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The Agile Deployment using Machine Learning in HealthCare Service

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Abstract. Hospitals are in search of industry-proven processes through which an increasing gamut of complicated operations can be managed most prudently and also reduce the operative costs to a considerable degree coupled with better care for quality. The Agile methodologies provide adequate in healthcare using machine learning. The Agile is now ubiquitous in many work and organization. The 'Agile' redesign deals with improving system responsiveness to the patient through an improvised source of flexibility and coordination. Machine learning help in healthcare to diagnose disease, recommend the treatment, online consultations improve, speeding up drug development and improve the training of doctor and medical student. In hospital healthcare services are good but the quality of service provided in rural areas as a comparison to urban is not up to the mark. In this research an actuarial model of healthcare system is build which is very cost efficient. The adoptions of a higher number of computerized tools have resulted in the advantage identified with the procedure for taking care of patient. According to W.H.O less than one (0.8) doctor assigned for 1,000, patients that's why heavy workload on doctors in India and has placed 112th position among 191 countries of the world. In this research work design smart and secure healthcare service for rural areas to provide better healthcare service and healthcare cost estimation using Agile Methodology in machine learning.

Keywords: Agile, Machine Learning, Healthcare service, Extreme Programming, Automation Testing.

1 Introduction

The Agile methodology is used by most software development teams due to its flexible nature, the ability to respond to change. In the healthcare sector adopting Agile can help an organization to the changing needs of patient care and quality as well as the estimated cost for health plan member populations. It motivated the value

of both patients and providers. Examples are in the form of frequent communication and interaction between patients, caretakers, and doctors [23]. This also leads to the application of agile techniques on modulated production system [17] and decrease of probable assumption in the initial stage through virtual tests [21]. The idea of Agile to use in healthcare is the concept of small group self-organizing and working on a priority basis. As compared to traditional methodologies such as the waterfall model which consist of sequential and linear phases that flow downward from conception to initiation, analysis, design, construction, testing, production/implementation, and maintenance. The strength of Agile in healthcare has increased the strength of staff by allowing them to work in self-managed teams and provide a better quality of patient care. In healthcare machine learning is a tool used for study and methods for identifying patterns in data. The machine learning follows some algorithm to find hidden data and no need to tell where to look.

There are various ways to implement machine learning

- Supervised machine learning
- Unsupervised machine learning.
- Reinforcement machine learning
- Semi-supervised machine learning

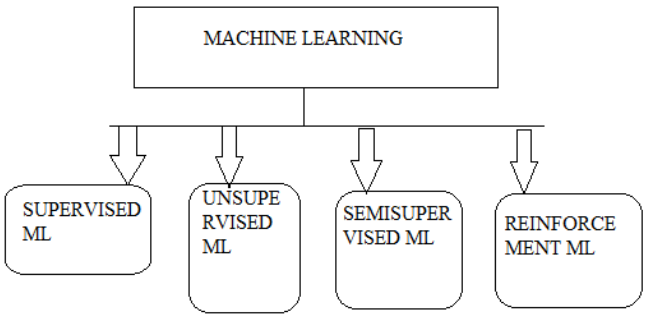

Fig. 1 Machine Learning Paradigms

In **supervised machine learning** train the machine by suitable examples and compare the input to identify the correct output to identify the error. The input could be patient description that comes to the clinic and output could be whether the patients have certain disease or not. The output could be categorical or continuous

In **Unsupervised machine learning**, there is no need to train the machine and work with unlabeled data. The goal of unsupervised learning is not really to produce output. It is used to find pattern in data. [10]

In **Semi-supervised machine learning**, there is a combination of labeled data with unlabeled data. It is used when you don't know enough labeled data. For example, it is used to detect fraud for a large bank.

Reinforcement machine learning is part of machine learning that train the machine to give reward and punishment. The difference between supervised learning and reinforcement learning is that in supervised learning there has answer key and model

gives output according to that answer key whereas reinforcement learning there has no answer. [25]

In healthcare agile machine learning establish a good relationship exists between doctor and patient and reduces the increased cost of healthcare. [1] The data contained in medical is either structured health data or unstructured health data. The structured health data is easily categorized such as patient weight, height, temperature, a general symptom like headache, stomach pain. Unstructured health data has different notes, reports, discharge summaries, images, audio, and video recording. [6] For example, two patients occur with the same problem cold the symptom and history of both patients would differ.

1.1 Challenges of Traditional Model and Agile deployment

Software development process is the stages of dividing tasks involved in developing software into various phases for enhancing the design and management of the product and the projects.

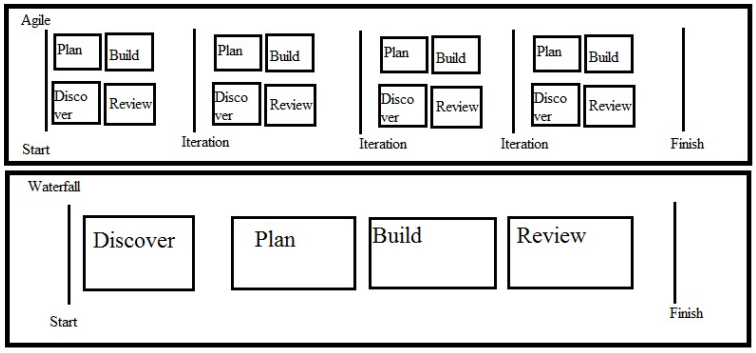

Fig 2 Agile vs. Waterfall model

Before the implementation of agile methods of development, the waterfall method of development was being used for a very long period. However, the transition from waterfall to Agile took a lot of time. This shift brought a lot of challenges for the companies to be dealt with.

The quality of the final product needs to be compared and a proper study needs to be done. Certain discussions and outcomes are based on private case studies. The main challenge in this is that the actual parameters on which the case studies are being done are unknown, so it becomes difficult to analyze the case studies. [16] The private case studies need to be replaced with general case studies so that the outcome and the analysis of the case studies can be properly observed and a proper conclusion can be derived.

While in the processing of the software modules in the case of agile development, many things are not refined, especially the process model. Studies need to focus on the refinement of programming models by making use of different case studies.

Considering the size of the team and individual inputs from every team member, there is a huge number of hours are invested in the development of projects. A study needs to be done to compare this number of hours invested in agile development with traditional methods and derive an outcome. This outcome will be used to calculate the efficiency of agile development methods. [20]

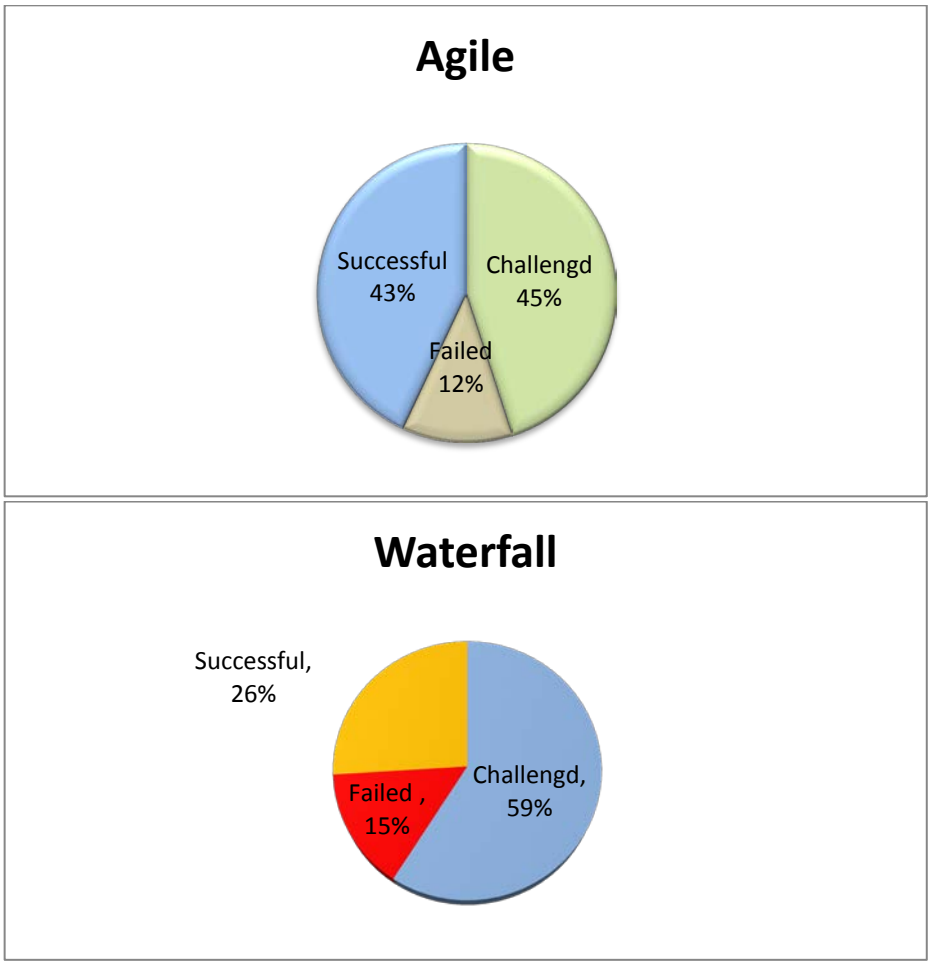

Fig. 3 Comparison of Agile and Waterfall in Challenged, Failed and successful projects

When the traditional model used, the project involved in machine learning is very complex but when an agile model is used in machine learning projects becomes easy and a company can take benefit from this. In an Agile environment, we have already discussed the challenges faced. It is needed that certain process needs to be automat-

ed. Automation testing will help in certain processes to increase in the efficiency of the teams working on the project this will increase the overall efficiency of the team. Overall, automation testing will help the projects to be refined.

2 Principles Agile with Machine Learning

The outline of agile software development methodology has given rise to continuous development in the software development field. There have been various studies done to find out suitable methods with regards to ML to find out the current organizational requirement. In other studies, customized ways have been derived to follow agile software development with Machine Learning [18]. Organizations have been continuously trying to find out new ways to minimize cost and increase the efficiency and quality of software development methodologies. Machine learning is scientifically studying the statistical models and algorithms which computers utilize in performing a specific task without the use of specific instructions depending on inference and patterns instead. [2]

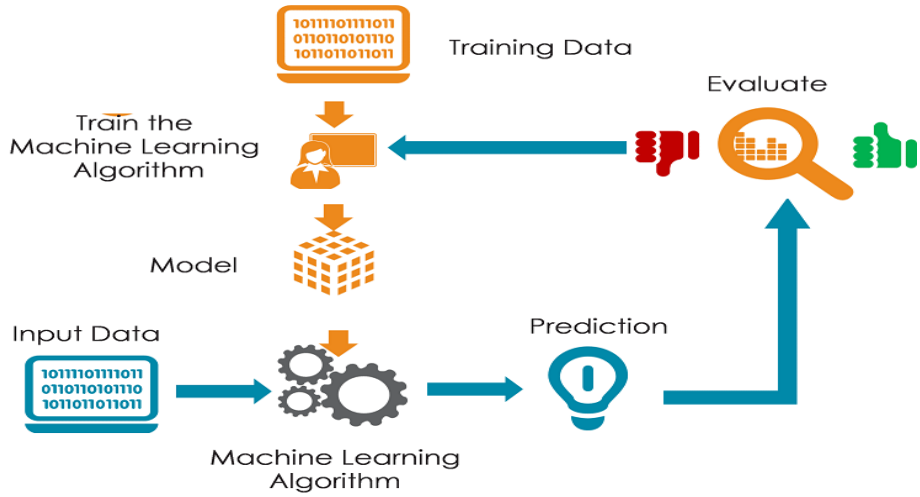

Fig 4 Agile with Machine learning

3 Literature Review

Various studies relating to agile machine learning have been reviewed and presented in tabular form in Table 1.

Author name, Year	Objective of the paper	Conclusion of the paper	Research gap
Yogesh K Dwivedi et al.,(2020)	AI deployed in education sector and healthcare to improve student engagement, teacher effectiveness and diagnose of disease	Artificial intelligence creates solutions for many problems such as challenges in healthcare, education and agriculture.	AI system is essential to address issues of transparency, ethics, and misuse prevention. AI framework will needed towards an equitable prosperity
Jackson et al., (2019)	To estimate the cost of healthcare using Agile methodology using machine learning models.	Agile Methodology was used in healthcare analytic deployment and hybrid squad model was used to improve communication among team member in teams.	The hybrid squad model has used in isolated teams and not involved everyone at team management level.
Schmidt et al., (2019)	Validation of the applicability along with the value of progress maps by adopting TMS setting and applying the derived Tobi. Board to different teams of the project.	The applied methodology It provided an intuitive and structured manner to maintain an overview of the activities of the project of the past as well as the future.	More studies are required with respect to its implementation in the industries.
A. M. Sidey-Gibbons1 et. al.,(2019)	Machine learning techniques were used to predictive model of diagnosis of cancer using General linear regression, Support Vector Machine.	Machine learning algorithm is used to classify high accuracy and comparison of these two algorithms	In future, Machine learning techniques will used in other diagnosis of disease.
R. Sindhwani, V.Malhotra et. al., (2019)	Discuss the present status of Agile implementation system in healthcare. It provides an efficient framework to organize and discuss its barrier, factors and issues.	Agile Healthcare system is used to overcome the fluctuating demand of the customer	More studies are needed in Agile approach in healthcare organization to meet the customer demands.

Kirubha.M. et. al., (2019)	Classification of thyroid disease into normal and abnormal from simple goiter to thyroiditis and thyroid cancer and discuss its method	It describes the comparison between fuzzy c means and k-means algorithm. Both are the popular algorithm of data mining.	This paper discusses the comparison between fuzzy c mean and k-mean. The fuzzy c mean is best for overlapped data. The drawback is that it has less accuracy.
Asmar et al., (2018)	Design a framework for Agile developing innovative PSS.	A concept for the self-managed, home-based physical rehabilitation was introduced and a model for the Agile development of innovative PSS was proposed.	This paper just proposes the theoretical concept for developing innovative PSS for rehabilitation and its practical implementation is a challenging and complex process.
Shaik Razia et. al., (2018)	Diagnosis of machine learning techniques by using machine learning algorithm and comparison of this algorithm	Various algorithm of machine learning is used such as Support Vector Machine, Multiple linear regression, Decision tree and Naïve bayes	This paper discuss the comparison of machine learning algorithm and observed that decision tree is best among these algorithm
Anwer et al., (2017)	Comparison of two Agile methods XP and Scrum	This examination revealed that Scrum and XP had contrasting as well as common features. Some of differentiating highlights supplement each other that urge scientists to explore different avenues combining Scrum and XP for developing software.	This study is a theoretical comparison; practical comparison is yet to be conducted.
Ghobadi, & Mathiassen et al., (2016)	Evaluate the thinking of developers, project managers, and user representatives on the barriers of sharing knowledge effectively in Agile development.	Project managers primarily emphasized on the barriers of project settings, while the main worry of engineers was communication, testers was the organization of the project and that of user representatives was the abilities of the team.	The study used a CCM approach in a less explored domain and hence the considered sample size was limited.

Table1. Review of existing studies

4 Problem Statements

The healthcare is very important for every human. Most people die because of carelessness in healthcare. The problem occurs in healthcare is the ratio of doctor to

patient in India is low. Various researches occur in healthcare for protecting people from their disease. Machine learning provides various algorithms for healthcare but when used with Agile it reduces the time, cost and gives the patient better care. Artificial Intelligence can be applicable to several healthcare data such as Structured and unstructured. Machine learning is a popular techniques of healthcare used for structured data. There are various diseases such as cancer, neurology, thyroid that uses machine learning tools.[14] This paper focus on thyroid disease which are Implemented using Agile machine learning. The thyroid disease is that disease that cannot be predict without algorithm. [19] The Thyroid look like butterfly shaped which is residing at the base of neck. The thyroid consist of two iodine containing hormones [11]

- Thyroxine(T4)
- Triiodothyronine(T3)

The main hormone in thyroid is thyroxine (T4) also called T4.Thyroid affect body, reducing metabolism, influencing growth and development and body temperature. [26] Due to the excess of T4 flowing in blood the pituitary reduces the measure of TSH due to which thyroid movement is slow. [11].The most important thyroid hormone emitted by thyroid is thyroxine knows as T4 which contain four iodine particles. Now a day most common and second largest disease in healthcare is thyroid and 42 million people suffer in India suffer from thyroid disease. [3]

Here are some of the symptoms on which we will develop a machine learning tool based on Agile to diagnose both of types of thyroid-Hypothyroidism, Hyperthyroidism.

- Are you sleeping more than you used to?
- Do you always sleepier and tired?
- Have you gained weight in last couple of months?
- Do you feel colder than other family members?
- Have you started feeling weak from last couple of months?
- Does your skin getting dry?
- Do you feel trouble in concentrating or remembering things?
- Have you regularly feeling depressed?
- Do you have constipation?
- Do you generally have heavy or irregular periods?
- Did your mood swings?
- Do you feel constantly thirsty?
- Do you need to pee more often than usual?
- Do you feel swelling in your neck?
- Do you feel twitching or trembling?

5 How Machine Learning affect Agile Development

Introducing Machine learning in agile development reduced the time to weeks instead of months. Agile methodologies used machine learning projects in healthcare. It helps to increase the level of communication within the project and create strong bonds between team members. Using Agile in machine learning allows the project to be a market-focused and complete project within a timely manner. [9]
In Agile team interact with each other to get the best solution in healthcare. Using Agile ensures that all efforts dedicated to the machine learning project and there is no ambiguity among the process and each developer understands their role in the process. Agile is especially powerful in the healthcare domain using machine learning. In healthcare Agile allows developers to test different models and deals with a large dataset, its best to have a methodology that provides flexibility and scale when using Agile. In healthcare when used with Agile in machine learning not only the successful delivery of the project but the patient also improves. [8]
Agile is a very board term that is difficult to define properly and it includes various method the most popular method are Extreme Programming, Scrum, Kanban and so on. This paper focuses on the extreme programming method in agile machine learning in healthcare. The Extreme Programming is most popular in agile methodology. Extreme programming is very simple to work and bring the whole team together It is based on values of discipline such as communication, courage, simplicity and feedback. [22]From many years companies use agile models rather than the traditional model to deliver better products, faster to meet customer needs in the marketplace [12]. The tools used for Agile are JIRA which is used by developers all over the world. JIRA tool is used for both Technical and business team organization. [7].

6 Proposed Actuarial Model in Healthcare

Estimation of healthcare cost is difficult to estimate in medical organization, societies, government. The role of actuarial model in healthcare is to provide advice and involved in healthcare from many years. [25] A various type of machine learning algorithm has been developed for evaluating healthcare cost. [4] Machine learning can help physicians to provide proper patient care by providing up-to date medical information from textbooks, journals, and so on. Machine learning can help to reduce diagnostic and error in disease that are unavoidable in doctors. [14]
Actuarial model in Healthcare is accepted and there are various example of healthcare such as disease variations, cancer care, and medication delivery. Machine learning works on diagnosis on physiology data when the criteria can be reduced to classification task. Agile model can be deployed in healthcare application and the data generated from diagnosis, screening and so on and they need to be trained through supervised machine learning [14]. Agile deployed in the organizations to deliver efficient, customized, and standard quality service on time at a reasonable cost.

7 Advantage of Actuarial Model in Healthcare

Advantage of actuarial model in healthcare is appropriate data is collected and used to determine the model. In 2016, Actuaries in the USA was estimating healthcare cost nearly 18% of GDP while in India the GDP has very squat in FY19, the GDP of India is 1.5 % and in FY20 the gross domestic product has increased little bit 0.1% and it would be 1.6% by the government spend in healthcare[27]. By using agile and machine learning the cost of healthcare will be affected to efficiently analyze patient, diagnose the disease and improve the patient care. The benefits of actuarial model in healthcare are to analyze medical image and create report on that and prepare financial plans. Agile machine learning in healthcare will helps in cost optimization by consultation of remote patient and other medical activities.
Analysis of medical image is used to identify various cancers in breast, blood, thyroid, liver and disease of lung and many more. [28] By using Agile machine learning the problem of shortage of doctors will be removed in rural areas as well as urban areas. Machine learning helps in ICU (intensive care unit) where patient totally depended on analysis of real time data and adjust medical dosages and equipment. 64% patients are comfortable with machine learning algorithm in healthcare and using tools it provide patient to monitoring health 24*7, and book visit to hospital at any time. Nowadays machine learning algorithms are not replaced doctors by 100% but the implementation of machine learning using agile will try to replace doctors.

8 Conclusion and future Scope

Healthcare services exist in complex systems, fraught with delays and prone to generating unintended consequences. The system of healthcare consists of medical research, hospitals, health insurance and clinical trials. The growing complexity and interdependence of healthcare service delivery, and the inherent variability of patient demand, ensure that matching the supply of services with its demand is almost impossible to ensure for any significant period of time. This mismatch between patients and providers has been shown to lead to significant adverse effects in rural areas. The software has progressed toward becoming a vital part of our life. Yet, the improvement procedure of software is as yet developing and continually experiencing changes with time. New Development strategies are evolving and being refined. Utilization of Agile improvement strategies has expanded numerous folds over the recent years. In Agile the method used in this paper is extreme programing to develop the application of healthcare and find that Agile-based practices can improve the access, quality, and cost of healthcare delivery systems hence this paper and review how Agile software development could help improve the delivery of healthcare. From the study it can be concluded that adopting agile methods helps in accomplishing better execution as far as reduction in the time expected to perform crucial activities, decreasing the congestion in these procedures. Hence from the technological aspect, the encoding of Agile factors could be the subject of developing a model which in real-time provides a considerable improvement in healthcare delivery. Agile with Machine learning solve the

problem of healthcare field because it is more expensive. There are various problems in healthcare field such as Neglect of Rural Areas because mostly doctors are not willing to work in these areas. The other problem in Healthcare is the medicine is very expensive, Lack of Staff, Nurses and doctors. There are various diseases to diagnose in healthcare such as blood cancer, lung infection, breast cancer, thyroid cancer, liver infection and many more. In future issues of Healthcare problem will resolve using machine learning algorithm for people living in rural areas. Using Agile deployed in the Healthcare organization provide service to rural people at reasonable cost.

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