorithm, we can surely test out more and apply different models to find a better fitting one. The current algorithm has tremendous room for improvements, leaving its doors open for any coming idea or innovation. The user interface is, for now, user-friendly and easy to understand but

it can be reshaped to make it more pleasant aesthetically.

Thus, the current program is efficient and effective but it has room for improvements and leaves a large scale for ideas and changes.

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APPENDIX

A. Source Code

https://github.com/smartinternz02/SPS-8812-Predict-heart-failure-using-IBM-auto-ai-service