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Seamless Integration of Chatbots using NLP

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ABSTRACT: For Advancement of digital market is due to analytics. While this statement is true but pushing of customer technology f path is majorly contributed by natural language processing (NLP).In simple NLP technology simply processes the human voice, translates them into text (even it sometimes understands the behavioral changes into the human voice like tone, long silences) and enable the computer applications to process it. Alexa, Siri and similar like "bots" allow speech interaction technology based NLP which is behind the speech enabled interavitve voice response (IVR). This is now considered as basic element and technology for call recording."Natural Language Processing (NLP) Market Research Report- Global Forecast to 2022" which is the recent artile mentioned by market research team mentions that overall contact center market is set to grow in coming years and step by step it will be fueled by the need of quick turn around time. This will specifically target learning, education, automobile and health-private sectors.
NLP as a product / service or solution has sees lot of evolution from the last decade. They are now capable enough to manage, process and execure the larger data sets. Previosly mentioned in the reports predicts that the NLP's market will grow upto $16.07 billion by 2021 from $7.63 billion which is around 16.1%.
Companies like Nauance, IBM, Microsoft, Google, SAS, Verint Systems, Oracle and 3M take this as a good news who are leading utilizers of NLP market as technology solution providers.
As technology is eveolving every hour the high installation cost which is one of the major obstacle for growth to NLP market will be brought down and the credit goes to avalabiliy of colud based solutions for NLP and it will for sure give boost to smaller companies.

KEYWORDS: Chatbot, conversational agent, Artificial Intelligence, Machine Learning, Natural Language Processing, Natural Processing Understanding

I. INTRODUCTION

We often come across frequently asked questions (FAQ) or providing simple and timely information are perfect scenarios for a chatbot Responding to the same requests over and over is a major burden for customer support. A chatbot will be of great help by providing correct answers, directly replying, or even escalating the request to a person freeing up agents' time to work on more complex issues. Chatbots make life even easier for consumers. Long waits on hold to talk to a person on the phone or going through multiple steps to research and complete a purchase on websites with the help of Chatbots. Machine learning Chatbot works using various algorithms of artificial intelligence. Users can be liberal and not to be more specific while talking with a bot because it understands the natural language, not only machine commands. These kinds of bots get continuously better or smarter by learning from past conversations with people. In the near future, the simpler Chatbots are predicted to dominate with less Artificial Intelligence and more rule-based development (like websites or apps that you click or do something that triggers another action). One can already see various apps' latest adjustment to use more buttons (vs. primarily texting). user input, people and technology are just not quite there yet. With evolution in technology, more and more opportunities arise for integrations (like you see every day with APIs, IOT etc.). Chatbots can become a great hub for these, translating to us, keeping us updated and waiting for us to give certain commands. Technically, now everything that you interact with in your everyday life could be communicated with you and each other via a Chatbot in the future. In case of longer term, as technology evolves and we go with the flow, more AI Chatbots will be invited to our lives. Speech recognition has also improved enormously in the last couple of years, but it's nowhere near where it should be. Therefore, as years pass by, more efficient and convenient Chatbot will hopefully surround us. Most likely there is going to be a point where humans and bots partly join each other. From here on we must optimize our brains as well to a point where we can just call information with a thought; don't have to use inefficient words or texts anymore. That is why these days; certain

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tools enable people who have no clue about how technology works to build pretty usable websites. Some solutions that already exist for bots as well and it is only going to get better.

II. RELATED WORK

In 2016 Facebook Messenger announced it has over 30000 chatbots rapid increase from its API in April. There are wide range of chatrbots available to check weather, order food organise travel. In china We Chat has provided the ability to chatbots in company official accounts since 2013. There are 10 million such accounts on We Chat many of which using mixture of chatboxes and human agents to offer customer service in a wide range of sectors. Customer today are facing exposure to chatboxes and intelligent assistants on their smart phones and other devices. Apple, Google, Microsoft , Amazon, Facebook companies investing million to develop digital assistants on their respective platform

III. PROPOSED SOLUTION

Natural language processing (NLP) is an artificial intelligence feature that is being implemented across industries globally for various usage like Chat Bots and Virtual assisitance for customers. This will be embedded in the commercial applications and will be used for speech analysis, behevaorial analysis and change impact analysis.
In my previous organization, we have used NLP for development of translation system to translate English to eight Indian languages using three-translation engines

- EBMT(Example-based machine translation)
- SMT(Statistical machine translation)
- TAG(Tree Adjunction Grammar)

The application used the language processing to understand the grammatical construct of source language and rebuild it to target language. A sentence is tokenized and pre-processed to normalize. The Syntactic parsing is done to tag each word with Part-Of-Speech tagging (POS Tagger).

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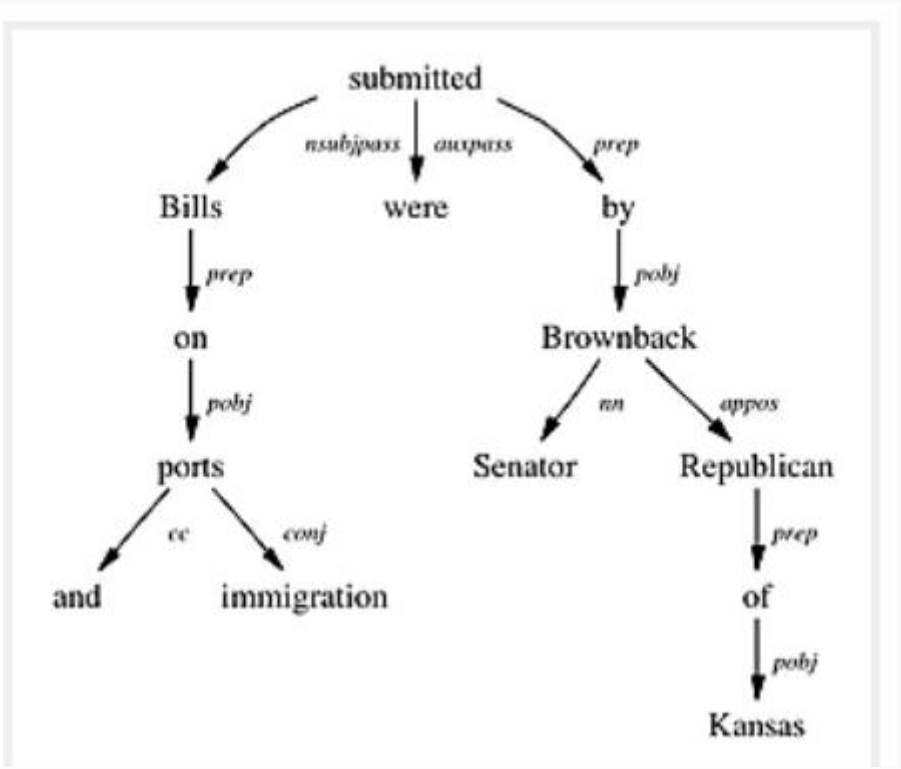

The memory parsing is then applied to generate category string for that sentence. It is then sent to dedicated engine for target language, where TAG parser algorithm is applied. Ultimately Generator produces restructured translated sentence.

Later we utilized deep learning algorithm to train the system with lots of incoming sentences and corresponding sample outputs. It usually follow the iterative layers of algorithms. Each cycle passes the simplified set of data representations and these passed to next layer.

When a neural network is being trained it act like a cycle which has set of inputs, a process in between and the dependent output. The inputs are passed through the various processes on each layer of the network. Each stage will transform the inputs into more simplified set which will be understood and can be processed to the next layer and the cycle continues. The overall outcome is then compared to pre-defiendd sets and quality check for correctness on the outputs completed and accordingly adjustment to the parameters on each of the neurons through special algorithms is performed. This is an iterative process and performed with very high number of cycles till the time we get desired outcome or conclusive option to complete the action or feed it back as input.

Microsoft LUIS.ai, Facebook Wit.ai, Google Api.ai and IBM Watson are some of the popular platforms of NLP as a service.

Some of the examples and use cases where the NLP is used are:

- Natural language understanding - goes beyond just basic sentence structure and attempts to understand the intended meaning of language. Human speech is peppered with nuances, subtleties, mispronunciations, and colloquialisms – NLU is designed to tackle those complexities.
- Summarize an entire article by determining the key sentences.
- Categorize e-mails based on their content so that they can be (re)routed to the relevant department or to determine a fitting standard reply.
- Automatically determine the mood of a client from his/her e-mail
- Identify which topics people on your social media channels talk about and do sentiment analysis.

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- SPAM filter applied to your email inbox: by keeping track of an active inventory of Spam marked emails, algorithms can learn which specific word combinations are often correlated to segregate unwanted and hazardous emails

Case for Chatbots

You need to have a vision and thought for implementation as in in today's competitive marketplace, there are business opportunities for implementing auto responsive bots powered by AI which are proficient at dealing with inquiries. This has a scalability options as such which will take inputs and based on the trasnsitions it will act proactive with questions and options. In the context the NLP has now the ability of understaidng the user inputs and then be ready with alternatives close to the response of human being.

For businesses handling large amounts of queries during the day, chatbots are highly skilled on the speciifcs of Natural Processing and can increase customer satisfaction with their more humanized, personalized responses. They can also understand questions on a deeper level, reducing the need for escalation to a human agent.

Lot of financial institutes are running surveys, agent chat discussions, emails, feedback, complaints and many other forms to gather the data and make NLP chatbots equipped enough to enhance the customer experieicne. Royal Bank of Scotland is the one who leads in data collection for such cases and improve the customer relationship through NLP.

Some examples and use cases of Chatbots are:

- Structure physical letters sent by pension funds requesting a reimbursement of their unduly paid pension money. All data sets are created in pre-agreed / approved strucutres and robotics process automations triggers the appropriate follow-up process flow.
- Categorizing Insurance Claims: Algorithms identify patterns in historical examples of insurance claims.
- Autobots for Gym training
- Autobots for career consultation

NLP Market Trends:

The NEW is expected to be interactive anywhere. We have seen forms of IVR responces and Natural Language Processing is following the footprints and expected to register the 22.5% of growth in coming 5 years sapn. Everyting is getting simplified in last few years with use of flexible architectures and alogorithms which has made impressive progress of optical Image/Character Recognition (OCR) and speech processing. Some of the leading companies working to develop the Natural Language Processing products and technologies are:

- Apple Incorporation
- Dolbey Systems
- Google
- Microsoft Corporation
- Verint Systems
- 3M
- IBM Incorporation
- NetBase Solutions
- SAS Institute Inc
- HP

We solved many problems to make DiPA production ready chatbot. Thanks to team DiPA! and now we have below new challenges in DiPA

How to add new content that is developed and trained by an external team with no code change in DiPA.

How to build Enterprise chatbot or BOT .

How to build a TRUE Dialog system – While most of the chatbots are Q&A Pair and closed ended conversation – imperative, DiPA understands and responds every query with enterprise context and context of your previous query ,

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but still its declarative. We will have to work on generative models and I think neural network will be way to go to build an intelligent chatbot that can have LONGER and SENSIBLE conversation with user .
We have some solution for (1) – PoC completed and working on adopting in DiPA, but for (2) , we have couple of approaches and we are now working on a PoC, and for (3) I need more inputs and if anyone is working on this item, please drop in your comments , happy to connect and discuss .

Chatbot using NLP

Do we really need one chatbot for an enterprise ? why not we just live with bot catalog – we didn't have one Mobile APP for all enterprise applications. While I hear all these arguments – I think ONE enterprise BOT is very much needed, as chatbot is a persona and it can be only one bot that will be closer to employee. It can record all interactions and get employee insights to build personal relationship with employee . bot can talk with other bots, few things to be consider when we build the framework for bot

Context – How to maintain context in bot ? when individual chatbot continue to exits and people can chat with these individual bots and each bot will have its own context and structure – then how it will exchange the context with bot? or can we ignore context in bot and it will just route to other bots ?
Channel – Chatbot is powerful and gaining more popularity because you can built a chatbot and use it any interfaces (WebApp – Skype – Teams – Facebook) without any change in the bot code . Now on top of this, you can use the bot conversations as skill in voice enabled assistance like Cortana and Alexa (yet to do this experiment)
Continued conversation – If individual bot have structured conversion flow , how to route follow up questions to the same individual bot till the conversation ends.
Tools /Technology – Can bot efficiently interact with other chatbot build using any technology?
We are working below 3 approaches for building bot –

Approach 1(a) – Server Side

Thanks to Suhas – he recommended this approach!

bot will be a bot application like any other chatbot built using MS bot framework
Individual chatbots need to be registered with bot . we will save Bot secret, conversationID and watermark .
bot will get user queries and send it to all chatbots(direct line API)
All chatbots should return response along with confidence score – if chatbot built with multi level text classification (like DiPA) – lowest level NLP model score to be returned to bot in a specified format
bot receives all responses and bot that returns with highest score will be returned to the user.

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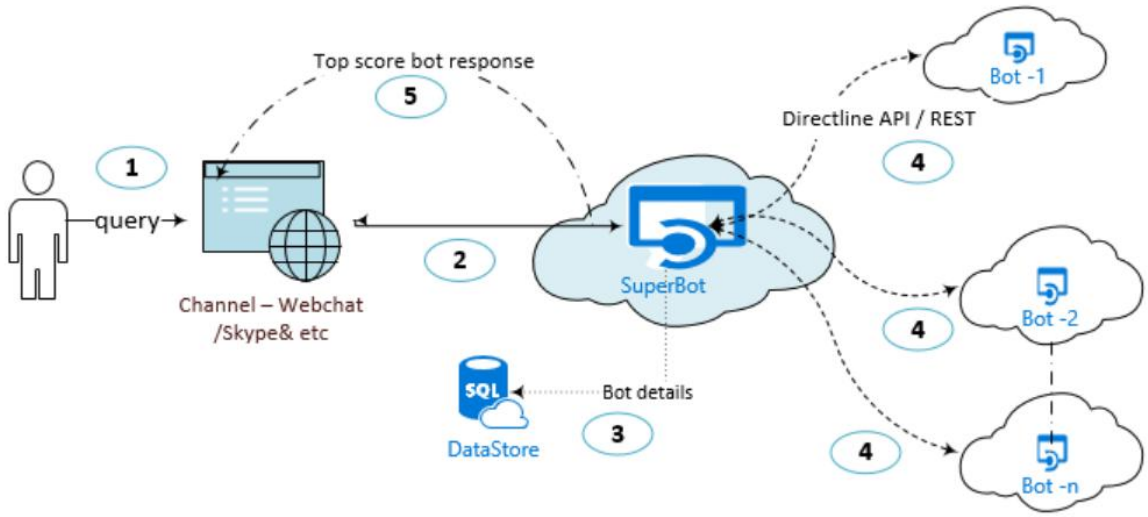
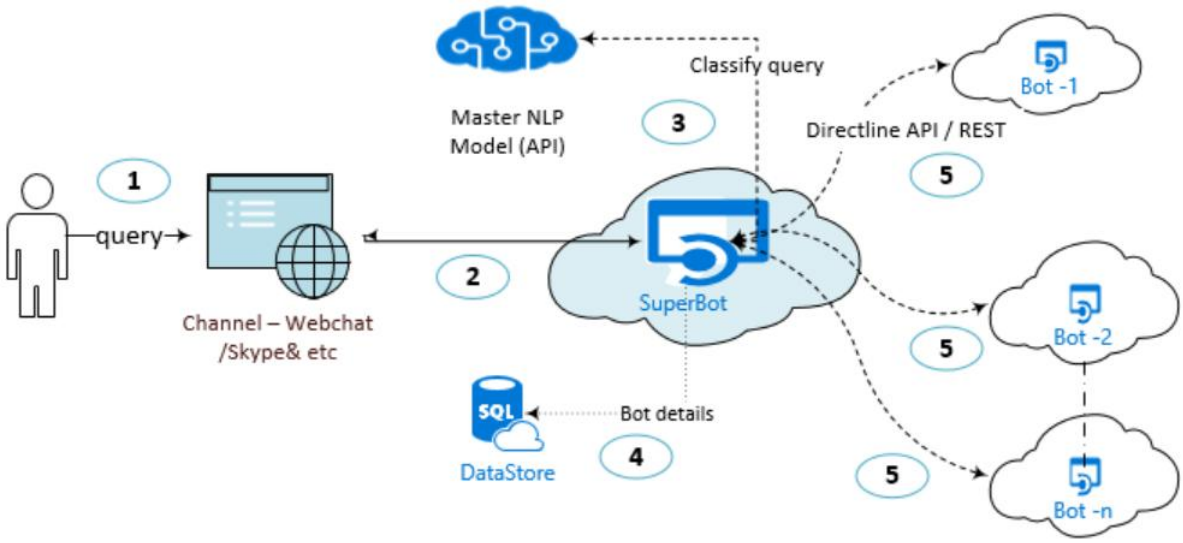


Challenges

Context cannot be maintained in bot- will be disjoint conversation and imperative
Dependency on confidence score returned by individual bots- is it really comparable? since score returned by NLP model of each bot is based on the training of that bot
When there are overlapping content – duplicate use cases implemented in multiple bots – how to determine the best response?
Approach 1(b) – Serverside



Similar to approach 1(a) , but we are creating master NLP model that need to be trained to classify user queries based on the domain and capability of individual bots.

we will send all user queries to routed to respective bot based on the master NLP model output.

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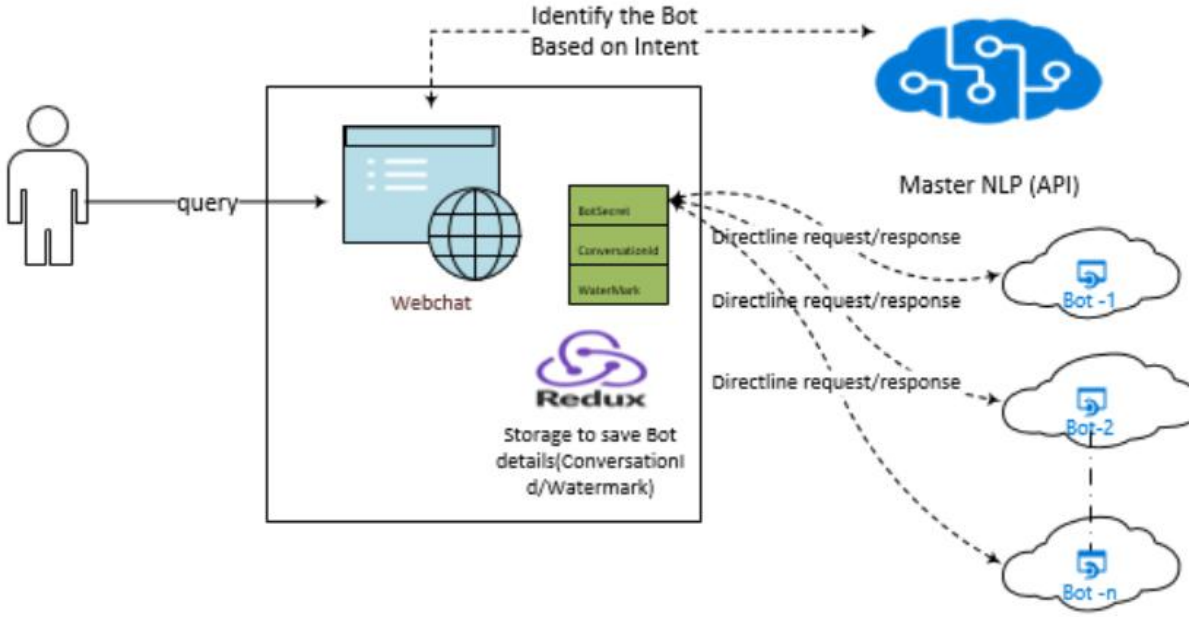
Challenges

Dependency – All registered bots need to provide the minimal training corpus data for the mater NLP model to get trained and to get queries routed to their bot.
Approach 2 – Client side

Similar to approach 1(b), but we are planning to do implementation in client side web chat java script code. We are trying to customize MS open source webchat.js to support this bot orchestration approach , we already reached a saturation point and further customization will risk adoption of new version of webchat control releases from MS. We are now working on a custom JS code that will route to individual bots



challenges

Channel specific – Since bot orchestration is done in specific channel, bot cannot be used in any other channel
Custom code – only text will be supported and we have enrich the code to adopt to other content type returned by individual bots.
I have just recorded my random thoughts in this. We now have more human brains building intelligent / AI chatbots, your thoughts and inputs will really be helpful to build a framework for enterprise chatbot

IV. CONCLUSION AND FUTURE WORK

A chatbot is a virtual human being that has been integrated with various industrial applications. With the passage of time, new features are added to the existing platform to create virtual assistants. Alice and Eliza virtual agents have created an impact in the world of technology. the concepts of Artificial Intelligence, Machine Learning, Natural Processing Language and recent advancements in machine learning techniques like Deep Learning, it has been made possible to develop humanoid chatbots. Samsung Technology have developed a technology, Neon, a chatbot that has been designed to behave like a human with emotional ability and intelligence. This issues and several other questions and aspects can be added that the employees may need help with. These bots d help the employees sort out issues that does not require a person's involvement. Future innovations can be done where the message can be conveyed in a

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better way so that the solutions also can be enhanced. Bots aren't "know-it-all" bots instead programmed to act like a real one. Chatbots, unlike other AI tools, will be used to enhance human capabilities and free human interference.

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