

# Motivation behind Project 2

## How Machine Learning Is Transforming Healthcare

The healthcare industry is one of the most labor-intensive industries around the world. It requires the presence of humans to take care of people at various stages of their illnesses. One of friends was at the **AI Conclave held by Amazon** in 2017 in Bangalore and was amazed to see how an acute problem of staff scarcity, which has been plaguing the healthcare industry in the United Kingdom, has been aptly solved by creating artificial tabletop bots that would take care of elderly patients needs.

The artificial tabletop bots remind elderly patients to take their pills, track their prescriptions, and track and suggest wakeup routines. At the heart of Echo Alexa (as it is known) is the machine learning developed by the Amazon team using its cloud infrastructure Amazon Web Services (AWS). At the heart of Alexa is the Python machine learning code that helps it to perform tasks and learn from them through a feedback mechanism. The wonderful part of this service is that Echo Alexa is available to a common Python developer to use and develop their own programs and products based on Amazon's infrastructure.

## Project 2 : Lab Coordinator Problem

Dr. Deshmukh was sitting in his office on a Monday morning, and he had in front of him on his laptop screen a report from the financial department about the financial situation of his healthcare organization, DIRECTPyth diagnostic centers global chain, which was comprised of more than 250 diagnostic centers around the world.

The core business of DIRECTPyth was diagnostic centers for diabetes. The sudden growth of DIRECTPyth diagnostic centers has occurred in the last 5 years. DIRECTPyth started as a homegrown diagnostic company, with just four centers in India. In the last 10 years of its operations, it had expanded its diagnostic centers to all major cities in not just India but also in Southeast Asia, the Middle East, and Canada. Most of its overseas centers had turned up in the last 5 years as diagnostic companies had seen rapid growth in the need for people to get diagnosed for diabetes.

The World Health Organization report on diabetes (<http://www.who.int/diabetes/global-report/en/>) shows that diabetes has now become an epidemic around the world. In 2012 diabetes caused 1.5 million deaths due to heart attack, stroke, blindness, kidney failure, and lower limb amputation. Various governments around the world have been spreading awareness by running information programs in the media about the epidemic of diabetes. Delhi Ford also highlights that since 1980 there has been an increase in patients with Type 2 diabetes, which has quadrupled since then. In order to control this epidemic, the governments around the world in the last 5 years have stepped up prevention and treatment of diabetes programs. The DIRECTPyth diabetes diagnostic healthcare chain is right in the middle of this epidemic and offers tests for any person to diagnose whether they have diabetes.

The report that Dr. Deshmukh was looking at pointed out financial losses in the past 2 years to the tune of 200 million US dollars. The financial position of the company is given in Table 1.

***Table 1. Two-Year Financial Synopsis Report***

<b>Financial Synopsis (\$US million)</b>	<b>Fiscal Year, 2015-2016</b>	<b>Fiscal Year, 2016-2017</b>
Income from diagnostics	930	1221
Cost of operations	1031	1354
Average operational days for diagnostic centers	118	106
Loss due to non-operations	101	133

Let me briefly explain Table 1. The financials are given for two financial years: 2015-2016 and 2016-2017. The status given in columns 2 and 3 as the income from diagnostics has been given by the financial department, and you can see that that income for the DIRECTPyth organization has been growing on a yearly basis. Cost of operations was higher than the income from diagnostic in the first year as well as in the second year. The last row gives the loss due to non-operations, which is a DIRECTPyth subtraction of the cost of operations from income from diagnostics. The combined loss for both years stands at 234 million dollars. The third row provides the number of average operational days for all diagnostic centers of DIRECTPyth around the world. The average operational days for DIRECTPyth is 118, which is significantly lower than the benchmark number of 200, which DIRECTPyth follows internally to gauge its performance. We can also see that in the year 2016 and 2017, the average operational days for diagnostic centers has gone down to 106 days. Loss due to non-operation has also gone up from 101 million dollars the first year to 133 million dollars the second year.

In order for DIRECTPyth to remain competitive in the market, it needs to decrease its cost of operations and loss due to non-operations, and it will need to take serious measures now.

The report clearly shows the loss due to human resource constraint. Dr. Deshmukh called for an early morning meeting with the human resource manager at DIRECTPyth. The purpose was to discuss the financial losses and to find out what the single-most cause of this problem. The human resource manager was Ms. Abbey, and she was to give a presentation to the Dr. Deshmukh regarding the cause for the financial losses DIRECTPyth and how to prevent them in the future. Dr. Deshmukh then got up, well-prepared for the 10 a.m. meeting. Ms. Abbey arrived at the meeting along with her staff. After the greetings were over, she started presenting the 2-year financial synopsis. She pointed out to Dr. Deshmukh that the cost of operations had gone up by 131 percent between years. The loss was also at the same percentage, as it was derived from cost of operations. She explained that the average operational days for diagnostic centers was calculated based on the number of days a diagnostic center remained open on any given business day throughout the year. The target average operational days for DIRECTPyth was 200 operational days. She presented the breakdown of the average operational diagnostic centers data given in Table 2.

**Table 2.** Breakup of Average Operational Days (AOD) Data

Average operational days	No. of centers meeting AOD benchmark	No. of centers not meeting AOD benchmark
India	32	234
Oversees	13	98
Consolidated	45	332
%AGE	11.9	88

The breakup of average operational days data shows that on an overall global basis, the percentage of diagnostic centers at DIRECTPyth that were meeting the benchmark of 200 days was only 11.9 percent and the percentage of centers not meeting the AOD benchmark was 88 percent. This shows the criticality and extent of the problem at DIRECTPyth. It also shows that there is acute loss of revenue happening because of the centers not meeting the AOD benchmark. In order to deep-dive into the problem further Ms. Abbey presented data relating to human resources at the lab diagnostic facilities for the DIRECTPyth organization. This data is given in Table 3.

**Table 3.** Human Resources Data at DIRECTPyth Labs

Human resources at DIRECTPyth Labs	Lab coordinator	Lab technician	Lab attendant
Average days present	88	97	194
Average days absent	26	15	8
Attrition rate (%)	12%	9%	6%

We can see from Table 3 that the highest absenteeism occurs with the lab coordinator and lab technician roles. The lab attendant has the highest average and lowest absenteeism. The best data has been pulled from the payroll systems of DIRECTPyth Labs, which records the daily attendance of each human resource in the lab. The total number of days present is taken as a benchmark value of 220 productive business days. The role of lab coordinator is one that interacts with the customer who walks into the diagnostic lab, taking them to the various diagnostic

options available in the lab and then helping them find the most appropriate test for their diabetic condition. The lab coordinator checks whether the patient is already registered with the diagnostic center and then pulls up computer records and requests a new test. A technician at DIRECTPyth is the one who actually conducts the lab test for the patient who is waiting in the queue. The lab attendant is the person who takes the data from the lab technician for a particular patient, enters the data into the computer, and then produces a report that is to be presented to the patient. These three key positions are very important for the business operations of the diagnostic center at DIRECTPyth. Ms. Abbey presented in the meeting that the high absenteeism at the lab coordinator and lab technician roles was leading to the losses in revenue for DIRECTPyth. There was an urgent need for the organization to find out how to improve the productivity and decrease the absenteeism in this role. We can also see that the lab coordinator role has the highest attrition rate (12 percent) followed by the lab technician (9 percent). The lowest attrition (6 percent) showed the need for DIRECTPyth to find a way to decrease the absenteeism and attrition rates for the lab coordinator. The most important was the lab coordinator role, where the absenteeism and attrition rates were very high. The human resources department should try to look at ways to reduce the absenteeism and attrition rates. They had tried for five ways over the past 3 years but with very marginal success in finding a solution. So it was very clear that if DIRECTPyth wanted to increase its profitability and reduce its losses, it needed to urgently address the problem of absenteeism and attrition in the lab coordinator role.

The solution, which required an immediate implementation, should be to use technology to emulate the role of a lab coordinator. DIRECTPyth had received funding from foreign investors and was in a position to invest in technology in order to increase its efficiency, thereby increasing its revenue. You are required to use Python-based machine learning to address and answer the questions given in this case study.

1. What do you think is the reason for the losses at DIRECTPyth Diagnostic Centers?
2. What human issues are we dealing with and how do you think they can be addressed?
3. Do you think technology can help address the issues that you identified in Question 2?
4. Will a Python-based machine learning solution be able to address these issues at DIRECTPyth?

5. What is your proposed Python-based machine learning solution?
6. What business justification do you give for your solution that you think will be acceptable by the business leaders at DIRECTPyth?

**Team@Suven** would suggest that you first try to independently answer these questions and then look at the solution given below. *Please note the solution we have given is one among many solutions that can be given in this business scenario. It is the business owners that ultimately decide if your solution is good and is able to address their business problem.*

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Now let us try to answer the questions in our own way, giving the solution we had proposed, which was accepted by the organization.

1. What do you think is the reason for the losses at DIRECTPyth Diagnostic Centers?

The reason for the losses of DIRECTPyth Diagnostic Centers was the high operational losses, with about 88 percent of the diagnostic centers not meeting the average operational-based benchmark. The real reason for this was attributed to high absenteeism and attrition rate by lab coordinators in the organization. Lab coordinator absenteeism was very high at 26 percent, and attrition rate was 12 percent, whereas for the lab technician the absenteeism was 15 percent, and the attrition rate was 9 percent. The human resources came up with five various techniques to stop attrition and absenteeism but with very marginal results.

2. What human issues are we dealing with and how do you think they can be addressed?

Our **team@Suven** thinks we are dealing with a work force with low morale, and that is the reason we are seeing high absenteeism and attrition rate.

3. Do you think technology can help address the issues that you identified in Question 2?

In our opinion using technology in areas where human beings fail to perform at an optimal level required by a business is an apt scenario for bringing in automation, machine learning, and artificial intelligence. The good point about technology is that it can do any given task repeatedly without getting bored or tired. It can also use intelligence on data and be trained to perform expert tasks very easily. In the case of DIRECTPyth Diagnostic Centers, we can use technology to **replace the task of lab coordinator**, putting an automated lab machine on its premises, thereby letting the customer choose the lab test that they want to perform. The automated lab machine can run Python-based machine learning programs that help the customer choose the best diagnostic test for their scenario.

4. Will a Python-based machine learning solution be able to address these issues at DIRECTPyth?

Yes, a Python-based machine learning system can be used to automate the entire process in the lab right from the time the customer comes in and selects the diagnostic package to generate the lab test to the next stage of generating the report with its meaningful interpretations for the customer. Python-based machine learning systems can be connected to any modern automated lab testing machine to get the output from it.

5. What is your proposed Python-based machine learning solution?

In this **Project**, We are going to give a solution that is going to be short; however, it is going to emulate the real solution that we gave to the client in their production environment. The **Intern** can build upon this solution using their own ideas in the real world for similar situations.

**A word of caution to the Intern: this is a very minimalistic approach that we have taken to create a chatbot; however, it does not limit the user from extending its functionality. Chatbots in real life are more complicated than seen here, as in project 1 and 2.**

## This solution is :

To build a chat-bot to emulate the work of Lab coordinator using Google Machine Learning engine called Dialog Flow.

Business Need: The business need of the solution is to emulate the work of a lab coordinator and interact with the user through a chat interface. We present to you some of the use-cases that are applicable in this case study scenario.

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**Pro Tip** Even before you start coding, divide your work into short use-cases and get them ratified by actual users of the system as you will be developing for them. If you skip this step, it is likely you will be developing a product that the user may reject, as you may have misunderstood some of the requirements.

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Use-Case: As a user of an automated chatbot for diabetes diagnostics, I should be able to know my past test data records in order for me to check my history.

Use-Case: As a user of an automated chatbot for diabetes diagnostics, I should be able to know the type of tests conducted at the center and their purpose so that my doctor and I can decide on the test.

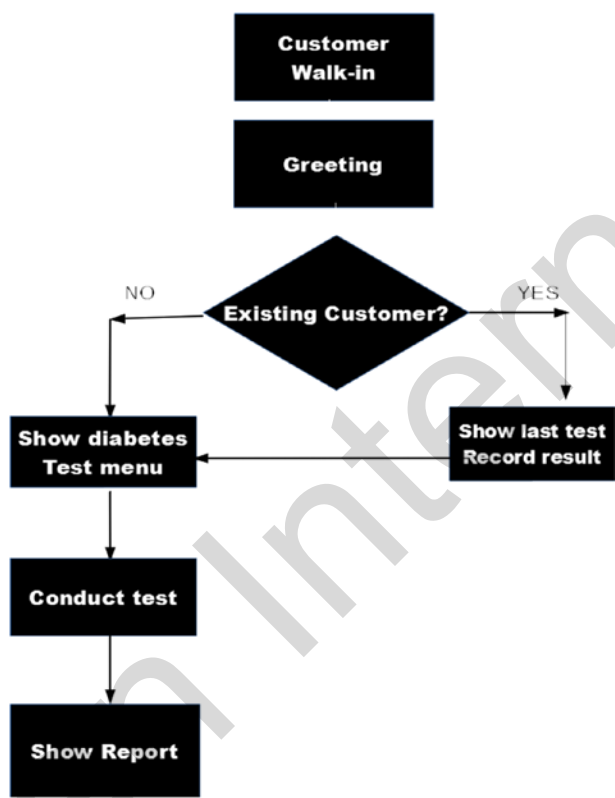
Use-Case: As a user of an automated chatbot for diabetes diagnostics, I should be able to get the results of my tests done so that I can get a report.

Use-Case: As a user of an automated chatbot for diabetes diagnostics, I should be able to get a recommendation on my test results so that I am able to know the future course of action.

For DIRECTPyth Diagnostic Centers, there are more use-cases that are applicable than those given here. However, to keep the process simple, we will be considering only these four use-cases for our **chatbot**.



Now we are going to look at the flowchart in Figure 1, which applies the process that will be followed by other chatbots while interacting with the customer. Please remember that we are using a minimalistic approach to this solution because it is not a production code; it is to give you an idea as to *how to train DialogFlow ML engine in the area of emulating lab coordinator in the healthcare segment*.



**Figure 1.** *Process of interaction between customer and lab coordinator chatbots*

In Figure 1 we can see that the process starts when the customer walks in and meet the chatbots in the lab coordinator, so there is no human interaction or human supervision in this process. The kiosk has sensors that detect the presence of a human being nearby and gives out a greeting to the customer. In the next part of the process, if it is an existing customer, the chatbot asks the customer for a membership ID. Now the **lab coordinator chatbot** has to make a decision based on the input provided if the membership id given by the customer is found in the database; then it shows the last

test record result to the customer. If it is not an existing customer, then the chatbot shows diabetes tests—many that list the entire set of tests available at the lab.

Once the customer has selected the test from the list, the lab coordinator Chat-bot allocates **a Lab Technician** to perform the (selected or advised ) test and the supporting Lab attendant then produces a report. The report is auto-mailed to the customer. The mail id was taken by the chat-bot during the introduction phase.

Now that we have the **process flowchart** for our chat-bots defined, we can go ahead implementing it using DialogFlow.

### **Expected outcome :**

fully implemented chat-bot with its bot link like

<https://bot.dialogflow.com/dummy-599e-4396-a35f-0d77497b46ef-id>

to be submitted for assessment by the AI Engine.

Post that you would face **5 mins MCQ test** for each project, on clearing which you would **be awarded your Certificate of Internship**