

Development of An e-commerce Sales Chatbot

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Abstract—This paper presents the development of an e-commerce sales chatbot in order to provide customer support and increase sales. The system uses machine learning for natural language understanding. It is developed on an modular chatbot framework. The system has several components. First, a web based natural language training platform. Second, a microservice to classify input text and extract entities. Finally, a framework which routes user request to specific controller for processing and serves the response.

Keywords— *natural language understanding; chatbot; artificial intelligence; machine learning; e-commerce; sales; customer support;*

I. INTRODUCTION

The rise of e-commerce over the past 2 decades has had a major impact on society and the way business is done on a global scale. Along with revolutionizing the retail industry this industry has many positive impacts on both the business and on consumers on a personal level. Enabling people to shop online has a monumental impact on consumers throughout the world. Users have become more relied on e-commerce than ever before in the recent years, and outlets such as Amazon is taking down giants like Walmart with absolute ease [1].

Perks include having a greater choice of goods available to them at much lower prices than they would pay in a local store due to the fact that they can shop anywhere in the world and take advantage of currency exchange rates and economic differences throughout the world.

There's one visible downside about using e-commerce as a means to sell your products could be that some customers are wary of not having direct face to face contact with a sales representative. This is particularly apparent with the older generation who are not digital natives. As an example a seasoned gardener who regularly shops in B&Q and who wants a new spade may be apprehensive about purchasing online as he can not speak to a sales representative about the product quality and the warranty on the product. The other issue that might put people off from buying online is the returns policy as there is not as much opportunity to speak with someone about returning the product. A customer may have a lot of queries for an online e-commerce store, this could only be represented as a circumpolar struggling point. A lot of e-commerce giants have taken the steps to hire customer supports who would provide live chat support. However, this is a very expensive option and since the customer traffic is

always unpredictable, it is never possible for them to serve 100% of their customers. Other attempts have been to develop and train artificial intelligence to answer basic faq questions, not highly trained and have no understanding of context, the most important part of a human conversation.

The intent of the proposed solution is to push the boundaries of natural language processing (NLP) and natural language understanding (NLU) and take them a step closer to understanding context. The biggest challenge in the NLP/NLU as of now, is to develop a chatbot that can render an experience that mimics real human sales agents, bringing together two industries, e-commerce sales and AI to create an immersive model to perform synergy.

The remaining paper is organized as follows: section II shows the related work on this field, section III explains the system description of the work presented in this paper and section IV draws the conclusion of the research and briefly discusses future plans.

II. RELATED WORK

One of the major challenges of building an automated customer support system is categorizing natural language. Several researches have been conducted on this topic. I. Androutsopoulos, G. D. Ritchie and P. Thanisch [2] have shown different methods of natural language inferences to database. They have also explained the advantages and the disadvantages. Their system did not use artificial intelligence. T Joachims [3] in his paper tried to explore the Support Vector Machines (SVMs) to categorize texts. He explained SVM performs better for text categorization because of high dimensional input space, fewer irrelevant features, sparse document vectors and the ability to linearly separate text categorization problems. George Kassabgi [4] has shown a very simple algorithmic approach to classify texts using multinomial naive bayes. He also explained a simple [5] machine learning approach using a neural network to classify texts.

Tensorflow is a great tool machine learning developed by Google. Illia Polosukhin [6] explained a text classification model by using Tensorflow. Sadia Zaman Mishu and S. M. Rafiuddin [7] have compared the performance among Naive Bayes, Multinomial Naive Bayes, Bernoulli Naive Bayes, Logistic Regression, Stochastic Gradient Descent, SVC, Linear SVC and Back Propagation Network.

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Some research were conducted on implementation of chatbot on different sectors. Supratip Ghose and Jagat Joyti Barua [8] worked on a frequently asked questions based chatbot for university students in order to provide the experience of an undergrad advisor. N T Thomas [9] implemented an e-business chatbot using Artificial Intelligence Markup Language (AIML) and Latent Semantic Analysis (LSA).

III. SYSTEM DESCRIPTION

The main focus of the project is to develop a modular chatbot architecture so that accuracy can be improved, new features can be added easily. In order to do that [10] microservice architecture was chosen. Instead of creating a larger system, several smaller components were developed which are connected with each other. It improves modularity and makes refactoring easier. The main system consists of 5 major components, Figure 1 shows the system structure.

A. NLU Engine

The Natural Language Understanding engine is one of the major parts of the system. It is a HTTP server which takes text as input and returns intent, entities and confidence about its prediction as JSON string. Figure 2 shows a sample response.

B. Recommendation Engine

The purpose of the recommendation engine is to find the products that users are more interested to purchase. The recommendation engine selects products based on what types of products users browse for, price range, user gender, previous purchase, important occasions for the user etc.

C. Adaptive Pricing Engine

The adaptive pricing engine generates real time discounts or deals for users. It collects product information from the recommendation engine, based on user interest and history, and provides discounts and deals to the user. The system is based on a fuzzy engine and rules are based on [11] a blog post written by Evan Prodromou.

D. Bot Engine

The Bot Engine is the core platform of this system. It is connected with the NLU Engine and Adaptive Pricing Engine. The bot engine receives input from users and classify user input using the NLU engine. Then using a routing engine it routes user request to specific controller which handle the request and creates a response for the user. The bot engine can also receive signals from the Recommendation Engine and Adaptive Pricing Engine, based on which it can generate response for the user.

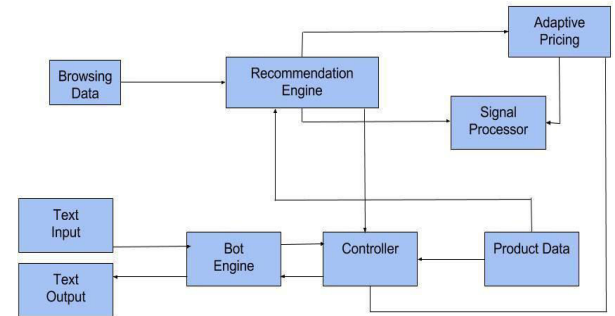


Figure 1: System architecture of the sales bot

```

{
  "text": "show me chinese restaurants",
  "intent": "restaurant_search",
  "entities": [
    {
      "start": 8,
      "end": 15,
      "value": "chinese",
      "entity": "cuisine"
    }
  ]
}

```

Figure 2: JSON response from the NLU Engine

The backbone of the bot engine is a bot framework which has 5 major components, Figure 3 shows the architecture of the bot framework.

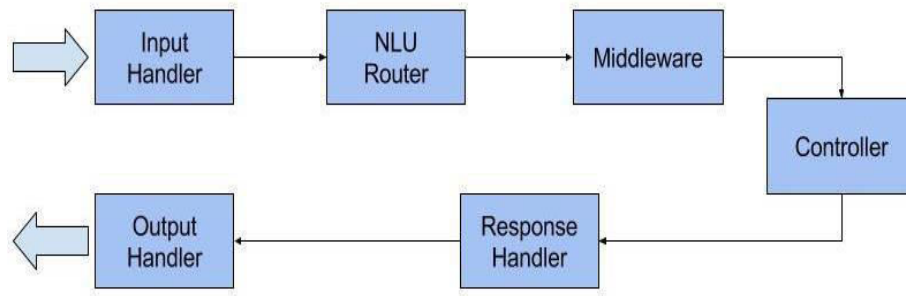


Figure 3: Architecture of the chatbot framework

A. Input Handler

The input handler receives input from multiple platforms (like facebook, slack, telegram, websocket etc.) and process it for the NLU router.

B. NLU Router

The NLU router collects user input and classifies input data using NLU Engine. Based on the classified input, it executes the controller.

C. Middleware

The middlewares are wrapper over controllers, it can prepend or append features and modify controller response.

D. Response Handler

The response handler generates response based on demographic. The controller selects response type, based on user data, user sentiment and response type the Response Handler generates the response.

E. Output Handler

Like the Input Handler, the Output Handler prepares the response data for the user platform and delivers the response.

Apart from all these platform, the system also has a visual platform to train the NLU Engine. This platform is based on Django, VueJs and MySQL. It is a single page application which serves all the frontend login and the views as a single file whenever user browses the site, it reduces server side call, improves performance and provides a smooth experience. Users can handle intents, texts, entities and entity synonyms easily using the platform. Figures 4.a and 4.b show the platform.

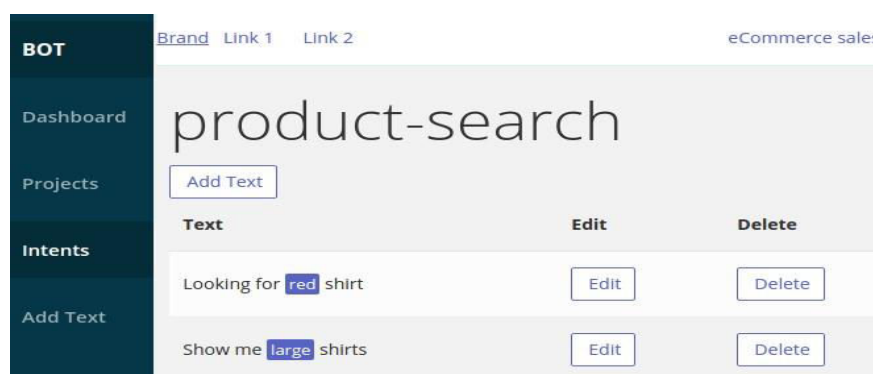


Figure 4.a: Intent text list with tagged entities

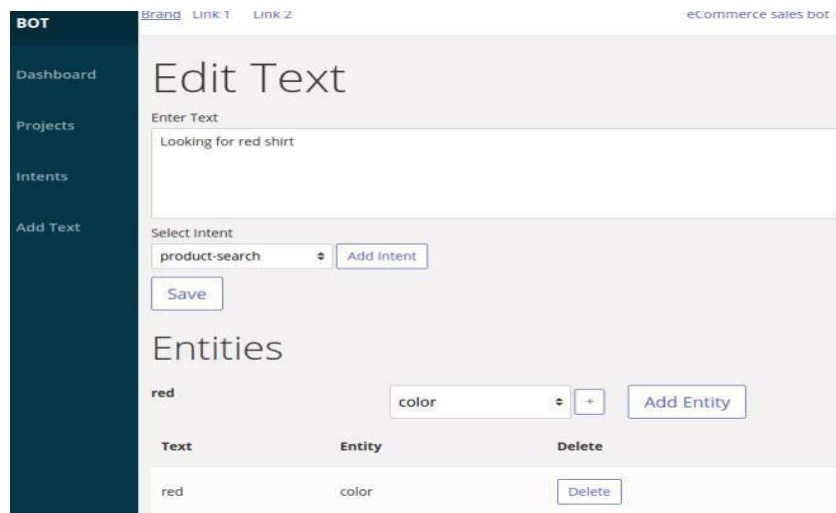


Figure 4.b:Text management with entity tagging

IV. CONCLUSION AND FUTURE IMPLEMENTATIONS

The reason for building such modular system is to make the system available to more platforms. This present NLU engine trains its classifier from the classified training data provided by the admins. Also, it is based on SVM. Artificial Neural Network can be used to improve the accuracy of the NLU Engine. Also, a semi supervised learning system can be implemented in order to increase the dataset. The platform can be made available to word press based system because 60% e-commerce websites are powered by woo commerce which is a word press plugin. Also, an integration can be developed for Shopify. This project may help improve the relationship with customers which can lead to more sales. Also, it has the potential to make customer service cheaper and more satisfying.

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