

An Expert System Development For Education Using Machine Learning

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This Report Presented in Partial Fulfillment of the Requirements for the
Degree of Bachelor of Science in Computer Science and Engineering.

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APPROVAL

This Project titled “**An Expert system development for education using machine learning.**”, submitted by Md. Sahabuddin, ID: 162-15-7269, and Sweet Khan Sunny, ID: 161-15-7284, to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 08-07-2020.

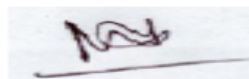
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We hereby declare that, this project has been done by us under the supervision of **Md. Tarek Habib, Assistant Professor, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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ABSTRACT

Our work is developing a Chatbot using recurrent attention model focuses on developing a model which will be able to generate responses automatically to the questions asked using a number of different machine learning techniques. Expert system development is assisting for students as a guideline, being informed of what is happening now in a university, library and its resources information, frequently asked questions for newcomers to know specific information like admission procedure, requirements, address of the faculty members office and so on. Any questions related to a university might provide through chatbot for educational purpose. Chatbot which is a computer program, conversation with human beings by using AI in messaging platforms or in a website. It has own management way of ability setting up discussions include a description of making things convenient how natural language processing executes on it. Natural Language Processing (NLP) is an area of research and application that explores how computers understand and manipulate natural language text or speech in order to achieve meaningful results. Through natural language processing, researchers aim to gather knowledge on how people understand, process and make use of language. This is done in such a way that appropriate tools and techniques can be developed to prepare computer systems understand and manipulate natural languages to perform desired tasks. Chatbots, following set of rules and Machine learning, the process through which we conducted in here. The dataset that we had trained, have three main components which are story, questions, and answer. Training data regarding an educational institution on which newcomers along with currently enrolled students may get their required query about what they are asking through the chatbot. Saving time by solving query of desired people's frequently asked questions in one place is sole purpose of this chatbot.

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CHAPTER 1

1.1 Introduction

A chatbot represents an application or a software system which allow a conversation of type audio or textual. Thus, programs are developed have as main objective the simulation of a conversation like a human partner. User must be needed to be more specific when talking to a bot as it only can get natural language, not commands. This kind of bot becomes smarter in course of time as it learns from its past converse with it with human. The main purpose that was built for it is to solve the problem of systems of communications form domains like students assist or information acquisitions. The following is a conversation between a human being and a computer bot.

Information are labeled as in story mode like Daffodil International University has a faculty of Science and Information Technology. Under this faculty, it provides bachelor's degree like Department of Computer Science and Engineering and Department of Software Engineering and so on.

Questions: Does Daffodil International University provide bachelor degree in Computer Science and Engineering?

Answers: Yes

Human: Do I have to attend a minimum number of classes to attend the examinations?

Bot: Minimum of 60% of the classes you must attend.

By training required dataset of a particular educational institutions, it'll interact with user for providing support. Among the most used platform we want to implement on official websites.

1.2 Motivation

Over the past few years, massaging through applications have become popular other than social media sites. Human beings are using application messaging system these days like messenger on the same way business websites managing their visitors through online trained bots for becoming more productive and making customer's relation with them easier. On the contrary, implementing bots for educational purpose might not be bad after all. Getting information regarding desire institution's query remotely be more convenient. Office closed period, offline messaging system to provide information which may delay to reply back. Overcoming the limitation of confused information from other website might lead anything wrong decisions for this reason the concept of chatbot for the educational institute has arisen to overcome the limitations.

1.3 Rationale of the Study

According to the online statistics, around 1.4 billion people ^[1], are using chatbots in variety of platforms, specially for helping customer's asking questions or solve trouble quickly and easily. Students have a lot of query and their learning does need and they do need an assistance on it. Assigning a human to addresses this might not be effective as human resources have certain limits.

Our works brings bot in education that may enable mentors to help, provide assist and counsel to their students, finding out student queries and aid their learning fast in an innovative approach.

1.4 Research Questions

- What does chatbot make more convenient?
- Why does chatbot become popular?
- Why do people involve with chatbot?
- What's the effect of chatbot in life?

1.5 Expected Outcome

Implementation of a chatbot technology into an educational institute's official website, which may assist to overcome the limits of user's time killing obstruction and confusing Steps regarding its preferred query. By the application of this technology, we look forward to resolve few matters like providing assist for user's asking information, by analyzing questions that was asked in different approach, proving precise knowledge.

1.6 Report Layout

In chapter one, we have denoted an introduction of the research with motivation, rationale of the study, research questions, expected output and report layout. In chapter two, we have demonstrated briefly the background of this research. Including the related workings, comparison of studies, scope of the problems and challenges. In chapter three

CHAPTER 2

BACKGROUND STUDY

2.1 Introduction

Newcomers and currently enrolled students often get misinformation and find it trouble go to university physically for seeking out the query regarding it. Over the few years chatbot gaining a place for overcoming online services by the help of artificial language. By training it with required dataset, it can operate its tasks. Chatbots are using machine learning algorithms to make easier for the users, in most cases it seems it time saving and more efficient than other medium.

2.2 Backgrounds of Usage

The chatbots can be used in different workspaces, because as it was presented previously, they can be used in many industries to inform clients regarding to the activity domain of company. Among the most used workspaces can be highlighted:

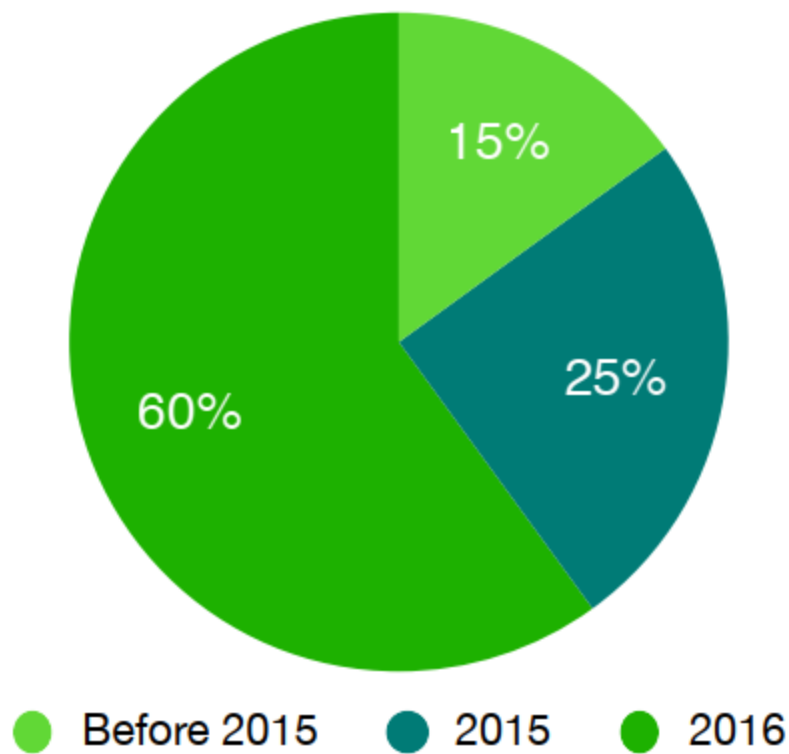


Figure 2.2.1: Usage of chatbots by year

commerce, assurance, healthcare, sales, health, logistics, recruitment, technology. No wonder these environments are predominantly exploited by chatbots, as they are environments with an increased transit of articles and information that require titanic journalistic work and in which the distribution of information is very important but expensive. The chart below shows about it:

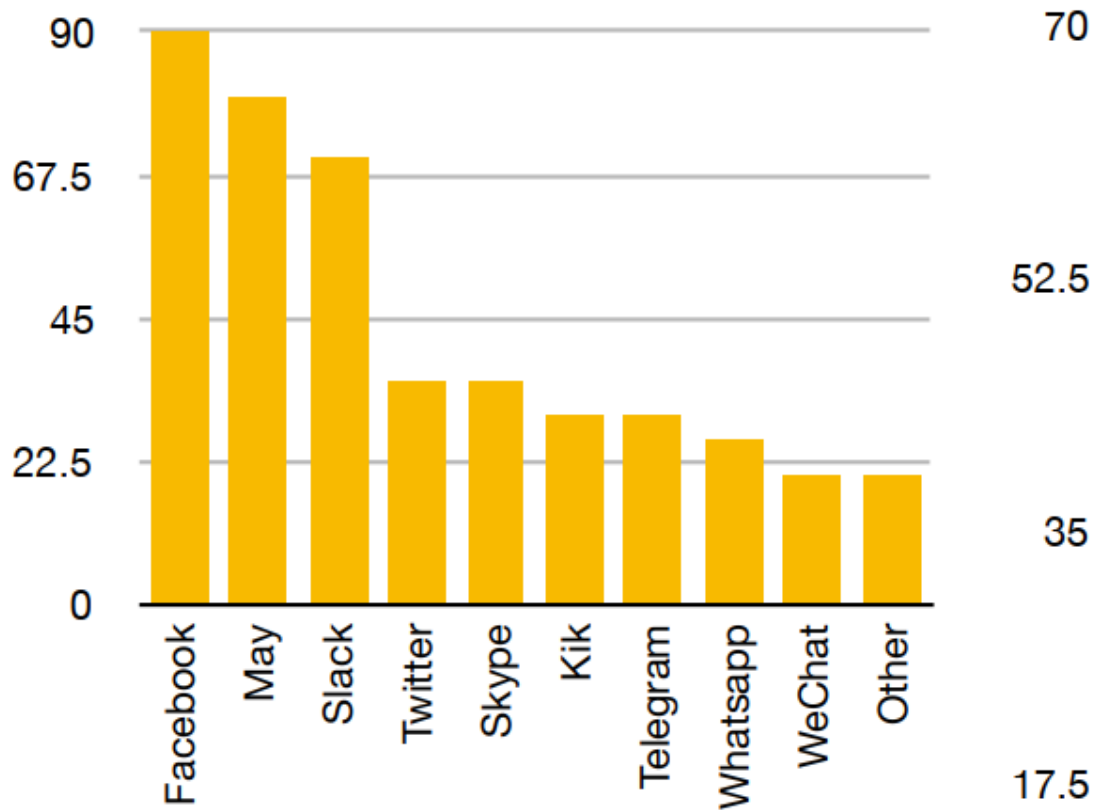


Figure 2.2.2: Platforms that support integration with Chatbots

Nowadays, the number of users, whose who interacts with chatbot are beyond imaginable. Day by day it growing bigger in percentages and also preferring chatbots rather than email marketing. Below two statistics are shown below:

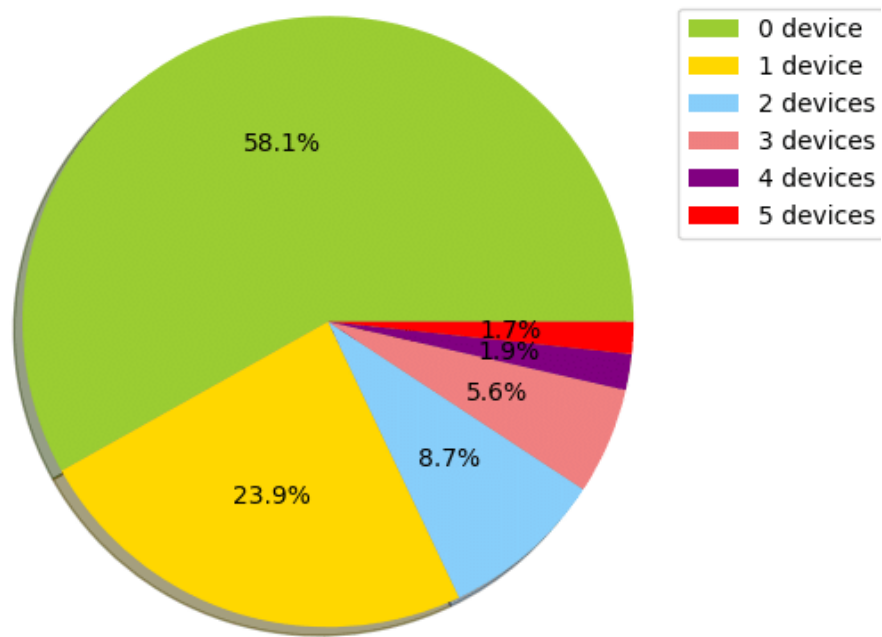


Figure 2.2.3: Device subscription statistics of the chatbot users

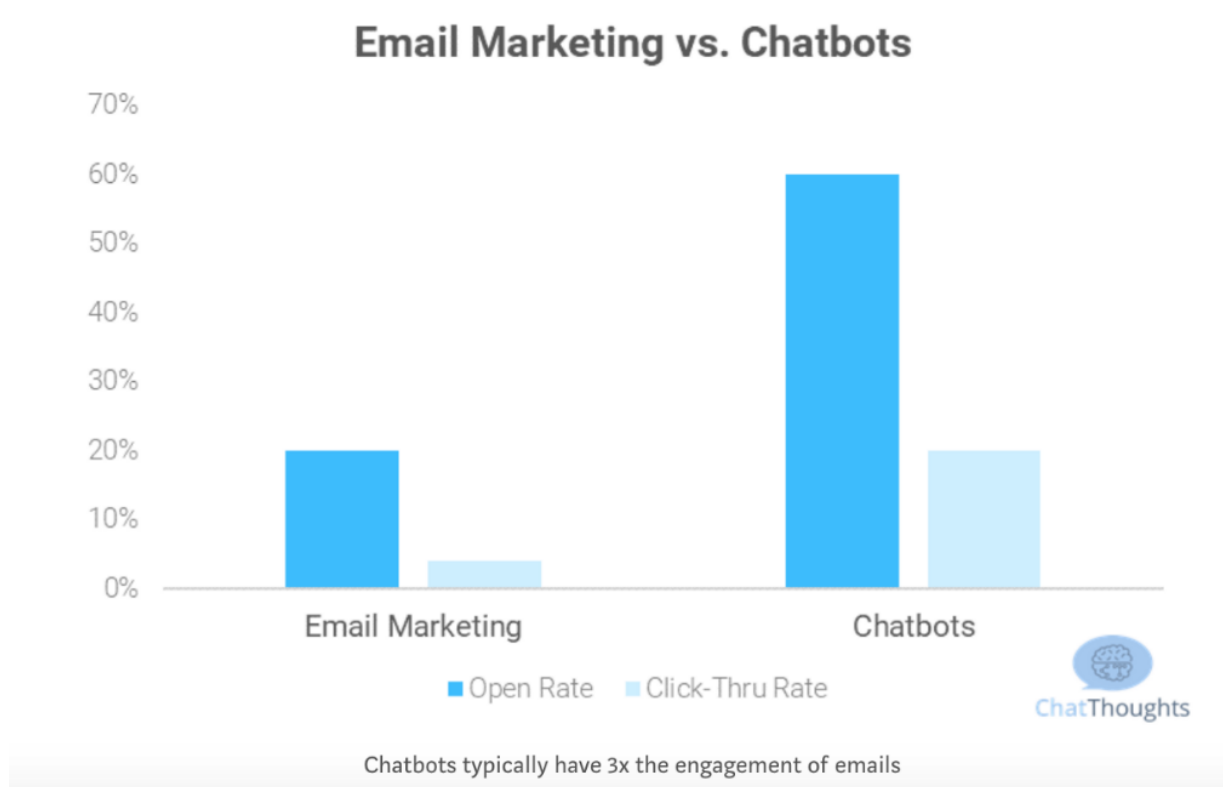


Figure 2.2.4: Preference of chatbots by users

2.3 Predicted Use Cases:

Chatbots are tiny programs that help simulate interactions with customers automatically based on a set of predefined conditions, triggers, and/or events.

There are several advantages to using chatbots:

1. They can be proactive or reactive.
2. Their responses are consistent every time.
3. They can respond to customers immediately.
4. They can help you collect important data and also learn from the data collected.
5. They can be used through a variety of different mediums like SMS, live chat, or even social media.

The concept of a chatbot itself is nothing new. In fact, they've been around since the 1960s. A graph showing the prediction of its usage in future:

What do you predict you would use a chatbot for?

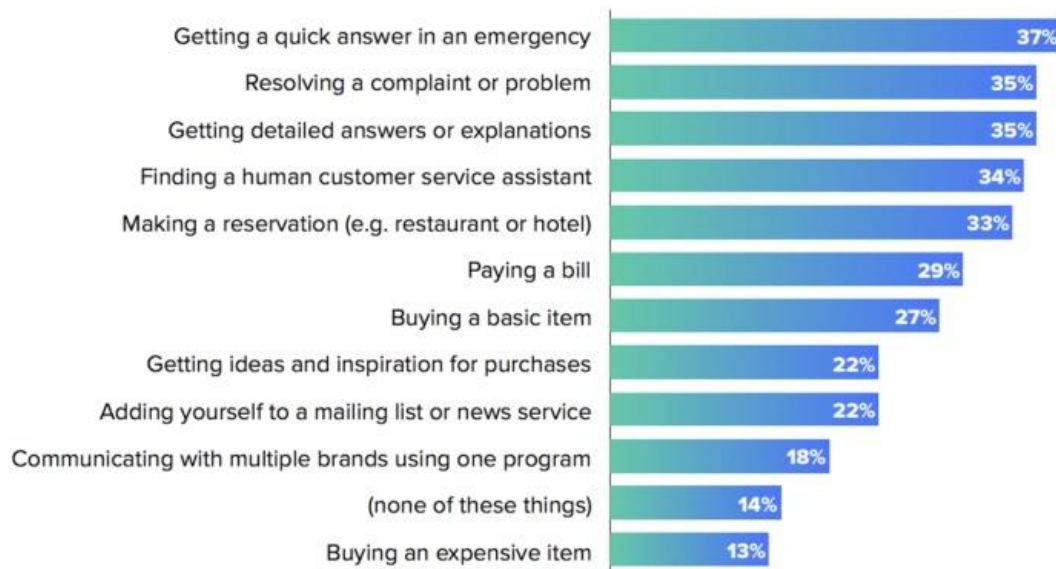


Figure 2.3.1: Predicted use cases for chatbots

2.4 Working on Education Chatbots

We rarely noticed chatbots for educational institutes for providing virtual assistant for students and those who seek information about a university. If we implement a conversational chatbots for this, it might not be a worst thing at all. For any college or university, swift communication is crucial when it comes to converting prospective applicants into enrolled students.

In the lead up to the start of a new academic year candidates are buzzing with questions relating to courses, fees, accommodation and the like. It's undoubtedly a busy time for admissions departments, and responding to this influx of questions quickly requires a lot of time and resource. Essentially, chatbots provide an antidote to this problem. They are incredibly convenient, easy to use and are designed to provide automated responses to common questions, avoiding ambiguity and delayed replies. Students can chat with them for free at any time of the day or night, which is of particular benefit to international candidates living in different time zones. AI bots serve another purpose too. Over the duration of their interactions with candidates and students, they gather large amounts of data. This data contains helpful information about student behavior relating to information that they can(or can't) find on a university's website, making them a useful tool for reflection and improvement, and a valuable asset for marketing teams as well as admissions teams.^[10]

2.5 Related Works

A number of recent efforts have explored ways to capture long-term structure within sequences using RNNs or LSTM-based models^{[4][5][6]} A number of works done in this field, chatbots have built for different purpose on business field, finance, getting a quick answer in an emergency cases of companies, resolving problem or complaint, getting details answer or explanations, all of things in one place and so on. People would like to engaged their conversation with bots as the data says. While in our country we rarely find educational institutions build online messaging system for their website rather often seen in business sites. Some of the very early work on neural networks by Steinbach and Piske^[7]

and Taylor^[8] considered a memory that performed nearest-neighbor operations on stored input vectors and then fit parametric models to the retrieved sets. This has similarities to a single layer version of our model.

2.6 Approach

In this work we took a discrete set of inputs $x_1, x_2, x_3, \dots, x_n$ that are to be stored in the memory, a query q , and outputs an answer a . Each of the time x_1, q , and a contains symbols coming from a dictionary with V words. The model writes all x to the memory up to a fixed buffer size, and then finds a continuous representation for the x and q . The continuous representation is then processed via multiple hops (multiple computational steps which we term “hops”) to output a .

2.7 Research Summery

Primary intention of doing this work for making things convenient for the students. For them, getting information going to the educational institutions physically and seeking everything in one place, gets them in trouble. Integrating online messaging system for the ones who wants to know about university related information into the official websites, whose prime features to assist through messaging system, chatbot

2.8 Comparative Analysis and Summary

Why do we choose spacy in our works, as it was proclaimed earlier working with online messaging system, which on is more efficient, in natural language processing we generally do work with natural language tool kit, but spacy which is more good, as it works with better algorithms which is already built-in and very upgraded ones. For making a chatbots for educational sites for better performance spacy need to be better to work with. Test error rates (%) on the 20 bAbI^[3] QA tasks for models using 10k training

2.9 Training Details

Ten percentage of the dataset was hoped to build validation set. were trained using a learning rate of $\eta = 0.01$, with anneals every 25 epochs by $\eta=2$ until 100 epochs were reached. When trained on all tasks simultaneously with 1k training samples (10k training samples), 60 epochs (20 epochs) were used with learning rate anneals of $\eta=2$ every 15 epochs (5 epochs). All training uses a batch size of 32.

2.10 Scope of the Problem

In lack of training data, performance to a machine learning becomes critical, because of few confidential and privacy, chatbots can not provide much of data for users, for that reason default message needed to provide based on experience although for that accuracy must be certainty. To keep chatbots up to speed with changing company products and services, traditional chatbot development platforms require ongoing maintenance. This can either be in the form of an ongoing service provider or for larger enterprises in the form of an in-house chatbot training team. To eliminate these costs, some startups are experimenting with Artificial Intelligence to develop self-learning chatbots, particularly in Customer Service applications.

2.11 Challenges

Insufficient data of this machine learning research hampers prime goals, as online messaging system works better with trained label data and gets better day by day with its experiences. At the beginning its performance was lag behind. Once a developer has integrated the NLP, then comes the real challenge of building a truly productive chatbot. Basically, parts four through eight. Developers will realize during the construction of these stages that they are building yet another application with lots of hand-coded logic, decision trees, and persistence management that must be personalized for each user.

In essence, the NLP does not address any of the challenges that you typically face in developing a real-world line of business application. It simply presents the opportunity to deliver a broader and more satisfying experience using a chat interface.

Many of the new chatbot vendors are trying to solve these challenges by introducing a richer declarative syntax that enables developers to define the goals of the bot and handle much of the heavy lifting related to system integration, conversation flow, and persistence management within the chatbot framework. If such an evolution is not taken, chatbots will continue to be costlier to develop and maintain than traditional applications.

CHAPTER 3

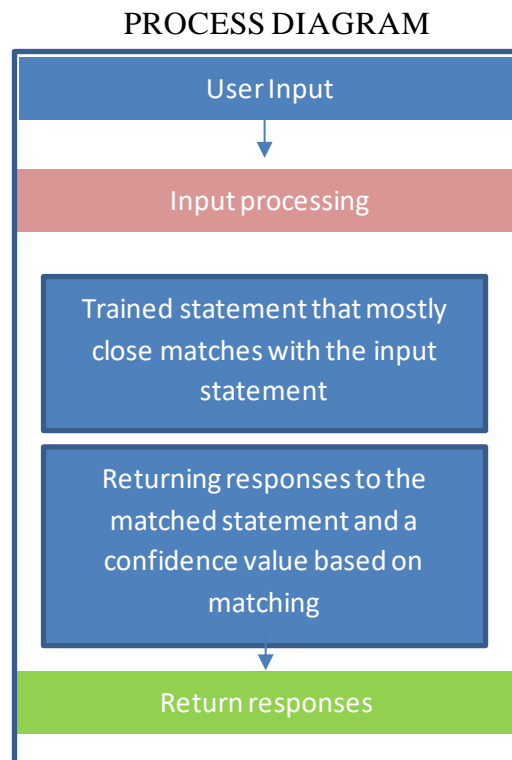
RESEARCH METHODOLOGY

3.1 Introduction

In this research, we have tried machine learning techniques to train data and test data which we got from^[3] popular Babi dataset. Which is a question answered dataset. By using python library called spacy which is very upgraded for natural language processing. In this work, we present a novel recurrent neural network (RNN) architecture where the recurrence reads from a possibly large external memory multiple times before outputting a symbol. Our model can be considered a continuous form of the Memory Network implemented in [23]. The model in that work was not easy to train via backpropagation, and required supervision at each layer of the network. The continuity of the model we present here means that it can be trained end-to-end from input-output pairs, and so is applicable to more tasks, i.e. tasks where such supervision is not available, such as in language modeling or realistically supervised question answering tasks. Our model can also be seen as a version of RNNsearch^[11] with multiple computational steps (which we term “hops”) per output symbol. We will show experimentally that the multiple hops over the long-term memory are crucial to good performance of our model on these tasks, and that training the memory representation can be integrated in a scalable manner into our end-to-end neural network model.

3.2 Objective

Constructing a question-answer chatbot which will give responses in the form of yes or no, the questions will be trained, based on queries a user asked. For a user instead of user attending the troubles themselves and this bot reply on the basis of the data that is provided by the user to avoid disturbance in many cases.



CHAPTER 4

EXPERIMENTAL RESULTS AND DISCUSSION

4.1 Tool and Library Used in this Work

Making this, we used python language, plotting out the accuracy graph we took Matplotlib and keras, neural networking library on Jupyter notebook inside of anaconda.

4.2 Evaluating on Given Test Set

Ten percentages of the bAbI training set was held-out to form a validation set, which was used to select the optimal model architecture and hyperparameters. Our models were trained using a learning rate of $\eta = 0.01$, with anneals every 25 epochs by $\eta=2$ until 100 epochs were reached. No momentum or weight decay was used. The weights were initialized randomly from a Gaussian distribution with zero mean and $\sigma = 0.1$. When trained on all tasks simultaneously with 1k training samples (10k training samples), 60 epochs (20 epochs) were used with learning rate anneals of $\eta=2$ every 15 epochs (5 epochs). All training uses a batch size of 32 (but cost is not averaged over a batch), and gradients with an ℓ_2 norm larger than 40 are divided by a scalar to have norm 40. In some of our experiments, we explored commencing training with the softmax in each memory layer removed, making the model entirely linear except for the final softmax for answer prediction. When the validation loss stopped decreasing, the softmax layers were re-inserted and training recommenced. We refer to this as linear start (LS) training.^[6] In LS training, the initial learning rate is set to $\eta = 0.005$. The capacity of memory is restricted to the most recent 50 sentences. This question-answer bot's results by which it predicts, the split words got joined and after taking the question, it evaluates the story to get back the results, then it predicts the results in the one word like `yes` or `no`.

4.3 Creating Own Question and Model

We have created out a new vocabs similar as like the given dataset built up, whereas the questions, answer and the word that will show up with yes or no is added to the new own vocab variable then cast into list with split. By vectorizing the required variable.

Then we expected the predicted result from the model by generating. Tokenizing the maximum valued key will show the percentage of its accuracy of understanding the question and the answer.

4.4 Fitting the Model

The model building's input sequence and question, answer through which we got a summary of the model and the model fitted the inputs that trained and queries that trained. Train on 10000 samples, validate on 1000 samples. Answers trained where batch size is selected 32 and the epochs, we have done is 120, the more of epochs and batch sized increased, better accuracy we get vice versa less epochs to fit not so much accuracy to be looked.

4.5 Evaluating the Model

Plotting out train history with the help of matplotlib and summarizing history for accuracy of the train and testing data. By increasing the number of the epochs to fit the models the better accuracy to get.

The more we execute, we get

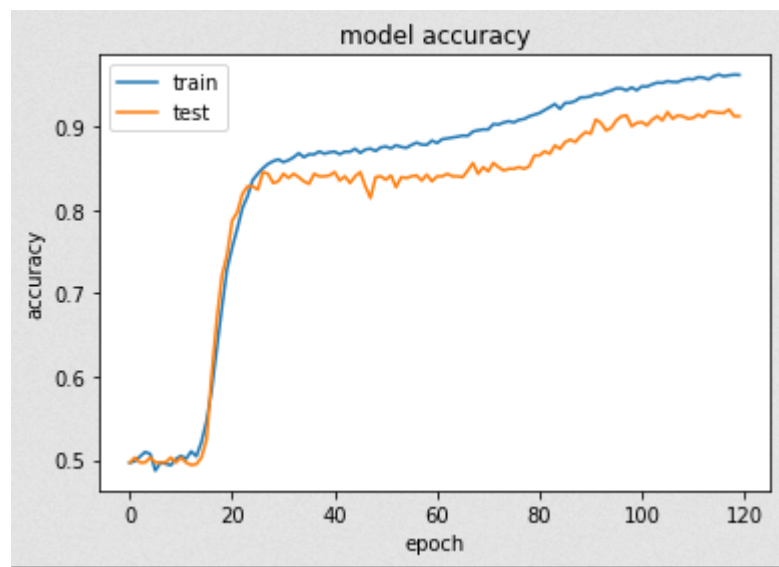


Figure 4.5.1: Evaluating the model

CHAPTER 5

Summary, Conclusion, Recommendation and Implication for Future Research

5.1 Summary of the Study

Implementation of a chatbot technology into an educational institute's official website, which may assist to overcome the limits of user's time killing obstruction and confusing steps regarding its preferred query. By the application of this technology, we look forward to resolve few matters like providing assist for user's asking information, by analyzing questions that was asked in different approach, proving precise knowledge. On some tasks, we observed a large variance in the performance of our model (i.e. sometimes failing badly, other times not, depending on the initialization). To remedy this, we repeated each training 10 times with different random initializations, and picked the one with the lowest training error.

5.2 Conclusions

Academic advising, in particular course selection advising, has become an important component of student support. A faculty member, acting as academic advisor, is now seen as the window for cultivating student engagement with the university. As the student population becoming more and more diverse, there are genuine needs for more such windows, each of which is dedicated for certain need or designed for certain requirements. We have come to realize, one of the most highlighting benefits of bots is, it can learn from past interaction with customers and become intelligent over time with the help of artificial intelligence. Here comes the ardent need for education to utilize the power of chatbots to engage with their students in real-time. The future of chatbots is bright and it can make educational tasks effective in terms of services. Just like every new data collection technology the chatbots will drive the industries to adopt and adapt, ultimately providing consultants and researchers with one more tool for the toolbox.

5.3 Implication for Further Study

In this work we showed that a neural network with an explicit memory and a recurrent attention mechanism for reading the memory can be successfully trained via backpropagation on diverse tasks from question answering to language modeling. Compared to the Memory Network implementation of [9] there is no supervision of supporting facts and so our model can be used in a wider range of settings. Our model approaches the same performance of that model, and is significantly better than other baselines with the same level of supervision. On language modeling tasks, it slightly outperforms tuned RNNs and LSTMs of comparable complexity. On both tasks we can see that increasing the number of memory hops improves performance. However, there is still much to do. Our model is still unable to exactly match the performance of the memory networks trained with strong supervision, and both fail on several of the 1k QA tasks. Furthermore, smooth lookups may not scale well to the case where a larger memory is required. For these settings, we plan to explore multiscale notions of attention or hashing, as proposed in [9]

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APPENDICES

Abbreviation

RNN = Recurrent neural network

LSTM = Long short-term memory

NLP = Natural language processing

Appendix: Research Reflections

At the beginning of this research work, we had very little idea about machine learning and artificial intelligence detection and prediction. Our supervisor was very kind and sincere. He gave us valuable guidance and helped us a lot. In this whole time of research, we learned many new techniques, learned new information, learned how to use algorithms, how to work with different methods. I also learned about the Anaconda-navigator and Jupyter notebook and Python programming language. Initially, there were problems working with these, but gradually we became more and more familiar with Anaconda-navigator and Jupyter notebook and Python.

Finally, by doing the research we have gained courage and been inspired to do more in the future.

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