AI in Pharmacy

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1. Problem statement :

We are now living in an age that is briming over with technological advancements in every field possible. One such field is pharmacy and the business of pharmacist. Even though there are now ecommerce cum pharmacy shops available online, a very large part of masses still prefers buying medicines from their local pharmacy shop. Many pharmacy shops aren't able to grow the way they predicted while launching it because of the way the customer interacts with them. A customer at a pharmacy shop wants an environment where he can feel like they are being treated as a friend and not just as a money bearer customer. To overcome the need of understanding of how a customer felt and if he/she will return to this shop again, Machine Learning can be used to predict the how good a customer felt with the shop and his will to if they will return back.

2. Market / Customer/ Business Need Assessment:

We are aware with the rise of population on earth. To overcome the need of providing better healthcare to every human, we should fill the gaps of mutual understanding and reliability between a customer and the pharmacist. A huge number of medical shops are being opened in very part of country and most of them, due ot not having much idea f the market, doesn't flourish. Customers, or more precisely patients, need a more friendly medical shop and the pharmacist also looks up for way for providing better services to patients o they feel at home. The feeling of being alien to the medical environment needs to descends to keep up to the growing demand of the public and medical shops.

In this report, I am going to emphasize about machine learning which is a branch of artificial intelligence helping pharmacist to understand the customer needs and there having a AI product through whivh they can analyse and predict how good a customer felt at their shop. This is a system which takes in data, finds patterns, trains itself using the data and outputs an outcome. In this report we explore applications of artificial intelligence to provide pharmacist with an understanding of current and emerging trends among patients, and addressing the importance of building a pharmacy shop that stands up to the test of time.

3. Target Specifications and Characterization:

A. To help pharmacists better understanding their market.
B. To provide a product that helps pharmacist in predicting the customer satisfaction and their degree of preference to return the same shop.
C. Taking a medical dataset and training model to characterize the contentment of a customer.

Above, mentioned targets can be achieved by analysing:
a) What the patient looks for
b) How does a patient want to be treated at a medial shop?
c) The psychology of a patient buying medicines.
d) The communication gap between customer and pharmacists.
e) How much the patient trusts the shop's services.
f) Analysing the comforts of the patients.

4. External Searches:

Applications of Machine Learning in Pharmacy

The capability of machine learning to "learn" from past examples and to detect hard-to discern patterns from large, noisy or complex data sets is particularly well-suited to medical applications. As a result, machine learning is frequently used in many diagnoses that involve heart, brain, liver, lungs, etc and tumour detection in cancer. Equally, we can leverage the power machine learning on consumer side too. We can use machine learning to predict the success of a pharmaceutical outlet. This approach is particularly useful as it is part of a growing trend in applying machine learning to healthcare.

Machine learning-based prediction of customer contentment and resentment

Since the dawn of humanity, human emotions to a kind of act, or anything may it be a product, survive, etc has played a big role in the success of something. If we a tie up an emotion to a certain product or

service, we can make a person come back to us to fulfil his/her need. But how to we know in such a small interaction between customer and pharma owner whether a customer's emotions got fulfilled or not? Here, we can use machine learning to "predict" how customer felt or behaved to our service. In other words, we can predict, based on some relevant customer data, how that customer responded to our service in pharma shop. Using these predictions, a pharma shop can better analyse the factors he/she needs to work on.

5. Benchmarking alternate:

A good reasonable number of pharmaceutical apps are available now. But they all, most of them, are developed for the economical side of customers (patients) rather than medical shop owners. For apps that exists for pharma owners, the main focus is to help them find new medicine and companies, better billing systems, new schemes on products, etc. Now the service which I am talking about is to give them a tool that leverages " the power of machine learning to understand the customer behaviour". This system, even though fairly new since it uses AI, can be compared to existing visualization techniques. But those techniques will then require them to understand the internal abstractions of machine learning. With my service, we can build a tool, a service a web app for instance, that can give them an interface to do the same thing but with abstractions and ease.

6. Applicable Patents:

A. Behavioural Analysis: These patents describe systems for analysing user and entity behaviour by detecting anomalies in event counts and patterns using machine learning models like Exponential Moving Averages (EMA) and Markov Chains.

B. Customer Behaviour Prediction: These patents focus on predicting customer purchasing behaviour using different machine learning techniques.

C. Behavioural Pattern Recognition: These patents cover methods for recognizing and analysing patterns in customer behaviour to generate actionable insights. It involves using sophisticated algorithms to detect deviations from typical behaviour patterns, which can help in personalizing customer experiences and identifying potential issues.

7. Applicable Regulations:

a) Patents on ML algorithms developed
b) Laws related to privacy for collecting data from users
c) Ensuring open-source, academic and research community for an audit of Algorithms.
d) Review of existing work authority regulations.
e) Giving credits and recognising existing works and authors

8.Applicable Constraints:

A. Requires a substantial amount of research to gather the data to build up the model.
B. Constructing good features to collect the most relevant data.
C. Establishing e-mail service in the product which have to send the report after the machine learning model is deployed in any server.
D. Genuine health data to be obtained to train the model.
E. A deep understanding of correlation between different variables is a difficult constraint.

9. Business Model:

A pharmacist has various activities that are performed on his/her shop on a daily basis. Using AI, the pharmacist can speed up various tasks and increase the quality of those tasks. With our product, a pharmacist can buy a subscription and then can perform analysis with the tools available on our service site, say a web application. We can develop interface in such a way that we will train our model on the data we collect and then for the purpose of analysis we will ask pharmacist to enter the relevant data which will then predict how likely is it that a patient will prefer coming back in future to the same pharmacy. The concept of developing a web app and providing subscription-based analysis tools will monetize our ideation.

10. Concept Generation:

A pharmaceutical shop that resides in a locality has the perks of being close to the people locally. A patient prefers to go the shop and quickly grab things easily. But for a pharmaceutical shop to flourish in the locality and to keep up with the growing economy, they have to analyse and understand the market and compete with it.

The problem lies in understanding how a patient felt or experienced in the short time he visited the pharma store. Based on that little time span, we have to extract and engineer features and then go on to build the machine learning model.

11. Concept Development:

In order to generate the model based on the problem stated, we need to use Machine learning. Machine learning (ML) is the study of computer algorithms that improve automatically through experience and by the use of data. Machine learning algorithms build a model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so. Any Machine Learning model relies hugely on the data and then on the type of ML algorithm to work with.

We have to collect data by looking if the data exists on some dataset sites like Kaggle or e have to collect in the form of survey. For the model to be robust, we have to ask survey question to both patient and pharma owner.


Once data is collected, we have to clean t and construct features and then start to develop or model. The aforementioned process can be done in any of the IDE such as VSCode, Spyder, Jupyter Notebooks or even build a model from scratch.

Finally, when the model is developed, we can test it using our test data. The next step is to integrate the model into our web application that has all our services and UI for subscriptions and other things.

12. Final Product Prototype:

The final product prototype will start by taking the survey dataset of both patients and pharma and clean and perform ED on it . After that, we will use binary classification algorithm to train our machine learning model on our datasets. Once completed we will integrate the mailing service and deploy our model in the form of subscription and analysis module of web app.
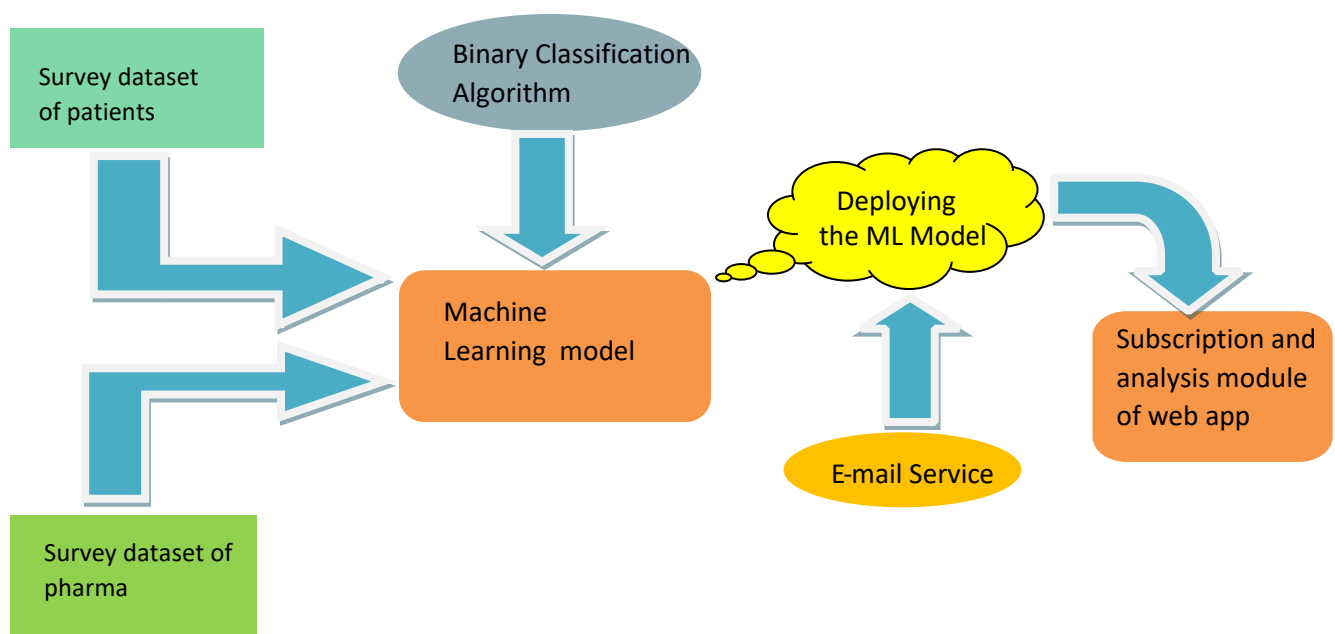
13. Product details:

Our service is a kind of system which takes in data, finds correlations, leverages the correlation, trains itself using the data and outputs an outcome. Machine learning can help humans by providing them a mechanical tool to speed up their tasks. Machines can do something which humans aren't that good at. They can repeat themselves thousands of times without getting exhausted. After every iteration, the machine repeats the process to do it better. Humans do it too, we call it practice. While practice may make perfect, no amount of practice can put a human even close to the computational speed of a computer.
So, we can leverage the power of data that is being generated with the rise of IoT and all other aspects.

Algorithm:

We can use classification model to predict whether a patient will prefer the same pharmaceutical shop in future or will go to any other.

1. Logistic Regression: Logistic regression is a classification algorithm used to predict binary outcomes based on a set of predictor variables. A binary outcome has two possible values—either the event occurs (1) or it does not (0). Predictor variables are factors that may influence this outcome. Logistic regression is suitable for binary data, where the dependent variable fits into one of two categories, such as "yes" or "no," "pass" or "fail." This method is ideal for analysing data with dichotomous or categorical dependent variables.

2. Support Vector Machine: The objective of a Support Vector Machine (SVM) algorithm is to classify data by establishing a boundary with the maximum possible margin between the boundary and the data points. The advantages of SVM include:
    - High effectiveness in high-dimensional spaces.
    - Remains effective even when the number of dimensions exceeds the number of samples.
    - Memory efficiency due to the use of a subset of training points (support vectors) in the decision function.
    - Versatility, as different kernel functions can be specified for the decision function.

Libraries and frameworks:

- Pandas: Pandas is a Python library designed for data manipulation and analysis. It provides functions for analysing, cleaning, exploring, and manipulating data. Pandas can handle large datasets and facilitate making statistical conclusions. It excels at cleaning messy data sets and transforming them into readable and relevant formats.

- Scikit-learn: Scikit-learn is a robust Python library used for machine learning. It provides simple and efficient tools for data analysis and modelling, including classification, regression, clustering, and dimensionality reduction algorithms. Built on top of NumPy, SciPy, and matplotlib, it integrates seamlessly with these libraries. Scikit-learn supports various machine learning tasks with well-documented APIs, making it accessible for both beginners and experienced practitioners. It is widely used in academia and industry for building predictive models and conducting data analysis.

- Seaborn: Seaborn is a Python library for creating statistical graphics, built on top of matplotlib and designed to work seamlessly with Pandas data structures. It is a visualization tool that can be used to illustrate the count of benign and malignant cells using predefined datasets. Seaborn simplifies the process of creating informative and attractive visualizations, making it easier to interpret complex data through various plots and charts.

Team required to develop:

1. Machine learning engineering
2. Business analyst
3. Software developer
4. Cloud engineer
5. Data Engineer

14. Conclusion:

AI is poised to transform the pharmacy industry significantly in the coming decades. Currently, machine learning (ML) models for predicting customer behaviour are in the experimental phase. As datasets expand and improve in quality, researchers are building more accurate models. While we may not see ML completely replace human decision-making today, it's expected that ML will eventually become integral in pharmacy operations. ML models still need more data and suffer from biases, but they can analyse customer behaviour quickly and accurately, allowing pharmacy owners to focus on enhancing customer service and optimizing inventory. ML is undoubtedly the next step in revolutionizing how pharmacies understand and serve their customers.