

Medicine Indication on Basis of Previously Prescribed Disease Symptoms by Machine Learning

Abu Bakar Siddique Fahim and Sharmin Sultana Moon

A Thesis in the Partial Fulfillment of the Requirements
for the Award of Bachelor of Computer Science and Engineering (BCSE)



Department of Computer Science and Engineering
College of Engineering and Technology
IUBAT – International University of Business Agriculture and Technology

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Spring 2022

Letter of Transmittal

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Subject: Letter of Transmittal

Dear Sir,

With due respect, this is our pleasure to present our thesis report entitled "Medicine Indication on Basis of Previously Prescribed Disease Symptoms by Machine Learning". We have prepared this report as partial fulfillment of the requirement for the degree of Bachelor of Computer Science and Engineering. It was certainly a good opportunity to work on this paper to actualize our theoretical knowledge in the practical arena. Now, we are looking forward to your kind appraisal regarding this thesis report. We will remain deeply grateful to you if you kindly go through this report and evaluate our performance.

I hope that you would find the report comprehensive and competent augmented.

Yours sincerely,

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Student's Declaration

We Abu Bakar Siddique Fahim and Sharmin Sultana Moon declare that the work presented in this thesis paper titled, "Medicine Indication on Basis of Previously Prescribed Disease Symptoms by Machine Learning" is the outcome will help people to sort out the best machine learning algorithms for suggesting medicine primarily and the research carried out by us under the supervision of Prof. Dr. Utpal Kanti Das, Professor & Chairman, Department of Computer Science and Engineering, IUBAT and co-supervised by Md. Hasibul Islam, Lecturer, Department of Computer Science and Engineering, IUBAT. No parts of this report have been submitted anywhere for any degree, diploma or certificate.

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Supervisor's Certification

This is to certify that the thesis report on “Medicine Indication to New Diseases on Basis of Previously Prescribed Disease Symptoms by Machine Learning” has been carried out by Abu Bakar Siddique Fahim bearing ID=19203009 and Sharmin Sultana Moon Bearing ID=19203027, students of Department of Computer Science and Engineering of IUBAT-International University of Business Agriculture and Technology, as a partial fulfillment of the requirement for the degree in Bachelor of Computer Science and Engineering. The report has been prepared under my guidance and is a record of work carried out successfully. To the best of my knowledge and as per their declaration, no parts of this report has been submitted anywhere for any degree, diploma or certificate. Now they are permitted to submit the report. I wish their success in future endeavors.

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Abstract

In our modern world, we try to live our life in a much easier and modern way. We need to cope up with the situation calmly. But when we attacked by any disease, we become hyper and take strong step to defend our situation from the primary stage. It can be decided by ourselves or we take decisions from others. That time it can be risky according to our health. So, it is mandatory to consult a doctor but every time it is hard to consult a doctor or manage to go to the hospital. It is easily can be cured if we have the proper indication according to the previous disease symptoms. For example, in COVID-19 pandemic situation, many of the patients become so much afraid of the primary symptoms like fever, body-ache, headache, muscle pain etc. So, this can be easily cured staying in the house by following approvable medicines. The medicine which are easily can be taken on the basis of the symptoms are known as OTC (Over the Counter) medicines. These medicines avoid the anti-biotic risks. Here we used deep learning theory. In this study, a comparative analysis is done on machine learning algorithms where we used NLP (Natural Language Processing) which work with NLTK (Natural Language Toolkit). data preprocessing part is done by text mining which includes tokenization, stemming. The accuracy of this research is done in two different sections. Before the implementation of data preprocessing by the survey, we came to a conclusion that we can generate an idea by the help of which we can get the advantage by the machine easily to get prescribed on the basis of the symptoms of the primary stage. The main concern for the anti-biotic medicines which can create a big risk for us can also be solved by following the OTC (Over the Counter) medicines. This sort of medicines is under the acceptance of risks as well.

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During our work on this thesis, many people supported us from technical, organizational and personal perspective. At this point, we would like to express our gratitude to them.

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Chapter I

Introduction

Medicines are the way and material criteria to be cured from any kind of diseases. Human being and human body can be easily be affected with many unwanted diseases without being facing any kind of issues. A disease attacked body needs to be cured as much possible way to be cured for the need of own or others' life needs. There are high possibilities to protect our body from the severe attack of any disease. As we can say, a long years ago there are some people who can identify any disease by checking the nerve easily and gave the medication at home. But now in modern generation, we can easily can able to appointed ourselves to check by a doctor which is a great achievement but we become habitual of it. Following the way, we can easily can solve the problem, we are making it big problems. To overcome from this situation, we are generating an idea through which we can overcome the phase of primary stages easily without monitor ourselves by a doctor. In recent times, already we have discovered a lot of diseases and also the medication according to the diseases. The medical science has now in an advanced stage from previous generation. Mostly without anti-biotic medicines it is not that much harmful for the doctors to suggest medicines to get the result to overcome the situation in primary stage. So, it is easily to be identified and also notified how the solutions are given and by which machine can also generate results as the modern life is improving a lot day by day.

The medicines included in OTC (Over the Counter) are the medicines that are not included in severe risks to be faced. In total we are generating an idea by which machine can easily generate that solution of a doctor. Medical science is improving but the stage it is now already is, we can have a lot of solution of medication which we cannot even overcome few years before as well. But for the primary stage of a new disease arrival, we become so much hyper and conscious that we make it as an epidemic situation. Then it creates a negative situation faced by the government and the people. We can easily calm ourselves controlling and curing in the primary stage of any new

disease also. The motive arises on the basis of the situation we faced in between the phase of the COVID-19 pandemic. A lot of patients cured themselves at the end of the epidemic by following the medication of symptoms matched by the disease at that time. The Medi-Bot is also created to make the solution of this problem and generate the overview by giving the practical scenario of the solution.

1.1 Background and Context

Medication is the process to cure body from diseases and attacks. By the help of medication, we can be prepared to avoid diseases and also, we can protect body from the attacks. Every disease after its attacks produces some symptoms that the body is affected. The attack can be normalized at the beginning by following the medication process of those symptoms. In many diseases, germs and bacteria create the body effected with other symptoms to make the body affected to enter the other disease viruses. So, by following the medication process of primary stage this process can be stopped at the beginning of any attack.

The increase of population is also making all kind of improvement much difficult to utilize in case of the high-density countries. All the people are not able to have the advantage of any improvement of not having many vacancies for any situation. Whether we need to face a bounding of possibilities everywhere. In case of monetarized by a doctor for any disease or attack is very difficult to manage for sure. By the comparison in between the symptoms of other diseases we can deliver an idea to overcome this problem and create this situation much normal. Comparison with the other symptoms can be generated a solution.

1.2 Problem Statement

In recent time, our generation have faced some very unwanted situation like COVID-19. It was a unwanted situation for which we need to lose lot of people. Many of the people attacked by not taking the situation with much serious but after the attack it depends on the process how us body's immune system is reacting on it. In the primary stages of many COVID-19 patients, the symptoms were quite similar to identify whether the patient was attacked by that virus or not. So, in that primary stage it was quite easy to maintain a medication process by which we can focus on the immune system to react on the primary stage. The concern and fear create the patient more to focus on dependent on hospitals and that's the reason the patients who need the ICU the most were not able to find the bed to fight against that virus till the end. As like another epidemic situation of diseases, this thing can be repeated again.

1.3 Importance of the proposed research

The aim of the paper is to evaluate the performance and the comparative analysis of deep learning to make a bot to deliver a prescription according to the symptoms mentioned by the patient. The NLP Natural Language Processing algorithm is used to create the project. The section of porter stemmer. With this study machine will give a medication through which a patient can get treatment in primary stage. The medicines that are suggested by the doctors in this stage will be under acceptance for other disease primary stage which can generate an idea on machines to be an alternative way. In case serious issues it will be must for a patient to consult a doctor.

1.4 Research Questions

- Why we need to use NLP algorithm?
- Is this study really impact in others research papers or ideas?
- What could be the probable risk in this research?

1.5 Research Objectives

In this study, a performance analysis is done on some deep learning algorithms and library functions including:

- ✓ NLP (Natural Language Process).
- ✓ Porter stemmer.
- ✓ ~~Numpy, Pytorch and Tensorflow.~~

Chapter II

Literature Review

2.1 Key Concepts:

The first paper named "Intelligent Medicine Case System with Distributed RFID Readers" where the authors propose a latest edition of **iMac** that can identify medicines in its memory storage by using an RFID reader installed in the case. There are number of elder people who sometimes forgot to take their medicines and also forgot about the medicine doses. By taking wrong medication, there is always a high chance of happening accidents. So, this intelligent case system mainly secures the type of medicine, time of medicine, quantity of medicine every time by using a sensor when a person picked up any medicine. This system helps the caretaker for monitoring those old people and also when any wrong medicine is chosen, the system will automatically inform the caretaker by sending e-mail. The **iMac** System can also identify the movement of the objects in the recipient's house, such as medicines, drinks, foods etc. by using RFID readers.

TABLE 2.1: CONFIRMATION ITEMS ON MEDICATION MONITORING

Confirmation Items		Examples	Risks
Dosage	Type	Take capsule A and pill B.	High
	Quantity	Take 3 capsules and 2 pills.	High
Usage	Timing	Take before eating break fast.	High
	Way	Take with water not with tea.	Middle

Table 2.1 Describes about the medicine doses, usage and about the risks. To avoid the high risks, this paper presents the adequacy of evaluation so that the recipients can maintain the type, quantity, timing and the proper way.[1]

2.2 Theories and Studies:

In this paper, the *iMac* System is used for identifying the medicine dose and timing. It uses the internal camera which is located at the bottom side of the memory storage for identifying the dosage of the medicine by simple image processing and it also uses a global sensor which is located on different places of the recipient's house to identify the timing of the medicine. The *iMac* loads the adequacy of timing and dosage onto the *iMac* server so that the caretaker can monitor easily.

TABLE 2.2: IF-THEN RULES FOR ADEQUACY EVALUATION

Specified Way	System Judgment			Adequacy of Way
	With Water	With Milk	With Alcohol	
With Water	True	False	False	Correct
	True	False	True	Incorrect
	False	False	False	Incorrect
Without Milk	True	False	True	Correct
	True	True	False	Incorrect
	False	True	False	Incorrect

Table 2.2 describes the adequacy of the way on the basis of IF-Then rules. If the adequacy of way is wrong, that time the system will send an e-mail to the caretaker.

The medicine case which is created that is made of plastic boards. As they used RFID version *iMac* System, first they settled vertically a high-power RFID reader in the back portion which can recognize the 4 types of RFID tags in the memory storage and the range of scanning is 30 cm. To detect the person in front of the case, they used a sensor (AMG2112, Panasonic Electric Works) and to warn the person, they used a compact speaker (MS-77UBK, ELECOM). To receive the

sensing data, they placed a compact computer (AspireEvo R3600, Acer) and a wireless communication device (SubSPOT, Sun Microsystems). They all are connected by the USB interface to the computer.



Figure 2.2 The new iMac (intelligent medicine case) embedded a RFID Reader

Figure 2.2 presents the new iMac System which is consisted of two main parts. If the upper part of the medicine case is shifted, the RFID reader and other materials will take place. [1]

2.1.1 Key Concepts:

The second paper named "MEDIDEN: Automatic Medicine Identification Using a Deep Convolutional Neural Network" which is a smart phone application for automatic medicine selection and also the remembrance of the medicines. There are some consequences of having wrong medicines, especially for the elder people. It can cause major health difficulties. The researchers used Inception (V3, V4) deep-learning architecture to classify the medicine packages. Here Inception V3 used for the deployment as it is smaller in size. The medicine packages consist of fourteen most common medicines to cure seven most common diseases by which the old patients can be affected. Those diseases cover hypertension, Alzheimer prostate cancer, high cholesterol, diabetes, heart diseases and osteoporosis. And the fourteen types of medicines are

~~Amlopinex~~, ~~Amhes~~, ~~Anolets~~, ~~Analsenil~~, Calciferol, Fosamax Plus, ~~Harnal~~ OCAS, ~~Madinlet~~, ~~Miformin~~, ~~Caltab~~, ~~Prenolol~~, Sandos, ~~Vitabion~~ and ~~Zimmer~~. In case of medication reminder, one of the family persons of the patients can set the reminder on the smartphone application with details information and once it set, it will give the reminder every time. Moreover, the neural network model can be run by using the Server which is made up of Python backend. [6]

2.2.1 Theories and Studies:

In this paper, after the data collection, the dataset was divided into two parts which are training set and test set. The medicine package classification depends on the image classification which is based on deep convolutional neural network architecture named Inception (V3, V4). The model deployment part is done in the Windows Server 2016 which is called PHP. The hardware configuration requires 1 virtual CPU with 8 GB RAM and it doesn't require GPU. Whenever any image is sending to the application, the application will transfer the image to the server. Then it calls the model to identify the medicine. When the user gets the medicine name and if it is correct then it sets the reminder on the application. Along with the medicine name, the application will also show the generic name, trade name and the manufacturer. The authors applied ~~Tensorflow~~ for training deep neural networks which made the networks fine-tuned. Here the input image size which are used in the networks has to be 299x299 pixels. For the client side, it is available on the Android application by installing Android Studio and Kotlin and both client and server can connect with each other by using REST API.

Table 2.2.1: Dataset Details

Specifications	Description
Number of Images	52,500 images
Train data	3,750 images
Test data	1,260 images

Table 2.2.1 describes about the dataset details. The dataset has total 52,500 images and among from them, they used 3,750 images for each class to specify 14 classes for training. For testing data, they used 1,260 images to specify 7 classes where each data used 90 images. Before training, the size of all the images must have to be '805x604' pixels.

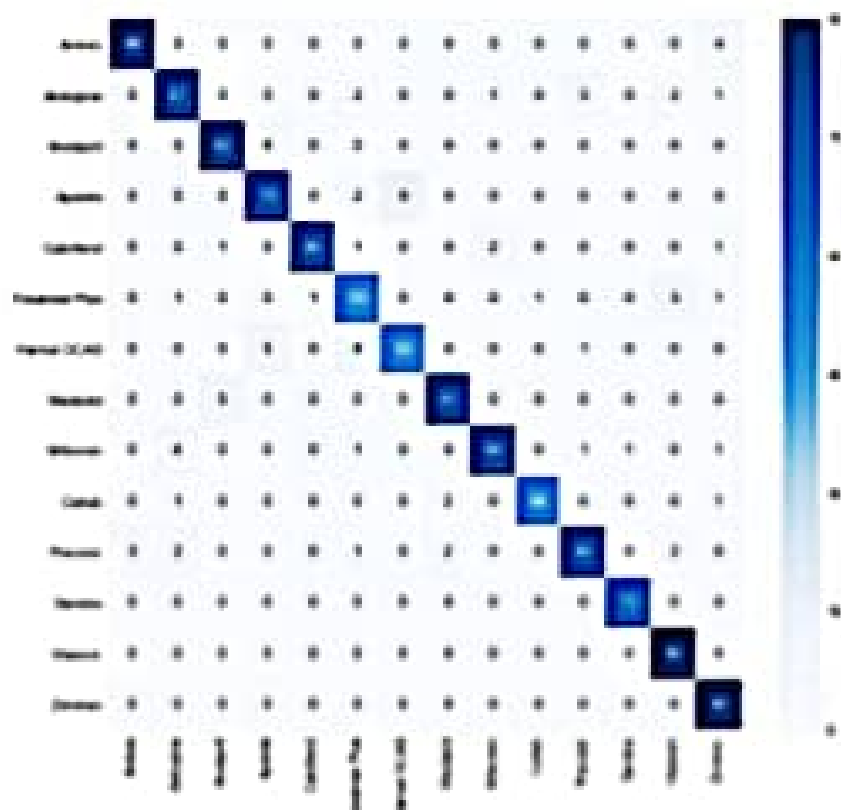


Figure 2.2.1 The confusion matrix over the test set for Inception-V3

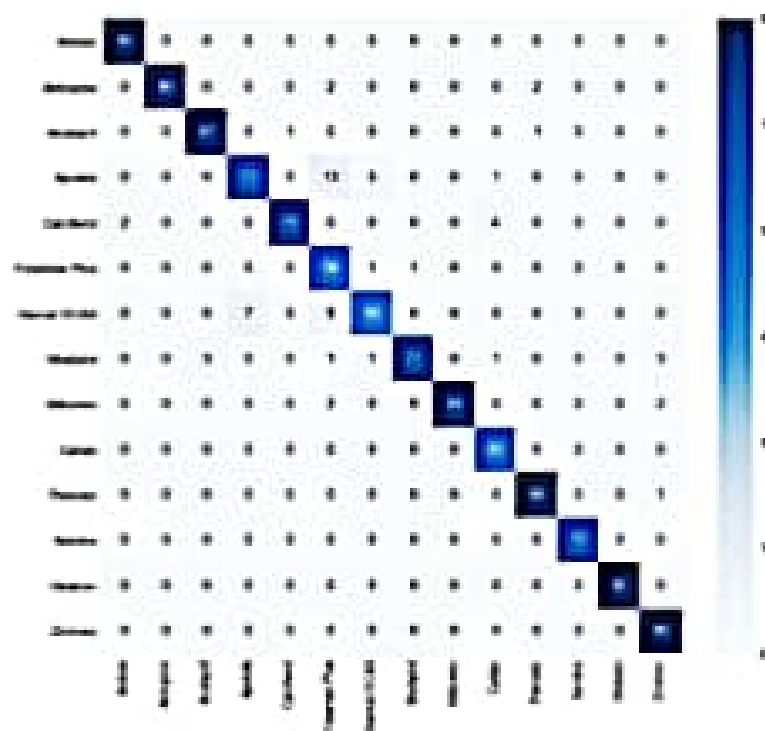


Figure 2.2.1.1 The confusion matrix over the test set for Inception-V4

From both of the figures, it was noticed that there are not that much dissimilarities in case of performance between Inception-V3 and Inception-V4. But Inception-V3 was more fine-tuned among all the data, that is why Inception-V3 was determined to apply for the deployment and stored as a graph file for the deployment. [6]

Chapter III

Research Methodology

Dataset preparation, pre-processing, application of various deep learning classifiers, and performance evaluation of deep learning classifiers were the three processes in the research process.

Preprocessing: In the preprocessing section, according to the survey done with the doctors we came to a decision to process our data with the sort of some individual data on which the data can provide an output to the patients. According to the mentioned symptoms the bot will provide the prescription. In the pre-processing the data is organized for the machine by doing text mining. In text mining it was totally done by the project on porter stemmer. In porter stemmer the tags in which the patterns and responses are designed will be called and according to the chosen tags the data will be compared to that pattern and response. As the dataset are created according to the medicine characteristics, it will be the directed based responses with the created short file from the dataset. The created short data set will be count to be trained for the future output of this project.

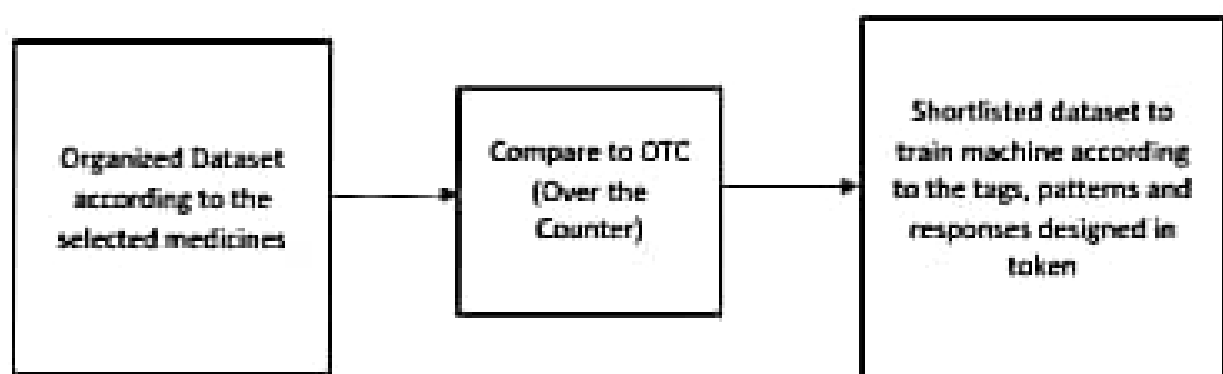


Fig 3.1 Data Preprocessing

Table 3.1: Dataset Details

Specification	Description
Number of medicines	850 samples
Train Data	158 medicines
Test Data	108 patterns

Table 3.1 shows the details of the dataset that is use in this research. That dataset contains 850 samples and for train the model we use 158 medicines and for testing the model we use 108 medicines.

3.1 Research Design

The proposed system will use some classifier machine learning algorithms. In this proposed system we will use:

- NLP (Natural Language Process).
- Porter stemmer.
- ~~NumPy, Pandas~~ and ~~Tensorflow~~.

3.2 Research Methods

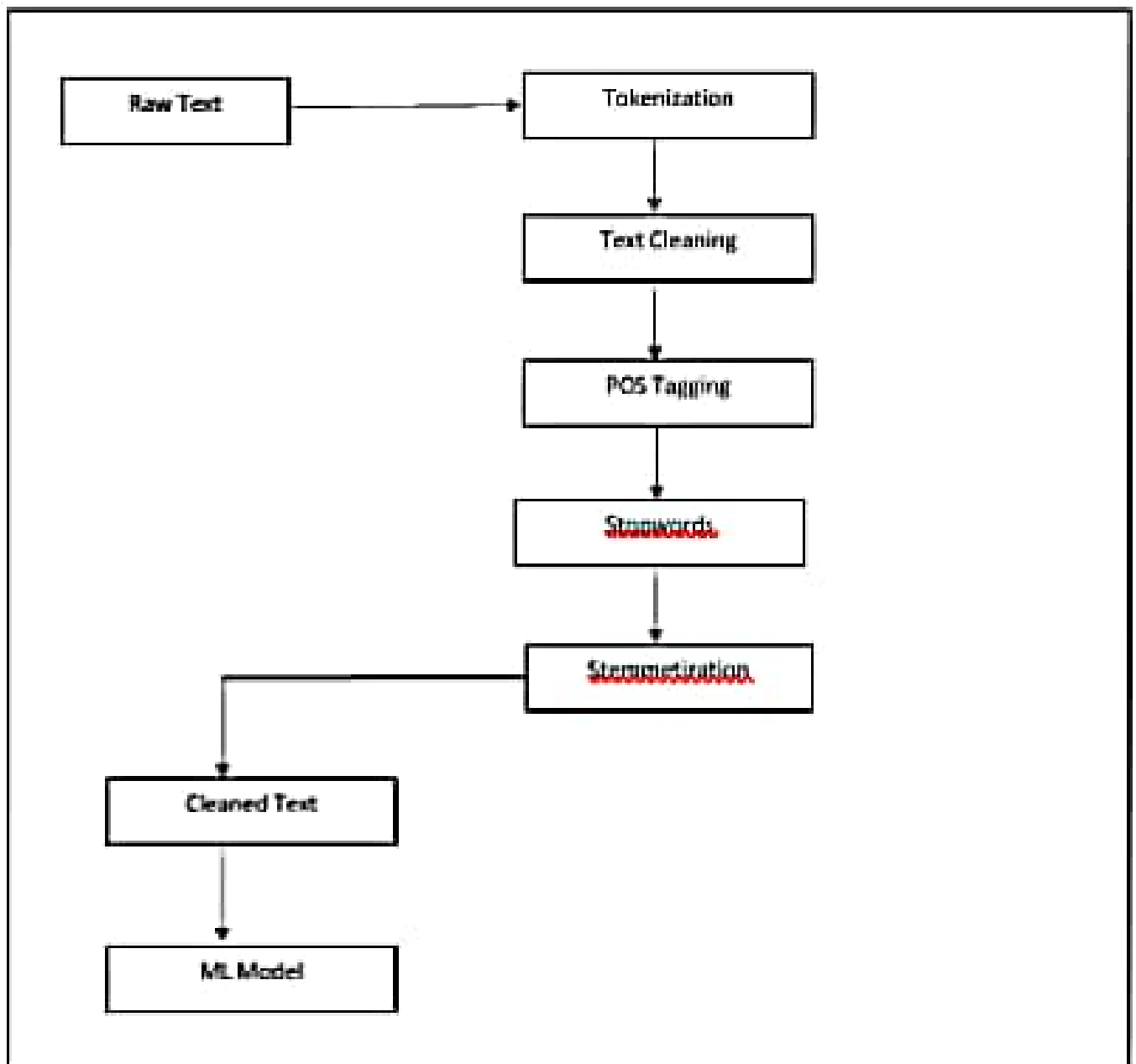


Fig 3.2: Method Process

NLP (Natural Language Process)

The area of artificial intelligence known as deep learning for NLP is used to aid computers in comprehending, modifying, and understanding human language. Building computational methods for the analysis and representation of human languages using machine learning and algorithmic approaches are the subject of NLP. Since the text to voice data and real-time applications are always changing; we require a wide range of techniques. Neural networks are the basis of deep learning. Deep learning techniques are assisting in the resolution of Natural Language Processing (NLP) issues that machine learning algorithms were unable to resolve. [2]

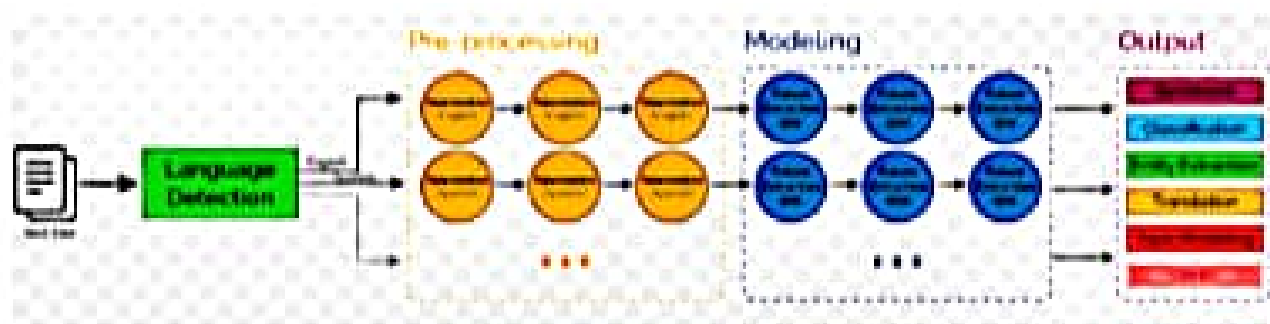


Fig: 3.3 Natural Language Processing

How NLP works

Text is converted into a machine-understandable format via text vectorization, and machine learning algorithms are then fed training data and predicted outputs (tags) to teach machines to associate a specific input with its associated output. The machines then make predictions for unobserved data after building their own "knowledge bank" and determining which features best characterize the messages. In the end, the text analysis models will be more accurate the more data these NLP algorithms are fed. One of the most common NLP tasks is sentiment analysis, where machine learning models are trained to categorize text according to the polarity of opinion.

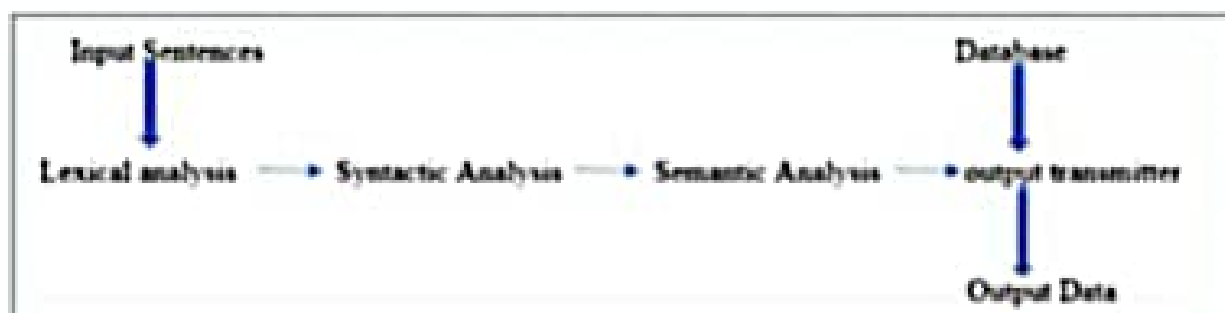
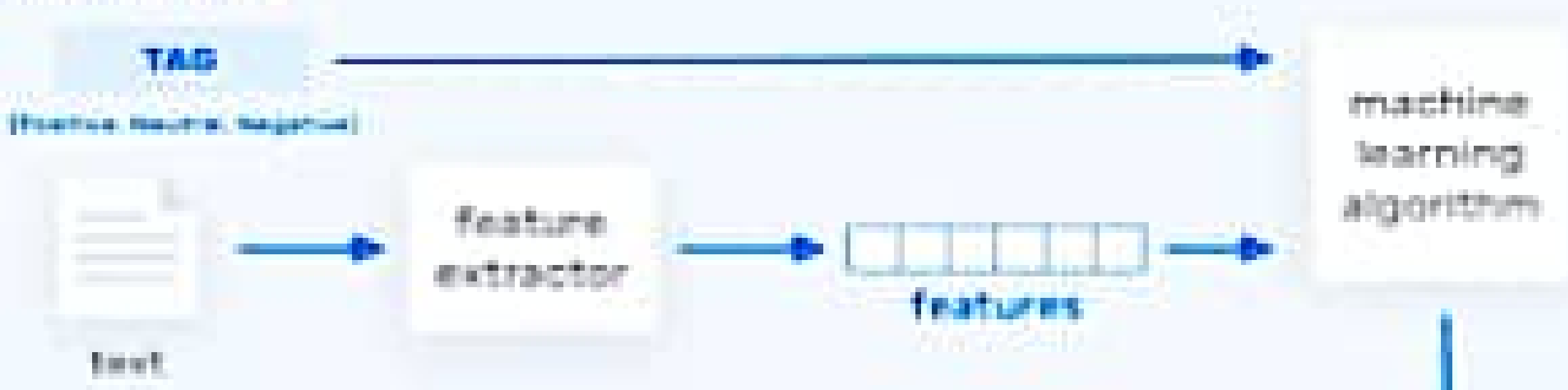


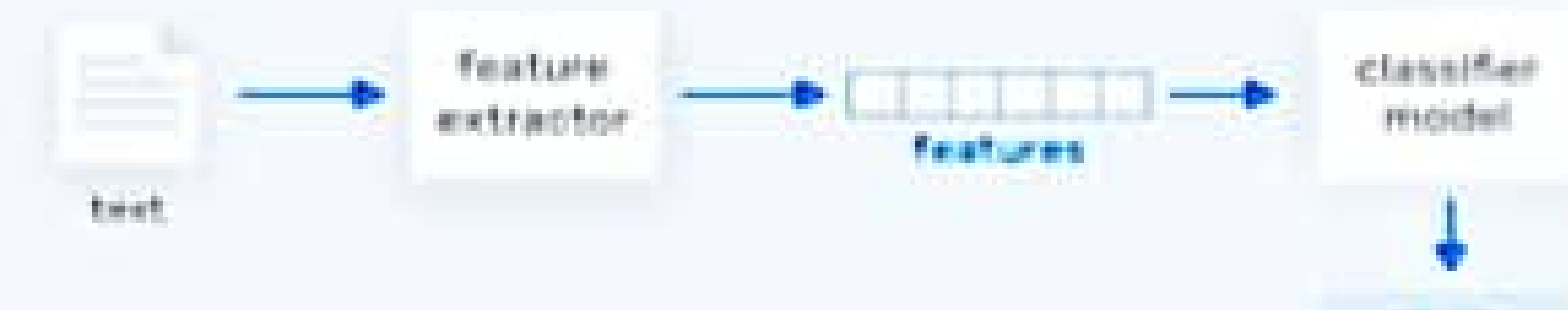
Fig 1.4. Process of NLP

NLP is challenging to define because of the many ways it can be used. Its foundation is the assumption that people navigate the environment using internal "maps" that they develop via sensory experiences. NLP seeks to identify and change any unintentional biases or constraints in a person's worldview. Hypnotherapy is not NLP. Instead, it works through altering someone's beliefs and behavior through the deliberate use of language. A PFS is identified by an NLP practitioner, who bases their therapeutic framework around it. The framework can entail developing a rapport, learning more about them, and making goals with them. [3]

Step 1: Training



(b) Prediction



3.3 Research Tools

In this system we do not need any external hardware. We will run our project on google collab. As this project will run under high classification, it will be run under a cloud spaced hard drive storage. There will be no possibilities of any kind of obstacle or problem to face in this platform.

The project was design under NLTK (Natural Language Tool Kit) which used to design the module of NLP and train the data according to the pre-processed data for machine.

3.4 Practical Considerations

The system that we are working on, during designing a prototype we have to make a system for our local machine, and fortunately we got the result under the natural language process system to make a medi-bot to get the outcome.

[illegible]

1. What is the main purpose of the document?

1. *Staphylococcus aureus*

— *Illegible text* —

— *Journal of the American Medical Association*, 1997

[illegible]

— 11 —

Abstract—The purpose of this study was to determine the effect of a 10-week training program on the heart rate (HR) and energy expenditure (EE) of sedentary, middle-aged women. The subjects were 12 sedentary women, 30 to 45 years of age, who were randomly selected from a telephone directory. The subjects were divided into two groups: a control group and an exercise group. The control group was instructed to maintain their current level of physical activity, while the exercise group was instructed to engage in a 10-week training program. The training program consisted of three sessions per week, each lasting 30 minutes. The sessions were designed to increase the subjects' aerobic capacity and endurance. The HR and EE were measured at the beginning and end of the 10-week period. The results showed that the exercise group had a significant increase in HR and EE compared to the control group. The increase in HR was 10 beats per minute, and the increase in EE was 1,000 kcal per week. These results suggest that a 10-week training program can effectively increase the HR and EE of sedentary, middle-aged women.

Subject: _____

Abstract

Figure 1

— ۱۱۱ —

Abstract

[illegible][illegible]

Chapter IV

Result and Discussion

In the result, the output can be highlighted on the epochs on which the tokenized stemmed data are provided. The epochs in each phase are checked under 8 bits of data.

```
Epoch [100/1000], Loss: 0.2832
Epoch [200/1000], Loss: 0.1279
Epoch [300/1000], Loss: 0.3566
Epoch [400/1000], Loss: 0.0020
Epoch [500/1000], Loss: 0.0007
Epoch [600/1000], Loss: 0.0002
Epoch [700/1000], Loss: 0.0002
Epoch [800/1000], Loss: 0.4850
Epoch [900/1000], Loss: 0.0000
Epoch [1000/1000], Loss: 0.0000
final loss: 0.0000
```

Here in the first epoch we get 0.2832% data loss and in next two epoch it loss 0.1279 and 0.3566% data loss. The percentage rise down gradually and reaches approximate 0 till 800 epoch check but then it rises on 0.4850 and in the end the total data loss stands on 0.0000%. So, the considered final data loss stands on 0.0000%.

Chapter V

Conclusion

Limitation: The data with which we trained under the consideration of risk factor to avoid the anti-biotics and work with the only over the counter medicines to provide the outcome.

Future Scope: As much the medical science will be collaborated with technology and be connected with the machine, this process of medication will be counted to provide as a primary stage medication process as an exceptional in future.

Conclusion: This research work was driven by the increasing rate using the machine as an exceptional use for the medication. In case of future epidemic diseases, we can be prepared for the ultimate situation to overcome. An epidemic become more dangerous when the fear takes place in patients' mind. The solution of primary stage can easily be defended on the basis of the medication and body immune system. According to the most accepted medicines suggested by the doctor the machine can provide an output to fight the primary stages of any diseases. The Natural language process will work as a trained machine to create and solute this problem.

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