

A Despicable Chatbot

By Zachary Canoot and Benjamin Xu

For our chatbot, we chose to decouple the work into two separate sections, the preprocessing, and the model itself. The preprocessing is a couple different combinations of NLP techniques while the end result, the model, provided quite a few roadblocks. Regardless of what we tried to create along the way, the end result is a chat that can simply answer questions about the Despicable Me franchise. In this report on our experimentation we will describe our preprocessing, what different approaches we considered and how they work, and of course how the final product works. While the end result isn't much, and we will evaluate the reasons why, the amount of methods learned along the way was quite valuable.

Preprocessing

We actually used two different approaches when extracting data. Because we knew we were probably only going to have the time to use DialogFlow, we wanted to explore the capabilities of the KnowledgeBase feature, which allows the bot to automatically answer questions if it finds the answer inside the knowledge base. It takes either unstructured data, or a csv/txt file with two columns, one for questions and one for answers. With our goal in hand, we focused on extracting question and answer pairs out of our data. This means web-scraping, tokenization, named entity recognition, language recognition, and various approaches to generating question answering pairs.

Starting with the root words Despicable Me, we used BeautifulSoup to loop through 30 links that contain the text Despicable Me from the wikipedia page on the film. Extracting the paragraph text, we stored them in text files, and cleaned them by dividing the text with a sentence tokenizer and throwing out whitespace. This text was either directly related to Despicable Me, or related films... and reviews in other languages. So we used a library called langdetect to delete cleaned text files that contained languages that were not English. Finally we moved on to extracting entities from all the data using NLTK's built-in NER model. The script entity-context.py took in all our text files of scraped data and produced a csv with one column containing recognized entities, and one for the sentence that the entity was found in.

Two approaches were taken to create question and answer pairs. One used the distilBERT model from Hugging Face to create simple pairs... that didn't work very well! Turns out we should have used way more context in our entity context pairs. We then moved to OpenAI's davinci-002 model to do 'generative question answering'. This of course generated a very good database of question-answer pairs that both focused on the domain while extrapolating extra context. This generated csv was good, with ~1500 question answer pairs that seemed good for fine tuning LLMs.

To further add to the database, we also used web-scraping to also take from the fandom wiki page, which thankfully has very structured data. The pairs of bold and regular text was great for creating very specific question pairs about characters from Despicable Me. It was compiled into a text file to test out the unstructured data extraction in DialogFlow. Thus completing our database! The result was added to DialogFlow, but Zachary spent an inordinate amount of time trying to get fine tuning, so it's worth at least talking about what approaches were tried there.

Transformers By Zachary

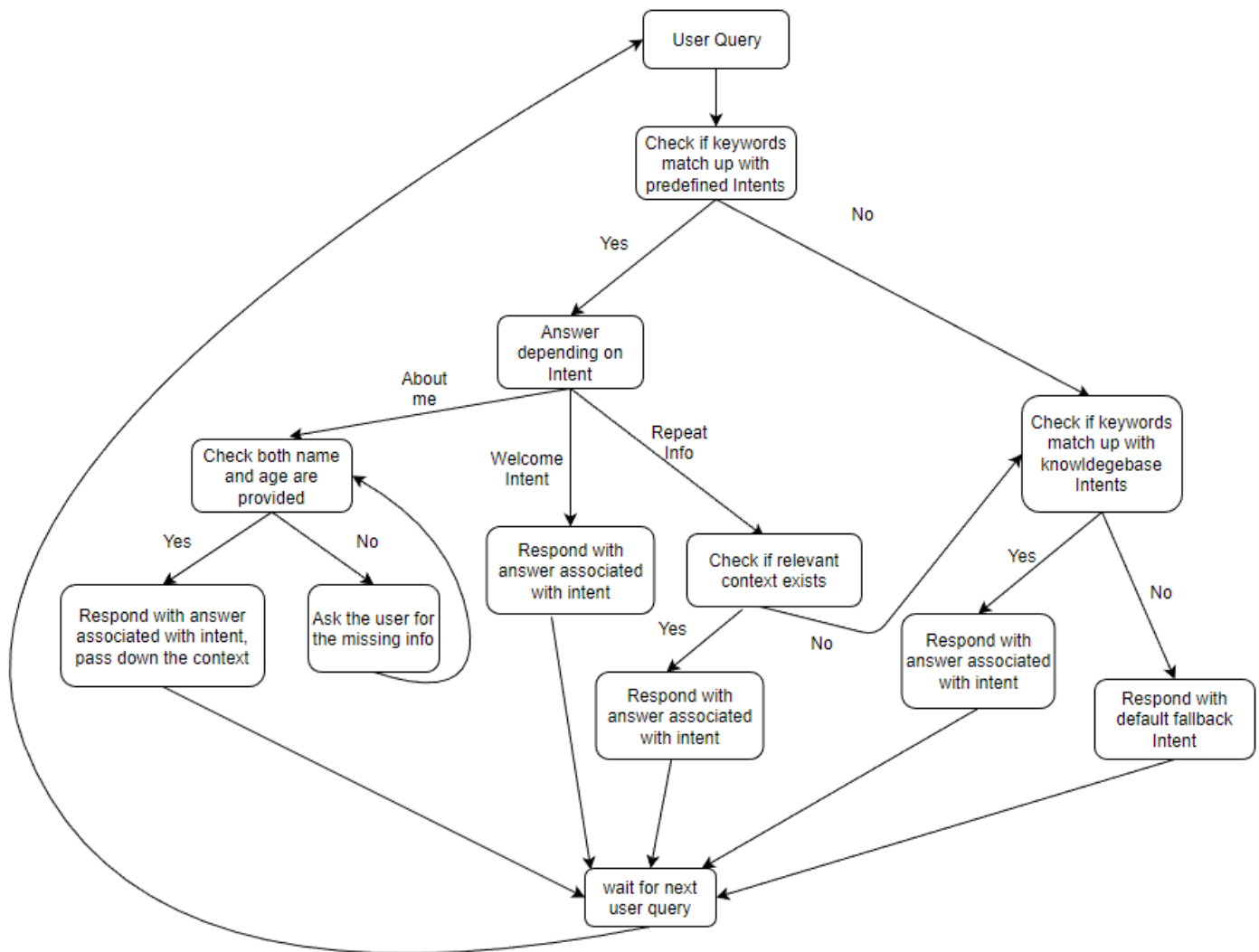
My best attempt at creating a conversational LLM was using DialoGPT-Small. For one simple reason. I just couldn't get enough memory. The model itself is a version of GPT2, so not that powerful by today's standards. However, it was trained on 147M Reddit dialogues to be a lot more conversational. That on its own... well compared to ChatGPT it could say basic words in verse. Training on our data, I had hoped would produce a conversational AI that also happened to know about Despicable Me. Couldn't use the results however. The best results I got when Collab graced me with more RAM would produce a bot that could occasionally mention the film and not much else. The worst was a bot that just is over and over!

The notebook was trimmed down and saved to a pdf, and can be viewed if you like. For my process I tokenized and embedded the csv question and answer pairs and initialized attention weights using Hugging Face's great automatic setup tools. And I initialized the model and its training weights using the same tools. I had the unfortunate task of tuning the model however, and as it did with other larger models I tried, either I produced bad results or the training would use up all the ram. And, then I gave up! I could have further used OpenAI and their excellent community to fine tune a model but my bank account didn't like the idea.

DialogFlow

DialogFlow is a platform that allows users to create chatbots that can understand and respond to human queries. Usually a basic implementation of a chatbot is difficult, because there are many ways to ask the same question, and it is hard to incorporate a response for every single one. DialogFlow makes this process much simpler by using NLP techniques to identify keywords, phrases, and other data to identify what the user is trying to ask. It then checks if this matches up with any intents that were defined. If it does, it will answer with the predefined answers that match up with that intent. If more information is needed in order to fulfill the request, the chatbot will be able to ask a follow up question to get the information needed. Additionally, the DialogFlow uses context, and may use it to answer a question. Each intent can pass on or receive a context, and the information from this context can be used to enhance an answer. In our chatbot, when a user would introduce themselves, the intent is identified, then the chatbot would ask follow up questions until all the information it needed was received. Finally, it would pass on the context, which would be received and used by any intent that needed it. For example, if the user asked the chatbot to repeat their information back to them, if the context existed. One other thing to mention is the knowledgebase. A user can create a knowledge base using a pdf of question answer pairs to feed into DialogFlow. Because we wanted our chatbot to answer a wide variety of questions, we decided that manually creating intents for each one of them was infeasible, so we opted to use the preprocessing methods mentioned above to feed into the knowledgebase. When a query is made, DialogFlow first searches through the predefined intents to check if there is an intent that matches up. If there isn't, the knowledgebase is then searched. If the knowledgebase doesn't have the intent either, then it will resort to the default fallback intent. This logic can be seen in the diagram below:

Flowchart



Evaluation

The issue with this Despicable little bot is that our original approach was very much trying to avoid the manual tuning of chatbots of the past. While it has a very nice knowledge base that could be programmatically generated from any starting link, it has no way of accessing the data in a naturalistic manner. In that sense, the process of creating the chatbot has value in it's possible use as an information extraction tool, yet not as some you can *chat* with. Giving someone a prompt on how to use the bot the most effectively, by mimicking the style of the question-answer database formed, results in a somewhat manageable user experience.

In a simple review I asked 5 people to test the chat bot, 2 with no guidance on how to use it, the other 3 did. I asked 2 questions with simple 1-5 scale responses.

- Does this bot accurately relay information relating to Despicable Me?
 - Unprompted: 2/5 Prompted: 4.5/5
- Does this bot feel like a friend?
 - Unprompted 1/5 Prompted: 1.5/5

These results are a symptom of how theoretically the bot had a lot of knowledge, but no language modeling to respond in a naturalistic way. If done again using the models of the time with a good GPU, the product could be a good practice. We would also like to try and use a data retrieval model in the future if possible, to simply use an LLM that can retrieve knowledge from a database like DialogFlow. Overall, this was a good *learning* experience.

Appendix

Generative Question Answer Database

What is Illumination	Illumination is an American film production company founded by Chris Meledandri.
What is Chris Meledandri	He is the founder of Illumination, a film production company. He is producing the upcoming film "The White Lotus" with Benjamin Renner and Mike White.
What is Despicable Me	The Despicable Me franchise launched in 2010 follows Gru, Steve Carell, reformed supervillain who ultimately becomes a father, husband, and secret his yellowhued pack of Minions.
What is Gru	Gru is a reformed supervillain who ultimately becomes a father, husband, and secret his yellowhued pack of Minions.
What is Steve Carell	The Despicable Me franchise launched in 2010 follows Gru, Steve Carell, reformed supervillain who ultimately becomes a father, husband, and secret his yellowhued pack of Minions.
What is Minions	Minions are a yellow-hued pack of creatures that follow Gru, a reformed supervillain who ultimately becomes a father, husband, and secret agent.
What is Universal	Universal is a film studio that has collaborated with Illumination on 15 feature films, including Despicable Me 4.
What is Carell	Carell is an actor who is best known for his role in the Despicable Me franchise.
What is Kristen Wiig	Kristen Wiig is an American actress, comedian, and producer. She is best known for her work on the sketch comedy series Saturday Night Live.
What is Pierre Coffin	Pierre Coffin is a French animator, voice actor, and director who is best known for his work on the Despicable Me franchise.
What is Miranda Cosgrove	Miranda Cosgrove is an American actress and singer. She is best known for her roles as Carly Shay on the Nickelodeon sitcom iCarly and as Summer Hathaway in Despicable Me.
What is Steve Coogan	Steve Coogan is an actor who is known for his role in the movie Despicable Me 4.
What is Chris	Chris Renaud is a French-American animator, film director, and voice actor. He is best known for his work on the Despicable Me franchise and The Lorax.
What is Renaud	Renaud is an animation director who is directing the movie Sing.

Note that this is a snapshot. Some data was adjacently related to Illumination, or film in general.

Origin Data For the GQA above

Oscar nominee Benjamin Renner Ernest et is directing from an original screenplay by Mike White School of Rock The White Lotus with Illumination founder Chris Meledandri producing
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Despicable Me 4 marks Illumination's 15th feature film collaboration with Universal and will see Carell reprising his role alongside Kristen Wiig Pierre Coffin Miranda Cosgrove and Steve Coogan
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Chris Renaud Despicable Me 1 and 2 The Lorax The Secret Lives of Pets 1 and 2 is directing with veteran animation director Patrick Delage Sing Sing 2 The Secret Life of Pets 2 codirecting from a script by White and Meledandri producing
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You can see the generative part of the model did a lot in extracting context in the answers above.

DistilBERT Question Answer Database

Describe Animation?	Animation Film Festival
Describe Film Festival?	Animation
Describe Universal?	Ent Despicable Me bows
Describe Chris Meledandri?	Illumination Ent Despicable Me bows
Describe U.S.?	US July 9
Describe Steve Carell?	Steve Carell Me was animated at Paris Mac Guff
Describe Paris?	Paris Mac Guff
Describe Pierre Coffin?	Chris Renaud
Describe Chris Renaud?	Pierre Coffin
Describe France?	Pierre Coffin and Chris Renaud
Describe Stassen?	Brusselsbased NWave
Describe NWave?	Stassen s Brusselsbased NWave
Describe Moon?	Stassen s Brusselsbased NWave
Describe StudioCanal?	2009 s Cannes fest

Not as good...

User Model

We incorporated the user model in two of our predefined intents. When the user is introducing themselves, the chatbot will ask follow-up questions until it gets the information it needs. It then passes this information down as context that is available to any predefined intents that need it. If this context exists, then the chatbot will be able to repeat the information back to the user at any time when the user requests it. For example, “My name is Benjamin and I’m 23” would result in the chatbot remembering my name and age, and then passing it down as context. If I only said: “Hi, I’m Benjamin”, it would prompt me for my age, and then pass it down when it got the age. When asking the bot something like “Repeat my info back to me”, or “What is my name and age”, The bot would answer with the name and age I provided to it earlier. Because the knowledgebase functionality of DialogFlow is still in beta, the functionality is still limited. The intents defined in the knowledgebase can neither receive nor can it output intents. This means it is impossible to incorporate the user model into answers that come from the knowledgebase. We hope that the implementation of the user model in this chatbot serves to display the possibilities of DialogFlow and future implementations of this chatbot, even though it has little functional value currently.