Enhancing Post-Incarceration Support: A Custom Chatbot Solution for the Brazilian Prison System

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Abstract: This paper presents the development and implementation of a dedicated chatbot to assist former inmates of the Brazilian prison system, integrated into the ESVirtual application. This initiative addresses the multifaceted challenges faced by this vulnerable group by providing a comprehensive and sustainable approach to support their social reintegration. The proposed architecture leverages Docker Compose, Rasa NLU, Stories, and Actions, creating a robust and scalable framework capable of understanding natural language, adapting to diverse interaction scenarios, and executing customized actions. By integrating the chatbot into ESVirtual, we enhance its utility and accessibility, offering former inmates a reliable and accessible channel for obtaining information and support. The decision to manually craft the chatbot's content, rather than using generative AI, ensures the accuracy, relevance, and reliability of the provided information, allowing for quick adaptation to changes in policies, legislation, and available services. Socially, this project aims to significantly contribute to the reintegration of former inmates into society, reducing recidivism rates and fostering a more just and inclusive community. By providing essential support and resources, the chatbot empowers individuals to overcome the challenges they face after leaving the prison system and to build dignified and productive lives. This work underscores the potential of technology and innovation to promote social well-being and justice, marking a significant step towards a more humanized approach to former inmates reintegration in Brazil.

1 INTRODUCTION

In Brazil, the issue of reintegrating former inmates is a multifaceted challenge that requires a holistic and innovative approach. The transition of individuals who have served their sentences back into society is often marked by a series of obstacles, ranging from stigmatization to lack of access to employment opportunities, adequate housing, education, and healthcare (Storck, 2023; Tharshini et al., 2024). These challenges significantly contribute to the high recidivism rates in the country.

In this context, there is a need to develop effective solutions that can support former inmates in their journey of social reintegration. Among these solutions, technology plays a crucial role, providing accessible and scalable tools that can meet the diverse needs of this vulnerable group (Dores and Dores, 2019).

This project proposes the development of a chatbot dedicated exclusively to providing information and support to former inmates of the Brazilian prison system and introduced through an existing app for their assistance (Canedo et al., 2024). A chatbot is an artificial intelligence application designed to simulate human conversations, offering automatic and interactive responses to users' questions and requests (Al Husaeni et al., 2024).

By using a chatbot, it is expected to offer former inmates a reliable source of information and guidance, available at any time and place through mobile devices or computers connected to the internet. This is particularly relevant given the difficulties former inmates face in accessing traditional support and counseling services, often limited by geographical, financial, or social stigma barriers (Benard et al., 2023).

The proposed chatbot will provide a variety of resources and functionalities, including guidance on their legal rights, information on reintegration programs, access to employment and education opportunities, emotional support, and connection to rele-

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vant social services. By offering this comprehensive support, the chatbot aims to empower former inmates, helping them overcome the challenges they face during the reintegration process. It is believed that by promoting autonomy, confidence, and access to essential resources, the chatbot can help its users to reintegrate themselves into society and reduce recidivism.

2 BACKGROUND

2.1 ESVirtual

In 2021, the CNJ launched the Social Office Virtual (ESVirtual) app (UNDP, 2024), which aims to expand the reach and enhance the availability of services for individuals reintegrating from the prison system. It complements the in-person assistance provided at Social Offices, which are present in 17 states, and the psychosocial services offered prior to release, especially during the Covid-19 pandemic (Cançado et al., 2022). The app uses georeferencing to help users locate social public service facilities, including healthcare units, social services, shelters, community restaurants, legal aid centers, and civil documentation offices (Portal CNJ, 2022).

The app is also integrated with the Unified Electronic Execution System (SEEU), allowing former inmates and their families to track the progress of their sentences quickly and easily through the app (Portal CNJ, 2022). Additionally, it offers free courses in various fields of knowledge and content specifically focused on job and income generation. Beyond its diverse range of services, the app aims to boost the implementation of physical Social Offices, which are currently established in over 20 municipalities across the country. The Social Office Virtual app is available for both Android and iOS devices (PlayStore, 2024) and its interface is shown in Figure 1.

2.2 Chatbot

A chatbot is an artificial intelligence (AI) software designed to simulate human-like conversation with users through text or voice interactions (Al Husaeni et al., 2024; Silva and Canedo, 2024; Gonçalves et al., 2024). Chatbots are increasingly popular due to their ability to provide instant responses, handle multiple queries simultaneously, and operate 24/7, thereby enhancing user experience and operational efficiency (Misischia et al., 2022). There are two primary types of chatbots: generative and retrieval-based (Pandey and Sharma, 2023).

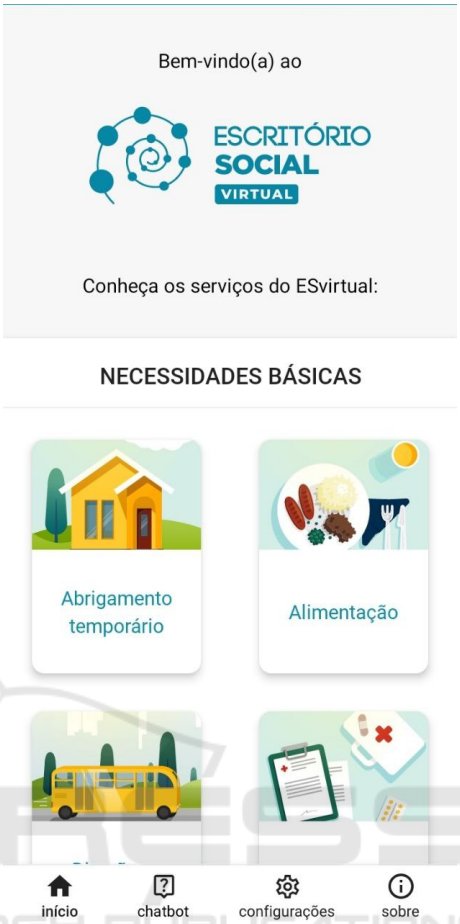

Figure 1: ESVirtual app.

Generative chatbots use machine learning algorithms, particularly neural networks, to generate responses in real-time (Pandey and Sharma, 2023). These chatbots are capable of producing more flexible and varied responses as they do not rely on predefined scripts. However, they require extensive training data and computational power, and their responses can sometimes be unpredictable or less accurate.

Retrieval-based chatbots, on the other hand, operate by selecting the most appropriate response from a set of predefined replies (Bachtiar et al.,). They leverage machine learning models to match user queries with the best possible answers from a database. While they may lack the flexibility of generative models, retrieval-based chatbots are generally more reliable and easier to control, making them suitable for many practical applications.

One of the most widely used frameworks for building retrieval-based chatbots is Rasa. Rasa is an open-source framework that provides tools for developing and managing conversational AI applications (Joshi and Sharma, 2020). It supports both intent

recognition and entity extraction, enabling developers to create sophisticated dialogue systems. The choice of Rasa can be justified by its robust architecture, active community support, and the flexibility it offers in customizing and deploying chatbots (Dagkoulis and Moussiades, 2022). Additionally, Rasa's ability to integrate with various messaging platforms and APIs makes it a versatile choice for building chatbots tailored to specific business needs.

2.3 Related Work

Brazil has seen a growing interest in the development of chatbots aimed at addressing various social issues, particularly in health, education, and community engagement. These initiatives leverage artificial intelligence and natural language processing to facilitate communication and provide essential services to diverse populations.

In response to the COVID-19 pandemic, a chatbot was developed by a large telehealth service in Brazil to assist with screening and monitoring (Chagas et al., 2023). This chatbot provided users with evidence-based information regarding COVID-19 symptoms and facilitated web-based assessments of symptom severity. Evaluations conducted through a mixed-methods approach highlighted the usability of the chatbot, revealing strengths and areas for improvement based on user feedback. This initiative showcased the potential of chatbots to deliver timely health information and support public health efforts during a crisis. Key challenges included ensuring the chatbot provided accurate, up-to-date information and creating a user-friendly interface for a wide range of users. Adapting the chatbot to the Portuguese language and cultural context was likely crucial for its success.

Another significant project is the Amanda Selfie chatbot (Massa et al., 2023), designed specifically to create demand for pre-exposure prophylaxis (PrEP) among adolescent men who have sex with men (AMSM) and transgender women in Brazil. Developed through a participatory process that included input from the target demographic, Amanda Selfie functions as a virtual peer educator. The chatbot's design reflects cultural sensitivity, as it embodies a Black transgender woman, making it relatable to its audience. The development process spanned 21 months and involved rigorous testing to assess acceptability, functionality, and usability. The results indicated that Amanda effectively increased awareness and demand for PrEP services among adolescents, illustrating the power of targeted digital interventions in public health.

The work of (Tueiv and Schmitz, 2023) focused on optimizing the value delivered by Chatbots, a crucial tool in the digitalization of government services. By applying the Incremental Funding Method (IFM) alongside the Analytic Hierarchy Process (AHP) technique, the study developed a method tailored to the unique characteristics of Chatbot and Machine Learning projects. The approach demonstrated that, using a customized optimization delivery sequencing method, Chatbot-enabled services, such as those implemented in the Institute of Social Security and Pension of Brazil (INSS) application, couldcan enhance the efficiency and effectiveness of government services. This research highlights the significant role of Chatbots in advancing digital inclusion and accelerating the transformation of government services to better serve citizens.

IAraBot is an architectural model and proactive chatbot developed to detect misinformation in real-time on WhatsApp and Telegram in Brazil (Cacabro et al., 2023). The chatbot aims to provide media education and help users critically evaluate content. Key challenges include accurately identifying misinformation, providing relevant examples and explanations in Portuguese, and encouraging users to develop critical thinking skills. Adapting the chatbot's language and approach to different age groups and education levels is also important.

The work of (Andrade et al., 2020b) presents a novel approach to enhancing user support for the EV.G platform through the development of a specialized chatbot. This chatbot is designed to handle frequently asked questions and reduce the burden on human support staff by utilizing an architecture that adapts to new information and user requests. Leveraging open-source tools customized for EV.G's needs, the chatbot, named Eva, aims to improve service quality by providing rapid responses, which is crucial for customer satisfaction. Notably, EvaTalk is tasked with understanding and processing Portuguese written text, including its variations and informal usage such as shortcuts, misspellings, and acronyms often encountered in online communication. These challenges are underscored by the need for the chatbot to handle the diverse linguistic expressions used by users, which deviates from standard Portuguese and impacts the coherence of interactions. Despite its capabilities in managing repetitive queries, EvaTalk's effectiveness is contingent on addressing these language complexities and ensuring that more intricate issues are escalated to human support.

These examples highlight the innovative use of chatbots in Brazil for social purposes, demonstrating their potential to enhance communication, promote health awareness, and improve access to essen-

tial services. Developing chatbots for Portuguese involves overcoming a range of challenges due to the language's diverse dialects, regional variations, and cultural nuances (D'Ávila, 2018). Portuguese is spoken across multiple countries, each with distinct vocabularies and idiomatic expressions, making it difficult for chatbots to universally understand and generate appropriate responses. These challenges are compounded by varying cultural expectations; for instance, among Brazilian users and Portuguese users (Thomé-Williams, 2004). Still, language-specialized models have a tendency to perform worse than multilingual models (Shaitarova et al., 2023).

Additionally, the grammatical complexities of Portuguese, such as gendered nouns and intricate verb conjugations (Wilkens et al., 2024), pose significant hurdles for chatbots in accurately interpreting and responding to user inputs. The scarcity of high-quality, annotated datasets for Portuguese further hampers the development of robust natural language processing models (Trajano et al., 2023). Most existing chatbot frameworks and AI tools are designed primarily for English (Liang et al., 2023), requiring developers to invest extra time and resources to adapt these tools for Portuguese. This adaptation process can increase development costs and extend deployment timelines, complicating the creation of effective chatbot solutions.

3 CHATBOT PROPOSAL

This section presents the chatbot proposal, outlining the key requirements and the proposed architecture designed to meet these needs. It details the specific functional and technical requirements that the chatbot must fulfill. Following this, it presents the proposed architecture, which includes a robust framework and technology stack intended to support these requirements efficiently. This section will provide a comprehensive overview of how the proposed design aligns with the objectives and operational demands, ensuring a seamless and effective implementation of the chatbot.

3.1 Requirements

The project proposes an innovative and comprehensive solution to address the challenges faced by former inmates in Brazil by integrating a dedicated chatbot into the ESVirtual application (Canedo et al., 2024). ESVirtual is already recognized as a robust platform aimed at providing support and resources for people in vulnerable situations, and the inclusion of a specialized chatbot will further expand its utility and effectiveness in supporting former inmates.

To ensure accessibility and flexibility in implementation, the chatbot will be developed using a free open-source framework. This strategic choice will not only reduce costs but also allow for smoother integration with the existing ESVirtual app infrastructure. Moreover, utilizing an open-source framework offers the advantage of an active developer community and constantly evolving resources, ensuring the continuous maintenance and improvement of the chatbot over time.

The chatbot's scope will be comprehensive, addressing a variety of crucial topics for former inmates. This will include information and guidance on shelter, food, access to healthcare services, ways to contact support organizations, available benefits (such as social programs and financial assistance), professional training opportunities, and legal assistance. By offering support in a wide range of areas, the chatbot aims to meet the diverse needs of former inmates, providing them with tangible resources to help them reintegrate into society.

A distinctive aspect of this project is the decision not to use generative artificial intelligence to generate responses. Instead, the chatbot's responses will be crafted and managed by the project team. This approach was adopted to ensure the accuracy, relevance, and consistency of the information provided, as well as to enable quick responses to changes in policies, legislation, or services available to former inmates. Although this requires additional effort from the team, we believe it is crucial to ensure the quality and reliability of the service offered.

3.2 Architecture

The proposed architecture for the chatbot integrated with the ESVirtual application is designed to be modular, scalable, and easy to maintain. To achieve these goals, we opted to use Docker Compose, a tool that simplifies and standardizes the definition and execution of multi-container Docker applications. There will be containers for Rasa and the Action Server. The full architecture is presented in Figure 2.

Docker Compose is a tool that allows for the easy and consistent definition and execution of multi-container Docker applications. It uses a YAML file to configure the application's services and dependencies, ensuring that the development environment is replicable and consistent across different machines. This simplifies the installation, update, and maintenance of the chatbot, while also allowing for more efficient scalability by adding or removing containers

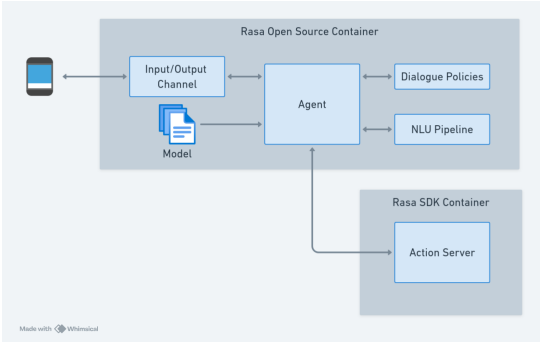

Figure 2: Architecture of the proposed chatbot.

as needed.

Rasa is an open-source framework for building chatbots based on machine learning and natural language processing (NLP). It enables the development of highly customized chatbots capable of understanding and responding to questions contextually. The Rasa chatbot will be the core of our solution, providing interaction and response capabilities to users. Rasa allows for the creation of machine learning models specifically trained for the chatbot's context, ensuring that responses are relevant and accurate. Additionally, Rasa supports the implementation of complex conversation flows, allowing for a more natural and intuitive interaction with users.

The Action Server is a component of Rasa that allows for the integration of custom actions into the chatbot. It will be responsible for executing specific actions, such as performing complex operations that cannot be directly handled by the chatbot. The Action Server will be crucial for extending the chatbot's capabilities and providing more sophisticated and personalized responses to users.

These components, when combined using Docker Compose, form a cohesive and scalable architecture for the chatbot integrated with the ESVirtual application. The use of Docker containers ensures that the development environment is consistent and easily reproducible across different machines, while the use of Rasa and the Action Server provides the flexibility and customization capabilities needed to meet the specific demands of users. This modular approach facilitates the update and maintenance of individual components without affecting the entire system, promoting greater operational efficiency and the ability to adapt the chatbot to new needs and challenges.

Although there was a choice of not adding additional components for data tracking, as seen in (Andrade et al., 2020a), the architecture is flexible enough to be incremented in the future. This choice was due to privacy concerns of storing user data, which may be sensitive since users are free to send any message. Therefore, data is only in memory during the course of conversation, and it is not persisted after the conversation is over.

4 RESULTS

This section presents the results of the chatbot development, emphasizing both its content and interface. It details how the chatbot's responses have been refined for relevance and engagement, and how the interface has been designed to ensure user-friendliness. Additionally, we will discuss the challenges encountered in evolving the chatbot, including maintaining performance while integrating new features and adapting to content changes.

4.1 Knowledge Base

To ensure that the chatbot provides accurate and relevant responses to users, it is essential to supply it with appropriate content and train it to understand and adequately respond to user queries. This is achieved through the use of Rasa NLU (Natural Language Understanding), Stories, and Actions, which together form the core intelligence of the chatbot. Below, we detail each of these components and how they contribute to the chatbot content feeding process.

Rasa NLU is responsible for understanding the intents and entities in user messages. It utilizes advanced natural language processing (NLP) techniques to extract relevant information from messages and map them to the intents and entities defined in the chatbot model. To feed Rasa NLU with content, it is necessary to provide examples of user messages along with the associated intents and entities. These examples are used to train the Rasa NLU model, enabling it to recognize similar patterns and contexts in future messages.

Stories are representations of dialogues between the user and the chatbot. They describe sequences of interactions between the user and the chatbot, including user messages, actions performed by the chatbot in response to these messages, and the conditions for transitioning between different dialogue states. Stories are used to train the chatbot's conversation model, allowing it to learn to follow specific conversation flows and make appropriate decisions based on the context of the interaction. To feed the chatbot with content, it is necessary to create and provide a variety of stories that cover different conversation scenarios and relevant use cases for users.

Actions are the tasks that the chatbot can perform in response to user messages. These may include

sending a text message, asking a follow-up question, calling an external API to retrieve additional information, among others. Actions are defined and implemented by the developer and are triggered based on the decisions made by the chatbot's conversation model during user interaction. To feed the chatbot with content, it is necessary to define and implement the actions required to respond to the different user intents and achieve the chatbot's objectives.

By feeding the chatbot content using Rasa NLU, Stories, and Actions, we ensure that the chatbot can understand and adequately respond to user queries, providing a natural and effective conversational experience. The chatbot's design ensures it covers a comprehensive range of topics relevant to the needs of former inmates, providing them with a reliable and accessible source of information and support. Below, we outline the main topics covered by the chatbot:

1. General Interactions
   (a) Greeting and Farewell: The chatbot can initiate conversations, greet users, and bid them farewell.
   (b) Affirmations and Negations: It handles user affirmations and negations, ensuring smooth interaction flow.
   (c) Bot Challenges: Users can verify the chatbot's identity and capabilities.
2. Legal and Documentation Support
   (a) Fine Penalties: Information on penalties and fines.
   (b) Document Regularization: Assistance with regularizing various personal documents, including birth certificates, voter registration, CPF, CTPS, and military service certificates.
   (c) Legal Assistance: Guidance on obtaining legal support, including assistance from public defenders and legal assistants.
3. Employment and Professional Development
   (a) Job Opportunities: Information on finding job opportunities.
   (b) Professional Training: Details on obtaining scholarships for courses, finding vocational courses, and the requirements and documentation needed for these courses.
4. Housing and Shelter
   (a) Temporary Housing: Information on temporary shelters, including locations, availability, operating hours, and acceptance policies.
   (b) Social Housing Programs: Assistance with social housing programs, rental subsidies, and related services.
5. Health and Welfare
   (a) Public Health System: Access to information about the public health system, including how to obtain a SUS card, schedule appointments, and find medical establishments.
   (b) Psychological Support: Access to psychological support services for former inmates and their families.
6. Food and Nutrition
   (a) Food Assistance: Information on finding food, community restaurants, and food cards.
   (b) Basic Food Supplies: Guidance on obtaining basic food supplies.
7. Community and Social Support
   (a) Support Services: Information about CRAS, CREAS, and Centro Pop services.
   (b) Connecting with Other Former Inmates: Facilitating contact and support networks among former inmates.
8. Children and Family
   (a) Childcare and School Enrollment: Assistance with enrolling children in school and accessing childcare services.
   (b) Parental Support: Support for parenting and custody issues.
9. Social Programs and Benefits
   (a) Social Benefits: Information on various social programs like BPC, PBF, social electricity tariffs, and reclusion assistance.
   (b) Eligibility and Registration: Guidance on eligibility and registration for social programs and subsidies.
10. Miscellaneous Support
    (a) Transportation and Mobility: Information on transportation options and mobility assistance.
    (b) Leisure and Recreation: Details on accessing free leisure and recreational activities.
    (c) Emergency Assistance: Support for emergencies, including drug addiction help and domestic violence reporting.

A significant number of intents needed to be integrated into the chatbot to meet the requirements of social offices. We examined the progression of training examples and their impact on intent prediction confidence across multiple releases of the model. Figure 3 illustrates the number of training examples used in each release. This visual representation highlights the increasing volume of data incorporated into the training process, driven by the high volume of intents required.

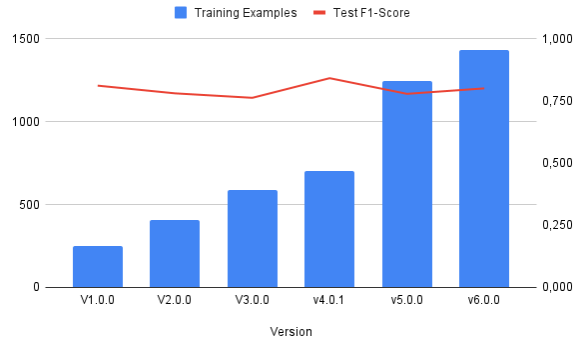

Figure 3: Number of training examples per release.

To assess the model's performance, we analyzed the distribution of intent prediction confidence at different stages of development. Figure 4 shows the confidence distribution for the first release. The initial distribution reveals insights into the model's baseline performance and the areas needing further refinement.

As the model evolved, the intent prediction confidence distribution showed some stability, despite the subtle increase in data volume depicted in Figure 3. Maintaining this stability was a challenge. It required constant updates to the pipeline to accommodate the incoming new data. This stability was not coincidental but rather the result of continuous adjustments to the pipeline, including modifications to the base training model and its hyperparameters.

Furthermore, with the large volume of intents, it became necessary to progressively reduce the fallback threshold. This threshold determines when the chatbot will return an "I didn't understand" response. Lowering it helped improve the chatbot's ability to handle the increasing number of intents accurately. Figure 5 presents the confidence distribution for the last release, showcasing the improvements achieved through these ongoing adjustments. Although the adjustments helped in the keeping the confidence ratings acceptable, the high volume of intents to predict still resulted in some decrease in performance, which was expected.

The evolution of the pipeline for the chatbot reflects the growing sophistication in handling the nuances of the Portuguese language and improving overall performance. Each iteration of the pipeline has introduced advancements aimed at enhancing both language understanding and user interaction quality. Here's a closer look at the progression and the reasons behind these changes:

The initial pipeline was quite basic, relying heavily on traditional NLP techniques, with Rasa's default tokenizers, featurizers, classifiers and response selector. The second pipeline made significant strides

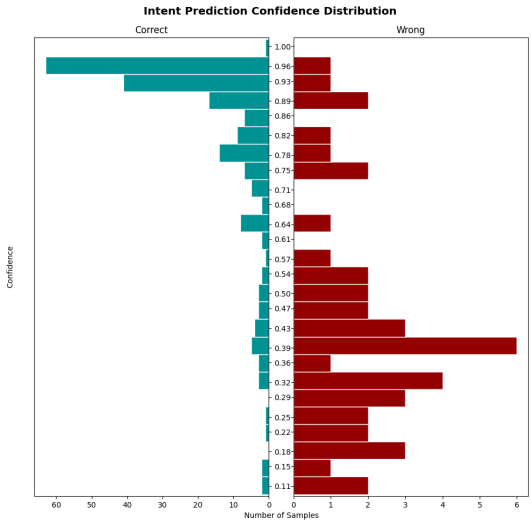

Figure 4: Intent prediction confidence distribution for the first release.

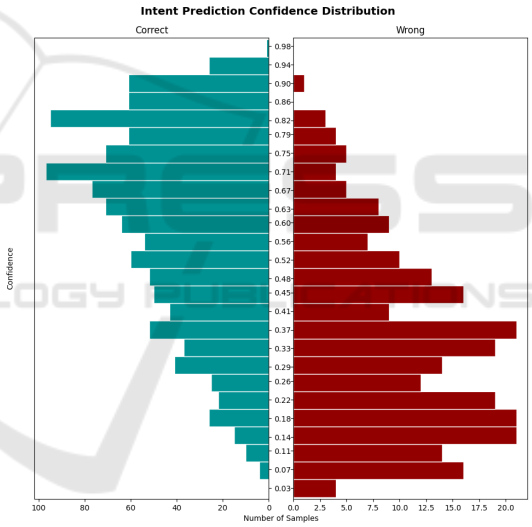

Figure 5: Intent prediction confidence distribution for the last release.

in handling the Portuguese language more effectively by integrating specialized tools and feature extraction techniques using spaCy's robust NLP tools, such as SpacyNLP and SpacyTokenizer.

Introducing spaCy's portuguese NLP model (pt_core_news_sm) and tokenizer enhanced the pipeline's ability to handle Portuguese text more effectively, thanks to spaCy's pretrained language models and more sophisticated tokenization. Later, the spaCy model was changed to the medium-sized model (pt_core_news_md) for better performance but longer training duration. Additionaly, adding the RegexEntityExtractor allowed for the extraction of

named entities based on regular expressions, improving the model's ability to recognize specific terms and entities in Portuguese through regex patterns and the list of works provided in the custom lookup table.

The third pipeline represents a more advanced and modern approach to building a Portuguese chatbot. The RegexEntityExtractor was updated to be case-insensitive, improving its flexibility and accuracy in identifying entities regardless of case variations. The third pipeline's use of advanced models like BERT highlights a shift towards leveraging deep learning for more nuanced language understanding and contextually appropriate responses. This version also reflects a greater emphasis on improving entity recognition and feature extraction capabilities, which are crucial for handling the complexities of Portuguese.

4.2 Custom Actions

In the realm of conversational AI, custom actions are pivotal in extending the capabilities of chatbots beyond predefined responses and static dialogues. These actions enable chatbots to perform complex tasks, interact with external APIs, and provide personalized user experiences. By leveraging custom actions, developers can tailor chatbot functionalities to meet specific user needs and integrate seamlessly with existing workflows and systems.

In the context of the ESVirtual application, custom actions play a crucial role in enhancing user interaction, ensuring that the chatbot can deliver accurate information and handle nuanced queries effectively. This section delves into the development of two such custom actions, highlighting their design and implementation to bolster the ESVirtual chatbot's performance and user satisfaction.

The ActionPhoneNumber custom action was developed to enhance the ESVirtual chatbot's ability to provide users with relevant contact information for various essential services. This action is triggered when a user requests a phone number for a specific entity, such as emergency services or public institutions. The ActionPhoneNumber class, extending the Action class from rasa_sdk, is designed to retrieve and deliver phone numbers based on user queries. The action operates as follows:

1. Entity Extraction: It extracts the entity (e.g., "SAMU", "Polícia Militar") from the user's message using the tracker.get_slot("entidade_telefone") method.
2. Phone Number Retrieval: It calls the obter_telefone method, which contains a predefined dictionary of service phone numbers, to fetch the appropriate contact number for the given entity.
3. Response Generation: If a valid phone number is found, the action constructs a response message with the phone number. For certain entities like "SAMU" and "Disque Saúde," the response includes additional information about health services. For "Defensoria Pública," the message provides further details about legal assistance services. If the phone number is not found, the action prompts the user to try again with a different keyword.
4. Message Dispatch: The response is then sent to the user using the dispatcher.utter_message(text=response) method.

This design ensures that users receive precise and helpful information promptly, improving the overall utility and responsiveness of the chatbot.

The ActionFallbackWithSuggestions custom action addresses scenarios where the chatbot fails to understand the user's input. By offering alternative suggestions, this action aims to guide the user towards more recognizable queries, enhancing user experience and interaction efficiency. The ActionFallbackWithSuggestions class, also extending the Action class from rasa_sdk, operates as follows:

1. Intent Ranking Retrieval: It accesses the ranking of the latest message's intents using tracker.latest_message['intent_ranking'].
2. Top Intent Selection: It selects the top three intents (excluding the fallback intent itself) for suggesting to the user.
3. Intent Mapping: It loads a mapping of intent names to their display names from a CSV file using the load_intent_mapping method. This ensures that the suggestions are user-friendly and easily understandable.
4. Button Generation: For each of the top intents, it constructs a button with a title (display name) and a payload (intent name).
5. Fallback Message Dispatch: The action sends a fallback message to the user, including the generated buttons, using the dispatcher.utter_message(text=message, buttons=buttons) method. This message encourages the user to rephrase their query or select one of the suggested options.
6. Utterance Reversion: It reverts the user's utterance to maintain the conversation flow, ensuring that the chatbot remains responsive and helpful.

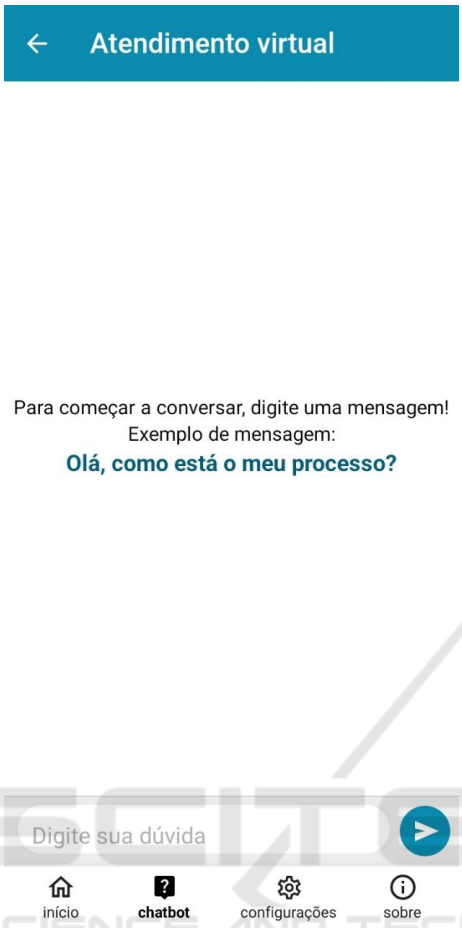

Figure 6: Initial presentation of the chatbot section in the ESVirtual app.

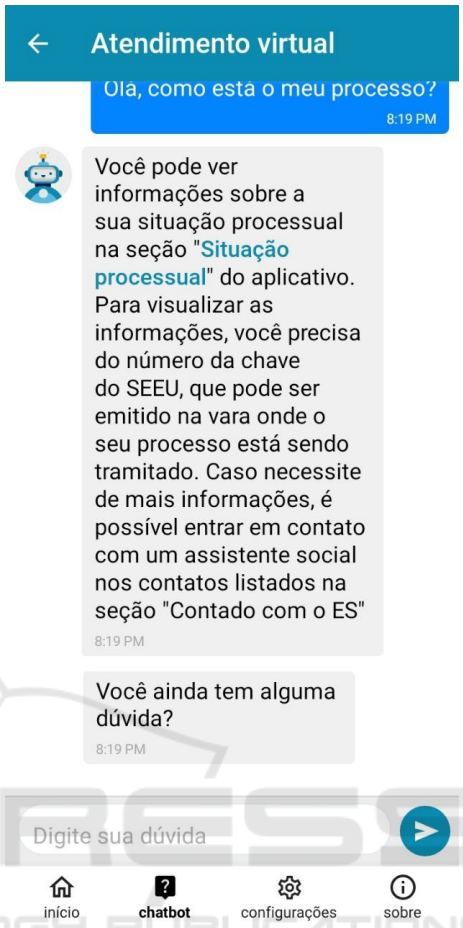

Figure 7: Message exchange with the chatbot.

By incorporating these mechanisms, the ActionFallbackWithSuggestions custom action significantly enhances the chatbot's ability to handle misunderstandings and guide users effectively, thereby improving the overall conversational experience.

4.3 User Interface

As shown in Figure 2, the chatbot was developed as a standalone service to facilitate easy maintenance and evolution. It was made accessible to the ESVirtual app via a REST API, ensuring that the chatbot interface remained entirely separate from the question-answer processing. Figures 6 and 7 illustrate the sections of the app where the chatbot is available.

Although the service and interface were modularized, certain details needed to be synchronized for a successful integration. For example, some keywords in the chatbot responses were used to redirect users to the corresponding help pages for additional information. This was necessary because some topics were too extensive to be fully addressed in a chatbot message.

Due to the limitations of mobile screen size, we faced the challenge of balancing the amount of information in the chatbot responses to avoid excessive scrolling, which could confuse users or cause them to overlook previous interactions. This required careful content curation and UX writing to ensure that information was presented clearly and concisely.

5 CONCLUSION

The development and implementation of a chatbot dedicated to assisting former inmates of the Brazilian prison system, integrated with the ESVirtual application, represents a crucial initiative in the search for innovative solutions to the challenges faced by this vulnerable group. Throughout this project, we explored a comprehensive and sustainable approach to providing support and resources to former inmates, considering technical, functional, and ethical aspects.

The proposed architecture, based on the use of Docker Compose, Rasa NLU, Stories, and Actions, offers a solid and scalable framework for the chatbot, ensuring its ability to understand natural language, adapt to different interaction scenarios, and execute customized actions. Integrating the chatbot with the ESVirtual application further enhances its utility and accessibility, providing former inmates with a reliable and accessible channel to obtain information and support on their journey to social reintegration.

The decision not to use generative artificial intelligence to generate responses, opting instead to manually craft the chatbot's content, demonstrates our commitment to the accuracy, relevance, and reliability of the information provided to users. This allows for a quick response to changes in policies, legislation, or services available to former inmates, ensuring that the chatbot remains effective and useful over time.

On a social level, the implementation of this project has the potential to significantly contribute to the reintegration of former inmates into society, reducing recidivism rates and promoting the building of a more just and inclusive society. By providing essential support and resources to former inmates, we empower these individuals to overcome the challenges they face after leaving the prison system and to build a dignified and productive life.

In summary, this work represents an important step towards a more humanized and effective approach to dealing with the reintegration of former inmates of the Brazilian prison system, demonstrating the power of technology and innovation to promote social well-being and justice.

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