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A Survey on Heart Failure Prediction

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ABSTRACT: Heart failure is being an unexpected death cause which yields heavy trauma to the deceased person's family. So it's very important and need of the hour to detect the heart failure conditions before it takes away someone's life. So many intelligent systems are exists in the field of software that is predicting the heart failures in advance. Among all of them most advanced systems are using complex event processing (CEP) tools to analyze the data through which predictions could be made timely. However, most of the time, these CEP tools largely depend on the huge input data from various sources and they have a less auto learning mechanism. So proposed methodology presents a novel idea to improve the detection process of heart failure conditions using linear regression and hidden Markov model on bundle of data. Finally, this process is catalyzed by the random forest classification algorithm to unleash the probability of the heart failure conditions.

KEYWORDS: Heart Failure, Hidden Markov model,

I. INTRODUCTION

Heart Attack is also known as Myocardial Infarction (MI) in medical term, happens when the flow of blood to a portion of heart muscles become slow or stop, which result in death of segment of heart muscle. The flow of blood usually stops or cut when an artery provides blood to the heart muscle is clog due to some reason. The main important symptom of heart attack is chest pain and person also experience instability in the heart muscle tissue. The person also feels discomfort in arm, shoulder, back, neck or jaw. Normally it happens in left side or chest center and last for a few minute. Some other symptoms are nausea, shortness of breath, feeling faint, feeling tired and cold sweat. Myocardial Infarction is a very serious medical emergency. Heart Attack risk increases with age.

The primary cause of Heart Attack is coronary artery disease that causes plaque buildup in the arteries that slow or stop blood flow to heart muscle. Heart Attack is also coming due to ripped, blood vessel or blood clots. Some of the other causes of Myocardial Infarction (Heart Attack) are older Age, high blood pressure, smoking, diabetes, high lipoprotein, HIV, obesity, genetics, work stress. The people who are less physically active are more liable to suffer from a heart attack in comparison to more active people.

Early diagnosis of chance of Heart Attack is very essential because there are many complications arise following a heart attack. Some of the complications arise immediately after a heart attack and some of them are later. Immediate Complications are:

- Irregular heartbeats the condition is termed as Arrhythmias
- Low Blood Pressure and heart stop supplying blood to different parts of the body.
- Oxygen level in blood becomes less, known as Hypoxemia.
- Lungs surrounded by fluid this condition is also termed as Pulmonary Edema.
- A blood clot is developed in the Legs deep vein and pelvis that prevent blood flow in veins.
- Heart wall becomes damage.
- A bulge is formed in a heart chamber know as ventricle.
- A scar tissue builds up around damaged heart wall knows as Aneurysm, it causes blood clot, abnormal heartbeat and low blood pressure.
- Chest pain caused by less oxygen supply reaches the heart.



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- The heartbeats become weak, the person feels breathless and exhausted the condition term as Congestive heart failure.
- Ankles and legs swell to fluid accumulation known as Edema.
- Depression due to loss of erectile function.
- Heart Lining becomes inflamed result in severe chest pain.
- Therefore, the regular monitoring of persons suffered from heart attack has been necessary for several months to prevent them for a complication arises after a heart attack.

Heart Attack Diagnosis Techniques

The early diagnosis of heart attack is very important to prevent person from heart attack complications. Some of the techniques to diagnose Heart Attack are:

1. **ECG (Electrocardiogram)** – In this method electrical signals are recorded which help in determining irregularity in your heart structure and rhythm. The major disadvantage of ECG is it did not diagnose all heart problems.
2. **Chest X-Ray**- In this technique a small quantity of radiation is used to produce images of heart, blood vessels and lungs. It is much frequently used to diagnose congenital heart disease. The size of the heart is also diagnosed using this method. The demerits of chest X-ray are it increases the chance of cancer caused by exposure to radiations; it is also harmful for pregnant women.
3. **Blood Test**- A blood sample is used to test signs of diseases that can damage the heart. Some of the test that's done using a blood sample to find heart conditions are cholesterol test, High-Sensitivity C-Reactive protein, Lipoprotein, Plasma Ceramides, Natriuretic peptides, etc. The demerit of blood test is that it does not give accurate results in finding heart attack.
4. **Holter Monitoring**- In this technique a wearable, portable device is used to continuously monitor ECG usually one to three days. In this method, an irregularity in heart rhythm that are failing to find in ECG exam is detected. This technique is failed to monitor or capture events that happen without symptoms.
5. **Echocardiogram**- The ultrasound of the chest is done in this method, which shows detailed images of heart and function of the heart. Though it is safe in comparison to other radiation based diagnosis technique, but some of the risk involved with this method are tube used in this technique cause irritation or scrape the patient oesophagus side and cause irritation.
6. **Stress Test**- This test involves an increase in heart rate by doing heavy exercise or medicine and examines how the heart responds.
7. **Cardiac Catheterization**- Inserted a sheath in an artery or vein of leg followed by longer, hollow and flexible tube. X-ray images are monitored and pressure on heart chambers is measured. Some of the risk involved with cardiac catheterization is bruised and bleeding at insertion place, nerve or blood vessel damage, allergic reaction, chance of minor heart stroke.
8. **CT Scan**- This test is used to capture images of the heart and chest. The biggest demerit of CT scan is that excessive radiation exposure increases the chance of cancer in patients.
9. **MRI**- Magnetic field is used to produce pictures of the heart, which later evaluate by a doctor. The demerits of this technique are the image of an MRI is distorted by metal, expensive, difficult to examine patient during MRI, patients using medical device is difficult to examine.



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In this paper, section 2 is dedicated for literature review of past work and Finally Section 3 concludes this paper.

II. LITERATURE REVIEW

[1] Presents the requirements concerning sensor data signal processing and sensing devices to enhance the administering of healthcare services for CHF patients of a complete and integrated ICT platform. The System introduces an ingenious home care model in order to support in unified and integrated fashion the whole procedure of the patient treatment, connecting in-hospital care with follow up out of hospital. With the remote monitoring, the medical staff can realize changes in the parameters of patients without frequently visiting them and consequently they can take concerned action to prevent possible aggravations.

[2] Proposes a portable behavioral and physiological monitoring system formulated for peoples 'well being empowerment and health. The system is inclusive of mobile device, a wearable supervising sensor, and an alternative remote constant storage unit. The wearable device records important data regarding the user's vital signs and sends them to the smart phone on which an Android app runs. The app behaves as supervisor supporting local storage, physiological data gathering, that also supports data uploading if further processing is needed, to the remote storage. The application based on android allows its users, to check their information and the vital signs data gathered by the wearable medical sensor.

[3] Introduces an alert system in medical monitoring which can be worn, focused at people at risk from respiratory and heart disease. The system fuses multi parameter assessment of vital signs, emergency detection and online analysis, analysis of activities and a constant connection to a medicine centre in a modest wrist worn device. While first prototypes had problems with achieving the required medical accuracy on all the measurement, the tests have provided clear indication of the validity of the solutions and feasibility of the concepts adapted by the project.

[4] Proposes a Real-time cardiac monitoring system for heart disease patients residing in remotely inaccessible areas. The proposed system framework is composed of, Android handheld device, web interface and wearable health sensors. The system is versatile and has the capability to obtain diverse cardiac parameters such as blood pressure, heart rate, and temperature of multiple patients concurrently. The gathered data is then transfer reutilizing Bluetooth low energy to an Android smart phone, which is then relayed to web application for further processing.

[5] Explores the fundamental functionalities of the middleware anatomy in the Fontane project, a telemedicine centre with a network of medical tele-monitoring devices in which the measurements are segregated with the intention of scrutinizing patients for whom a medical intervention is necessary. As the quantity of patients increases, monitoring daily measurement results turn monotonous and necessitate more personnel. Using machine-based classification can help to mitigate the risk of mistakes as well as to make doctors more productive, giving them more time for the relevant cases.

[6] Presents a blueprint of fusion health monitoring with accelerometer sensors and ECG, which was developed for the advance ubiquitous healthcare system using wireless sensor network technologies. Our system acts as a continuous event recorder, even under situations where the patient is unconscious and has the ability to carry out daily activity. The use of an cost-effective device for monitoring activities and analyzing ECG signals of elderly person at home can dispense descriptive details to the doctors using PDAPC, and simultaneously alert the doctor of any emergencies. The goal is to provide a capability for real time auditing of elderly person at home using ECG and accelerometer sensors and then notify to the doctor's PDA.

[7] Introduces a systematic strategy for sustainability root cause examination of chemical/energy fabrication process has been offered, where the economic, environmental, and social sustainability are all be scrutinized. The scheme will be comprehensive enough to be relevant to various chemical/energy production systems. It should help the designers advance their practice for sustainable development more systematically.



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[8] Develops an ICU research database involving automated techniques to gather therapeutic data and high-resolution diagnostic from a voluminous, assorted population of adult ICU patients. This freely available database is intended to support epidemiologic research in critical care medicine and aids as a resource to evaluate new clinical decision support and monitoring algorithms.

[9] Explores a health care supervising system that facilitates noteworthy responsiveness and process optimization by amalgamating complex event processing that influences context acknowledgement in Service Oriented Architecture. The project is at an early stage, and significant work remains in order to completely develop the system and fully validate the approach. The proposed work addresses the issues like patient identification, tracking, fall detection and health monitoring.

[10] Proposes CEP based home alone elderly monitoring system to identify time critical circumstances to generate alerts in an almost real time fashion. The CRHMS is supported by efficient priority-based scheduling service for alert generation to provide best effort service to the patients. It also provides extendibility support to CRHMS architecture by efficient rule management.

III. CONCLUSION

Heart failure is being considered as the one of the most common and cruel reasons of death, which suddenly takes away the life of an individual that leaves behind the mountain of sorrow. Therefore, prediction of the heart failure has had more importance in the health care system for a long time. Based on the analysis of the some past research work this paper comes to know some facts like, certain systems use predefined learning models to predict the heart failure condition for the given input of data. By analyzing some past works, proposed model uses Hidden Markov Model to unleash the possibility of the heart failure prediction, which is powered with random forest model to classify. Studies clearly indicate the possible increment of the accuracy in the prediction rates.

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