A Paw-sitive Addition to the Admissions Team?: A Georgetown University Office of Undergraduate Admissions "Jack the Bulldog" Chatbot

Jessica Cusi
Department of Linguistics
Georgetown University
`jdc286@georgetown.edu`

Zoe Chen Zhao
Graduate School of Arts and Sciences
Georgetown University
`cz355@georgetown.edu`

Abstract

"Jack the Bulldog'" is a chatbot built with Rasa for the Georgetown Undergraduate Admissions Office designed to answer commonly asked questions about admissions, the application process, and selective topics about the university. A persona, Jack the Bulldog, is incorporated into the system to make the chatbot more fun, engaging, and likable. We had 16 participants test our system, then asked them to fill out an evaluation survey. The system's overall performance was rated above a 4 (on a scale of 1-5) for 7 out of 8 questions, and the persona was rated highest for being appealing, offering a unique perspective, and making the conversation more empathetic. The chatbot can be expanded with more training data before potentially being implemented for public use by the university.

1 Introduction

Chatbots have become increasingly popular in recent years for both businesses and consumers (Yuen, 2022). They offer an additional branch of communication in many domains, such as customer service, entertainment, and education. The present project focuses on a university-domain chatbot. Although chatbots for universities may not be the most popular domain, it is not a novel idea. In particular, we have designed a chatbot for the Georgetown University Office of Undergraduate Admissions.

Deciding which college to attend is a big decision, and it is best to know as much information about the school you are applying to or planning to attend. Hence, many prospective students and their families often have questions about the application process or the university. For example, the Georgetown Undergraduate Admissions Office receives roughly 100 emails and 100 phone calls each day, with higher numbers as application deadlines approach.[1] Although the Admissions Office is staffed with full-time employees and students, there are limited working hours in which someone is available to answer questions via call or email. Especially considering that Georgetown's student population is one of the most geographically diverse in the country, representing every state and over 130 countries,[2] it may be difficult for all prospective students with questions from around the world to contact the office during working hours. Therefore, our chatbot was designed to automatically answer commonly asked questions about the undergraduate application and school so that people can ask questions anytime.

2 Related Work

2.1 Chatbots and the University Domain

Within the university chatbot domain, there are a variety of projects ranging from systems targeted for a specific course of study to questions about any part of a university. Many research papers have been published concerning university chatbots that were developed in European or Asian contexts, but

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[1] Kelvia Jaupi, Current Georgetown Undergraduate Admissions Officer

few studies have been done in America. In Vietnam, M.-T. Nguyen et al. (2021) created a chatbot for Hung Yen University of Technology and Education that focuses on the general admissions process, and T. T. Nguyen et al. (2021)'s chatbot for National Economics University allows users to get daily updates of the university's curriculum, admission for new students, tuition fees, and International English Language Testing System (IELTS) writing task II score.

Some colleges in the U.S. have already implemented chatbots. The University of North Carolina Greensboro and Northern Virginia Community College both have chatbots ("Minnie" [3] and "Ace," [4] respectively) linked to their admissions website that were made with Ocelot. [5] "Minnie" and "Ace" communicate that they specialize in the topics of admissions, financial aid, registrar questions, and student accounts. The University of Northern Colorado's "Klawz" chatbot was designed using AdmitHub (now Mainstay) [6] for the benefit of both current and prospective students. [7] For example, besides being linked to UNC's Admissions page, once a week, "Klawz" sends a message to all students about housing, campus activities, financial aid, fun facts, and even links to relevant videos. On the more specialized side, Guvindan Raju et al. (2018)'s chatbot provides information specifically for Southern Methodist University's Master's in Data Science Program. Despite these pre-existing university-domain systems, our Georgetown University Admissions Chatbot ("Jack the Bulldog") will be the first chatbot to our knowledge that is specific to Georgetown University.

2.2 Chatbot Persona

Despite scientists' efforts to design smarter chatbots, the deployment of social bots has been another focus. One of the first chatbots that has a persona is Parry, which was developed by Colby (1975). It was a rule-based chatbot designed to be a moody male clerk, and it was the first system to pass the Turing test.

Shum et al. (2018) argue that an intelligent system should not only be able to solve user problems but also establish emotional connections with people. The function of a chatbot is not limited to user task support, and people are looking for

ways to develop chatbots that are able to have a natural conversation with users. According to Shum (2018), an advanced social chatbot should have the ability to build a connection with the users, provide emotional support, and cater to users' specific needs. Some general design principles include the ability to understand users, personalization, contextualization, and integration of both intellectual and emotional quotient.

Personality traits are an important aspect to develop intelligent chatbots. Dibitonto et al. (2018) point out that anthropomorphism is an innate tendency of humans, and thus a chatbot with a personality tends to engage people in the conversation for a longer period, develop emotional connections with them, and therefore serve the users' needs better. A recent study in Australia by Shumanov et al. (2021) also found that a match between the user personality and the chatbot personality enhances the user experience of the chatbot and leads to an increase in financial outcomes for the company.

For the scope of our project, we focus only on the personality development of the chatbot and consider ways to implement the persona better in the context of university admission.

3 Approach

3.1 Data Collection

We chose to manually extract all data from the Georgetown University websites, including the undergraduate admissions page and pages that branched from the main university page. The information from these webpages was written into responses for specific user intents (this will be discussed later). There are both advantages and downsides to this approach. On one hand, the researchers could control exactly what the system, or "Jack the Bulldog" could say. Additionally, by finding specific information on a web page, the researchers could create a specific response but also offer the link to which more information could be retrieved if desired. On the other hand, manual extraction has a high cost, as it is time consuming to find specific information for a wide range of topics. This limited the range of topics and questions the system was able to answer.

3.2   Rasa Platform

To build the "Jack the Bulldog" chatbot, we used Rasa, an open-source framework that is utilized to build chat and voice-based AI assistants.[8] Rasa uses YAML for all of its training data, which includes files for the domain, natural language understanding (NLU), rules, and stories.

3.2.1 Domain

The domain file in Rasa contains the intent names, entities, and responses. Entities are specific pieces of information that Rasa could extract from a user's message, and responses are all of the system's outputs. The responses we created were specific to each user intent, which will be discussed in the next section, since they gave detailed answers and links based on what the user was asking.

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- intent: dates_regulardecision
  examples: |
   - regular decision
   - when are regular decision apps due
   - when are regular decision applications due
   - when is the deadline for regular decision
   - when is the application due
   - i'd like to know more about application deadline
   - normal application
   - when's the application deadline
   - when is the application deadline
   - i was wondering about the application
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Figure 1. Example of an intent in the NLU file

3.2.2 NLU

The NLU file contains all of the intents, which are topics of input that the user could say that have a matching response from the system. We originally drafted 47 intents with an average of about 10 intent examples for each. The intents for application questions had to be fairly specific, since they had 1:1 mappings in which there was one designated response for Jack to output for each user question. Figure 1 displays an example of the intent *dates_regulardecision*, the intent for which a user mentions anything about the deadline for the regular decision application, with the examples of ways that the user can ask this question. Besides intents based on user questions for the Admissions Office, we also had to include basic intents such as *affirm*, *deny*, *greet*, and *goodbye*, as well as ones for *fun_fact* and *bot_challenge*. We intentionally created an *out_of_domain* intent in which we listed categories and keywords or phrases that we did not

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need the system to respond to for the scope of this project.

3.2.3 Rules and Stories

The Rules and Stories files in Rasa are devoted to dialogue management. The main difference is that in Rules, only one intent and action could be used, and these paths are always followed. We made rules for scenarios such as the user challenging the chatbot, handling out of domain data, and NLU fallback. NLU Fallback is a pre-existing feature in Rasa that helps handle inputs that may belong to more than one intent. The *nlu_fallback* intent corresponds to the Fallback Classifier in the pipeline of the configuration file. If Rasa detects a confidence level of < 0.4 (chosen by the researchers), the system will ask the user to rephrase their question. This happens when the system is unable to classify the user's input as an intent confidently. A rephrase will also be requested if the ambiguity threshold is below 0.1. This occurs when the system has high confidence scores for two possible intents. We did not notice significant changes to the performance of the system when the Fallback Classifier was lowered and increased.

The majority of our dialogue management was incorporated in Stories. For each intent, we created a story that offered a response to the user's question and then asked for confirmation if the question was answered. We incorporated checkpoints that helped the conversation flow in the proper direction, based on whether or not the user was satisfied with Jack's response and the information that was presented.

3.3   Dialogue Flow

Before drafting our system, we created a Dialogue Flow diagram that maps out the conversation flow (Figure 2). After the user and Jack do their greetings, the user asks any question. Based on the words entered by the user, Rasa categorizes the input into an intent. To organize our intents, we created 11 categories that were related to topics one would find on a Georgetown University webpage, specific to the application process or the university in general: transfer students, dates, application requirements, admission statistics, international students, financial aid, housing, student life, visits, contact information, or out of domain. This helped us keep track of the user intents and what specific subtopics of each category had been accounted for.
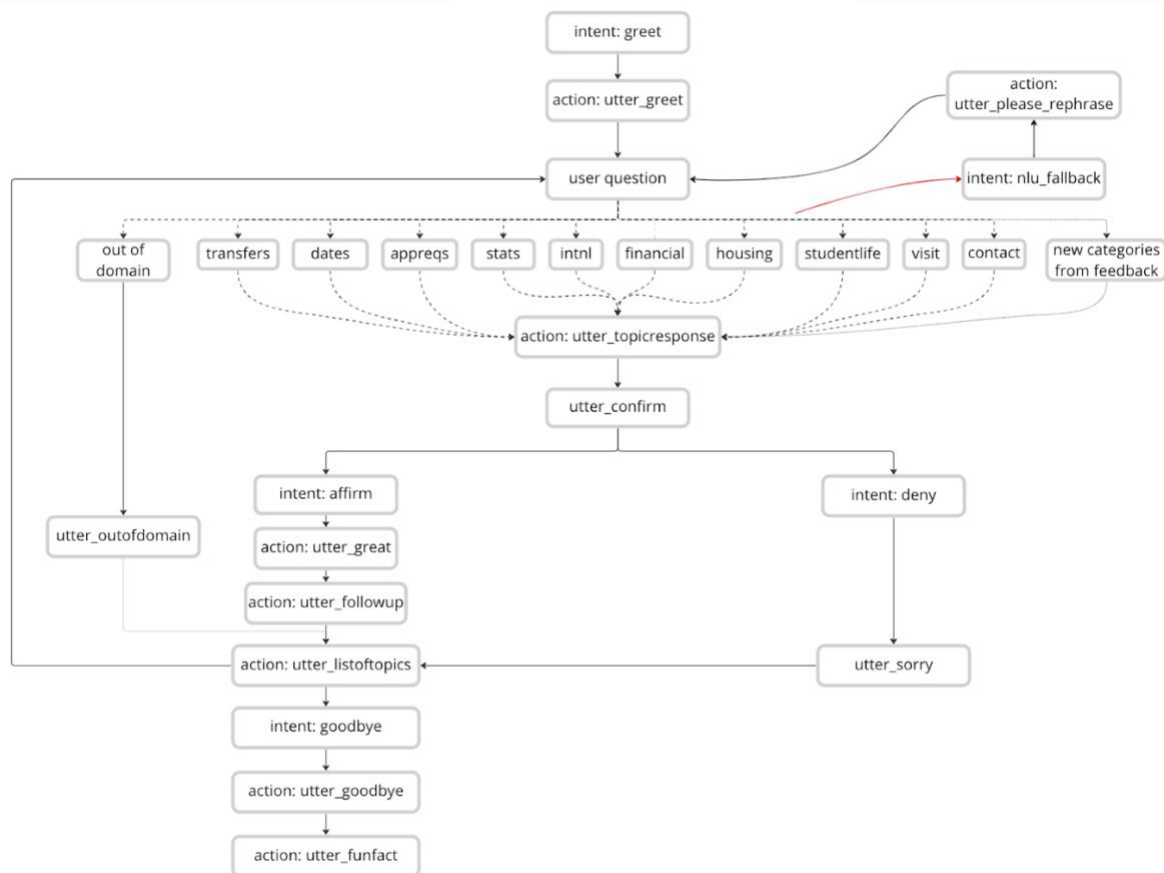

Figure 2. Dialogue Flow

Rasa selects the intent then matches it to a rule or story, in which Jack will utter the corresponding response. If the user confirms that the system did answer their question, the system allows the user to continue asking questions or end the chat. If the user says that the system did not answer their question, or if the system did not understand the user's input, the system asks the user to rephrase their question. If the attempt is still unsuccessful, Jack offers the user the Admission's Office contact information.

After doing some user evaluations, we added 9 new categories based on the feedback and rates of task success. Some of these new intents include *tuition*, *mealplans*, *transportation*, *diversity*, and *request_agent*. This resulted in a total of 56 intents.

3.4 Chatbot Persona

We chose Jack the Bulldog, Georgetown University's official mascot, as our persona. The system embodies the persona mainly through the use of language. We developed a well-rounded personality for Jack that is based on information provided by the university, as well as our own creative thoughts.[9]

He was born on January 24, 2019 and has lived in Georgetown since then. He is energetic and optimistic, and he loves sports. He is a Georgetown ambassador and always shows his passion and love toward GU to others.

Figure 3. One image of Jack that is presented to users

Jack has a unique way of saying things and it is incorporated throughout the conversation. For example, he calls the admission office "Paw-ffice" and he apologizes by saying "*I a-paw-logize*." We also tried to show his emotions and attitudes in the
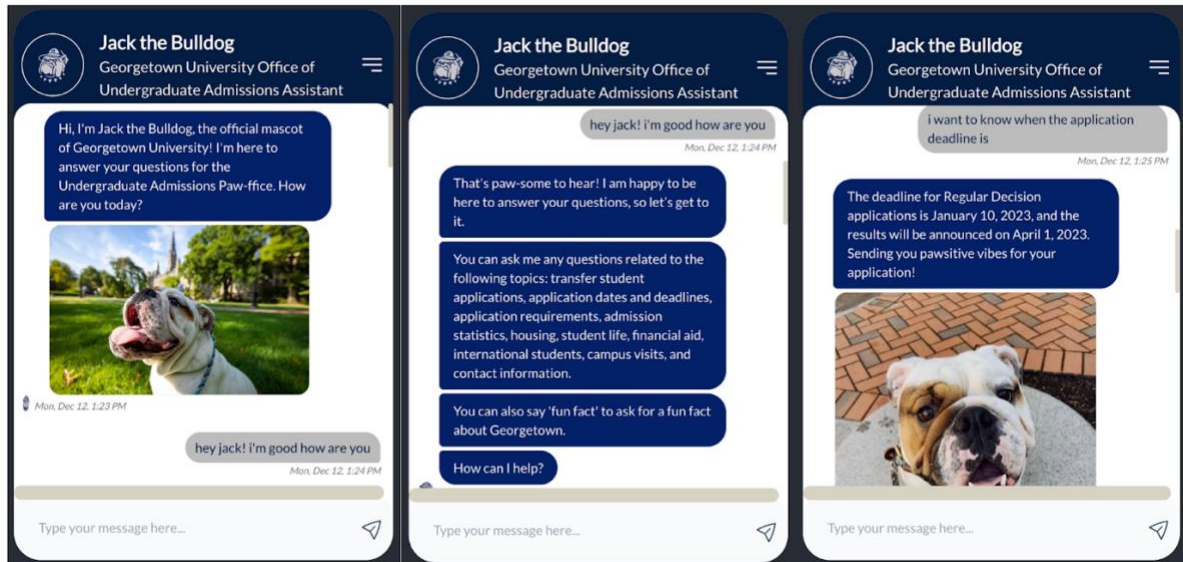

Figure 4. Example of an interaction with Jack on Widget 2.0

conversation. For example, when a student asks a question on the application, Jack would cheer the student up by saying *"Sending you pawsitive vibes for your application!"* Jack also tells a fun fact about Georgetown when he cannot answer a question, and he is willing to provide more fun facts if people ask for it. Jack shows off his selfies taken by his advocates every now and then and he can't wait to see the applicants on campus.

3.5 Rasa Widget 2.0

To interact with Jack, we modified Rasa Widget 2.0, a publicly available GitHub repository made for users to deploy their Rasa chatbots in a browser widget.[10] We matched the color scheme to match Georgetown University's visual identity.[11]

4 User Evaluation

To evaluate the system, both objective and subjective data were collected. A total of 16 participants were recruited to interact with the bot. Because our system can only run locally, the researchers had to host virtual meetings with participants who were unable to test the system in person. These meetings were hosted over Zoom, where the researcher shared her screen to allow the participants to see the chatbot widget. Each participant was directed to ask at least 3 questions related to the topics that Jack informed them about,

plus any additional questions they are interested in asking. To interact with the system, the researcher typed in whatever the participants wanted to say. The researchers offered to click any links that were a part of Jack's response so that the participant could see if the system offered the correct information.

Immediately following the interaction with the system, each participant was asked to complete a user experience survey.[12] The survey allows us to gather subjective feedback from real users on how they think the system performed and their attitudes towards the "Jack the Bulldog" persona. Statements on the system performance and the persona were provided to participants and they were asked to give a rating on a Likert Scale of 1 (strongly disagree) to 5 (strongly agree) based on their agreement to the statement. Questions on the system performance were extracted from Walker et al. (2000)'s paper and the SASSI list by Hone and Graham (2000). Questions on the persona were developed based on the paper by Dibitonto et al. (2018).

5 Results

The evaluation reveals that our system is able to perform its basic functions but still has a long way to go before implementation for public use.

Question	Avg. Score
The system was easy to understand.	4.87
The system understood what I said.	3.8
It was easy to find the information I wanted.	4.4
The pace of the interaction with the system was appropriate.	4.8
I knew what I could say to the system at each point in the dialogue.	4.67
How often was the system sluggish and slow to reply to you?	4.6
The system worked the way I expected it to in this conversation.	4.27
I like the character Jack the Bulldog.	4.87

Table 3. Survey Responses on System Performance

Question	Avg. Score
In general, I would like to see a persona incorporated into a university/admissions chatbot.	4.0
The "Jack the Bulldog" persona makes the conversation more appealing.	4.4
The "Jack the Bulldog" persona allows me to learn more about the university	3.87
The "Jack the Bulldog" persona offers a unique perspective about the university.	4.13
The "Jack the Bulldog" persona makes the conversation more empathetic and makes the application process less stressful.	4.33
I would prefer to talk to a real person (e.g., an employee from the admissions office) through the chat system rather than an automated bot.	3.27
The "Jack the Bulldog" persona makes the conversation more natural.	3.53
The "Jack the Bulldog" persona motivates me to chat with the bot.	3.87
The "Jack the Bulldog" persona makes Georgetown stand out from other universities.	3.67

Table 4. Survey Responses on Persona

For the objective evaluation, we have two sets of data: one measures the overall success rate of the system (Table 1), and the other measures the task success rate (Table 2).

# of Success	Total # of Interactions	% Success
172	212	81.10%

Table 1. Overall Success Rate of System

# of completed tasks	# of tasks	Task success rate (topic specific)
64	96	66.70%

Table 2. Task Success Rate of System

The only difference between the two measures is that for the task success rate, we excluded the confirmation, the greeting, and the farewell. After each evaluation session, we counted the number of times the bot fails to answer user questions manually.

Out of 212 utterances, the system was able to respond correctly to 172, giving a success rate of 81.10%. The success rate decreased to 66.7% when only questions from users were considered.

Table 3 displays survey responses regarding the overall system performance, and Table 4 illustrates our list of questions on the chatbot's persona and their respective scores. Out of the 9 statements we have here, people consider "*makes the conversation more appealing,*" "*makes the conversation more empathetic and makes the application process less stressful,*" and "*offers a unique perspective about the university*" as three main benefits of incorporating the persona to the chatbot. The statement *"I would prefer to talk to a real person through the chat system rather than an automated bot."* scores the lowest, which corresponds to the research finding by Dibitonto et al. (2018) that sometimes people feel more comfortable and confident talking to a bot.

6 Discussion

The evaluation results provide data and insights to improve the system and directions for future growth. We found that when users ask questions, they tend to provide additional contextual information about the topic they want to ask. This made it hard for our system to understand some of their questions. To improve our NLU, we added examples of longer conversations with contextual information (i.e., *"i already applied for georgetown, i'd like to know the decision date"*) and used entities to help the system identify the "key terms" of an intent. We also spotted some other commonly asked topics that the system could not handle and decided to add them. These include *tuition*, *mealplans*, *transportation*, *diversity*, and *request_agent*. We found that participants were particularly interested in the persona and the fun facts. To address this, we designed more dialogues for Jack and integrated his persona even further into the conversation. We also added a flow to allow users to ask for fun facts explicitly.

Our current bot still has a lot of room for improvement, especially with natural language understanding and the knowledge base of the system. Conducting user research allows us to gather user data on what questions people may ask from a university admission chatbot and how they would ask it. To improve the bot further and implement it in real life, it is constructive to have the bot learn from students' questions.

7 Conclusion

This project has the potential to be implemented by the GU Undergraduate Office of Admissions. We have identified two primary benefits of a university admissions chatbot: 1) it would reduce the work that current student and full-time employees need to do during business office hours and 2) it would serve as a live Q&A system for any questions prospective students have outside of working hours. One additional advantage to note is that this chatbot could serve as an option for anyone who prefers indirect contact with the Admissions Office, such as if they disfavor phone calls or emails.

7.1 Future Work

There are many possibilities for future work. The chatbot could be expanded to Georgetown's Graduate School of Arts and Sciences, School of Continuing Studies, Medical School, and Law School. This would expand the range of users that we expect to use the system. Instead of only high school students, the chatbot would be useful for Georgetown University applicants of any age. This dialogue system can also be developed for more specific degree programs, such as for the Computational Linguistics MS program, like Guvindan Raju et al. (2018) did for SMU's master's in data science Program.

Besides expansion, the "Jack the Bulldog" chatbot could be trained to answer questions relevant to topics outside of the application and basic university questions, such as things more relevant to a current student's daily life (e.g., library hours, the Corp location hours [13], and information about transportation). Lastly, we could incorporate more chit chat options, develop the Jack persona further, and deploy the chatbot on an app or messaging system so that it can send out relevant updates and notifications. Overall, a university-domain chatbot would be a beneficial avenue for prospective students to ask questions and learn more about a school when a person is not available in real time, and it could be an efficient tool for the Admissions Office.

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