ClicTest™
Software Testing Simplified

Predictive Analytics in Software Testing

Mitigate Operational Risks While Enhancing Planning, Delivery And Quality

Whitepaper

Abstract

Many companies today face sudden increase in costs, production delays and operational risks. Predictive analytics is a data driven technology which can be leveraged to predict failure points in testing activities and determine the future. It has the power to help optimize project data and make proactive decisions. This whitepaper will introduce the concept of Predictive analytics in Software Testing as a technique which could help businesses in identifying the issues at the earliest to make proactive decisions and avoid failures in the future.

Predictive analytics for reaping a rich testing productivity

Predictive analytics is extensively used today in many industries. The software testing industry also could leverage it to streamline and seamlessly run software testing activities. Predictive analytics is rapidly becoming one of the huge buzzwords in software testing projects. Software Testing has never been an easy activity and it involves a lot of aspects that need to be efficiently implemented for better results.

Whether it is Traditional Testing or Automation Testing, a software is tested to find bugs. If proper testing is not implemented, sooner or later, new bugs start floating after the launch or after the delivery of the product. To perform effective testing, a right tool, right resources, and right environment are necessary. After having all these right aspects in place, reaping a rich testing productivity is still a challenge for many organizations.

Moreover, accomplishing software testing project in the given timeframe is an additional pressure. On time delivery of the quality product is what everyone's concern is whereas a software product cannot be delivered without proper testing.

All the companies want to provide an application which is error-free because customers would never want to accept a faulty application and they would immediately switch to other vendors who are typically competitors. Crossing the deadline and requesting for more time to perform testing has been happening for a long time and it's no more an excuse. So, it is important to do root cause analysis which helps in identifying the low productivity areas in testing.

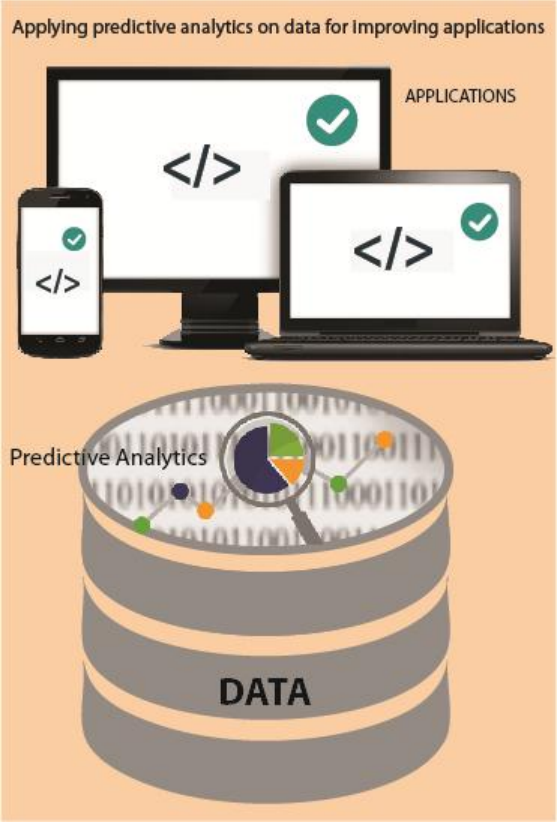
Predictive analytics can help in finding out the root causes of all the problems and helps in taking proactive actions towards performing effective testing. Predictive analytics is the practice of using current and historical data which helps to find insights about the performance of each tester, number of bugs identified per week or per month and the other related aspects. It also helps in predicting the performance of the coming future using the current testing data.

The modern digital enterprises can use predictive analytics in software testing projects to deliver the projects in time while continuously improving testing activity. It provides maximum value when the testing strategy for application is clearly defined. It is always important to keep tabs on where the software testing is heading. It is also important to keep tabs on software testing projects by running predictive analytics continuously.

Applying predictive analytics on data for improving applications

The web business is rapidly becoming better by using analytics. Analytics is something that has been most commonly used by the sales and marketing teams for quite a long time now. Data is now being used in some exciting ways in testing as well. Imagine, if we are getting some real time data from our customers which helps us to understand what user scenarios are being used to the greatest extent, then we can actually begin prioritizing which tests need to be written first and which tests need

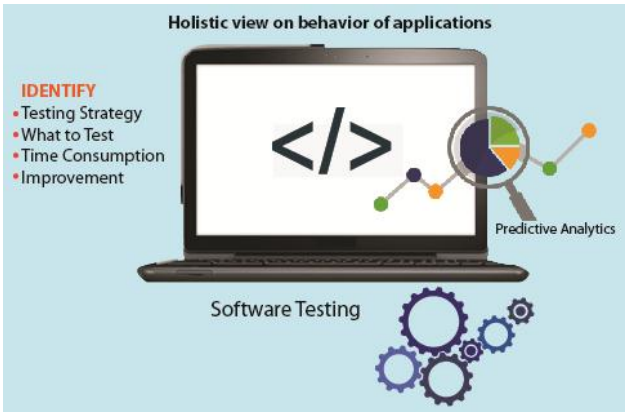
to be written last. If some features of an application are used the most, then we can automate those particular scenarios more and make sure that they are being regression tested extremely well.



Traditionally, companies wait until an end user finds a bug and posts in through customer forums or support. Now this kind of data will make the developers and testers see the issues before application goes to the end users. Data is rapidly turning out to be a new standard level of information for development and testing teams to make better decisions. Predictive analytics includes analysis of testing effort and provides weaknesses that need to be reduced. An insight is provided into how much effort is being put in and predictive analytics also helps in suggesting which area needs to be improved. Analytics is capable of tracking the testing effort and uncovering better approaches for transforming all the testing activities.

Holistic view on behavior of applications

Software Testing is no more a process which has to be implemented at the end of the Software Development Life Cycle. The ever-increasing role of IT in running businesses has raised the demand for producing quality software. It has to be ensured that defects are detected and fixed at the earliest. Software Testing can be considered as an opportunity to improve the quality.



At the same time, companies should have an effective testing strategy in place to mitigate the huge amount of time which is spent on testing activities. As a part of testing strategy, the most difficult part of testing is identifying what to test and when to test. Predictive analytics can help in figuring out what areas or processes have to be improved. It not only provides better experiences for testers, but the results can also help them to improve the performance of the testers. If Predictive analytics is correctly applied in testing, then the focus can be shifted to finding real defects in an application. It also provides a holistic view on the behavior of applications in production as well as the impacts on the customer experience. It has the power to allow companies to minimize software failure risks, increase agility, and bring in customer centricity to testing approach.

Preparation for Analytics in a traditional way

During SDLC, the injection of defects can happen at any stage. It can happen during the requirement phase or later during the build stages. The ability to predict the defect and preventing it from being injected into the next phases can help in mitigating the issues at the earliest. Using analytics for software testing and predicting the potential defects upfront is a right approach. There is a massive amount of information that can be seen during the development of an application. Historical application data is like the 'spine' of an application. Most of the data is ‘unstructured’ and hence comes with some challenges.

Firstly, there is a need to identify the historical data of an application which helps in future predictions. The second thing is that data needs to be indexed on the basis of values for faster retrieval and faster searches which are the keys for dynamic defect modeling. The data is also used to estimate the number of defects in a software project, to identify the release date and the needed effort of maintenance and measure the progress and quality of development.

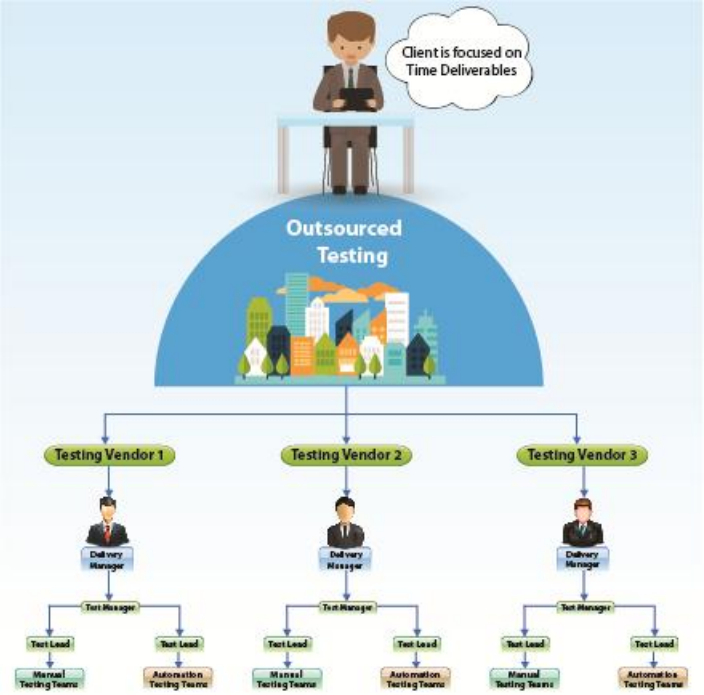
It is a difficult task to index unstructured data since this data doesn't follow any particular format or pattern. However, indexing unstructured data is attainable when it comes to application logs across testing environments.
It is crucial to figure out a soft structure for the data. This is again not an easy task as it involves heterogeneous data sources. One main aspect is that application data is classified on the basis of relationships that exist between the data. Data needs to be grouped and aligned in hierarchies on the basis of relationships that lies in the particular context. Inappropriate nomenclature and naming standards within a company are the common issues faced in this phase. Instead of building your own data platform, you can use available commercial or open source Data tools to automatically store and retrieve data and then use predictive analytics in the same way to figure out valuable insights. Because of the time and budget constraints, it's too hard for enterprises to have the right kind of support at the top and to be able to effectively use data.

Once the centralized repository is in place, an effective predictive analytics tool/engine is what you eventually need to have. Giving importance to predictive analytics helps in the betterment of software testing.

Predictive analytics at Business Level

Let's take a scenario of a software company that outsources all the testing projects. It would be only interested in timely deliverables without any delay.
A development company is handling multiple projects and is looking to outsource its entire testing activities to different testing vendors.

However, outsourcing testing activities to testing vendors and chasing them down till the completion of the projects is quite a difficult activity for the companies because each testing vendor has their own way of doing testing. If a company has a detailed record of previous testing projects which was done by different testing vendors from beginning to end, then it would be helpful in predicting which vendor has done well, which vendor has done a mediocre job and who are the vendors who have not performed well.



There may be a slight difference in SLAs made with different testing vendors but still predictive analytics can be performed on each task assigned to all these vendors. All it needs is the predicting capability by analyzing the records but doing it manually and creating a report would be a tedious job. There are a wide variety of predictive analytics tools available in the market which can be leveraged for predictions.

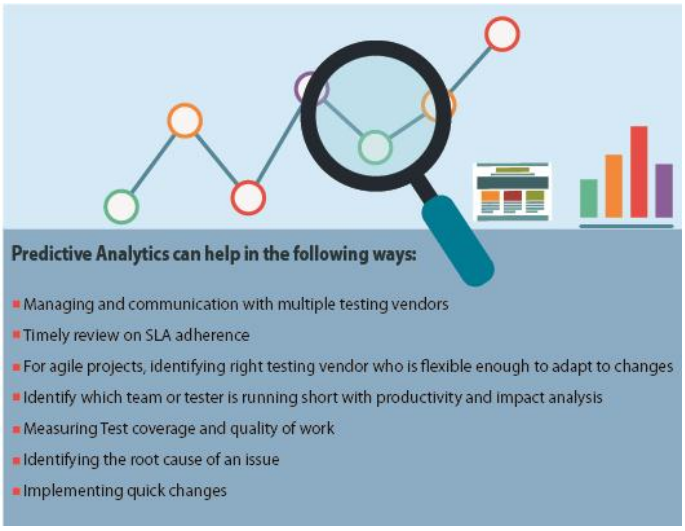
Making predictions from historical data is one type of scenario which helps in identifying and selecting who has done well and who needs to be given top priority for crucial projects.

When it is about distributing projects among the vendors chosen based on the performance level, a lot of special care has to be taken. Predictive analytics can be performed even during mid-way of the projects on who are the vendors who are actively performing and who are the vendors who are not performing. There are a lot of testing vendors in the market who offer testing services better than the other ones. It's quite difficult to find one versatile testing partner who can efficiently help meet the needs. Due to the time constraints, companies may randomly pick the testing vendors for their projects. After making SLA's, these vendors begin testing initiatives. Typically, online business platforms or web application based businesses and large enterprises want their applications to be continuously tested because these businesses keep adding or removing features based on the customers' ever changing needs.

So these businesses partner with testing vendors to get continuous support for their multiple applications. Usually companies make a contract every year with testing vendors. Some companies which work on long term projects outsource their testing activities after SLAs made with testing vendors every year.

Companies always want their testing tasks to be productive and this is what they expect from their vendors but the productivity provided by the vendors might not always be a healthy and constant productivity. The productivity or performance of the testing vendors may not be constant all the time. The testing approach of the vendors might be quite different from that of each other.

Typically, companies outsource entire testing activities to get consistent productivity and to avoid high costs associated with in-house testing activities.
The companies can still do predictive analytics on the performance of different vendors and decide which company should be given the testing projects. Usually, it's quite common for the client to find that the testing needs to be extended when the first period of testing finishes. It happens due to various issues with the vendors such as miscommunication, internal issues like power cut, slow systems, network failure, unavailability of resources, tools installations time etc.



Whatsoever the issues from the side of the vendor, the client has to experience more expenditure, more cost, more time in testing along with the vendor's inadequate productivity. It is no wonder that the client ultimately ends up in stopping the testing project due to budget constraints. The company could avoid this issue by doing predictive analytics at regular intervals to analyze the performance of each vendor.

The data or the service reports that are produced by the vendors during every month or quarter can be used to see the performance and to make quick business strategic decisions at the earliest.

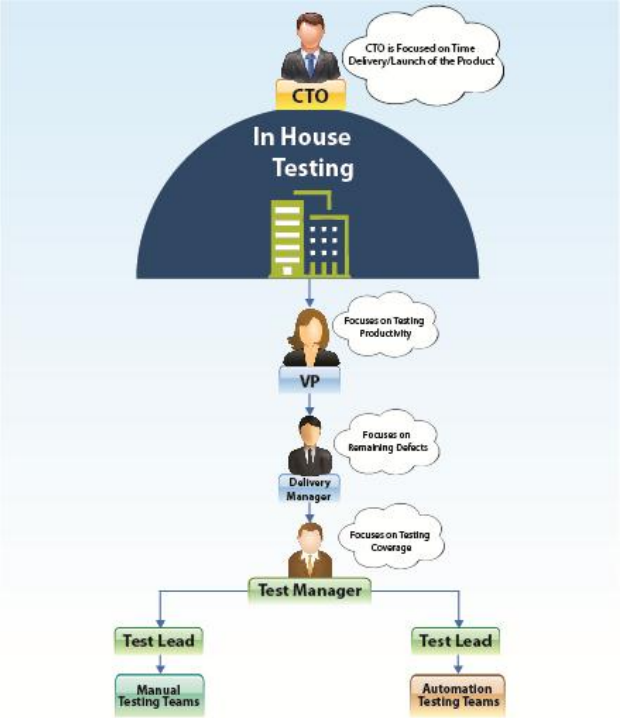
Testing productivity from all the corners may appear like ups and downs during the first three quarters of the year but the company wants its testing activities to reach a level which is pre-defined. A step before the end of the third quarter, a company can do a complete round of predictive analytics to find the average productivity in every quarter which is usually the predicted average productivity in the fourth quarter. It then becomes quite easy for the stakeholders of a company to take decisions at the end of the fourth month whether to renew the SLA with the existing vendor or to choose a new vendor.

Predictive analytics provides an insight into each aspect mentioned in the SLAs. Usually, based on the project's needs, companies mention the types of testing they want like Manual or Automation or both and how many testers they want. With an extensive capability of predictive analytics, it can allow a company to look into the productivity of each testing team of vendors. It also helps to determine which Vendor's Automation testing team and which Vendor's Manual testing team is doing well based on the reports provided by these vendors.

Predictive Analytics helps in reviewing productivity of each individual testing vendor. Because of the time and budget constraints, companies cannot afford to extend testing activities which were already supposed to be completed within the time. Many deliverables are also expected very frequently within in the SLAs.

Predictive analytics at Operational Level

It's always difficult for the testing companies which run multiple projects of different clients at the same time to complete the projects within the pre-defined time-frames mentioned in the Service Level Agreements (SLAs). The testing company has a large pool of testing teams. The company simply distributes equal amount of testing activities of similar projects to their teams. The companies cannot always afford to put some extra money on testing to complete it on time. They cannot hire additional testing resources and may not buy extra tools and licenses. Let's take a scenario of a software testing company which has its own extensive testing team that is expected to adhere to strict deadlines of performing testing. Typically, there would be short deadlines and long-term deadlines. Mostly, short deadlines would be around 15 to 30 days based on the type of project they are handling. Long term deadlines would be around 6 to 12 months. Let's consider a 15 day sprint or a deadline and look at the first 3 days productivity. Suppose there is no productivity for 8 hours



when it is expected to have 8 hours productivity every day. The cause for this particular loss of 8 hours productivity is unknown until and unless you perform predictive analytics.

On the 6th day when you again see the performance, it might be no surprise to observe that the productivity loss is 20 hours or more. This issue would force a company to extend the launch time of the product. In the meantime, the company is forced to face significantly escalated costs and due to over burden, a company might even give up the project. All these issues could be mitigated at the early phase itself if predictive analytics is in place.

If Predictive analytics is performed on productivity, it would help in finding out the root cause of the problems through data that is generated in these 3 days. To do it, a right predictive analytics tool is required which could be integrated to any testing tool to provide required information any time from the data. The data shows who were the testers along with their individual productivity, why some testers couldn't perform through logs and testing data, and other issues like when and what was system downtime, network issue, who were the absentees etc. The time taken to identify and post each bug can be determined as well. Using Analytics, a company can also check productivity of each testing team and each tester and the number of valid and invalid bugs posted by teams and testers and the time consumed.

Predictive Analytics can be performed on the internal testing teams to find out the average productivity generated in a month. It helps companies running multiple projects with multiple testing teams to find out the reasons for the slow progress of the testing or issues in testing. This ultimately helps in finding out what needs to be improved and in providing better quality services to the client.

All these issues helps to identify the changes required to improve the process. Like all necessary changes, if some testers kept performing low due to various reasons, predictive analytics allows to find out the right tester with right experience in right tool for the right project. This allows to seamlessly and efficiently run testing activities. However, as each stake holder expects different reports, then generating stake holder based reports becomes a challenge.

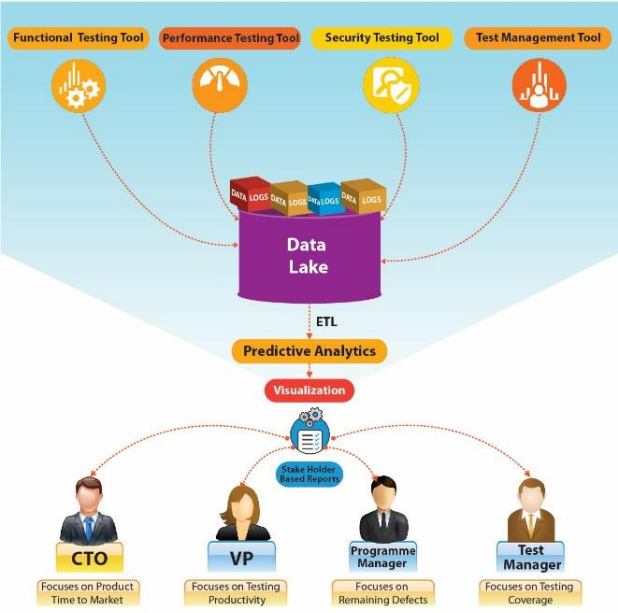
Challenges in generating stake-holder based reports

- To generate the appropriate reports, information has to be extracted from Database, application logs or hardware logs/events.
- In a testing practice, multiple testing activities are performed and multiple testing tools are leveraged to fulfill the requirements and each testing tool works in siloes and respective testing data and logs storing in siloes.
- Benchmarking the server infrastructure is a big challenge as it requires performance tools with huge infrastructure and respective performance and system engineers.
- Integration of all the tools requires a lot of time, effort and expertise.
- Appropriate maintenance and support.

There are 3 major techniques used in Predictive analytics - Predictive model, Descriptive model and Decision model which helps in predicting the present and taking proactive measures for the future. Predicting the present helps in meeting the set goals by increasing the efficiency and improving the effectiveness of the testing operations. Proactive measures for future helps in identifying the root cause of all the problems and help in predicting where exactly the system might fail. Implementing Predictive analytics to generate different kind of reports is a laborious and lengthy process. Most importantly, the data needs to be identified and extracted from different sources where too many tools are used and each tool works in silos. Moreover, it's a costly approach and takes lot of time in connecting different sources and extracting the required data.

To optimize the cost, time and effort, new techniques and technologies should be used and integration of predictive analytical has to be done. This approach also helps in meeting the expectations of different stakeholders.

Predictive analytics in Integrated Approach



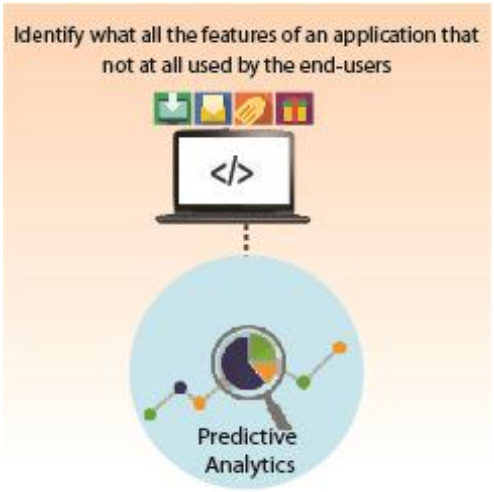
- There should be one E2E platform with flexible integration framework and a Centralized repository for all the testing data and logs /Events
- The system should be able to capture all the required information from Testing tool, webserver/ Application server and cloud or In-house servers
- The Predictive analytics tool should be part of E2E platform
- Generate stake-holder based reports in a graphical or grid view
- Advantages of Predictive analytics at Operational level

Advantages of Predictive analytics at Operational level

- Task Delegation - Identifying versatile Testers for particular task
- Managing multiple testing projects and measuring Testing team Productivity
- Managing multiple testing tools and the required infrastructure
- Identifying the root cause at a right time
- Identifying issues which can lead to challenges in future
- Generating different stake-holders reports in a preferred view
- Measuring Test coverage and quality of work
- Timely alerts and notifications

Reduce development efforts through Analytics

It's difficult for the enterprises to decide what should be focused on to improve their business. They should use analytics to find this out. More importantly, these analytics bring in data about application which is impossible to know otherwise. Analytics tools help to determine which software features never got used. Online business platforms would be more cost effective if they know that some of the features are redundant and needless. It simply means that those features have extracted developer's time, effort and company's money. These features also distract and confuse users. Analytics simply helps to avoid building that kind of features. It is also important to first focus on understanding how the customer operates, and then bringing in a predictive tool will not only help in identifying whether that understanding is valid or not.



Predictive analytics on Bugs

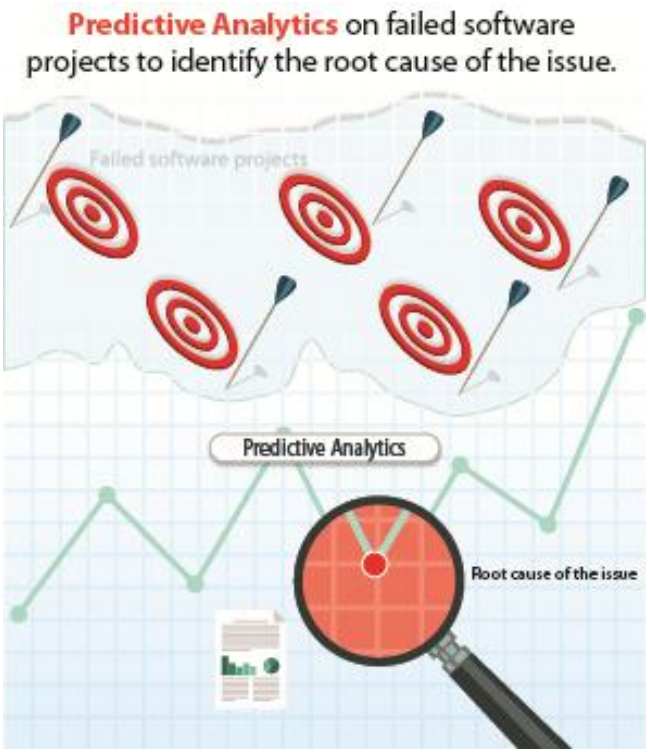
Predictive analytics is a multi-faceted technique which is instrumental in providing valuable insights from historical data and in predicting the nature of the present data. It helps in many ways. For example, a company is handling multiple testing projects, and ideally there should be a list of all the bugs posted by multiple teams. Predictive analytics can be performed to check which bugs get repeated very frequently. Analysis on this would help to find out the real reason behind the bugs which are same and repeatedly happening (it might be issue at the development's end).

Predictive analytics on Testing Requirements

Predictive analytics can be performed on Testing Requirements. For example, consider a company which is in the middle of the talks about requirement which is gathered from the client. The company could perform Predictive analytics here if the project is very similar with the one the company has earlier worked on. Typically, requirement includes the type of application which needs to be tested, how many manual and automation testers are required, what type of testing needs to be performed and the time required for completing it. So this particular data or requirement gathered from the client can be used to perform predictive analytics. Picking out the past requirement information of the project and doing analysis before making an SLA is a right approach as it helps to find out who were the testers and how much time they took to perform, what were the bugs, and whether the test is completed on time. All these factors helps to identify what could be the nature of the project which has to be handled. So, its helps the company to sign the SLA based on the predictions which it has made. Moreover, the company which has already predicted bugs and the number of testers required to post bugs and the time taken deals with things in a better way.

Predictive analytics for Project Success

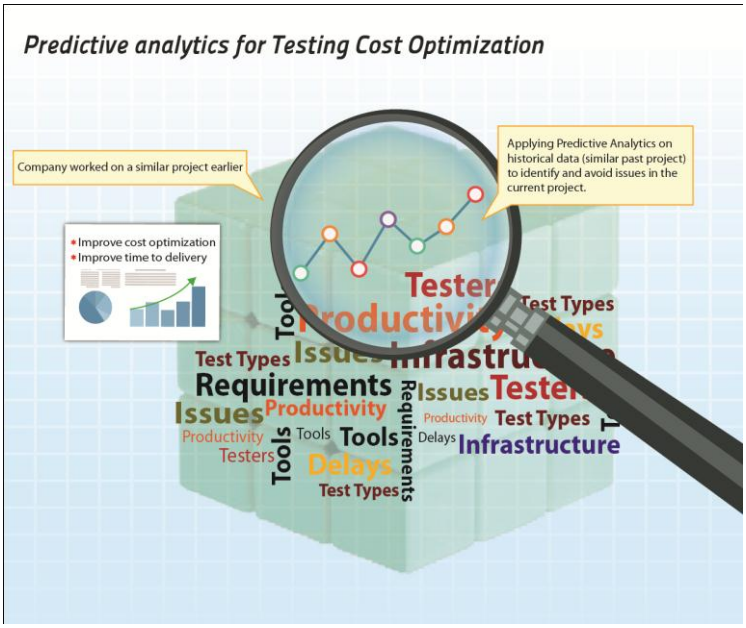
Predictive analytics can be performed on successful software projects when a company is frequently facing failures than success. As known, predictive analytics is a data driven technology which helps in making predictions which can influence the future. Predictive analytics determines the failure points in the projects and relates them to specific causal factors of testing. Predictive analytics enables to optimize project data and information to offer real-time decisions that reduce financial risks associated with failed projects. Predictive analytics provides predictive intelligence to understand what is happening now, what should be done about it and what is going to happen. The outcome of software engineering cannot be predetermined. Software project failures are costly and often result in an organization losing millions of dollars due to termination of a poor quality project.



Needless to say, software testing is an essential component of software engineering. However, project complexities make it the most challenging and costly phase of the SDLC.

Predictive analytics allows to leverage company's past project performance data to predict outcomes of future work. It identifies the effectiveness of testing by correlating previous project failures with inadequate testing to separate those areas for improvement. The results achieved from the predictive analytics would provide a company with leadership insight into all aspects of the company.

Predictive analytics will assist in improving a company's testing capabilities by providing insights on where to improve testing like identifying whether the client's requirements are understood properly, whether estimated timelines are right, whether estimated manpower is correct etc. By identifying the tendency of project failure during the early planning phase, this key activity will promote a more successful project portfolio for the company. Predictive analytics would really help in predicting what will happen in the future and what steps to be followed on this insight.



Predictive analytics for Testing Cost Optimization

A company can optimize their in-house testing costs through predictive analytics. Based on the client requirement, the company can correlate the requirements with past similar or same project. It helps to identify what was the infrastructure, what were the tools, who were the testers and the productivity reaped out from this environment. It could also show how many times the testing activities were delayed and what were the issues. Major point of predictive analytics here in this context is to find out the issues, why did these issues happen, what to do to mitigate these issues and how to be highly productive. Once the root cause is identified, then it would be easy to improve cost optimization all the time and improve time to delivery.

Conclusion

In this whitepaper, we have come across how predictive analytics can help software testing companies, and software development companies which perform testing for their software projects using their in-house testing constituency. Our proposed techniques and solutions is a step towards reducing the complexity of software testing and making it more productive for the companies by providing early and continuous feedback to the respective people. A Software Testing framework with integrated predictive analytics would help in identifying the current situation of the project and take proactive measures to avoid failure points ahead. It is broadly used to identify the root cause of the problems and mitigate them before the damage becomes irreparable and causes heavy loss. Moreover, it advances software testing at every level to achieve rapid development and faster time-to-market objectives.

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