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QUANTITATIVE COMPARISON OF MACHINE LEARNING MODELS FOR AGILE PROJECT MANAGEMENT SUCCESS FACTORS

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ABSTRACT :
Agile software development is a flexible approach to managing and executing software projects, prioritizing adaptabil- ity, teamwork, and gradual advancements. This approach differs from the traditional Waterfall model, which relies on a sequential and rigid process. Agile is particularly well-suited for projects where requirements may evolve, and where customer feedback and adaptations play a crucial role.
Utilizing responses gathered from a Google Form survey, we aim to provide accurate forecasts of project success rates by analyzing the insights of 200 Project Management Professionals across 10 different criteria using machine learning algorithms.

INTRODUCTION:

The effectiveness of an IT project hinges greatly upon the capabilities of its project manager in making sound decisions, guiding teams, and overseeing operations. Equally vital is the project's timely completion within designated budgets and scopes. Nevertheless, grasping the essential success elements and experiences of agile managers remains elusive, encom- passing aspects like personnel, processes, technologies, and developmental tools.
Research outcomes underscore the indispensability of ex- tensive customer engagement in agile software development teams, alongside structured project management processes. Furthermore, the pivotal role of the product owner in aligning stakeholder interests and maximizing business value delivery is emphasized. Integration of best practices in agile engi- neering and deployment of relevant development tools are also highlighted. Organizations cognizant of these key factors stand poised to enhance their project management strategies, yielding amplified cost-efficiency, profitability, and productiv- ity, to the benefit of management, staff, and clientele. The implications extend towards fostering positive social change. In the realm of IT, innovative business solutions are im- perative for project conceptualization. Moreover, project man- agement should prioritize the generation of economic value and competitive advantages. A comprehensive understanding of project processes and tools is fundamental for project success. Project managers must ensure project efficiency while considering its impact on customers, business outcomes, and sustainable long-term development to gauge IT project effi-cacy.
In contemplating project management achievements, diverse guidelines and models come into play. Oilsen's cost, time, and quality framework, conceived almost half a century ago, initially served as success criteria. However, contemporary analyses, such as Wright's, assert that budget and time are the primary determinants. Yet, the spectrum of success factors extends beyond cost, time, and quality, as acknowledged by numerous authors. Exploring alternative methodologies alongside the iron triangle and incorporating factors conducive to project management success are paramount. Models that account for stakeholder satisfaction, organizational benefits, and enduring project ecosystem effects undoubtedly warrant further expansion.

PROBLEM DEFINITION :

Examining the triumph factors of Agile methodology in project management through the lens of machine learning marks a pioneering venture. Within this exploration, a mul- titude of interconnected

elements such as requirements, time allocation, human resources, financial investments, and available assets are taken into account.

A precise estimation during the initial planning stages lays the groundwork for accurately forecasting the triumph of Agile-driven software ventures. The inherent disparities between Agile methodologies and traditional strategies render conventional forecasting methods insufficient for anticipating success in Agile software projects with pinpoint accuracy. These inaccuracies can lead to both time and budgetary overruns, posing significant challenges.

Intelligent methodologies are imperative for forecasting suc- cess in Agile software endeavors to attain superior outcomes. In response to these challenges, an innovative framework has been proposed. This model harnesses the potential of Linear Regression, Logistic Regression, Decision Trees, Ran- dom Forests, and Support Vector Machines to refine success prognostication, paving the way for more precise project management in Agile environments.

SUCCESS FACTORS OF PROJECT MANAGEMENT :

The project manager is accountable for the successful completion of the project, which is defined as" completing the project within the constraints of scope, time, cost, quality, resources, and risk as approved between project management and senior management. "Project management itself, business planning, a skilled leader, human resource management, team- work, and communication skills all contribute to a project's success.

- How would you rate the level of training and development provided to team members in your agile Project?
- How would you rate the importance of technical excel- lence in agile practices?
- How would you rate the effectiveness of test-driven development (TDD) in ensuring technical excellence?
- How would you rate the importance of continuous inte- gration and continuous delivery (CI/CD) in agile devel- opment?
- How would you rate the effectiveness of pair program- ming in ensuring technical excellence?
- How would you rate the importance of code reviews in agile development?
- How important is it to have a dedicated product owner who can make decisions and prioritize tasks?
- How important is it to have a retrospective meeting at the end of each iteration or sprint?
- How important is it to have a culture of trust, respect, and accountability within the team?

APPROACHED CUSTOM MODEL V/S BASIC MACHINE LEARNING MODELS :

Our approach involves harnessing the power of machine learning techniques to produce accurate predictions regarding project success rates. This methodology entails employing algorithms capable of analyzing data gathered from a Google Form survey. This survey, administered to 200 Project Man- agement Professionals, evaluates performance based on nine specific criteria. By leveraging the information gleaned from this survey, our aim is to provide precise forecasts that offer valuable insights for enhancing project management strategies.

- Linear Regression: Finds the relationship between vari- ables using a straight line.
- Ridge Regression: Similar to linear regression, but adds a penalty to prevent overfitting.
- Lasso Regression: Another type of linear regression that shrinks some coefficients to zero for variable selection.
- Decision Trees: Models for classification and regression, splitting data based on features.
- Logistic Regression: Used for binary classification, esti- mating probabilities of belonging to a class.

DATA COLLECTION:

Our initiative involved an extensive data-gathering process, where we engaged with 200

Project/Product Managers from renowned IT firms that have adopted Agile practices. Utilizing a meticulously crafted Google Form survey, we ensured a wide spectrum of responses, aiming to capture diverse insights. By tapping into the firsthand experiences and perspectives of these professionals, we gained invaluable insights into the essential components driving success within Agile projects in the IT industry.

Through our efforts, we gained access to a wealth of knowledge, enabling us to uncover critical factors contributing to the success of Agile projects within the IT domain. The direct involvement of 200 Project/Product Managers provided us with firsthand accounts and viewpoints, offering a compre- hensive understanding of what drives successful outcomes in Agile Methodology.

METHODOLOGY: MACHINE LEARNING ALGORITHM :

Our approach involved collecting primary data from 200 Project/Product Managers employed at esteemed IT companies practicing Agile methodologies, enabling us to conduct quan- titative analysis. We utilized Supervised Machine Learning techniques, particularly focusing on regression models, to analyze the gathered data. This included employing algorithms such as Linear Regression, Ridge Regression, Lasso Regres- sion, Decision Trees, and Logistic Regression. Furthermore, we engineered a bespoke algorithm specifically designed to augment the capabilities of our regression model within the realm of Supervised Machine Learning, thus refining our analytical methodology.

Custom Regression: Our Custom regression is a custom class representing a polynomial regression model.

- The degree parameter specifies the degree of the polyno- mial to fit.
- The fit method generates polynomial features up to the specified degree and fits a linear

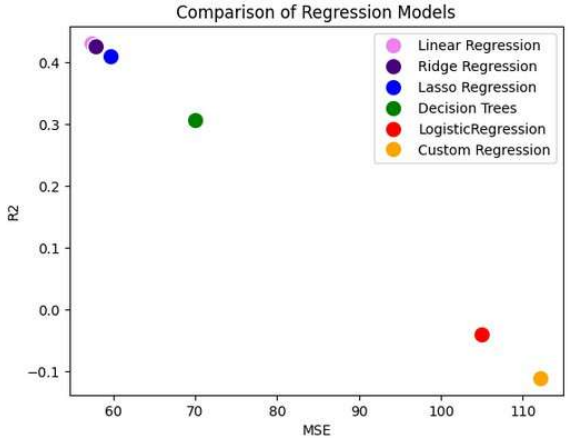

Fig. 1. Regression Models MSE and R2 Graph Comparison.

Model	MSE train	R2 train	MSE test	R2 test
Linear Regression	45.140576	0.439407	57.422809	0.431457
Ridge Regression	45.159472	0.439172	57.868917	0.42704
Lasso Regression	45.599834	0.433703	59.632434	0.40958
Decision Trees	3.289474	0.959149	66.25	0.344059
LogisticRegression	38.157895	0.526123	105.0	-0.039604
Custom Regression	2.990766	0.628582	11.216835	-0.110578

Fig. 2. Regression Models MSE and R2 Table Comparison

- regression model to the transformed data.
- The predict method generates polynomial features for new data and calculates predictions using the learned coefficients.
- You can adjust the degree parameter to control the complexity of the polynomial regression

model. Higher degrees can capture more complex relationships in the data but may also lead to over fitting.

CONCLUSION :

In summary, our research emphasizes the vital significance of Agile methodologies within projects marked by fluid re-

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can augment their flexibility and decision-making prowess, ultimately driving better project results amidst ever-changing

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demands and make informed decisions, thus positioning them[1-5] S. Ahmed, S. Ahmed, M. Ali, A. Naseem, A. Razzaq, and N. Ahmed,

selves for success in dynamic environments. Embracing these methodologies signifies a proactive stance towards navigating

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In essence, integrating Agile methodologies and sophisti- cated analytics techniques isn't just an option but a fundamen- tal strategy for organizations aiming to prosper amidst today's rapid pace of change. By embracing agility and leveraging data-driven insights, businesses can not only adapt to shifting circumstances but also proactively steer their projects towards favorable outcomes, ensuring resilience and growth in an ever- evolving landscape.

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