IRMA: Intelligent Referral Matching Assistant for Social Good

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ACM Reference Format:
Srinidhi Nandakumar[1,2], Chris A. Mattmann[1,2], Nithin Krishna Ottilingam[1,2], Maribel Marin[1], Amy Latzer[1], Umesh Handore[1]. 2018. IRMA: Intelligent Referral Matching Assistant for Social Good . In *Proceedings of Grace Hopper Celebration (GHC 2018).* ACM, New York, NY, USA, 2 pages. https://doi.org/10.475/123_4

1 INTRODUCTION

The Information and Referral Federation of Los Angeles County (211 LA County) is a non profit organization providing information and referral services to connect people in need of services, e.g., food programs, homelessness, veterans assistance, etc., to the agencies that can help them most effectively and efficiently within LA County and beyond. Users connect with 211 LA County via a variety of mediums, including the phone, e-mail, text messaging, the web, and more recently via messaging services like Facebook, Twitter and other social media. There has been an increasing demand and strain on 211 to deal with users who communicate via messaging applications provided by these social media services - in particular users asking for services and help via the Facebook messaging platform has seen a particular increase in requests.

Keeping in line with the latest trends in information technology - as 211 LA County has a long history of - there is a promising application of modern machine learning, artificial intelligence, and natural language processing that we have been investigating as part of our work. Chatbots - or intelligent assistants - are increasingly being created to help augment capacity and to assist in complex and routine tasks that otherwise put a resource strain on humans to fulfill.

We introduce IRMA: Intelligent Referral Matching Assistant built using Facebook Messenger for social good. The chatbot implements 211's state of the art industry standard taxonomy model that provides three referrals for different services including housing, food, utility and senior needs. IRMA collects basic user information and preferred geo location and uses these features. In this paper we describe the motivation for IRMA, its implementation, and follow by pointing to current results and future work in the area.

GHC 2018, February 2018, Houston, TX USA

ACM ISBN 123-4567-24-567/08/06…$15.00
https://doi.org/10.475/123_4

2 PROBLEM AND MOTIVATION

Apart from the exceptional call referral service provided by 211 LA County, the agency also has a wide social media base. People frequently write to them through Facebook requesting help and assistance for certain services. A 211 Los Angeles County employee - typically a Community Resource Advisor (CRA) who answers the phones and provides direct care - is the best person to respond to these requests. However, this puts an undue workload on already occupied CRAs and their phone duties. To deal with this, we developed IRMA - or Intelligent Referral Matching Assistant. Users can now actively receive help, phone numbers, information, and direct referrals to services and sites that may provide them housing; counseling; veterans help, etc. in a timely fashion as if they were talking to a CRA. IRMA was trained using call center data from over a year of calls based on CRA referrals and incoming contacts [1].

3 APPROACH

IRMA is built using Facebook messenger and `wit.ai` to support natural language understanding. A user can begin a conversation with a greeting (`hi, hello, hey`) and will be prompted to browse from currently available services. The user can make a selection, answer two or three survey questions and proceed to get referrals. Post this stage, the user is prompted to share their preferred location where they seek these services. The user is then provided with three relevant referrals with options to contact the service providers, call 211 and share the referral via multiple means. 211 LA County's Resource Administrators maintain a database of referrals for different services that are classified under 211's industry standard taxonomy that has been developed over the last 20 years. The goal of the search application programming interface (API) is to provide direct and easy access to the thousands of sites and site details stored in the resource database. The search API can be called by registering with `https://my.211la.org/user/register` which opens up several features to filter our search and get curated results. This search generates a friendly URL which allows keyword search and taxonomy service code based search. This search API is used to make calls from the chatbot to receive referrals to services active on the interface.

211's Taxonomy is a hierarchy of thousands of social services. Each taxonomy has a service code that opens up access to curated results. The Facebook Messenger Chatbot is built on this model which makes best use of 211 Los Angeles County's taxonomies to provide the user referrals for services. The taxonomy model builds a tree with 591 taxonomies. When the user's choice of service

and preferred location is received, relevant taxonomies and their service codes are fetched by searching the tree. The user's latitude and longitude is extracted from their geolocation. This is then gecoded to fetch a zipcode. The service code, zipcode and radius of search (set to 15 miles) is sent as parameters to the search API. The API returns a JSON containing referrals, from which top three are picked and provided to the user.

Facebook released it's messenger API for developers to build chatbots in 2016. Since then, the messenger platform has evolved to accommodate many different features. IRMA is built using Messenger Platform 2.2 and has two components: `wit.ai` and custom messenger UI features, that we constructed. `wit.ai` is Facebook's home-grown natural processing model that enables developers to train and retrain a natural language model to help free text conversations. IRMA uses wit.ai to teach it's model to detect different states of conversation. The NLP model is trained to detect service taxonomies and enables keyword based searches for users to select from. A list of 211 taxonomies are given as inputs to the model which then trains to actively detect services.

IRMA sends and receives text and attachments. Attachments in the form of service selection payloads, location payload, site results payload and feedback payload are exchanged. The UI also gives access to webviews which allow users to open detailed information about their referrals and share it to themselves and others via email or social media. A user can interact with IRMA in two ways: Menu Driven and Limited Free Text.

In *Menu Driven*, the user begins the interaction with a greeting (`Hi, Hello, Hey`) and is prompted to click a button to browse services. This leads them to a hierarchy of five services: Senior/Care Support, Housing, Food, Utility Assistance and 211 LA Chat. Each of these services have sub categories to help narrow down the search. Once the user decides on their service request, they may have to answer two or three survey questions to help bring curated results. The user is then requested to send their preferred location prompted by a quick reply. Once the location is sent, IRMA runs the taxonomy model to generate referrals and returns them to the user. The user can choose to call 211 or the referral offices by clicking the call buttons associated with each referral. The user is also requested to provide feedback using quick replies (Positive, Can't Say, Negative). This feedback is used to analyze the accuracy and satisfaction of the referrals provided to the users.

In *Limited Free-Text*, a user can use some keywords to search. The subset of these active keywords is given in Table 1. When the NLP model detects these keywords, it provides intents to the taxonomy model. The model generates a list of hierarchical taxonomies for the user to select from. On selection, the user is prompted to share their preferred location. This is then geocoded and the user is provided with three referrals just like the Menu Driven workflow. This method is called Limited Free Text method because the chatbot can currently respond only to a limited range of free texts and may not be able to process long conversational messages.

4 RESULTS AND CONCLUSIONS

IRMA serves 5 high level services with 23 sub services. IRMA's referrals were tested and compared with those provided by 211 LA's community resource advisors (to people over the phone) .

Table 1: Limited Free Text Keywords

Housing Keywords	Food Keywords	Other Needs
low cost housing	meals	depressed
motel	food	legal assistance
shelter	senior food needs	alcoholic
internet	soup kitchens	HIV
toilet	quick food	cancer

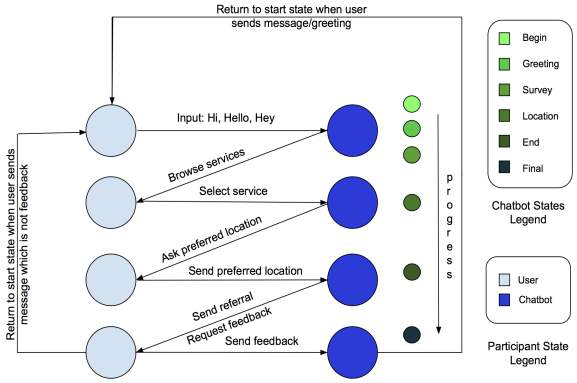

Figure 1: State by state interaction between user and chatbot

Of the 1019 test requests, 953 test requests were completed with 'Positive' feedback, 23 were completed with 'Can't say' feedback, 19 were completed with 'Negative' feedback and 24 were completed with no feedback.

IRMA supports 211 LA's goal to reach out to as many people in need, as possible. It gives the user several options to choose from and also allows them to use 211 LA Chat - to live chat with a 211 LA employee. IRMA is live on 211 LA County's Facebook page [`https://www.facebook.com/211lacounty`] and can be found when the user sends a message to the page.

5 REFERENCES

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ACKNOWLEDGMENTS

This effort was supported in part by the Information and Referral Federation of Los Angeles County (211 LA County) and additionally in part by the DARPA Memex/X- DATA/D3M programs. NSF award numbers ICER- 1639753, PLR-1348450 and PLR-144562 funded a portion of the work.