



Machine Learning Models to Assess the Impact of Weather Conditions on Cardiac Arrest

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Abstract: In general, some studies suggest that the risk of cardiac arrests is higher in winter than in summer. It has also been clinically proven that winters increase the chances of cardiac arrests. We are also seeing it empirically. The number of outpatient visits to the hospital with problems such as heart pain and a feeling of heaviness in the heart increases by 30 percent in winter. Also, the number of hospitalizations for serious cardiac arrests has increased by 10 percent, according to statistics. What is the relationship between winter and cardiac arrests, and whether it is possible to prevent cardiac arrests in winter; various types of research are being carried out. Especially in the months of November, December and January, more patients come to the hospital with cardiac arrest symptoms and cardiac arrests than usual. In this paper, Machine Learning Model has proposed to assess the Impact of Weather Conditions on Cardiac Arrest. There are three main causes of cardiac arrest in cold weather. Cholesterol blocks deposited in heart blood vessels will break down and spread. The fat that spreads like that causes blood clots in the blood vessels. This causes a cardiac arrest. As the cold increases in winter, blood vessels become more constricted. Hence, the chances of fat loss will also increase. That is why the chances of cardiac arrests increase in winter..

Index Terms - Cardiac Arrest, Summer, Outpatient, Winter, Machine Learning, Weather

I. INTRODUCTION

Generally, flu-type infections such as colds and flu are more common in winter. Some of the viruses that cause those infections can cause the fatty deposits in the blood vessels to break down [1]. Because of this, some people may get infected and have a cardiac arrest. During winters the physical activity is very less. When working in cold air and cold environment, work is a little harder than usual. Both of these are causes of cardiac arrests [2-3]. These have also been proven in some studies. People over the age of 45, people with diabetes, high blood pressure, cholesterol problems, smokers, and people who are obese are generally more likely to have a cardiac arrest [4]. Because of that, the risk of cardiac arrest is slightly higher for them in winter as well. People who have already had a cardiac arrest are also more likely to have fatty deposits in their heart arteries [5]. So they are more likely to have a cardiac arrest again. Work-related stress increases for those working from home [6]. Insomnia is caused by long hours of work and working without sleep. Lack of sleep increases the secretion of stress hormones [7]. Due to this, the fatty deposits deposited in the blood vessels are destroyed; causing blood clots and cardiac arrests are likely to occur. Working from home can take a toll on physical activity. Even small activities such as going to work, coming to work, and climbing stairs will be reduced [8]. Most people can't even follow a strict diet while at home. They spoil their health by eating junk food, processed food etc. Many of my work-from-home patients have weight gain, uncontrolled diabetes, and high blood pressure [9-10]. All these are factors for cardiac arrest. Heart-related problems can also occur with Covid-19. Those on the high risk list should keep their blood sugar and blood pressure under control. If you have cholesterol, you need to take the medication and pills properly [11]. Avoid doing more strenuous work in winter than usual. At the same time things like exercise and walking should be followed in winter. People who smoke should give it up. Paying attention to such things can prevent a cardiac arrest [12]. Pain may occur in the middle of the chest or in the right or left side of the chest. Heartburn, feeling of heaviness in the chest, sweating with chest pain, shortness of breath, chest pain aggravated by walking [13-14]. Any pain from the lower jaw to the navel is likely to be a cardiac arrest. Therefore, if symptoms appear, do not ignore and go to the hospital immediately [15].

When winter comes, the number of heart related problems also increases. Cold constricts the blood vessels, which can increase blood pressure and lead to complications such as cardiac arrest or stroke [16]. Many people bathe in cold, jilted water to relieve inflammation, reduce pain, relieve stress, soothe sores and relieve fatigue. Cardiac arrests or strokes are more likely to happen when muscles don't get enough blood or blood clots form [17-18]. Depletion of oxygen levels in the body leads to such adverse effects. Age, family history, blood pressure, and high cholesterol are other factors that can lead to a cardiac arrest or stroke [19]. Apart from this some external factors and lifestyle lead to poor health. Bathing in cold water in winter is also a factor, say experts [20]. Medical experts say that sudden and unexpected exposure to cold water can lead to heart disease. The sudden cold water on the body constricts the blood vessels in the skin and shocks the body, slowing the blood flow [21-22]. Due to this, the heart starts working faster to regulate the blood flow throughout the body. If you are prone to getting sick in winter, keep warm by wearing adequate clothing. Exercise or walk for at least 30 minutes every day [23]. Indulge yourself in any physical activity, be it running, jogging, aerobics, yoga, exercise, dance or meditation. Daily exercise helps keep the body warm and active [24]. Always eat fresh, fruits, green leafy vegetables. Avoid fried, fatty, sugary and processed foods [25-26]. These increase blood sugar levels and increase cholesterol. Include especially warm foods and those rich in digestive power such as ginger [27]. People with diabetes, blood pressure, cholesterol, kidney problems and other health problems should get regular checkups and keep them under control. Avoid heavy and

heavy work as much as possible. Especially heart patients should follow this [28].

II. LITERATURE REVIEW

Coronary artery disease accounts for one-fifth of global deaths from heart disease. Also, Indians have a 3-20 times higher risk of heart disease compared to other people. While westerners see 23 percent of deaths from heart disease and stroke before age 70, it is 52 percent among world [29]. A cardiac arrest, medically known as a cardiac arrest, occurs when a blood clot blocks blood flow to a coronary artery. Coronary arteries are blood vessels that supply blood to the heart muscle. As blood flow is blocked in the heart's muscular wall, that part of the wall becomes 'damaged and destroyed' and stops pumping blood [30]. Changing lifestyles, high stress in urban areas, dietary habits, smoking, alcohol consumption and finally, drug use have increased the risk of heart disease among young people. A sedentary lifestyle is another major contributor to this life-threatening disease, which is on the rise among many young. In addition, young people generally have a tendency to underestimate risk factors [31]. Sometimes, neglecting regular checkups can leave young people suddenly prone to heart ailments. Most young people, including adults, fail to recognize warning signs such as shortness of breath, chest pain, undue fatigue and lack of stamina, cold sweats, chest pressure, asthma or side effects of emotional outbursts such as anger [32].

Now, cardiologists are not surprised to see a 25-year-old or teenager suffer a cardiac arrest. A quarter of cardiac arrests in India occur in people under the age of 40, putting a huge strain on labor productivity as the "younger" working population is at risk [33]. The seeds of heart disease are sown young. Therefore, as a preventive measure, comprehensive cardiac screening and health promotion is required in schools and colleges [34]. The government should proactively try to see if awareness about lifestyle and heart diseases can be included in the curriculum [35]. Heart screening in young adults includes blood pressure, family history, stress-related problems, heart-related symptoms and other risk factors [36]. It will need specific lower cut-offs and stricter targets for treating various risk factors than are currently recommended for Western populations, an example in practice: an upper limit for BMI (body mass index) that determines whether a person is considered obese [37]. For Asians, obesity has been reduced from 25 to 23 because they have a higher risk of obesity and cardiopulmonary occlusion. A strategy to prevent heart diseases before they occur is more cost-effective than providing interventions when the disease has already developed [38]. 30 minutes of exercise is essential to improve and maintain health. Exercise at least five days a week [39]. Adults should get at least 150 minutes of moderate exercise or at least 75 minutes of vigorous exercise each week. Being active is a great way to reduce stress and control your weight. Stress and obesity are risk factors for heart disease [40].

III. PROPOSED MODEL

Cold weather can increase the risk of heart failure because blood vessels constrict to build up body heat. Therefore, cardiac patients should be extra cautious during cold season. Heart patients should not overexert themselves in winter as any stress on the heart can lead to cardiac arrest. Comparing the trends in sudden cardiac death, January and February this year have seen the highest number of cardiac deaths compared to other months. Cardiac arrests are on the rise again as winter sets in. Heart rate and blood pressure are usually higher in winter, while physical activity also decreases. The doctor also emphasized the fact that heart patients should get flu shots. Influenza-related stress on the body can lead to a cardiac arrest. The proposed model has shown in the following fig.1

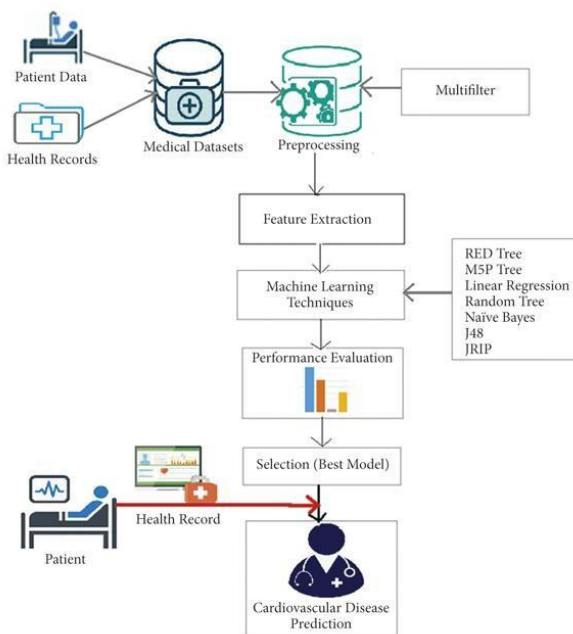


Fig 1: Proposed model block diagram

3.1. Symptoms dataset

- *Trouble breathing:* If you have symptoms like shortness of breath or chest pain, palpitations during physical exertion, these indicate a high chance of heart disease.
- *Shortness of breath at night:* If you have sudden shortness of breath, wake up at night and get better after sitting up, there is a possibility of heart disease. Check your heart immediately.
- *Swelling of the legs while climbing stairs:* If you experience shortness of breath and swelling of the legs while walking or climbing stairs, you may have valvular heart disease or heart disease related to weak heart muscles.
- *Family history:* If anyone in your family has heart disease or strong risk factors like bad cholesterol, poor sugar levels, high blood pressure, your heart is more likely to be unhealthy.
- *Chest pain or tightness:* If you suddenly experience severe chest pain or heaviness or burning in the center of the chest, radiating to the jaws/left arm, and these discomforts increase over time, this usually indicates a cardiac arrest and requires an immediate heart check.
- *Fatigue:* Fatigue easily and shortness of breath even during small activities are warning signs of heart disease.
- *Frequent dizziness:* Dizziness and dizziness can be caused by many health problems. But if this is a routine then it means that there is something wrong with your heart

3.2. Pre-processing

Older people have always been at higher risk of cardiac arrests. But now many people are dying of cardiac arrests at a young age. So we are forced to keep our heart healthy after reaching the age of 30. Many people do not know exactly what things are harmful to the heart. A person's heart is affected by his lifestyle, diet and certain things. Knowing about those toxins and correcting them can prevent the risk of a cardiac arrest. Many people today suffer from depression. When stress increases in the body, it not only affects the brain, but also increases anxiety and stress, affects blood flow in the body, and causes heart problems. Generally, our body can withstand stress for a certain period of time. But any time one is stressed, it can be life-threatening. So if the heart is to be healthy, it is necessary to keep the mind calm and happy.

3.3. Feature Extraction

People with lung disorders like asthma and COPD have been shown to have a higher risk of heart disease. It causes inflammation in the heart muscles and increases the risk of heart diseases. That is why doctors say that people suffering from it should try to keep their heart healthy. Studies have shown that people with problems like diabetes and high blood pressure have a higher risk of heart disease. So if you have diabetes, BP problem, don't miss to keep the problems under control. Otherwise, it can be life-threatening. People who have already had a mild stroke or a mild cardiac arrest should also try to keep their heart healthy, as the heart is vulnerable to severe damage. Exercising daily is a healthy habit. But when you do that exercise too hard, and as a result the heart is overworked, just like the rest of the body is overworked, at some point it will fail. So one should know the limits of their body and engage in exercises accordingly. As you get older, you should avoid doing more strenuous exercise. Drinking alcohol and smoking are two very bad habits that most people have today. If a person has this habit, he will get problems like diabetes, BP and the risk of heart disease will increase. And if you already have heart disease, you should give up these two habits. If not, it can increase cardiac arrest symptoms.

3.4. Classification

Cholesterol is a major problem that most people face today. From the young to the old, we all suffer from cholesterol. There are two types of good cholesterol (HDL) and bad cholesterol (LDL). Foods rich in good cholesterol provide you with many health benefits. Bad cholesterol can lead to life-threatening consequences such as obesity, stroke, heart disease and cardiac arrest. Therefore, you should always monitor your cholesterol levels. Most of the time, high cholesterol may not present with symptoms. However, a plaque build-up in blood vessels can lead to many diseases that lead to symptoms.

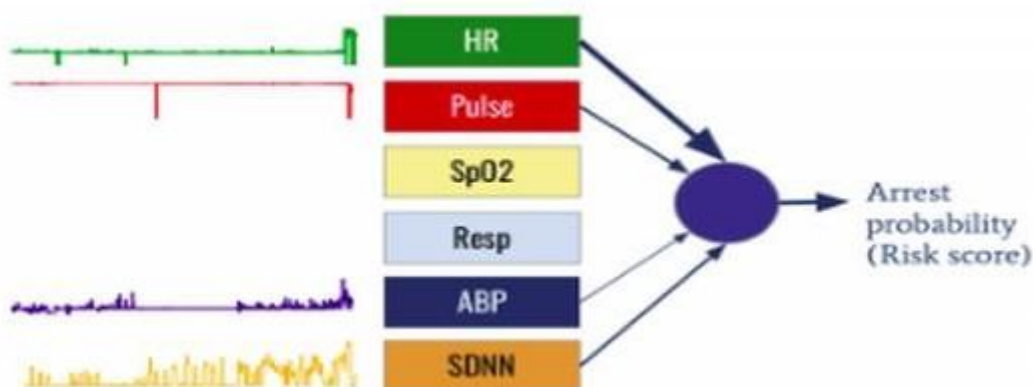


Fig 2: Cardiac arrest prediction

The cardiac arrest prediction has shown in the fig.2. People with heart disease are nearly six times more likely to have a cardiac arrest after the flu. Viral infections put extra stress on the body. It affects blood pressure, heart rate and overall heart function. It can increase your chances of having a cardiac arrest or stroke. Drinking too much alcohol can overheat your body, which can be dangerous when you're out in the cold. Body temperature adjusts slowly, so drink in moderation (no more than two drinks a day). Avoid smoking completely. Cigarette smoking is a major contributor to heart disease. The environment we live in and the seasons have a big impact on our health. In that way, cold weather does not create a good environment for the human heart. Blood vessels constrict due to cold. This then increases blood pressure and therefore the risk of cardiac arrest and stroke.

IV. COMPARATIVE ANALYSIS

The proposed Cardiac Arrest prediction model (CAPM) has compared with the existing Machine learning model (MLM) and Real-Time Detection of Cardiac Arrest (RDCA). Here the matlab r2022b is the tool is used to simulate the results.

4.1 Temperature Problem:

Whenever the outside temperature drops below our body temperature, especially below 25 degrees, the surface of the body tries to keep us warm. Due to this, the BMR (Basal Metabolic Rate) increases, which increases the workload on the heart. In winters, the chances of vasoconstriction increase, which can lead to an attack. An increase in certain clotting factors such as platelet aggregation and an early morning rise in fibrinogen levels increase the chances of blood clotting in the coronary arteries of the heart. The comparison of Temperature Problem has demonstrated in the following table.1

Table 1 Comparison of Temperature Problem

No.of Inputs	Temperature Problem (in %)		
	MLM	RDCA	CAPM
100	77.25	82.54	94.56
200	70.25	80.25	90.25
300	65.27	77.56	84.36
400	60.84	71.24	82.21
500	58.21	65.23	80.11

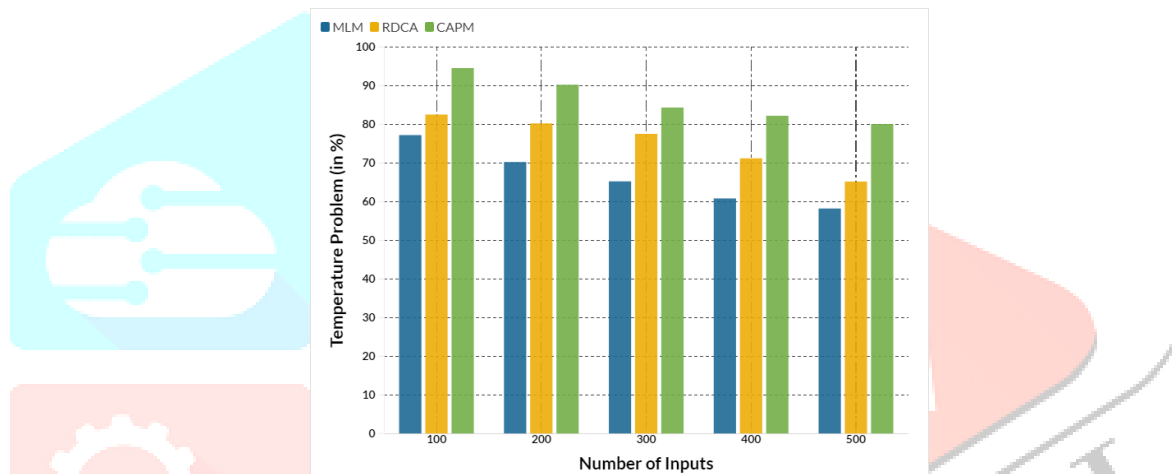


Fig 3: Comparison of Temperature Problem

The fig 3 shows the comparison of Temperature Problem. In a cut-off point, the proposed CAPM model reached 84.36% of Temperature Problem. In the same point the existing MLM achieved 65.27% and RDCA achieved 77.56% of Temperature Problem. While compared with the existing models, the proposed model achieved the better results.

4.2 Risk management

While the heart is really at risk in winter, there are some people who need to be extra careful with their heart health during winter. People with diabetes, high blood pressure and high cholesterol are at higher risk. Family members with heart disease and heavy alcohol and tobacco consumption are also at higher risk. The expert recommends that those with risk factors undergo a health check-up and take medicines at regular intervals. They should be under constant medical supervision, especially if they have a history of cardiac arrest or stroke. Regular medical check-ups are essential for people with previous heart problems. Experts have seen a surge in heart health during the pandemic as people focus only on Covid and ignore other medical tests. The comparison of Risk management has demonstrated in the following table.2

Table 2 Comparison of Risk management

No.of Inputs	Risk management (in %)		
	MLM	RDCA	CAPM
100	78.25	82.54	90.21
200	70.56	80.28	88.21
300	66.89	77.82	86.18
400	84.15	74.21	84.12
500	60.28	70.23	80.14

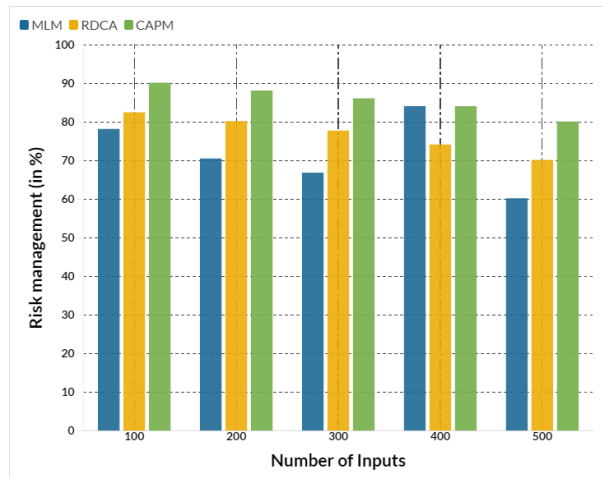


Fig 4: Comparison of Risk management

The fig 4 shows the comparison of Risk management. In a cut-off point, the proposed CAPM model reached 86.18% of Risk management. In the same point the existing MLM achieved 66.89% and RDCA achieved 77.82% Risk management. While compared with the existing models, the proposed model achieved the better results.

4.3 Food management

Winter comes with its own food habits. While many of us indulge in winter diets believing that seasonal foods are good for health, we often ignore the side effects. The answer to whether winter diet affects heart health is yes. During winters, people tend to eat more caloric food, especially sweets with added ghee. People should limit their consumption of alcohol in winter because it causes vasodilatation, which can be harmful. The comparison of Food management has demonstrated in the following table.3

Table 3 Comparison of Food management

No.of Inputs	Food management (in %)		
	MLM	RDCA	CAPM
100	55.27	78.25	92.38
200	57.25	76.58	94.25
300	59.26	74.25	95.15
400	61.84	70.58	96.89
500	62.58	68.25	97.88

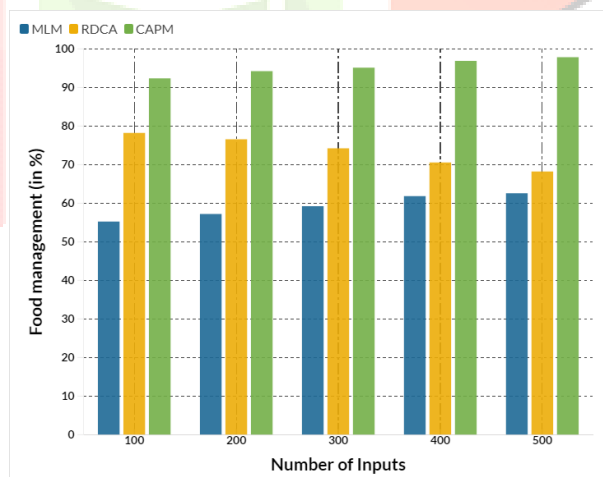


Fig 5: Comparison of Food management

The fig 5 shows the comparison of Food management. In a cut-off point, the proposed CAPM model reached 95.15% of Food management. In the same point the existing MLM achieved 59.26% and RDCA achieved 74.25% of Food management. While compared with the existing models, the proposed model achieved the better results.

4.4 Co-morbidities management

People with co-morbidities should take their medications regularly. They need to protect themselves from cold weather. If people begin to feel or show symptoms of a cardiac arrest, they should seek medical attention immediately. Experts say that occurrences of such symptoms are more common in the early morning in winter. The comparison of Co-morbidities management has demonstrated in the following table.4

Table 4 Comparison of Co-morbidities management

No. of Inputs	Co-morbidities management (in %)		
	MLM	RDCA	CAPM
100	55.26	78.58	92.58
200	59.68	80.25	94.25
300	62.25	84.58	95.65
400	65.58	88.56	97.28
500	68.89	90.56	98.56

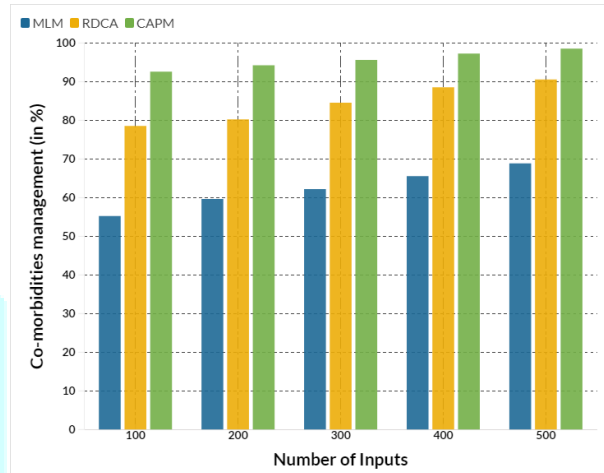


Fig 6: Comparison of Co-morbidities management

The fig 6 shows the comparison of Co-morbidities management. In a cut-off point, the proposed CAPM model reached 95.65% of Co-morbidities management. In the same point the existing MLM achieved 62.25% and RDCA achieved 84.58% of Co-morbidities management. While compared with the existing models, the proposed model achieved the better results.

4.5 PAD Management

According to studies, peripheral artery disease (PAD) occurs when the arteries become narrowed due to blockage caused by fatty deposits, leading to reduced blood flow to the arms or legs. According to the World Health Organization, in the case of peripheral artery disease, the legs or arms (usually the feet) do not receive enough blood flow to meet demand. When this happens it can cause leg pain - claudication - and other symptoms. Other symptoms of peripheral artery disease include leg numbness or weakness, no or very weak pulses in the legs or feet, shiny skin on the legs, skin discoloration on the feet, slow growth of toenails, ulcers on the toes, feet, or legs. The comparison of PAD Management has demonstrated in the following table.5

Table 5 Comparison of PAD Management

No. of Inputs	PAD Management (in %)		
	MLM	RDCA	CAPM
100	46.58	66.58	80.58
200	47.25	65.28	85.26
300	50.25	64.25	87.54
400	52.65	60.25	89.68
500	58.25	55.25	92.15

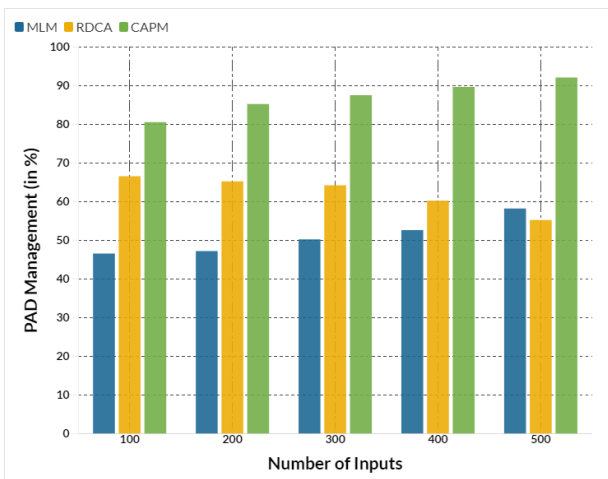


Fig 7: Comparison of PAD Management

The fig 7 shows the comparison of PAD Management. In a cut-off point, the proposed CAPM model reached 87.54% of PAD Management. In the same point the existing MLM achieved 50.25% and RDCA achieved 64.25% PAD Management. While compared with the existing models, the proposed model achieved the better results.

4.6 Obesity Monitoring

Many factors can lead to obesity. Unhealthy lifestyle is one of the main reasons among them. Eating a healthy diet and exercising regularly can greatly reduce your cholesterol risk. Instead of having too much saturated fat or trans fats, switch to healthy alternatives like green vegetables, healthy and hydrating fruits, and fiber-rich grains. Be physically active. Quit smoking and reduce alcohol consumption. Monitor your cholesterol levels regularly. Also, you should get regular health check-ups to know your risk and keep yourself safe. The comparison of Obesity Monitoring has demonstrated in the following table.6

Table 6 Comparison of Obesity Monitoring

No.of Inputs	Obesity Monitoring (in %)		
	MLM	RDCA	CAPM
100	65.25	68.56	88.54
200	67.89	69.25	89.65
300	69.65	75.25	92.35
400	72.54	80.54	93.66
500	75.25	84.25	94.58

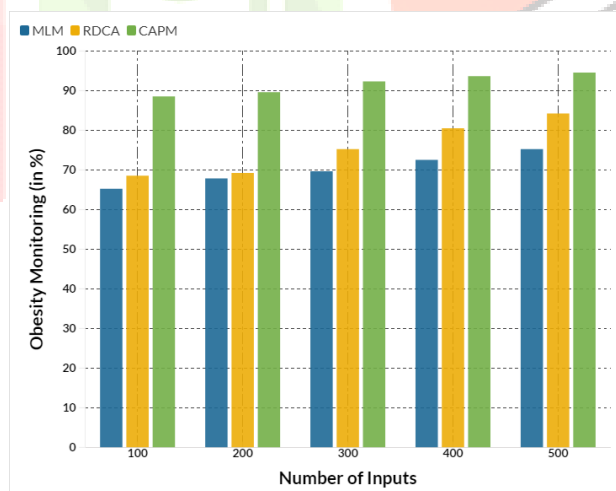


Fig 8: Comparison of Obesity Monitoring

The fig 8 shows the comparison of Obesity Monitoring. In a cut-off point, the proposed CAPM model reached 92.35% of Obesity Monitoring. In the same point the existing MLM achieved 69.65% and RDCA achieved 75.25% Obesity Monitoring. While compared with the existing models, the proposed model achieved the better results.

V. CONCLUSION

Cardiac arrests among people under the age of 40 have increased alarmingly in recent times and factors such as a sedentary lifestyle, unhealthy food choices and the side effects of COVID on the heart are largely responsible for this worsening risk. Factors beyond our control like family history are also behind this, but we can make lifestyle changes to prevent heart diseases and some chronic diseases that have an indirect effect on the heart. If you're having difficulty breathing while climbing the stairs or in the middle of the night, it's time to get tested. Swelling in your legs and fainting are other signs of an unhealthy heart and should not be ignored. Cold or crampy feet may indicate high cholesterol. Also, they appear on the feet. For example, a person may feel cramps when moving, but get relief when resting. They may feel cool or cold regardless of the season. It doesn't have to be on both legs. If you notice these

symptoms in your legs, you should get your cholesterol levels checked immediately.

REFERENCES

- [1] Nakashima, T., Ogata, S., Noguchi, T., Tahara, Y., Onozuka, D., Kato, S., ... & Nishimura, K. (2021). Machine learning model for predicting out-of-hospital cardiac arrests using meteorological and chronological data. *Heart*, 107(13), 1084- 1091.
- [2] Whig, P., Gupta, K., & Jiwani, N. (2022). Real-Time Detection of Cardiac Arrest Using Deep Learning. In *AI-Enabled Multiple-Criteria Decision-Making Approaches for Healthcare Management* (pp. 1-25). IGI Global.
- [3] Vaniprabha, A., Logeshwaran, J., Kiruthiga, T., & Krishna Bikram Shah (2022). Examination of the Effects of Long- term COVID-19 Impacts on Patients with Neurological Disabilities Using a Neuro machine Learning Model. *BOHR International Journal of Neurology and Neuroscience*, 1(1), 21-28
- [4] Watanabe, O., Narita, N., Katsuki, M., Ishida, N., Cai, S., Otomo, H., & Yokota, K. (2021). Prediction model of deep learning for ambulance transports in Kesennuma city by meteorological data. *Open Access Emergency Medicine: OAEM*, 13, 23.
- [5] Kivrak, M., Guldogan, E., & Colak, C. (2021). Prediction of death status on the course of treatment in SARS-COV-2 patients with deep learning and machine learning methods. *Computer methods and programs in biomedicine*, 201, 105951.
- [6] Ramesh, G., Logeshwaran, J., & Rajkumar, K. (2022). The smart construction for image preprocessing of mobile robotic systems using neuro fuzzy logical system approach. *NeuroQuantology*, 20(10), 6354-6367
- [7] Qiu, H., Luo, L., Su, Z., Zhou, L., Wang, L., & Chen, Y. (2020). Machine learning approaches to predict peak demand days of cardiovascular admissions considering environmental exposure. *BMC Medical Informatics and Decision Making*, 20(1), 1-11.
- [8] Czernecki, B., Marosz, M., & Jędruszkiewicz, J. (2021). Assessment of machine learning algorithms in short-term forecasting of PM10 and PM2. 5 concentrations in selected polish agglomerations. *Aerosol and Air Quality Research*, 21(7), 200586.
- [9] Saravanakumar, K., & Logeshwaran, J. (2016, February). Auto-Theft prevention system for underwater sensor using lab view. *International Journal of Innovative Research in Computer and Communication Engineering*, 4(2), 1750-1755.
- [10] Sutharasan, M., & Logeshwaran, J. (2016, May). Design intelligence data gathering and incident response model for data security using honey pot system. *International Journal for Research & Development in Technology*, 5(5), 310-314
- [11] Zou, Y., O'Neill, S. M., Larkin, N. K., Alvarado, E. C., Solomon, R., Mass, C., ... & Shen, H. (2019). Machine learning-based integration of high-resolution wildfire smoke simulations and observations for regional health impact assessment. *International journal of environmental research and public health*, 16(12), 2137.
- [12] Augusto, J. B., Davies, R. H., Bhuva, A. N., Knott, K. D., Seraphim, A., Alfarih, M., ... & Moon, J. C. (2021). Diagnosis and risk stratification in hypertrophic cardiomyopathy using machine learning wall thickness measurement: a comparison with human test-retest performance. *The Lancet Digital Health*, 3(1), e20-e28.
- [13] Tang, K. J. W., Ang, C. K. E., Constantinides, T., Rajinikanth, V., Acharya, U. R., & Cheong, K. H. (2021). Artificial intelligence and machine learning in emergency medicine. *Biocybernetics and Biomedical Engineering*, 41(1), 156-172.
- [14] Ahsan, M. M., Mahmud, M. P., Saha, P. K., Gupta, K. D., & Siddique, Z. (2021). Effect of data scaling methods on machine learning algorithms and model performance. *Technologies*, 9(3), 52.
- [15] James, C. A., Wheelock, K. M., & Woolliscroft, J. O. (2021). Machine learning: the next paradigm shift in medical education. *Academic Medicine*, 96(7), 954-957.
- [16] Logeshwaran, J., Adhikari, N., Joshi, S. S., Saxena, P., & Sharma, A. (2022). The deep DNA machine learning model to classify the tumor genome of patients with tumor sequencing. *International Journal of Health Sciences*, 6(S5), 9364- 9375.
- [17] Logeshwaran, J., Malik, J. A., Adhikari, N., Joshi, S. S., & Bishnoi, P. (2022). IoT-TPMS: An innovation development of triangular patient monitoring system using medical internet of things. *International Journal of Health Sciences*, 6(S5), 9070-9084
- [18] Balogun, A. L., Tella, A., Baloo, L., & Adebisi, N. (2021). A review of the inter-correlation of climate change, air pollution and urban sustainability using novel machine learning algorithms and spatial information science. *Urban Climate*, 40, 100989.
- [19] Narayan, S. M., Wang, P. J., & Daubert, J. P. (2019). New concepts in sudden cardiac arrest to address an intractable epidemic: JACC state-of-the-art review. *Journal of the American College of Cardiology*, 73(1), 70-88.
- [20] Wu, X., Yuan, X., Wang, W., Liu, K., Qin, Y., Sun, X., ... & Song, L. (2020). Value of a machine learning approach for predicting clinical outcomes in young patients with hypertension. *Hypertension*, 75(5), 1271-1278.
- [21] Bhalgat, P., Bhoite, S., & Pitare, S. (2019). Air quality prediction using machine learning algorithms. *International Journal of Computer Applications Technology and Research*, 8(9), 367-390.
- [22] Ramesh, G., Aravindarajan, V., Logeshwaran, J., Kiruthiga, T., & Vignesh, S. (2022). Estimation analysis of paralysis effects for human nervous system by using Neuro fuzzy logic controller. *NeuroQuantology*, 20(8), 3195-3206
- [23] Liu, L., & Zhang, Y. (2021). Smart environment design planning for smart city based on deep learning. *Sustainable Energy Technologies and Assessments*, 47, 101425.
- [24] Karhade, A. V., Schwab, J. H., & Bedair, H. S. (2019). Development of machine learning algorithms for prediction of sustained postoperative opioid prescriptions after total hip arthroplasty. *The Journal of arthroplasty*, 34(10), 2272-2277.
- [25] Sekar, G., Sivakumar, C., & Logeshwaran, J. (2022). NMLA: The Smart Detection of Motor Neuron Disease and Analyze the Health Impacts with Neuro Machine Learning Model. *NeuroQuantology*, 20(8), 892-899
- [26] Choudhary, G., & Singh, S. N. (2020, October). Prediction of heart disease using machine learning algorithms. In *2020 International Conference on Smart Technologies in Computing, Electrical and Electronics (ICSTCEE)* (pp. 197-202). IEEE.
- [27] Gruson, D., Helleputte, T., Rousseau, P., & Gruson, D. (2019). Data science, artificial intelligence, and machine learning: opportunities for laboratory medicine and the value of positive regulation. *Clinical biochemistry*, 69, 1-7.
- [28] Kim, I. S., Yang, P. S., Jang, E., Jung, H., You, S. C., Yu, H. T., ... & Joung, B. (2020). Long-term PM2. 5 exposure and the clinical application of machine learning for predicting incident atrial fibrillation. *Scientific reports*, 10(1), 1-11.
- [29] Dehghan, A., Khanjani, N., Bahrapour, A., Goudarzi, G., & Yunesian, M. (2020). Short-term effects of ambient (outdoor) air pollution on cardiovascular death in Tehran, Iran—a time series study. *Toxin Reviews*, 39(2), 167-179.
- [30] El-Hajji, C., & Kyriacou, P. A. (2020). A review of machine learning techniques in photoplethysmography for the non-invasive cuff-less measurement of blood pressure. *Biomedical Signal Processing and Control*, 58, 101870.
- [31] Wu, C. L., Song, R. F., & Peng, Z. R. (2022). Prediction of air pollutants on roadside of the elevated roads with

combination of pollutants periodicity and deep learning method. *Building and Environment*, 207, 108436.

- [32] Pal, M., & Parija, S. (2021, March). Prediction of heart diseases using random forest. In *Journal of Physics: Conference Series* (Vol. 1817, No. 1, p. 012009). IOP Publishing.
- [33] Jasmine, J., Yuvaraj, N., & Logeshwaran, J. (2022, April). DSQLR-A distributed scheduling and QoS localized routing scheme for wireless sensor network. In *Recent trends in information technology and communication for industry 4.0*, Vol. 1, pp. 47–60
- [34] Ramkumar, M., Logeshwaran, J., & Husna, T. (2022). CEA: Certification based encryption algorithm for enhanced data protection in social networks. In *Fundamentals of Applied Mathematics and Soft Computing*, Vol. 1, pp. 161–170
- [35] Gupta, K., Jiwani, N., & Afreen, N. (2022, April). Blood Pressure Detection Using CNN-LSTM Model. In *2022 IEEE 11th International Conference on Communication Systems and Network Technologies (CSNT)* (pp. 262-366). IEEE.
- [36] Han, D., Kolli, K. K., Gransar, H., Lee, J. H., Choi, S. Y., Chun, E. J., ... & Chang, H. J. (2020). Machine learning based risk prediction model for asymptomatic individuals who underwent coronary artery calcium score: Comparison with traditional risk prediction approaches. *Journal of cardiovascular computed tomography*, 14(2), 168-176.
- [37] Jiwani, N., Gupta, K., & Afreen, N. (2022, April). A Convolutional Neural Network Approach for Diabetic Retinopathy Classification. In *2022 IEEE 11th International Conference on Communication Systems and Network Technologies (CSNT)* (pp. 357-361). IEEE.
- [38] Aydin, N., & Yurdakul, G. (2020). Assessing countries' performances against COVID-19 via WSIDEA and machine learning algorithms. *Applied Soft Computing*, 97, 106792.
- [39] Harishkumar, K. S., Yogesh, K. M., & Gad, I. (2020). Forecasting air pollution particulate matter (PM_{2.5}) using machine learning regression models. *Procedia Computer Science*, 171, 2057-2066.
- [40] Jiwani, N., Gupta, K., & Whig, P. (2021, October). Novel HealthCare Framework for Cardiac Arrest With the Application of AI Using ANN. In *2021 5th International Conference on Information Systems and Computer Networks (ISCON)* (pp. 1-5). IEEE.

