A PROJECT REPORT ON

Robolution: Real Time Predictive Analytics and Decision Making for Industrial Robots

SUBMITTED TO THE SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE

BACHELOR OF ENGINEERING (COMPUTER ENGINEERING)

SUBMITTED BY

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SAVITRIBAI PHULE PUNE UNIVERSITY

(2018-2019)

CERTIFICATE

This is to certify that the preliminary report entitles

Robolution: Real Time Predictive Analytics and Decision Making For Industrial Robots

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is a bonafide student of this institute and the work has been carried out by him under the supervision of **Prof. Dr. Pramod D. Patil** and it is approved for the partial fulfillment of the requirement of Savitribai Phule Pune University, for the award of the degree of **Bachelor of Engineering** (Computer Engineering).

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Date:

Place: Pune

Acknowledgment

It gives me a great pleasure and immense satisfaction to present our sponsored project **Robolution: Real Time Predictive Analytics and Decision Making For IndustrialRobots** which is the result of unwavering support, expert guidance and focused direction of my guide **Prof. Dr. Pramod D. Patil** to whom I express my deep sense of gratitude and humble thanks, for his valuable guidance throughout the presentation work. The success of this project has throughout depended upon an exact blend of hard work and unending co-operation and guidance, extended to us by the superiors at our college.

Furthermore, I am indebted to our Head of Department **Prof. Dr. Pramod D. Patil** and Principal **Prof. Dr. Pramod D. Patil** whose constant encouragement and motivation inspired me to do my best.

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Abstract

Robots have been playing a very important role in our day-to-day lives and will be a necessity in the coming future. Whenever we hear automation, the first thing that strikes our mind is a robot performing the given task. But if a robot fails to do the task, it could cost an individual or corporate a huge financial loss. The fact that 'we cannot rely fully on machines' stands out here. Therefore,we must take preventive measures in order to get the robot serviced before fail or use the robot in such a way that it does not produce(s) any harm to the individual, physically as well as financially.For detecting such anomalies in the robot, before they occur, we are developing a software that runs various classification algorithms such as Logistic Regression, Naïve Bayes, and K Nearest Neighbour for predicting the future state of various drives in a robot based on individual drive dataset. Result of the algorithm with maximum accuracy will be taken into consideration.

Contents

List of Figures

List of Tables

CHAPTER 1

1 INTRODUCTION

Robots now-a-days have witnessed a large number of users since the process of automation has begun. Today, we need Robots in every field, right from agriculture to performing various tasks in corporates.'Robolution' is the term that is used for this era of Robots. But the question arises do we know will the robot perform the given task accurately or even if it does it accurately, does it do it the right way. To overcome such difficulties and ease the human decision making for assigning task to robot, we need algorithms to predict the next result of robot, using its dynamic dataset which is integrated with the cloud. The program will be connected to cloud system and will provide output with a prediction graph.

The objective of this work is predictive maintenance of industrial robots and the possibility of building a condition monitoring system based on the data analysis of the robot's locomotion which brings the work of individuals at one place.The aim of this study is also to detect the robot's accuracy for performing a task correctly.This can be checked by observing a robot for a certain period and then using that dataset for prediction.

Present work majorly focuses on Industrial Robots because their robots perform critical tasks and its failure could be a hefty cost for the industry. Analyzing robot behavior from prior data is the fundamental basis of a data science approach like machine learning.

1.1 MOTIVATION

Robots now-a-days have witnessed a large number of users since the process of automation has begun. Today, we need Robots in every field, right from agriculture to performing various tasks in industries.'Robolution' is the term that is used for this era of Robots. But, do we know will the robot perform the given task accurately? Or even if it does it accurately, does it do it the right way? To overcome such difficulties and ease the human decision making for assigning task to robot, we have developed a program which uses 3 different classification algorithms such as K Nearest Neighbours, Naïve Bayes and Logistic Regression to predict the next result of robot using its dynamic dataset which has been integrated with cloud. This program will be connected to cloud system and on running will provide output with a prediction graph. Thus, increasing the efficiency and fault tolerance of robots. As a result, saving the industries from failure cost of robots.

1.2 PROBLEM DEFINITION

The objective of Robolution: Real Time Predictive Analytics and Decision Making For Industrial Robots is to build a program for industrial robots that will reduce the maintenance of robots before failure occurs and its cost to the industry as much as possible. It will alarm its human administrator before it itself fails. It will help to make industrial robots robust in market.

CHAPTER 2

2 LITERATURE SURVEY

2.1 Tawfik Borgi

Tawfik Borgi proposed,"Data Analytics for Predictive Maintenance of Industrial Robots"(Tawfik Borgi)presents the predictive maintenance of industrial machines based on the data analysis of robot's power measurements. A predictive modelling approach is proposed in the paper, to detect robot manipulator accuracy errors based on robot's current data analysis for predictive maintenance purposes. Also, an experimental procedure is carried out to oversee the correlation between the robot accuracy error and a set of extracted features from current time-series, and to evaluate the proposed predictive modelling.

2.2 Dutta, K., Jayapal, M.

Dutta, K., Jayapal, M proposed, "Big Data Analytics for Real Time Systems" (Dutta, K., Jayapal, M.) discusses the use of Big Data and its impact in our day to day lives. It focuses on the fact that Data, if processed at the right time could provide us with some eye opening insights. An overview of the Big Data Analytics for Real Time Systems and focus on its challenges (3V's of data), research trends and accuracy of results has been studied in the paper.

2.3 Caruana, Rich, and Alexandru Niculescu.Mizil

Caruana, Rich, and Alexandru Niculescu Mizil proposed, ”An Empirical Comparison of Supervised Learning Algorithms” (Caruana, Rich, and Alexandru Niculescu Mizil)comes up with an approach to find the best suited algorithms for Big Data problems using supervised learning methods: SVMs, neural nets, logistic regression, naive bayes, memory-based learning, random forests, decision trees, bagged trees, boosted trees, and boosted stumps. It also examines the effectof calibrating the models via Platt Scaling and Isotonic Regression has on their performance.

2.4 Tenorth, Moritz, and Michael Beetz

Tenorth, Moritz, and Michael Beetz proposed, ”KnowRob—knowledge processing for autonomous personal robots” (Tenorth, Moritz, and Michael Beetz) portrays how data could be processed in the robots in order to get the most out of robot. Knowledge extraction from the given data without hampering the working of robot is one of the major methods discussed in the paper. A Knowledge processing framework and its implementation has been explained which works in almost all the robots (as concluded in the paper). Since, most of the work is done in focused areas such as Robotics, Real time data processing, comparison of algorithms etc. This study tends to bring forward the work done in an interdisciplinary manner for ease of human. Therefore, the work proposes an addition to the existing technology for better robot efficiency and working.

CHAPTER 3

3 SOFTWARE REQUIREMENT SPECIFICATION

3.1 INTRODUCTION

Robots now-a-days have witnessed a large number of users since the process of automation has begun. American workplaces are using robots for many years. Today, we need Robots in every field, right from agriculture to performing various tasks in corporate world. 'Robolution' is the term that is used for this era of Robots.

Apart from traditional industrial robots, industries also use professional service robots and collaborative robots who work with humans. As a result we need good safety standards. Our program will raise these safety standards by notifying the failure of the robot to its human administrator before it disruptively fails.

To overcome such difficulties and ease the human decision making for assigning task to robot, we are using algorithms to predict the next result of robot, using its dynamic dataset which is integrated with the cloud. The program will be connected to cloud system and will provide output with a prediction graph.The objective of this work is predictive maintenance of industrial robots and the possibility of building a condition monitoring system based on the data analysis of the robot's locomotion which brings the work of individuals at one place.

The aim of this study is also to detect the robot's accuracy for performing a task correctly. This can be checked by observing a robot for a certain period and then using that dataset for prediction. Present work majorly focuses on Industrial Robots because they perform critical tasks and its failure could be a hefty cost for the industry. Analyzing robot behavior from prior data is the fundamental basis of a data science approach like machine learning

3.1.1 PROJECT SCOPE

Robots are used in a number of industries. Apart from traditional industrial robots, industries also use professional service robots and collaborative robots who work with humans. As a result, accuracy and precision of tasks performed by robots are very important. This project will help to increase the efficiency of robots to overcome difficulties and ease the human decision making for assigning the task to robot.

It plays a crucial role in the functioning of industries and factories where robot's accuracy for performing a task correctly is important, as due to a slight mistake can make a huge loss to the organization. Our program will also raise the safety standards by notifying the failure of the robot to its human administrator before it disruptively fails.

3.1.2 USER CLASSES AND CHARACTERISTIC

(1) Basic knowledge of using computers is adequate to use this application.

(2) Knowledge of how to use a mouse or keyboard and internet browser is necessary.

(3) The user interface will be friendly enough to guide the user.

(4) Knowledge of robot database is required.

(5) Graph understanding knowledge is necessary.

(6) Knowledge of Python is recommended.

3.2 FUNCTIONAL REQUIREMENTS

Feature 1 – Integration Our first bone is integration to the database. This is the foremost and the most important step in this project and must be done carefully. In fact, you shall not pass until the application has the fullest info about your current state. Actually, this move seems quite logical. Because this is typically what you do when you come to a live prediction algorithm.

However, our database integration procedure is a bit different and includes one more action to be performed before giving an exhaustive description of user's physical condition. I mean a standard uploading csv file to the project and a direct connection to the database which gets updated in real-time. Getting back to the idea of robot prediction, we want to give you a basic idea on what is may contain. Thus, application can interrogate a machine about:

(1) current state
(2) past state
(3) position
(4) external torque
(5) end effectors
(6) work done,etc.

Maybe the best but still the most hypercorrect data integration I've ever seen is the one provided by this project. The project has all the above mentioned. Thus, a user can get the best recommendations as for his or her robot. But what I like even better is their animated graph which gives a better understanding.

Feature 2 – Robot Controller integration with cloud Let's not forget that the main goal of our robot prediction algorithm is keeping up with the data, whenever it is updated. We might see whenever a data tuple gets updated, there is a change in accuracy values as well as the next prediction. Therefore, the data is sent by the drives of the robot to the controller and then controller updates them to the cloud for real time processing.

Feature 3 – Dashboard Actually, we have used three methods, Naïve Bayes, K Nearest Neighbours and Logistic Regression. Once input, daily stats should be visible. A dash of beauty and action is exactly what our application needs. That's why every user's move should be reinforced with a high-level visualization. This Dashboard helps a layman to understand whether robot is doing good or not and provides a user-friendly environment.

Feature 4 – Predictive Algorithms The algorithms are trained in such a manner that they provide accuracy values above threshold and if they don't because of underfitting problem, then they are ran again in order to get a better output. At the end, it's just a prediction and we cannot accurately predict the future.

Feature 5 – Notifications Consider the fact that a robot prediction should be always on the lookout. I mean it can push users toward their goals and prevent them for losses. And the best way to do it is to remind them of yourself. It would be nice to hear from your algorithm once a day. "Hey, sup?" or "Get a refresh!" once a day will be just enough so that data can sync to provide better output.

3.3 SOFTWARE INTERFACES

Python : Python is an interpreted high-level programming language for general purpose programming. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales. In July 2018, Van Rossum stepped down as the leader in the language community after 30 years.

Firebase : Firebase is a mobile and web application development platform developed by Firebase, Inc. in 2011, then acquired by Google in 2014. As of October 2018, the Firebase platform has 18 products which are used by 1.5 million apps.

3.4 SYSTEM REQUIREMENTS

3.4.1 DATABASE REQUIREMENTS

Database - Google Firebase Firebase is a mobile and web application development platform developed by Firebase, Inc. in 2011, then acquired by Google in 2014. As of October 2018, the Firebase platform has 18 products which are used by 1.5 million apps.

3.4.2 SOFTWARE REQUIREMENTS (PLATFORM CHOICE)

1. Tools - Python IDLE
2. Programming Language – Python
3. Software Version – Python 3.7
4. Data Base Tools –Google Firebase SDK
5. Front End - Tkinter (Python)

3.4.3 HARDWARE REQUIREMENTS

1. Processor - Pentium IV/Intel I5 core
2. Speed - 2.1 GHz
3. RAM – 4 GB (min)
4. Hard Disk - 100GB
5. Keyboard - Standard Keyboard
6. Mouse - Two or Three Button Mouse
7. Monitor - LED Monitor

3.5 SOFTWARE DEVELOPMENT LIFE CYCLE

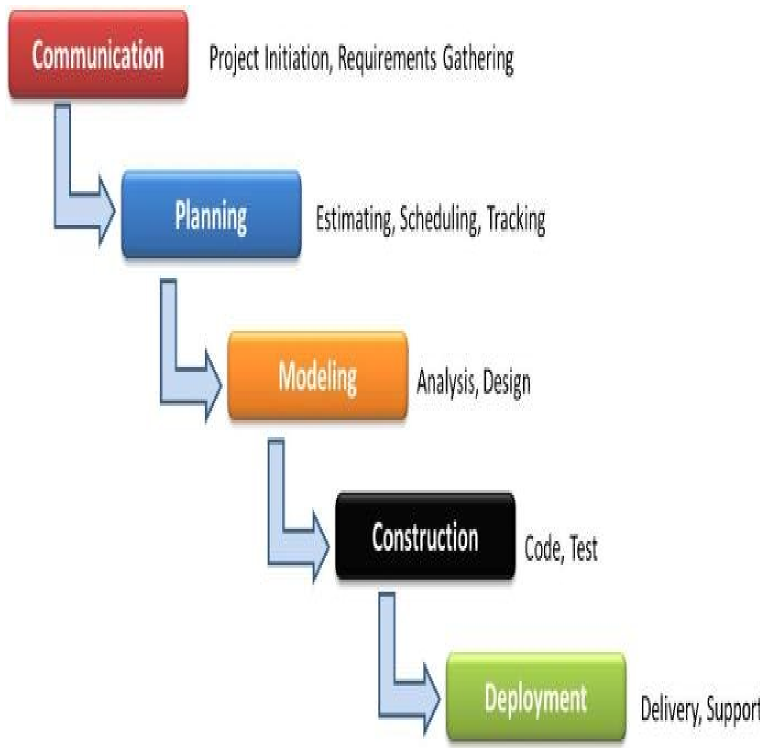


Figure 1: Phases in Software Development Life Cycle

In the waterfall model we start with the feasibility study and move down through the various phases up to Implementation, Testing, Deployment, maintenance and into live environment. The above diagram is a structure of waterfall model.

CHAPTER 4

4 SYSTEM DESIGN

4.1 SYSTEM ARCHITECTURE

System Overview Now, with the help of this prediction the human administrator can know which drive will work properly and which will fail in the next action, and thus industry can take necessary actions in order to minimize the costs of failure]A robot has a controller and drives attached to it which concurrently executes command(s) given by its administrator. Functioning of every drive(s) and storing the data generated by drive(s) to cloud is handled by the controller. Various machine learning algorithms are implemented on the motherboard of controller and whenever drive generates new data, the previous data is fetched from the cloud and model(s) are trained accordingly to classify new data. Different algorithms run on the controller simultaneously in a passive manner (without harming the current actions of robot), and the algorithm with best performance metrics is considered for the prediction. The prediction of various drive(s) of robot is sent to the administrator through a service installed on the linked remote device via Wi-Fi locally

Now, with the help of this prediction the human administrator can know which drive will work properly and which will fail in the next action, and thus industry can take necessary actions in order to minimize the costs of failure

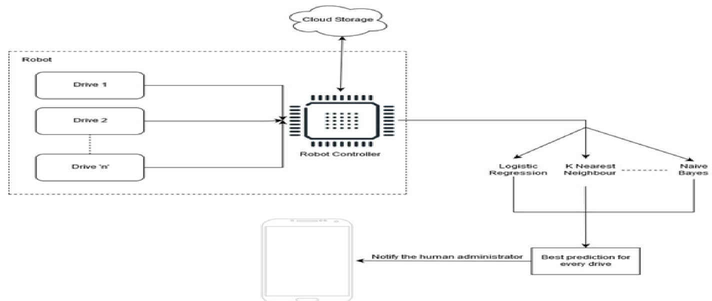


Figure 2: Architecture Diagram for the proposed model

Data Sets

The data generated by drives is mostly in .csv format. Data generally varies from robot to robot based on its use and implementation. A typical drive database consists various features such as time, positions, external torques, commanded pose and end effectors. A total of around 2,10,000 tuples training data was used.

- ## Performance Results

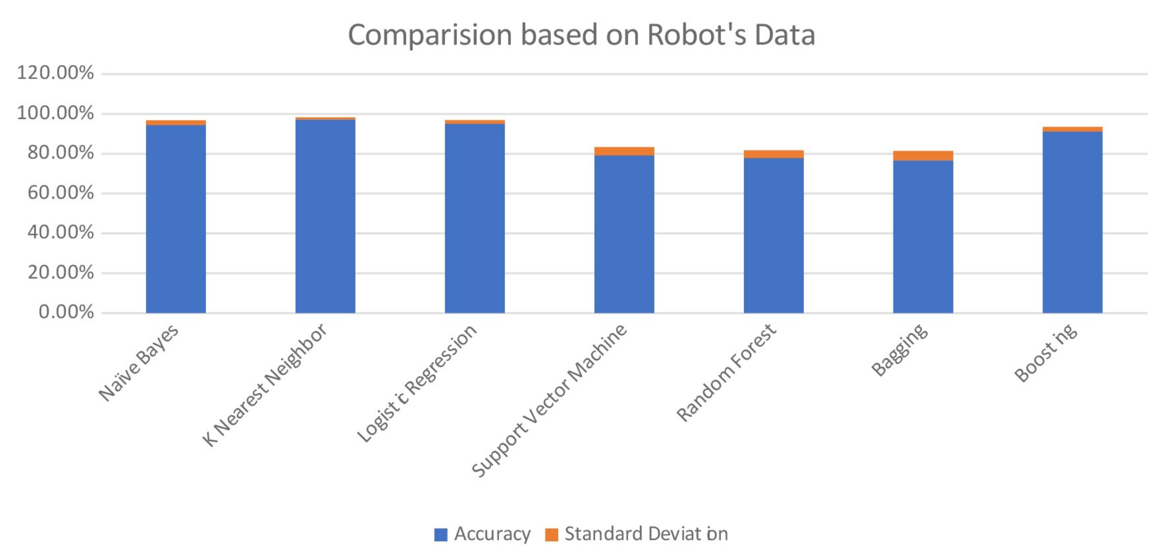


Figure 3: Graphical performance comparison between various predictive algorithms

Various predictive algorithms such as Naïve Bayes, K Nearest Neighbors, Logistic Regression, Random Forest, Support Vector Machines, Bagging and Boosting were used on the robot dataset to evaluate which algorithm works best. The parameters used for evaluating a model are Accuracy, Standard Deviation, Total time of running, time taken by model for training according to data and the scoring time.

4.2 USE CASE DIAGRAM

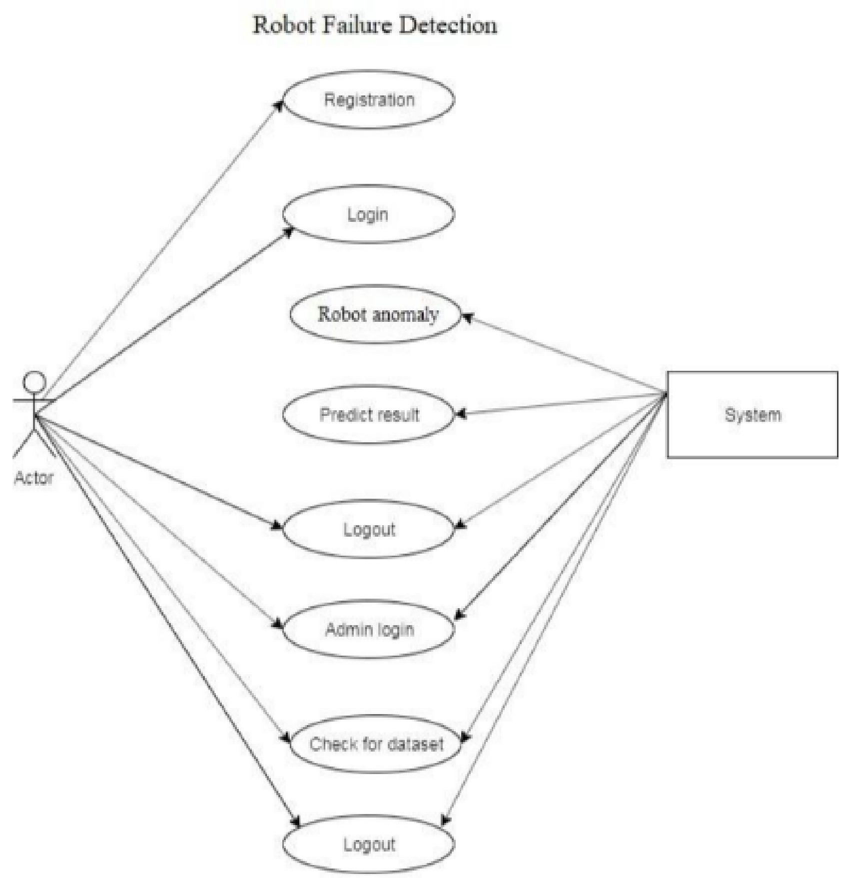


Figure 4: Use Case Diagram

The use case view models functionality of the system as perceived by outside users. A use case is a coherent unit of functionality expressed as a transaction among actors and the system.

4.3 SEQUENCE DIAGRAM

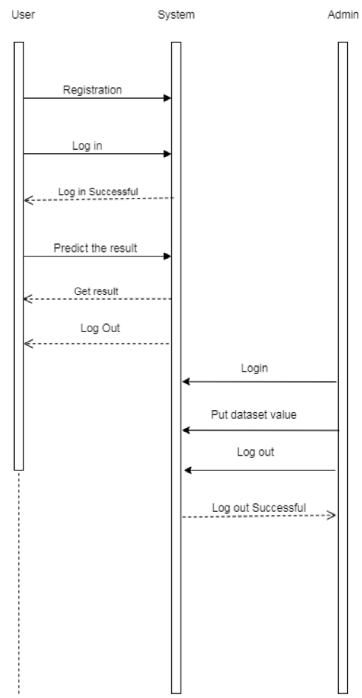


Figure 5: Class Diagram

A sequence diagram, in the context of UML, represents object collaboration and is used to define event sequences between objects for a certain outcome. A sequence diagram is an essential component used in processes related to analysis, design and documentation.A sequence diagram is also known as a timing diagram, event diagram and event scenario.

4.4 ACTIVITY DIAGRAM

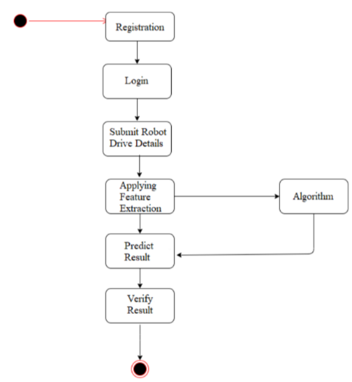


Figure 6: Activity Diagram

Activity diagrams show the sequences of states that an object goes through, thecevents that cause a transition from one state to another and the actions that resultcinto a activity diagram.

CHAPTER 5

5 Plan of Project Execution

Table 1: Plan of Project Execution

NO	**TASK**	**START DATE**	**END DATE**
1	Literature Survey	15^{th} July	20^{th} July
2	Requirement Analysis	21^{st} July	26^{th} July
3	Study about Robot Drives and Controller .	27^{th} July	2^{nd} August
4	Study about Logistic Regression	3^{rd} August	6^{th} August
5	Study about K Nearest Neighbour	7^{th} August	10^{th} August
6	Study about Naive Bayes	11^{th} August	15^{th} August
7	Study of Databases	16^{th} August	17^{th} August
8	Finalizing Problem Statement	18^{th} August	22^{nd} August
9	Online training session	26^{th} August	6^{th} September
10	Design and Modeling	16^{th} September	5^{th} October
11	Development of basic model of best prediction for every Drive Analysis	6^{th} October	4^{th} November
12	Adding other modules	1^{st} January	15^{th} March
13	Testing Model	16^{th} March	23^{rd} March
14	Bug tracking and resolve design issues	25^{th} March	5^{th} April
15	Deployment Process	7^{th} April	17^{th} April

CHAPTER 6

6 OTHER SPECIFICATION

6.1 ADVANTAGES

1. We detect accuracy of robot to perform tasks in order to avoid financial loss of industries.
2. Required less time for this K Nearest Neighbours, Naïve Bayes and Logistic Regression to detect robot's accuracy.
3. Improve robot's performance.
4. Automation with robots in industries improves speed and quality of process.
5. Automation with robots in industries also improves consistency of process.
6. Traditional methods hampers performance of industries and factories.

6.2 LIMITATIONS

1. Applicable for large data.
2. As it is a prediction model so we cannot rely always on accuracy and classification results.
3. Data may contain variations.
4. It hampers functioning of industries and factories, as robots does not perform well.

6.3 APPLICATIONS

In the present work, a survey of existing robot drive systems was conducted and the drawbacks of each system were studied. The present work suggests additional functionality to the existing system. Furthermore, it tries to leverage the functionalities of the system by selecting features with the best correlation to get more accurate results in optimal time. The system is based on drive predictions on the features and data generated by each drive of the robot as an input to the system. The system could use Reinforcement Learning and calculate best path the robot should follow in order to get maximum rewards. It will allow the robot to execute certain tasks with the utmost efficiency. Integration with voice home automation systems could be an effective addition to the system for ease of the end-user.

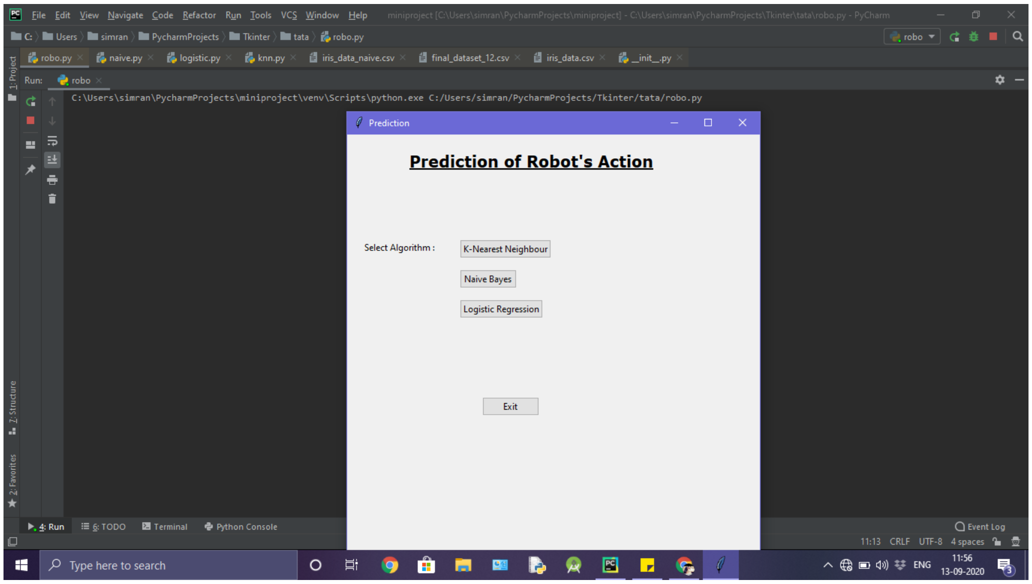
CHAPTER 7

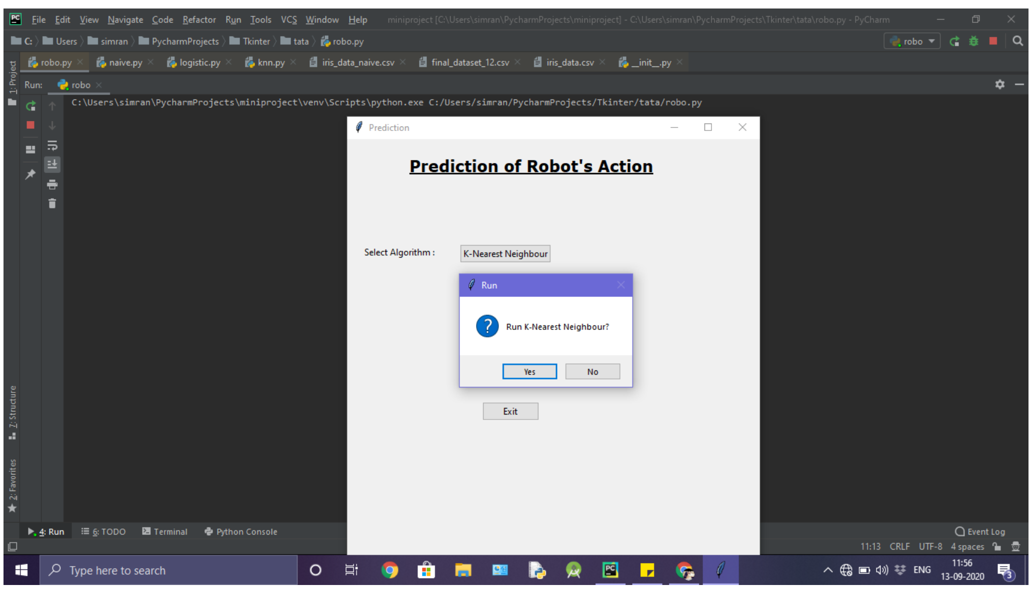
7 RESULTS

7.1 OUTCOMES

From study, it has been observed that K Nearest Neighbor, Logistic Regression, and Naïve Bayes shows exceptional accuracy of 97.2Bayes algorithm has the fastest execution time of 664ms in total and a standard deviation of + 2.4Robot's dataset is unpredictable. The research work done till now explains how to deal with outliers and missing values. But the integration of those methods with robot's drive dataset and using that dataset in models to predict robots' action has not been done which has been discussed in this paper. The data changes with working of drive(s) of robot and might have null values and missing values. The models have been built such that they remove noise from the data and then process it to get higher accuracy values with greater precision. Amongst various other models, Naïve Bayes performs exceptionally and is robust with almost all types of robots. The system is based on drive predictions on the features and data generated by each drive of the robot as an input to the system.

7.2 SCREENSHOTS





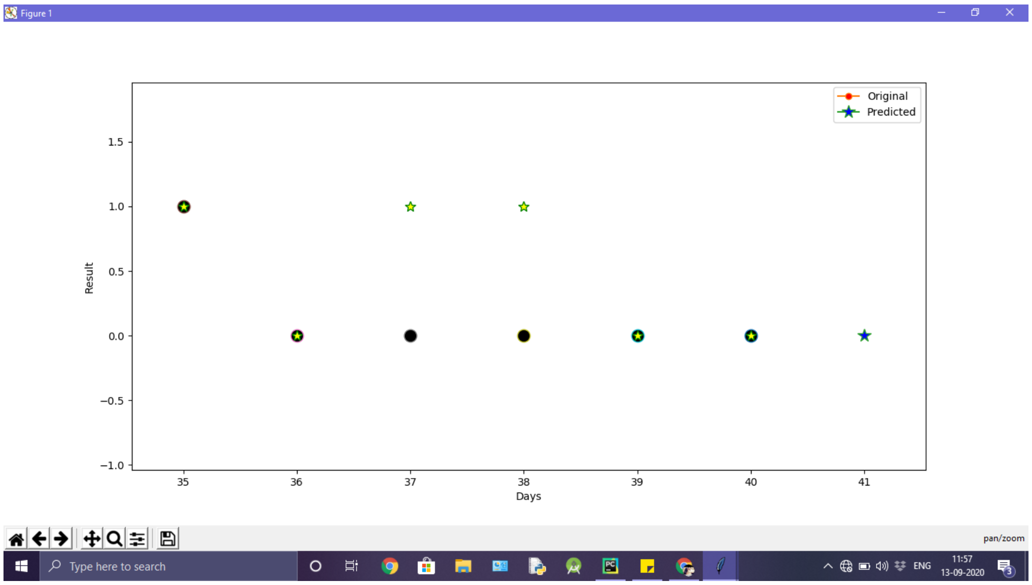
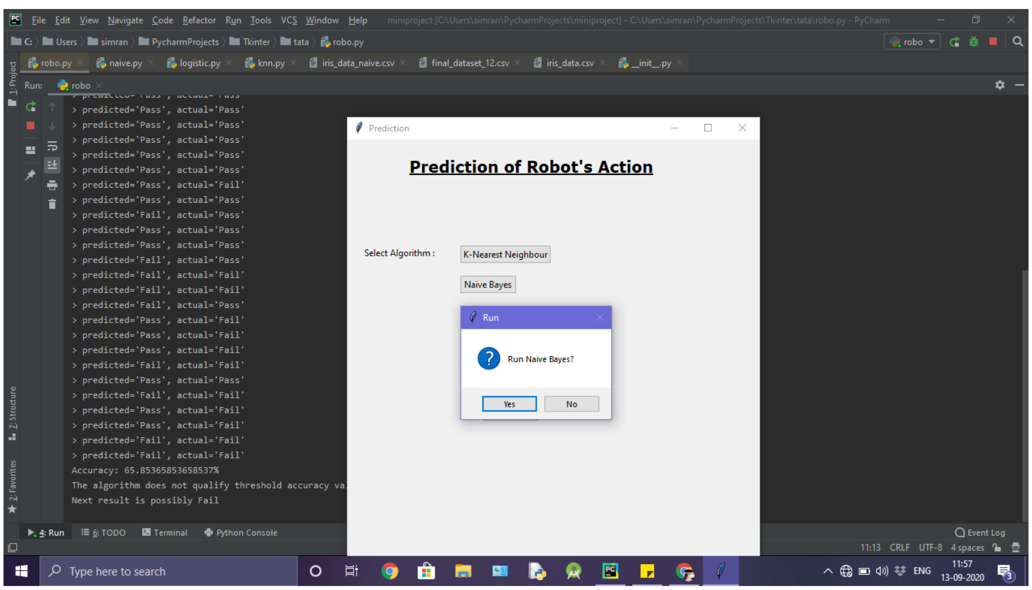


Figure 1
Original
Predicted
Result
Days
pan/zoom
Type here to search
11:57
13-09-2020


Prediction
Prediction of Robot's Action
Select Algorithm :
K-Nearest Neighbour
Naive Bayes
Run
Run Naive Bayes?
Yes
No
Accuracy: 65.85365853658537%
Next result is possibly Fail
Type here to search

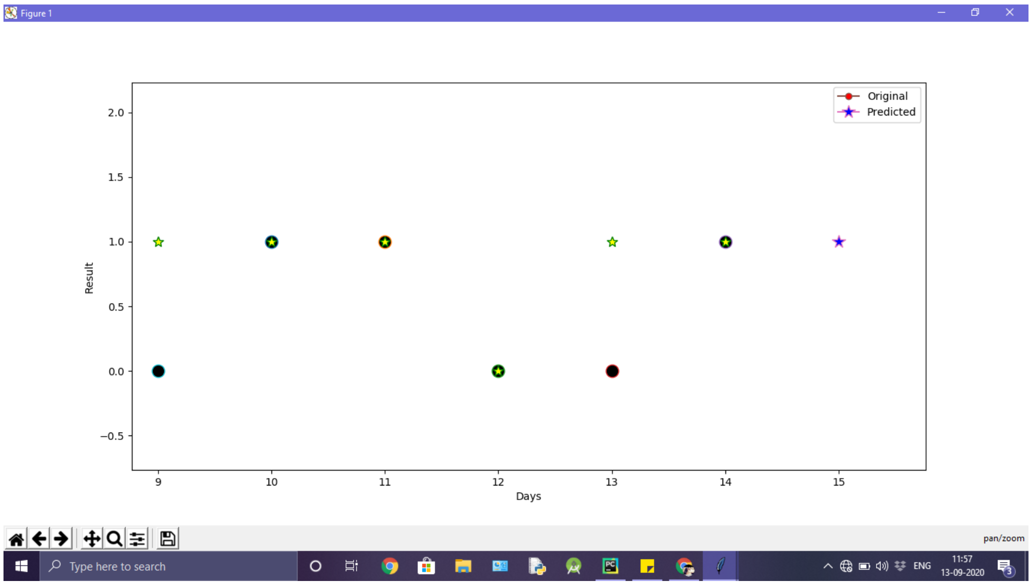


Figure 1
Original
Predicted
Result
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2.0
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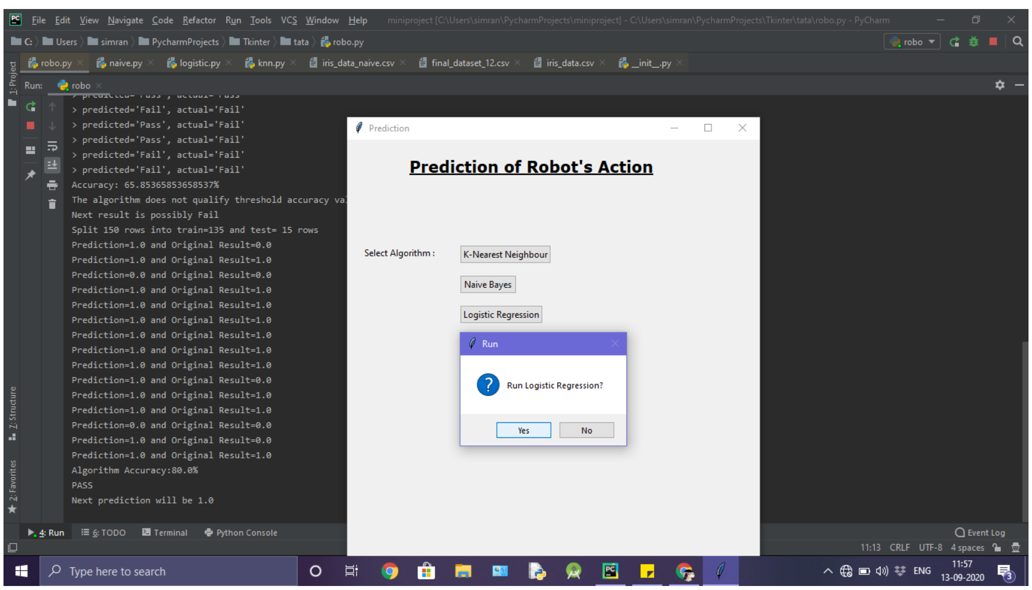
File Edit View Navigate Code Refactor Run Tools VCS Window Help
C: Users simran PycharmProjects Tkinter tata robo.py
robo.py naive.py logistic.py knn.py
Run: robo
> predicted='Fail', actual='Fail'
> predicted='Pass', actual='Fail'
> predicted='Pass', actual='Fail'
> predicted='Fail', actual='Fail'
> predicted='Fail', actual='Fail'
Accuracy: 65.85365853658537%
The algorithm does not qualify threshold accuracy va
Next result is possibly Fail
Split 150 rows into train=135 and test= 15 rows
Prediction=1.0 and Original Result=0.0
Prediction=1.0 and Original Result=1.0
Prediction=0.0 and Original Result=0.0
Prediction=1.0 and Original Result=1.0
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Prediction=1.0 and Original Result=1.0
Prediction=0.0 and Original Result=0.0
Prediction=1.0 and Original Result=0.0
Prediction=1.0 and Original Result=1.0
Algorithm Accuracy:80.0%
PASS
Next prediction will be 1.0
Prediction
Prediction of Robot's Action
Select Algorithm :
K-Nearest Neighbour
Naive Bayes
Logistic Regression
Run
Run Logistic Regression?
Yes
No
4: Run
6: TODO
Terminal
Python Console
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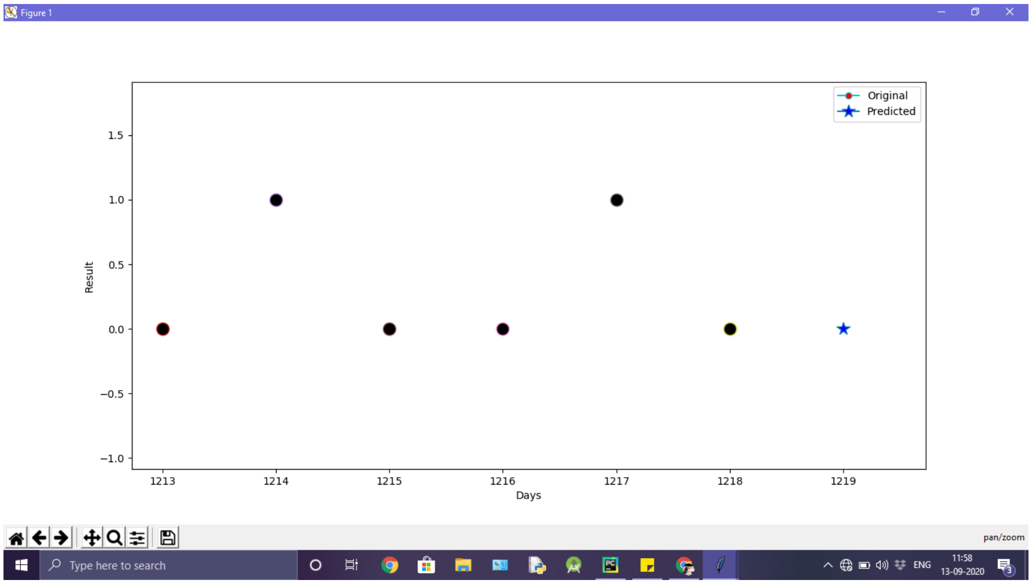
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Original
Predicted
1.5
1.0
0.5
0.0
−0.5
−1.0
Result
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1217
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Days
pan/zoom
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ENG
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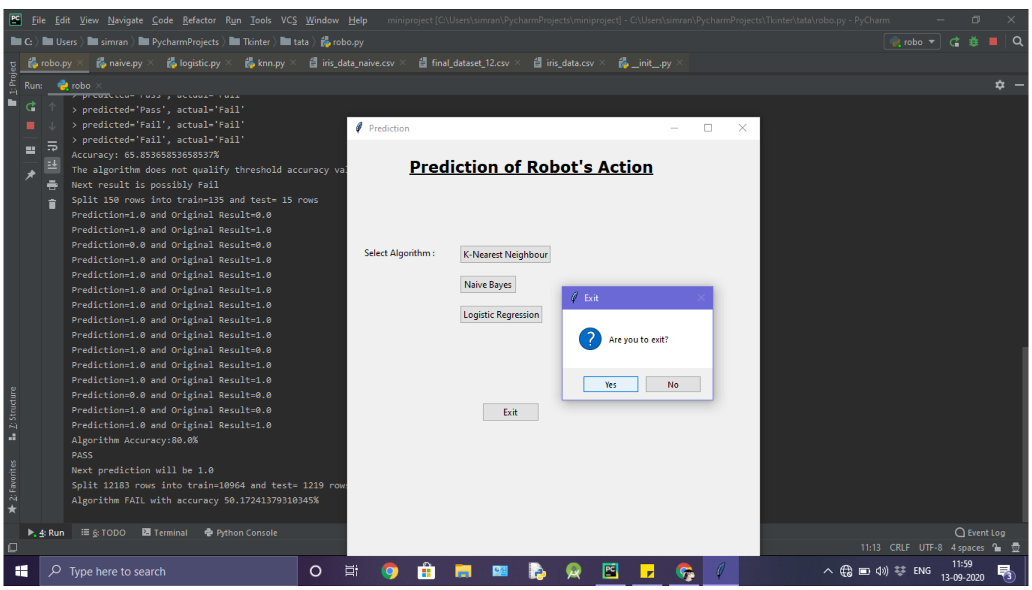
13-09-2020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C: Users simran PycharmProjects Tkinter tata robo.py
robo.py naive.py logistic.py knn.py iris_data_naive.csv final_dataset_12.csv iris_data.csv __init__.py
Run: robo
> predicted='Pass', actual='Fail'
> predicted='Fail', actual='Fail'
> predicted='Fail', actual='Fail'
Accuracy: 65.85365853658537%
The algorithm does not qualify threshold accuracy va
Next result is possibly Fail
Split 150 rows into train=135 and test= 15 rows
Prediction=1.0 and Original Result=0.0
Prediction=1.0 and Original Result=1.0
Prediction=0.0 and Original Result=0.0
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Prediction=1.0 and Original Result=1.0
Prediction=1.0 and Original Result=1.0
Prediction=0.0 and Original Result=0.0
Prediction=1.0 and Original Result=0.0
Prediction=1.0 and Original Result=1.0
Algorithm Accuracy:80.0%
PASS
Next prediction will be 1.0
Split 12183 rows into train=10964 and test= 1219 row
Algorithm FAIL with accuracy 50.17241379310345%
Prediction
Prediction of Robot's Action
Select Algorithm :
K-Nearest Neighbour
Naive Bayes
Logistic Regression
Exit
Are you to exit?
Yes
No
Exit
4: Run
6: TODO
Terminal
Python Console
Event Log
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CHAPTER 8

8 CONCLUSION

The field of Automation and Machine Learning has made substantial progress in the last decade. Learning methods such as boosting, random forests, bagging, and SVMs achieve excellent performance that would have been difficult to obtain just 20 years ago.

In the present work, a survey of existing robot drive systems was conducted and the drawbacks of each system were studied. The present work suggests additional functionality to the existing system. Furthermore, it tries to leverage the functionalities of the system by selecting features with the best correlation to get more accurate results in optimal time. The system is based on drive predictions on the features and data generated by each drive of the robot as an input to the system. The system could use Reinforcement Learning and calculate best path the robot should follow in order to get maximum rewards. It will allow the robot to execute certain tasks with the utmost efficiency. Integration with voice home automation systems could be an effective addition to the system for ease of the end-user.

With present work, it is revealed, Logistic Regression, K Nearest Neighbors, and Naïve Bayes have the best performance among all the and accuracy values with the robot datasets.

CHAPTER 9

9 REFERENCES

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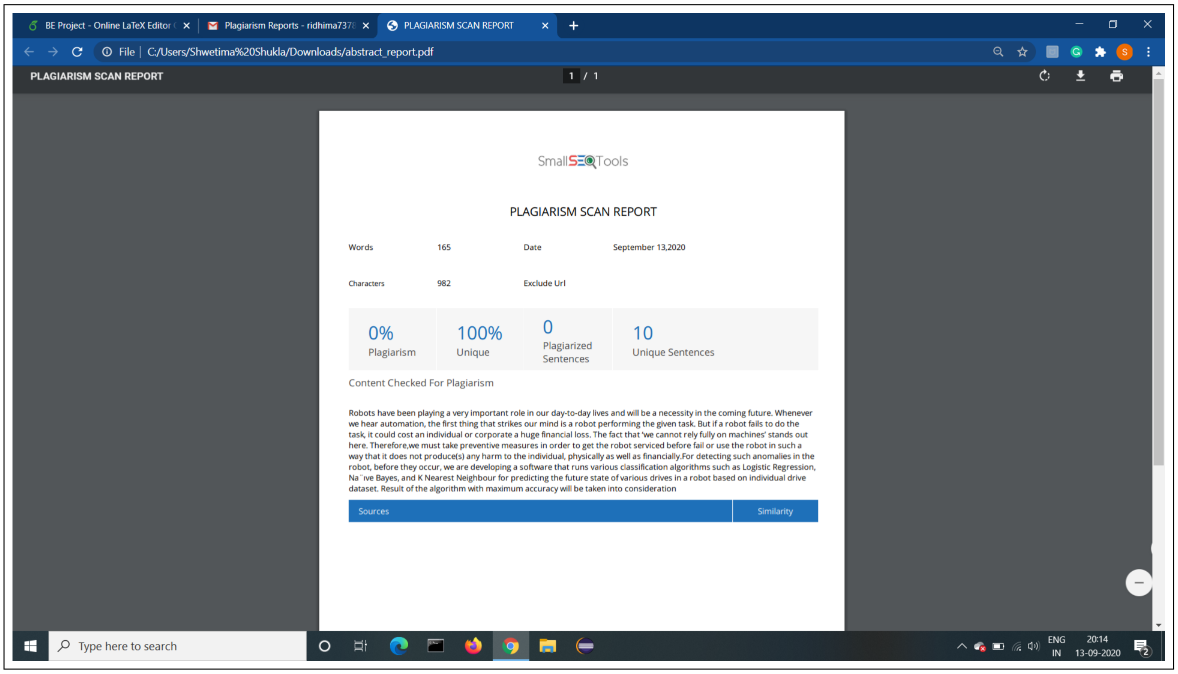
Appendices

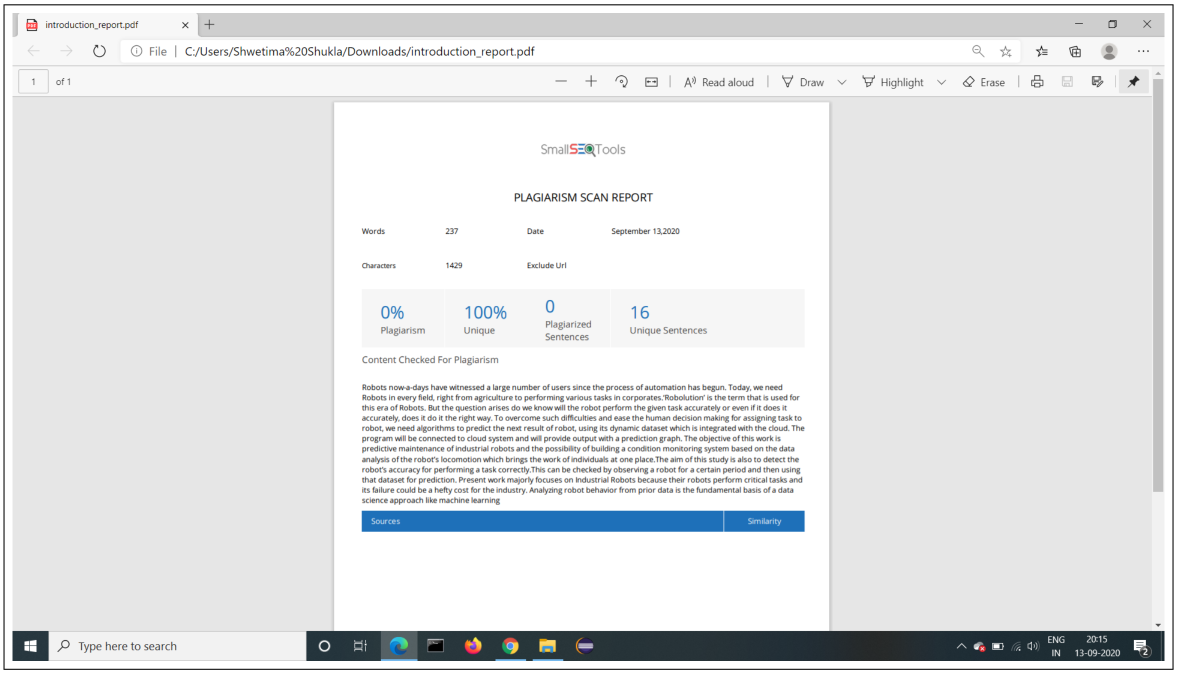
A Details of Paper Publication

(At-least one technical paper must be submitted in Term-I on the project design in the conferences/workshops in IITs, Central Universities or UoP Conferences or equivalent International Conferences Sponsored by IEEE/ACM)

1. Paper Title: ROBOLUTION: REAL TIME PREDICTIVE ANALYTICS AND DECISION MAKING FOR INDUSTRIAL ROBOTS
2. Name of the Conference/Journal where paper submitted : INTERNATIONAL JOURNAL FOR RESEARCH DEVELOPMENT IN TECHNOLOGY
3. Paper accepted/rejected : Accepted
4. Review comments by reviewer : None
5. Corrective actions if any : None

B Plagairism Report





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Robots now-a-days have witnessed a large number of users since the process of automation has begun. Today, we need Robots in every field, right from agriculture to performing various tasks in corporates.'Robolution' is the term that is used for this era of Robots. But the question arises do we know will the robot perform the given task accurately or even if it does it accurately, does it do it the right way. To overcome such difficulties and ease the human decision making for assigning task to robot, we need algorithms to predict the next result of robot, using its dynamic dataset which is integrated with the cloud. The program will be connected to cloud system and will provide output with a prediction graph. The objective of this work is predictive maintenance of industrial robots and the possibility of building a condition monitoring system based on the data analysis of the robot's locomotion which brings the work of individuals at one place.The aim of this study is also to detect the robot's accuracy for performing a task correctly.This can be checked by observing a robot for a certain period and then using that dataset for prediction. Present work majorly focuses on Industrial Robots because their robots perform critical tasks and its failure could be a hefty cost for the industry. Analyzing robot behavior from prior data is the fundamental basis of a data science approach like machine learning

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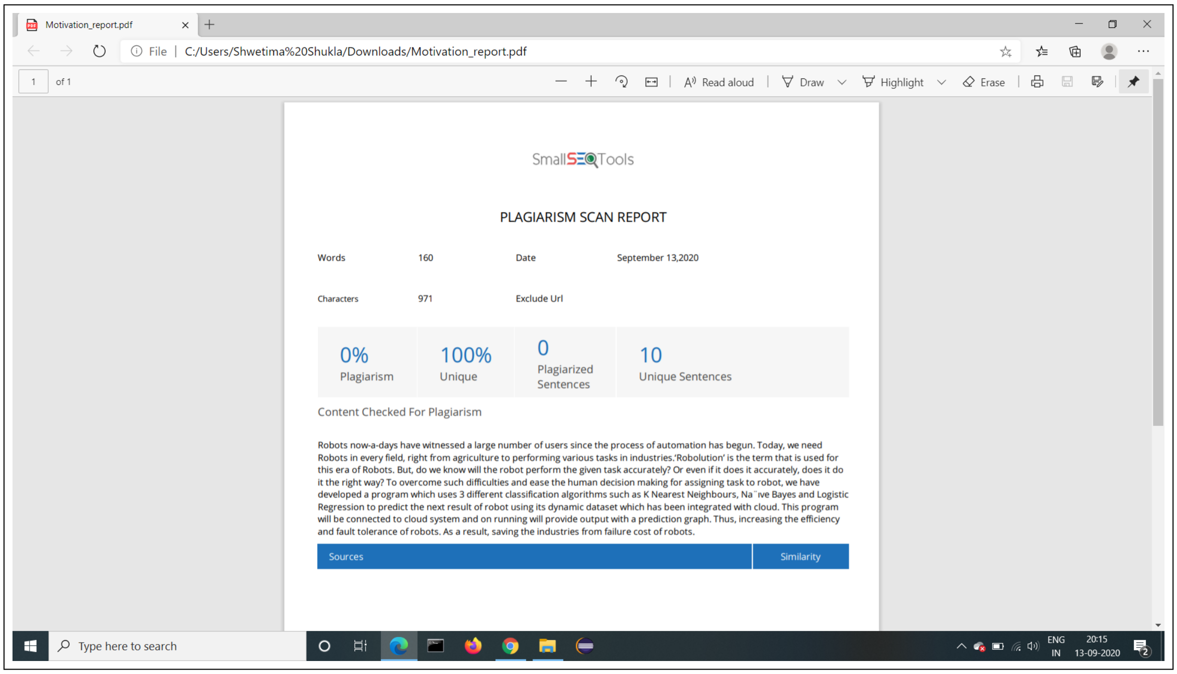
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Robots now-a-days have witnessed a large number of users since the process of automation has begun. Today, we need Robots in every field, right from agriculture to performing various tasks in industries.'Robolution' is the term that is used for this era of Robots. But, do we know will the robot perform the given task accurately? Or even if it does it accurately, does it do it the right way? To overcome such difficulties and ease the human decision making for assigning task to robot, we have developed a program which uses 3 different classification algorithms such as K Nearest Neighbours, Na¨ıve Bayes and Logistic Regression to predict the next result of robot using its dynamic dataset which has been integrated with cloud. This program will be connected to cloud system and on running will provide output with a prediction graph. Thus, increasing the efficiency and fault tolerance of robots. As a result, saving the industries from failure cost of robots.
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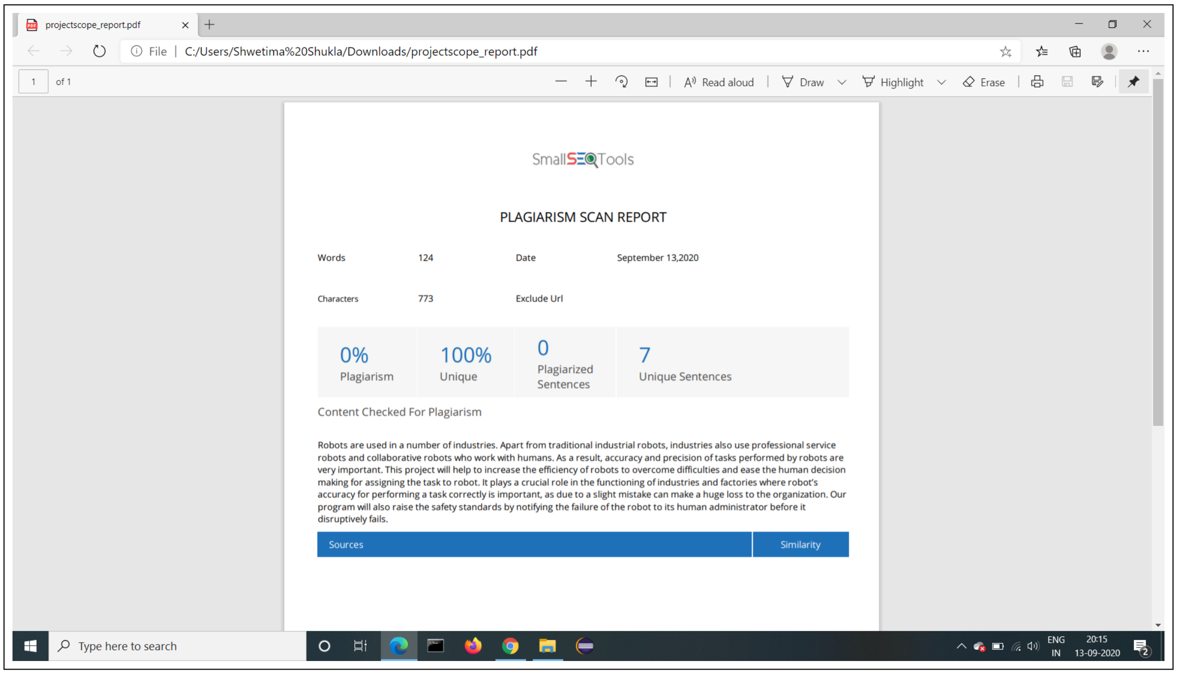

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Robots are used in a number of industries. Apart from traditional industrial robots, industries also use professional service robots and collaborative robots who work with humans. As a result, accuracy and precision of tasks performed by robots are very important. This project will help to increase the efficiency of robots to overcome difficulties and ease the human decision making for assigning the task to robot. It plays a crucial role in the functioning of industries and factories where robot's accuracy for performing a task correctly is important, as due to a slight mistake can make a huge loss to the organization. Our program will also raise the safety standards by notifying the failure of the robot to its human administrator before it disruptively fails.

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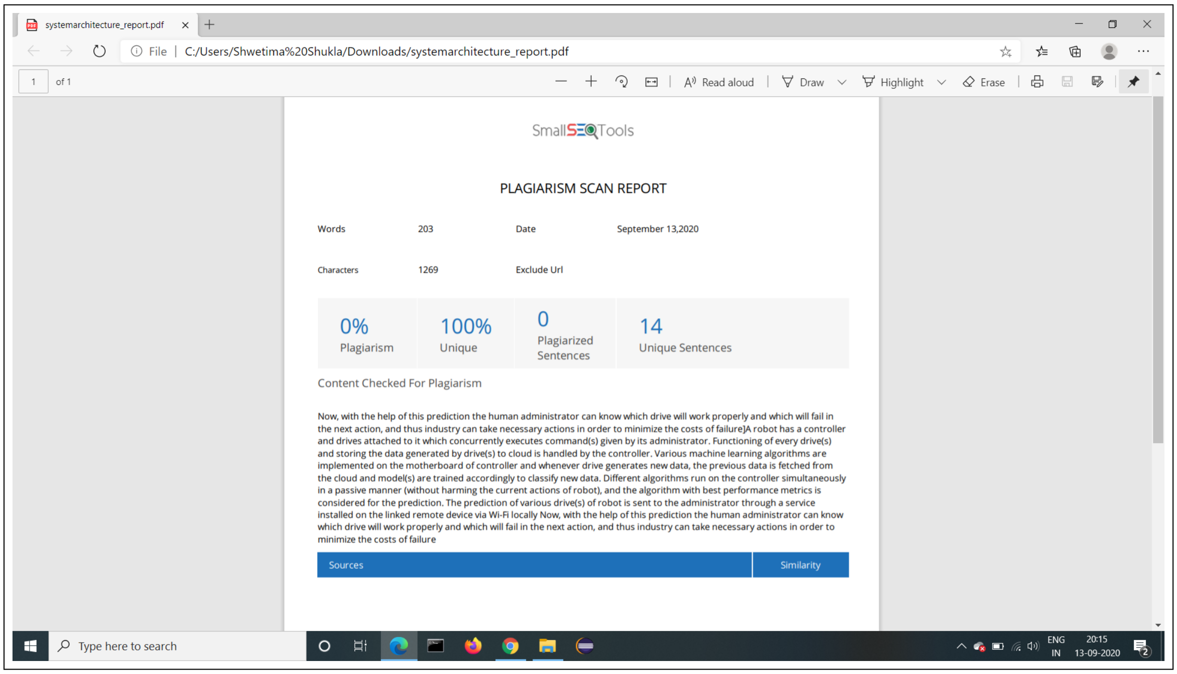
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Now, with the help of this prediction the human administrator can know which drive will work properly and which will fail in the next action, and thus industry can take necessary actions in order to minimize the costs of failure]A robot has a controller and drives attached to it which concurrently executes command(s) given by its administrator. Functioning of every drive(s) and storing the data generated by drive(s) to cloud is handled by the controller. Various machine learning algorithms are implemented on the motherboard of controller and whenever drive generates new data, the previous data is fetched from the cloud and model(s) are trained accordingly to classify new data. Different algorithms run on the controller simultaneously in a passive manner (without harming the current actions of robot), and the algorithm with best performance metrics is considered for the prediction. The prediction of various drive(s) of robot is sent to the administrator through a service installed on the linked remote device via Wi-Fi locally Now, with the help of this prediction the human administrator can know which drive will work properly and which will fail in the next action, and thus industry can take necessary actions in order to minimize the costs of failure
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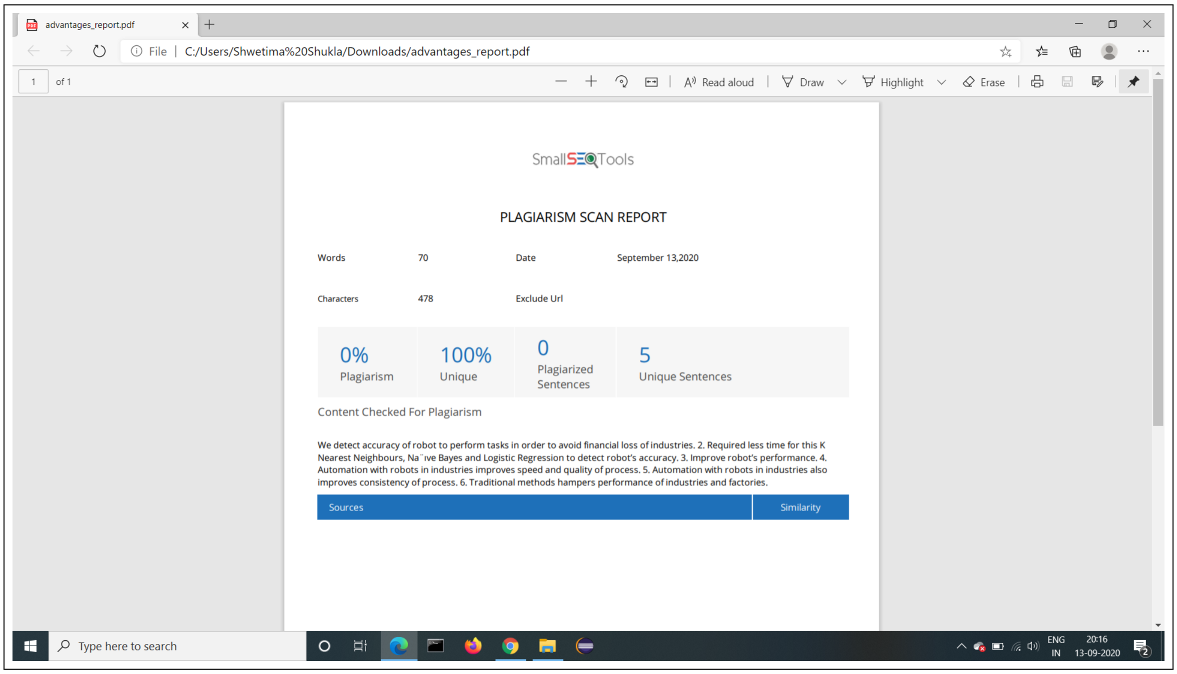
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We detect accuracy of robot to perform tasks in order to avoid financial loss of industries. 2. Required less time for this K Nearest Neighbours, Na¨ıve Bayes and Logistic Regression to detect robot's accuracy. 3. Improve robot's performance. 4. Automation with robots in industries improves speed and quality of process. 5. Automation with robots in industries also improves consistency of process. 6. Traditional methods hampers performance of industries and factories.
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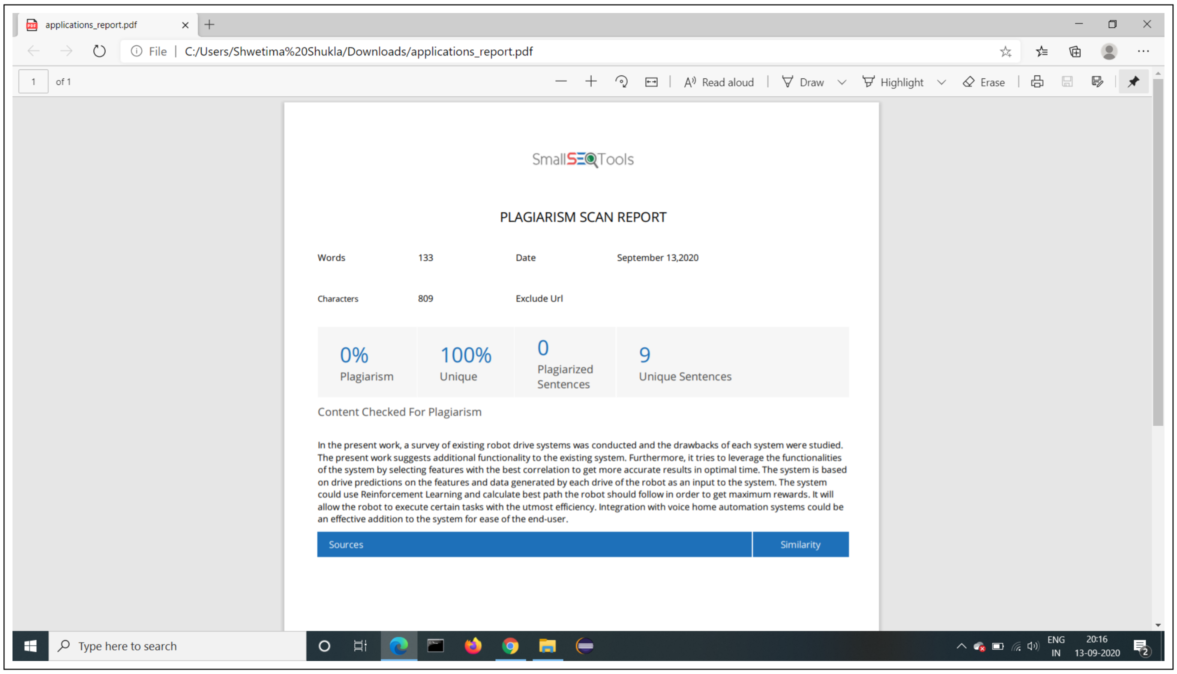
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In the present work, a survey of existing robot drive systems was conducted and the drawbacks of each system were studied. The present work suggests additional functionality to the existing system. Furthermore, it tries to leverage the functionalities of the system by selecting features with the best correlation to get more accurate results in optimal time. The system is based on drive predictions on the features and data generated by each drive of the robot as an input to the system. The system could use Reinforcement Learning and calculate best path the robot should follow in order to get maximum rewards. It will allow the robot to execute certain tasks with the utmost efficiency. Integration with voice home automation systems could be an effective addition to the system for ease of the end-user.
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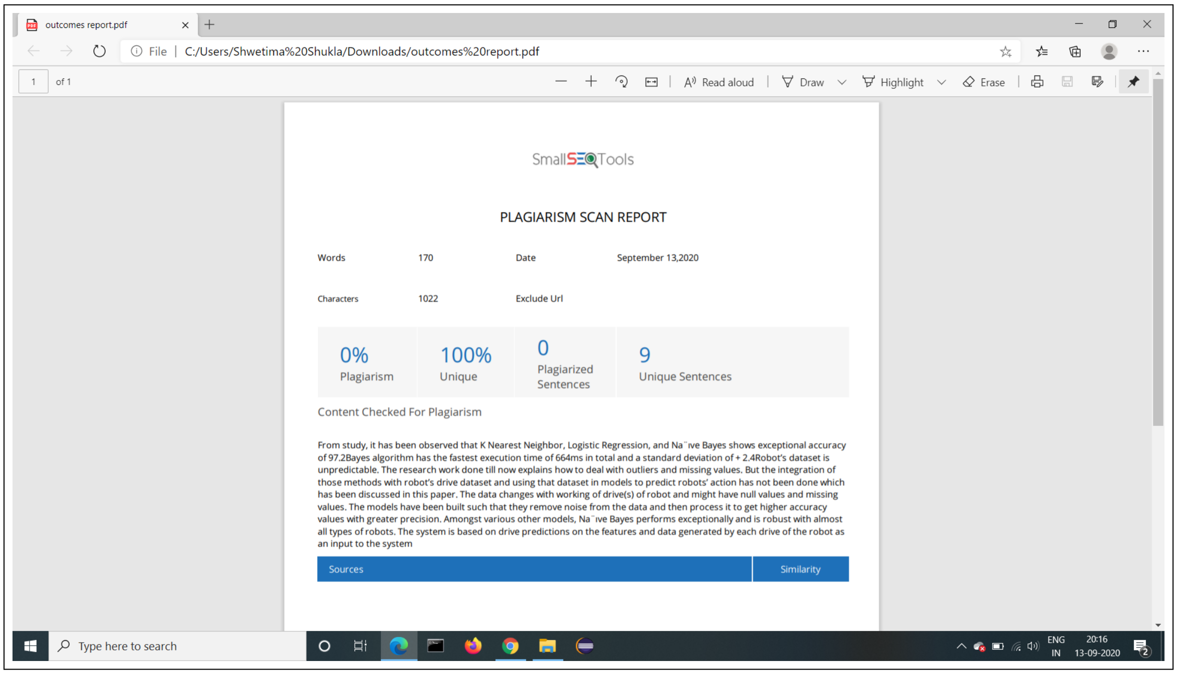

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From study, it has been observed that K Nearest Neighbor, Logistic Regression, and Na¨ıve Bayes shows exceptional accuracy of 97.2Bayes algorithm has the fastest execution time of 664ms in total and a standard deviation of + 2.4Robot's dataset is unpredictable. The research work done till now explains how to deal with outliers and missing values. But the integration of those methods with robot's drive dataset and using that dataset in models to predict robots' action has not been done which has been discussed in this paper. The data changes with working of drive(s) of robot and might have null values and missing values. The models have been built such that they remove noise from the data and then process it to get higher accuracy values with greater precision. Amongst various other models, Na¨ıve Bayes performs exceptionally and is robust with almost all types of robots. The system is based on drive predictions on the features and data generated by each drive of the robot as an input to the system

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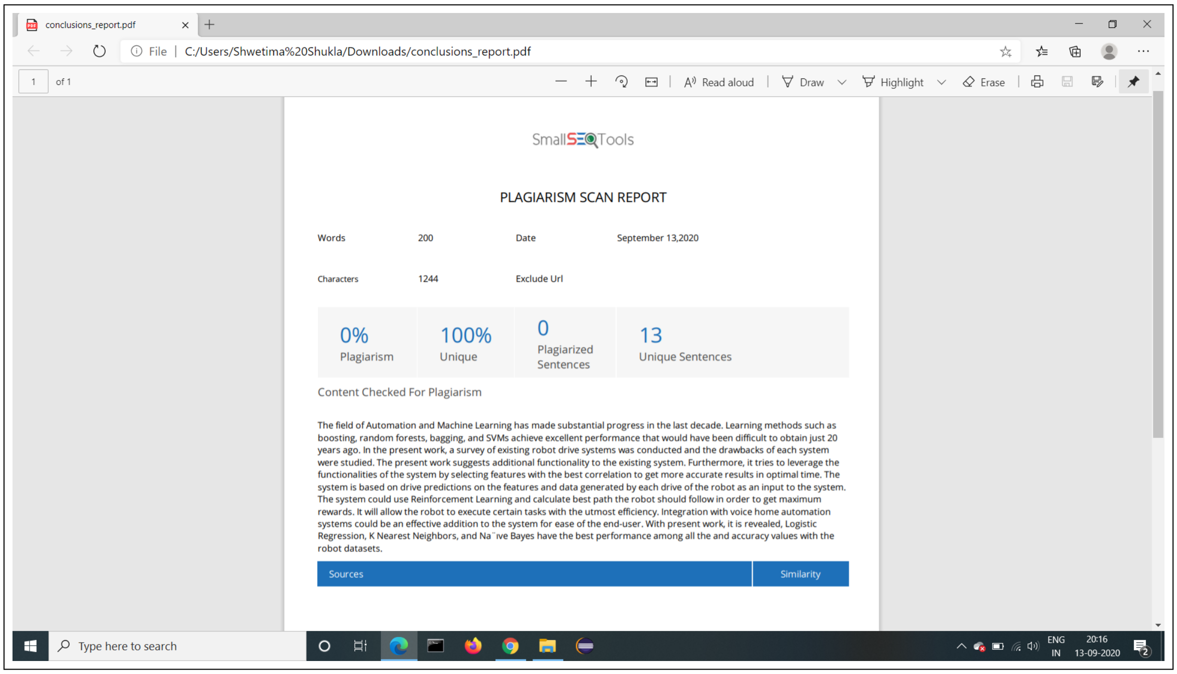

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The field of Automation and Machine Learning has made substantial progress in the last decade. Learning methods such as boosting, random forests, bagging, and SVMs achieve excellent performance that would have been difficult to obtain just 20 years ago. In the present work, a survey of existing robot drive systems was conducted and the drawbacks of each system were studied. The present work suggests additional functionality to the existing system. Furthermore, it tries to leverage the functionalities of the system by selecting features with the best correlation to get more accurate results in optimal time. The system is based on drive predictions on the features and data generated by each drive of the robot as an input to the system. The system could use Reinforcement Learning and calculate best path the robot should follow in order to get maximum rewards. It will allow the robot to execute certain tasks with the utmost efficiency. Integration with voice home automation systems could be an effective addition to the system for ease of the end-user. With present work, it is revealed, Logistic Regression, K Nearest Neighbors, and Na¨ıve Bayes have the best performance among all the and accuracy values with the robot datasets.

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