

Диалоговая Система

OTUS NLP

Что такое Чат Бот?

Создаем ChatBot для финансовой сферы

Чат Бот

инструмент для развития компаний. Он повышает скорость обслуживания клиентов, помогает оптимизировать расходы и численность персонала фирмы.

Быть на связи 24/7

График работ может не совпадать с привычками целевой аудитории. Покупатели заходят на сайт или в мессенджер в любое время суток. Бот ответит на вопрос в нерабочие часы или сохранит заявку на обратный звонок в базе данных.

Повышать клиентоориентированность

С чат-ботом вы сможете приблизиться к потребителям:

- моментально ответите на вопросы,
- поможете разобраться в работе сайта или тонкостях оформления заказа,
- предоставите актуальные сведения о продукте или услуге.

Цель Проекта

Создаем ChatBot для финансовой сферы



Цель Минимум

- Создания чат-бота который сможет отвечать на вопросы пользователей
- Изучения разных подходов и создать единый подход (любой)
- Добавления разные фич для диалоговой системы которые улучшат качество модель

Цель Максимум

- Создания рабочую генеративную модель которая отвечает на вопросы используя информацию из разных частей текста на которой ее обучали

Что есть на данный момент

Создаем ChatBot для финансовой сферы

Раздел (HELP) - Гид по разным вопросам

Ответы на вопросы из базы знаний на основе какой-то критерии близости

GrabrFi Help Center

What is|

- Updated in-app support section
- Consumer Privacy Notice
- What are the benefits of GrabrFi?
- What is GrabrFi?**
- Using Your GrabrFi Card in Argentina: A Complete Guide
- In what countries is GrabrFi available?
- What is the billing address of the card?
- Newly added error messages for card purchases and transfers
- What are the fees for sending / receiving money?
- What is the process for opening an account with GrabrFi?

General 

 Card

Grabr Fi English ▾

How can we help?

Home / General / What is GrabrFi?

Categories

- General**
- Account settings & Personal information
- Card
- GrabrFi account
- Transactions & Transfers

What is GrabrFi?

GrabrFi is a digital service that allows you access to US banking without having to travel to the US.

You don't need to be a US resident to open it. All you need is your ID, and you can receive all the benefits of banking in the US from the comfort of your home. GrabrFi is for you if you travel a lot, work for an overseas company, need to pay for international services or want to save in US dollars.

Read more about the benefits [here!](#)



Подходы для ChatBot

Создаем ChatBot для финансовой сферы



На останове правил

Чат боты которые используют Re и тд.

Поисковые

Парсинговые, БД + TF-IDF, QA Трансформеры

ML подход

Векторы + Классический ML классификация

DL Генеративные

Трансформенные Decoder

Подходы для ChatBot

Создаем ChatBot для финансовой сферы

TFIDF Поисковые

► Список вопросов и ответов

```
1 [('What is the main benefit of using GrabrFi?',  
2   'The main benefit of using GrabrFi is that you can  
access US banking without having to travel to the US.'),  
3   ('Who can open a GrabrFi account?',  
4     'Anyone can open a GrabrFi account as long as they have  
their ID.'),  
5   ('How can GrabrFi help people who work for international  
companies?'),  
6   'GrabrFi can help people who work for international  
companies by allowing them to receive payments in US  
dollars, without losing any money in conversion fees.')]
```

ML Классификатор

► Класс для вопросов

```
1 {  
2   "tag": "account_suspended",  
3   "patterns": [  
4     "My account has been suspended",  
5     "I would like to know why my account has been suspended",  
6     "I have had my account suspended",  
7     "I don't understand why my account has been suspended"  
8   ],  
9   "responses": [  
10    "We may place a security hold on your account if we detect suspicious  
activity such as suspicious logins, transfers, and charges. We do our best to  
communicate the issue to you via email within the first 24 hours. If you did not  
receive any communication after 24 hours after suspension, please contact our  
support team."  
11  ]  
12 },
```

QA Поисковые

► Текст содержащий ответ + вопрос

```
1 answer_text = "GrabrFi is a digital service that allows  
you access to US banking without having to travel to the  
US."  
2  
3 mes = 'What are the benefits of GrabrFi?'  
4  
5 extractive_answer = extractive_qa_bert(mes,answer_text)  
6 extractive_answer  
7  
8 'allows you access to US banking without having to travel  
to the US'
```

DL Генеративные

► диалог

```
1 user,"How can I make a top up or transfer money to my  
GrabrFi account?"  
2 bot,"You can make a top up or transfer funds to your  
GrabrFi account by making a transfer from another bank  
account."  
3 user,"What are the available top up options?"  
4 bot,"The available top up options are:  
5 SWIFT international transfers (worldwide),  
6 Wire transfers (within the US only)  
7 ACH transfers (within the US only)."br/>8 user,"How do I add funds to my account?"  
9 bot,"Please follow these steps: Log in to the application  
and click on [Home] & click on [Add funds] and select  
your preferred top up option"
```

Исходные Данные

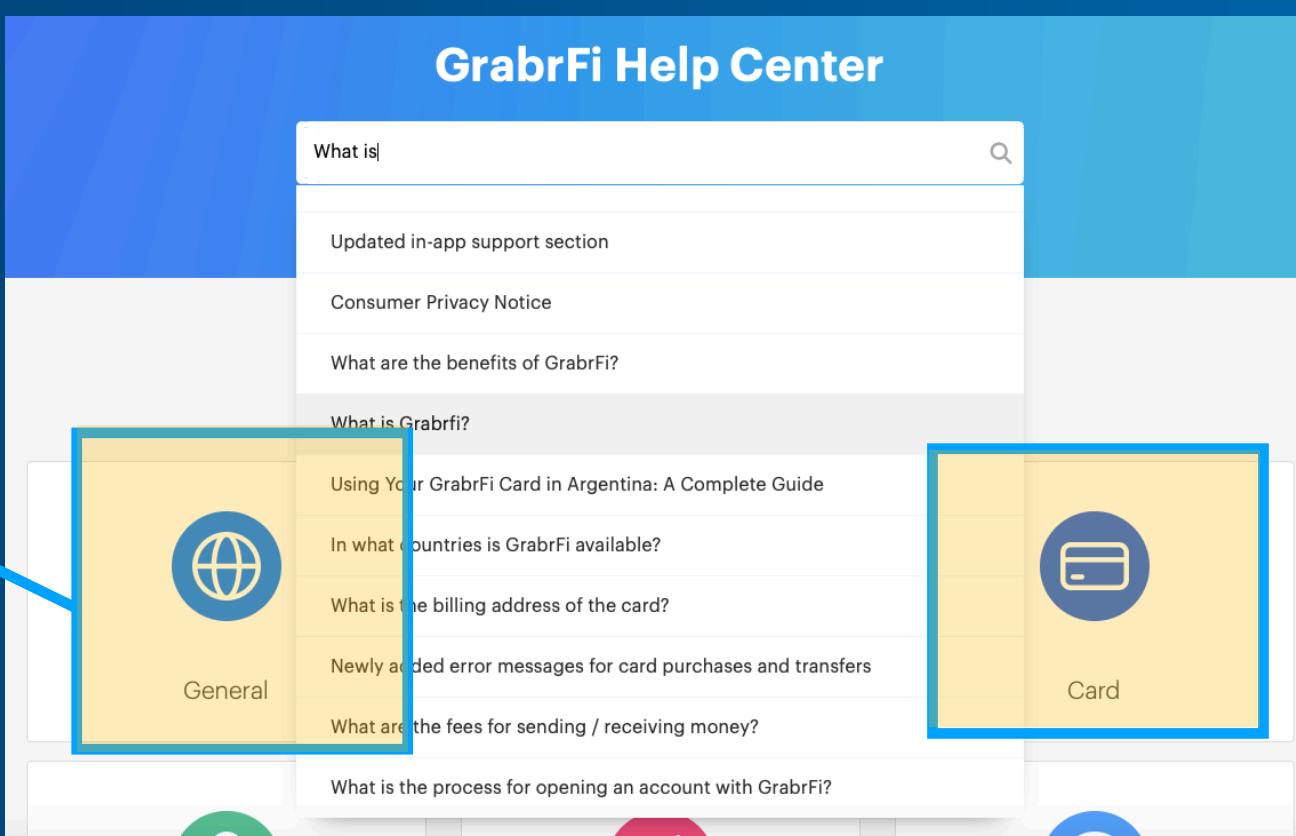
Создаем ChatBot для финансовой сферы

- 1 “1. What **is** the main benefit of using GrabrFi?”,
- 2 “2. Who can open a GrabrFi account?”,
- 3 “3. Why would someone want to use GrabrFi?”,
- 4 “4. What are the benefits of GrabrFi?”
- 5 ...

Categories	Topics	Articles	context	questions	answers
0 General	What is GrabrFi?	GrabrFi is a digital service that allows you a...	General\nWhat is GrabrFi?\n\nGrabrFi is a digi...	1. What is the main benefit of using GrabrFi?...	1. The main benefit of using GrabrFi is that y...
1 General	What are the benefits of GrabrFi?	GrabrFi is a digital service that allows you t...	General\nWhat are the benefits of GrabrFi?\n\n...	1. What are the benefits of GrabrFi?\n2. How c...	1. The benefits of GrabrFi include having acce...
2 General	What is the difference between GrabrFi and a t...	The biggest difference between GrabrFi and a t...	General\nWhat is the difference between GrabrF...	1. What are the benefits of using GrabrFi over...	1. The benefits of using GrabrFi over a tradit...
3 General	In what countries is GrabrFi available?	We currently offer accounts to residents of th...	General\nIn what countries is GrabrFi availabl...	1. What countries is Grabr available in?	1. The countries that Grabr is available in ar...
4 General	Requirements to open a GrabrFi account	You don't need to travel to open your account!...	General\nRequirements to open a GrabrFi accoun...	1. What is the minimum age requirement to open...	1. The minimum age requirement to open a Grabr...

questions

Topics



Topics

A screenshot of the GrabrFi website. At the top, it says 'How can we help?' with a search bar and a magnifying glass icon. Below that, it shows the URL 'Home / General / What is GrabrFi?'. On the left, there's a sidebar with 'Categories' and links to 'General', 'Account settings & Personal information', 'Card', 'GrabrFi account', and 'Transactions & Transfers'. The main content area is titled 'What is GrabrFi?' and contains text: 'GrabrFi is a digital service that allows you access to US banking without having to travel to the US. You don't need to be a US resident to open it. All you need is your ID, and you can receive all the benefits of banking in the US from the comfort of your home. GrabrFi is for you if you travel a lot, work for an overseas company, need to pay for international services or want to save in US dollars.' At the bottom of this section, there's a link 'Read more about the benefits [here!](#)'. At the very bottom right, there are social media icons for Twitter, Facebook, and LinkedIn.

Articles

Тестируем БД + TF-IDF

Создаем ChatBot для финансовой сферы

Top N

Берем наиболее подходящие с точки зрения критерии близости

```
1 Questions list:  
2   'What is the pull-to-refresh feature in the iOS application?',  
3   'How often are account statements sent?',  
4   'How can you access account statements?',  
5  
6 Request:  
7 please [tell me how often do you send me account statements]  
8  
9 top 3 results:  
10 [0.7191354216981398, 0.6026060825237777, 0.39624013529576035]  
11  
12 1 : Account statements are sent monthly, usually by the 16th day of the following month.  
13 2 : Account statements can be accessed in the 'Home' section of the application, and you should be  
logged in to see it. Click the 'Statement' button to see the list of all available statements.  
14 3 : You can update your email address up to 2 times within a 24-hour period.\n  
15  
16 [tell me how often you send account statements]  
17  
18 top 3 results:  
19 [0.7535790128121267, 0.6314684036986102, 0.4152183872234018]  
20  
21 1 : Account statements are sent monthly, usually by the 16th day of the following month.  
22 2 : Account statements can be accessed in the 'Home' section of the application, and you should be  
logged in to see it. Click the 'Statement' button to see the list of all available statements.  
23 3 : You can update your email address up to 2 times within a 24-hour period.\n
```

Выбор Порога

Выбираем порог для выбора ответа

```
1 if(top_val[0] > 0.80):  
2     return similarities.argmax()  
3 else:  
4     return None  
5  
6 Request:  
7 tell me how often you send account statements  
8 [0.7535790128121267]  
9  
10 'please add more detail to your question'
```

Тестируем QA Трансформеры

Создаем ChatBot для финансовой сферы



Задача Question - Answering

► Текст содержащий ответ + вопрос пользователя

```
1 question = "What are the requirements to open an account?"  
2  
3 answer_text = "The difference between GrabrFi and a traditional bank is that GrabrFi provides almost-instant access to US banking, which  
is online, whereas a traditional bank requires you to visit the US or be a resident. Other differences include: You will be able to  
receive & send US dollars worldwide with no to very low fees, there will be no monthly maintenance fees, there is no minimum bank balance  
requirement, no monthly maintenance fees & 24/7 customer support will be available to you. In what countries is GrabrFi currently  
available? GrabrFi is currently available for people who are residents of Argentina, Brazil, Canada, Chile, Colombia, France, Germany,  
Italy, Mexico, Portugal, Spain, United Kingdom, United States and Vietnam. Requirements to open a GrabrFi account: All you have to do is  
download the app and register. The requirements to open a GrabrFi account are: email address, a phone number where you can be reached and  
receive SMS, valid mailing address and you must be over 18 years old."  
4  
5 qa_bert(question,answer_text)  
6  
7 # Answer: "email address , a phone number where you can be reached and receive SMS , valid mail ##ing address and you must be over 18  
years old"
```

Выбор Текста

Перебор всех текстов

Классификатор

Для определения категории (Category)
ie. Классификатор “Category”

- > Активируется для задачи QA
- > Активируется для генеративной GPT модели

Подход для Question Answering

Fine-Tune **BERT** на данных **SQuAD v1**

Тестируем QA Трансформеры

Создаем ChatBot для финансовой сферы



(1) Классификатор

Для определения категории (**Category**)

```
1 # BoW Вектора (X)
2 array([[0., 0., 0., ..., 0., 0., 0.],
3         [0., 0., 0., ..., 0., 0., 0.],
4         [0., 0., 0., ..., 0., 0., 0.],
5         ...,
6         [0., 0., 0., ..., 0., 0., 0.],
7         [0., 0., 0., ..., 0., 1., 0.],
8         [0., 1., 0., ..., 0., 0., 0.]],
9         dtype=float32)
9 # (388, 321)
10
11 from sklearn.ensemble import
12     RandomForestClassifier
12 from sklearn.metrics import accuracy_score
13     as accuracy
13
14 qa_classifier = RandomForestClassifier()
15 qa_classifier.fit(X_train,y_train)
16 y_pred = qa_classifier.predict(X_train)
17 tr_accuracy = accuracy(y_pred,y_train)
18 # 0.9974226804123711
```

Inference

Проверим классификатор

```
1 def tester(sentence):
2     sentence = tokenize(sentence)
3     X = bow(sentence, all_words)
4     X = X.reshape(1, X.shape[0])
5     pred = qa_classifier.predict(X)
6     print(pred)
7
8 tester('How often can I change my phone number?')
9 tester('Can I use my ditial card with Google Wallet?')
10 tester('Is my account compatible with Apple Wallet?')
11
12 # ['account']
13 # ['card']
14 # ['card']
```

Тестируем QA Трансформеры

Создаем ChatBot для финансовой сферы

Выбор Порога

Находим argmax(max(logits))

(2) Задача Question Answerer (Процесс)

Получаем ответ на вопрос из текста

```
1 # user input
2 mes = 'What are the benefits of GrabrFi?'
3
4 # text source
5 answer_text = "GrabrFi is a digital service that allows you
access to US banking without having to travel to the US."
6
7 ['[CLS]', 'What', 'are', 'the', 'benefits', 'of', 'G',
'##rab', '##r', '##F', '##i', '?', '[SEP]', 'G', '##rab',
'##r', '##F', '##i', 'is', 'a', 'digital', 'service',
'that', 'allows', 'you', 'access', 'to', 'US', 'banking',
'without', 'having', 'to', 'travel', 'to', 'the', 'US', '.',
'[SEP]']
```

Токены текста

```
1 QuestionAnsweringModelOutput(loss=None,
start_logits=tensor([-4.1833, -4.9635, -5.6475, -4.8030,
-2.2221, -6.5630, -6.6779, -8.1316,
-8.4170, -8.1976, -8.1531, -3.4018, -3.5032,
2.8908, -3.9919, -4.5248,
-4.6423, -4.3546, -2.2339, -0.8731, -0.0142,
-1.1928, 1.4941, 6.6916,
3.1407, 5.3463, -1.2457, 2.2434, 1.7383,
4.7943, 1.4277, -1.4934,
5. -0.1052, -3.5509, -3.2912, -1.5679, -2.3753,
-4.2994]),
grad_fn=<CloneBackward0>),
end_logits=tensor([[ 0.2867, -5.3636, -6.2659, -6.1131,
-0.8645, -6.5708, -7.5951, -6.7791,
-6.6497, -6.8988, -5.7298, -4.4439, -4.4590,
-3.7229, -4.5408, -4.1239,
-4.7327, -1.3542, -4.8835, -4.8765, -1.5053,
0.4094, -4.6681, -0.5287,
0.0292, 0.3293, -1.2425, -0.1589, 5.8771,
0.8900, 0.0385, -0.3689,
4.8369, 1.4966, -0.0558, 8.8769, 7.0160,
-4.9427]),
grad_fn=<CloneBackward0>), hidden_states=None,
attentions=None)
```

Logits START токенов

Logits END токенов



```
1 tensor(6.6916, grad_fn=<MaxBackward1>)
2 tensor(8.8769, grad_fn=<MaxBackward1>)
3
4 'allows you access to US banking without having to travel to
the US'
```

Тестируем QA Трансформеры

Создаем ChatBot для финансовой сферы



(2) Задача Question Answer (Хороший и плохой ответ)

Получаем ответ на вопрос из текста

Плохой пример

Хороший пример

Выбор Порога



```
1 answer_text = "GrabrFi is a digital service that allows you  
access to US banking without having to travel to the US. "  
2 mes = 'How do I change my billing address?'  
3  
4 extractive_answer = extractive_qa_bert(mes,answer_text)  
5 extractive_answer  
6  
7 tensor(2.2373, grad_fn=<MaxBackward1>)  
8 tensor(3.2368, grad_fn=<MaxBackward1>)  
9  
10 'G ##rab ##г ##F ##i'
```



```
1 answer_text = "To change your billing address on your  
GrabrFi account, go to More → Profile & Settings → Billing  
address / Mailing address and enter your updated  
information.", "  
2 mes = 'How do I change my billing address?'  
3  
4 extractive_answer = extractive_qa_bert(mes,answer_text)  
5 extractive_answer  
6  
7  
8 tensor(7.4545, grad_fn=<MaxBackward1>)  
9 tensor(7.5104, grad_fn=<MaxBackward1>)  
10  
'go to More → Profile & Set ##ting ##s → Bill ##ing  
address / Mail ##ing address and enter your updated  
information'
```

Выбор порога по значению logins

Тестируем МЛ Подход

Создаем ChatBot для финансовой сферы

Задача Классификации

<tag> метка для вопроса

<patterns> Варианты вопроса

<responses> Ответ на вопрос

Варианты одного вопроса

```
1  {
2      "tag": "account_suspended",
3      "patterns": [
4          "My account has been suspended",
5          "I would like to know why my account has been suspended",
6          "I have had my account suspended",
7          "I don't understand why my account has been suspended"
8      ],
9      "responses": [
10         "We may place a security hold on your account if we detect suspicious
activity such as suspicious logins, transfers, and charges. We do our best to
communicate the issue to you via email within the first 24 hours. If you did not
receive any communication after 24 hours after suspension, please contact our
support team."
11     ],
12 }
```

```
1 # Bow Вектора (X)
2 array([[0., 0., 0., ..., 0., 0., 0.],
3        [0., 0., 0., ..., 0., 0., 0.],
4        [0., 0., 0., ..., 1., 0., 0.],
5        ...,
6        [0., 0., 0., ..., 0., 0., 0.],
7        [0., 0., 0., ..., 0., 0., 0.],
8        [0., 0., 0., ..., 0., 0., 0.]], dtype=float32)
9
10 # Hyper-parameters
11 num_epochs = 1000
12 batch_size = 8
13 learning_rate = 0.001
14 input_size = len(X_train[0])
15 hidden_size = 8
16 output_size = len(tags)
```

```
1 # Loss and optimizer
2 criterion = nn.CrossEntropyLoss()
3 optimizer = torch.optim.Adam(model.parameters(),
lr=learning_rate)
```

```
1 class NeuralNet(nn.Module):
2     def __init__(self, input_size, hidden_size,
3                  num_classes):
4         super(NeuralNet, self).__init__()
5         self.l1 = nn.Linear(input_size, hidden_size)
6         self.l2 = nn.Linear(hidden_size, hidden_size)
7         self.l3 = nn.Linear(hidden_size, num_classes)
8         self.relu = nn.ReLU()
9
10    def forward(self, x):
11        out = self.l1(x)
12        out = self.relu(out)
13        out = self.l2(out)
14        out = self.relu(out)
15        out = self.l3(out)
16        # no activation and no softmax at the end
17        return out
```

```
1 Epoch [100/1000], Loss: 0.1055
2 Epoch [200/1000], Loss: 0.0017
3 Epoch [300/1000], Loss: 0.0002
4 Epoch [400/1000], Loss: 0.0003
5 Epoch [500/1000], Loss: 0.0000
6 Epoch [600/1000], Loss: 0.0000
7 Epoch [700/1000], Loss: 0.0000
8 Epoch [800/1000], Loss: 0.0000
9 Epoch [900/1000], Loss: 0.0000
10 Epoch [1000/1000], Loss: 0.0000
11 final loss: 0.0000
```

Тестируем МЛ Подход

Создаем ChatBot для финансовой сферы

```
1 You: my account has been suspended
2 Sam: We may place a security hold on your account if we detect suspicious activity such as suspicious logins, transfers, and charges. We do our best to communicate the issue to you via email within the first 24 hours. If you did not receive any communication after 24 hours after suspension, please contact our support team.
3
4 You: I'd like to know why my account has been suspended
5 Sam: We may place a security hold on your account if we detect suspicious activity such as suspicious logins, transfers, and charges. We do our best to communicate the issue to you via email within the first 24 hours. If you did not receive any communication after 24 hours after suspension, please contact our support team.
6
7 You: I've had my account suspended
8 Sam: We may place a security hold on your account if we detect suspicious activity such as suspicious logins, transfers, and charges. We do our best to communicate the issue to you via email within the first 24 hours. If you did not receive any communication after 24 hours after suspension, please contact our support team.
```

Выбор Порога

`torch.softmax(logits)`

```
1 # probability threshold
2 if prob.item() > 0.75:
3     for intent in intents['intents']:
4         if tag == intent["tag"]:
5             print(f"{bot_name}:
6                 {random.choice(intent['responses'])}")
7         else:
8             print(f"{bot_name}: I do not understand...")
```

Не верный вызов

Продолжение диалога

Получив ответ на вопрос, user хочет получить разъяснение

```
1 You: my account has been suspended
2 Sam: We may place a security hold on your account if we detect suspicious activity such as suspicious logins, transfers, and charges. We do our best to communicate the issue to you via email within the first 24 hours. If you did not receive any communication after 24 hours after suspension, please contact our support team.
3 You: what should I do?
4 Sam: I do not understand...
```

Порог/пересечение данных

Не оптимальное пороговое значение +
пересечение данных

```
1 You: I've had my account suspended
2 Sam: We may place a security hold on your account if we detect suspicious activity such as suspicious logins, transfers, and charges. We do our best to communicate the issue to you via email within the first 24 hours. If you did not receive any communication after 24 hours after suspension, please contact our support team.
3 You: How do I contact the support team?
4 Sam: You can contact the support team by email or phone.
5 You: What is the phone number in Argentina?
6 Sam: Visit: https://app.grabrfi.com/. Use your email address to create a login and create a secure password. After registration, you will be prompted to verify your email address & complete the identity verification process. You will receive notification when it's approved, so you can open your account.
```

Тестируем DL Подход

Создаем ChatBot для финансовой сферы

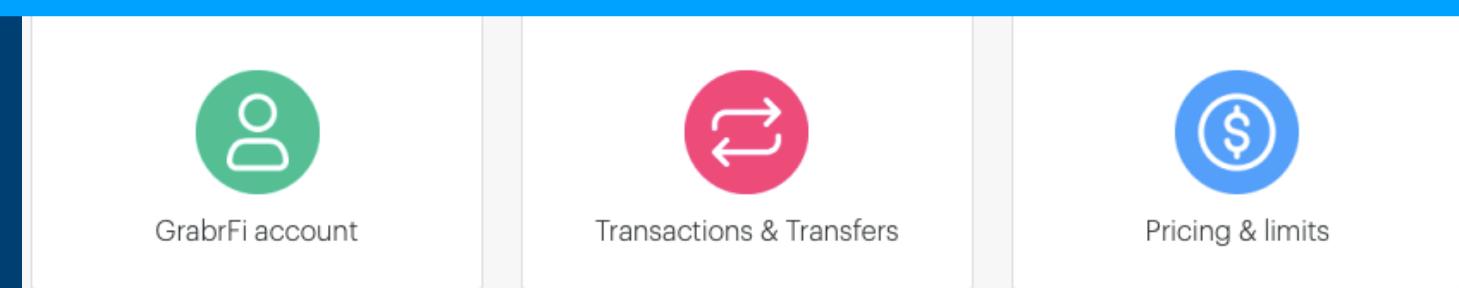
Генеративный GPT

Microsoft DialoGPT (medium)

345M параметров

147M reddit диалогов

Fine-tune



Разные варианты
развития диалога

Разные варианты
развития диалога

response	context	context/0	context/1	context/2	context/3	context/4	context/5
0	Sure, I'm here to help. Do you have any questi...	I need some help	My name is DialoGPT	What is your name?	I'm a generative model based on Microsoft's Di...	Who are you?	Hello, how may I help you? I'll be your assist...
1	I'll do my best to answer your questions. I'm ...	Can you please help me	Sure, I'm here to help. Do you have any questi...	I need some help	My name is DialoGPT	What is your name?	I'm a generative model based on Microsoft's Di...
2	Sure, go ahead, I'm all yours.	I want to ask some questions	I'll do my best to answer your questions. I'm ...	Can you please help me	Sure, I'm here to help. Do you have any questi...	I need some help	My name is DialoGPT
3	Well, that's an interesting question! I've	What can you help me with?	Sure, go ahead, I'm all yours.	I want to ask some questions	I'll do my best to answer your questions. I'm ...	Can you please help me	Sure, I'm here to help. Do you have any questi...

Контекст диалога

```
1 #
2 #
3 # 40. GrabrFi account | My account is suspended. Why and what sho
4 #
5 #
6 #
7 user,"I've had my account suspended and need some assistance"
8 bot,"I'm sorry to hear that. We may place a security hold on your ac
detect suspicious activity such as suspicious logins, transfers, and
you need some extra clarification?"
9 user,"Yes"
10 bot,"We do our best to communicate the issue to you via email within
hours. If you did not receive any communication after 24 hours after
please contact our support team."
11 user,"How can I get in touch with the support team?"
12 bot,"You can contact our support team by emailing support@grabrifi.co
13 user,"Thank you"
14 bot,"You're welcome"
15 #
16 user,"My account has been blocked and I need some assistance"
17 bot,"I'm sorry to hear that. We may place a security hold on your ac
detect suspicious activity such as suspicious logins, transfers, and
you need some extra clarification?"
18 user,"Yes please"
19 bot,"We do our best to communicate the issue to you via email within
hours. If you did not receive any communication after 24 hours after
please contact our support team."
20 user,"How can I get in touch with the support team?"
21 bot,"You can contact our support team by emailing support@grabrifi.co
22 user,"Thank you"
23 bot,"You're welcome"
```

Тестируем DL Подход

Создаем ChatBot для финансовой сферы

Протестируем генеративную модель

User хочет узнать какие опции есть для переводов

```
1 # Dataset
2 user,"What bank transfers do you offer?"
3 bot,"Several bank transfer options are available to you, ACH and wire transfers"
4 user,"What is the difference between them?"
5 bot,"A ACH transfer is completed through a clearing house and can be used to process direct
payments or direct deposits. Wire transfers on the other hand allow for the direct movement of
money from one bank account to another. Wire transfers will cost you for domestic Incoming wire 5
USD, and for domestic Outgoing wire 15 USD."
6
7 # Example 1
8
9 >> User:What bank transfers do you offer?
10 Bot: Several bank transfer options are available to you, ACH and wire transfers
11 >> User:Can you tell me the difference between them?
12 Bot: A ACH transfer is completed through a clearing house and can be used to process direct
payments or direct deposits. Wire transfers on the other hand allow for the direct movement of
money from one bank account to another. Wire transfer will cost you for domestic Incoming wire 5
USD, and for domestic Outgoing wire 15 USD.
13
14 # Example 2
15
16 >> User:Which bank transfer options does your service offer?
17 Bot: Several bank transfer methods are available to you, ACH and wire transfers
18 >> User:Any difference between them?
19 Bot: A ACH transfer is completed through a clearing house and can be used to process direct
payments or direct deposits. Wire transfers on the other hand allow for the direct movement of
money from one bank account to another. Wire transfer will cost you for domestic Incoming wire 5
USD, and for domestic Outgoing wire 15 USD.
20
```

```
1     # generated a response while limiting the total chat
2     history_ids = model.generate(
3         bot_input_ids,
4         max_length=1000,
5         pad_token_id=tokenizer.eos_token_id,
6         no_repeat_ngram_size=3,
7         do_sample=True,
8         top_k=100,
9         top_p=0.7,
10        temperature=0.8
11    )
```

Пример с проблемой недоступности аккаунта

```
1 >> User:I've had my account suspended, I don't understand.
2 Bot: Sorry for the inconvenience, we value security, so we may place a security hold on your
account if we detect suspicious activity. I'll contact our team and we'll get in touch without 24
3 hours.
4
5 >> User:I haven't done anything wrong, please restore my account
Bot: We do our best to communicate the issue to you via email within the first 24 hours, if you did
6 not receive any communication after 24 hours after suspension, please contact our support team.
7
8 >> User:How can I contact your support team if I don't know the number?
9 Bot: You can contact oursupport@grabrifi.com
10
11 >> User:What is the number of your support?
12 Bot: The number is 121042882.
13
14 >> User:How can I contact your support?
Bot: Our support email address is support@grabrinights.com, we hope to resolve the issue as soon as
15 we can.
16
17 >> User:Can you tell me the GrabrFi's routing number?
18 Bot: Please get in contact with our support email support team (support@GrabrFi.com)
19
20 >> User:What is the ACH routing number?
Bot: Let me walk you through it: **paypal_instructions**
```

Тестируем DL Подход

Создаем ChatBot для финансовой сферы

Протестируем генеративную модель

User хочет узнать ответы на несколько тем, модель генерирует текст из мест вне контекста

```
1 >> User:I'm upset because my account is suspended
2 Bot: Sorry for the inconvenience, we do value security, so we may place a security hold on your
   account if we detect suspicious activity. I'll contact our team and we'll get in touch without 24
   hours.
3 >> User:What do you mean by security hold?
4 Bot: A security hold is when GrabrFi places a hold on accounts due to suspicious activity,
   typically for a period of 24 hours or more.
5 >> User:Okay fine, how do I contact support?
6 Bot: You can contact our support team by emailing support@grabrfi.com
7 >> User:Get me in touch with your support team
8 Bot: Please don't
9 >> User:This is unacceptable I can't wait so long
10 Bot: Sorry, we are simply following standard security procedures.
11 >> User:What is the difference between ACH and wire transfers?
12 Bot: Transaction approaches vary: ACH transfers are completed through a clearing house and can be
   used to process direct payments or direct deposits. Wire transfers on the other hand allow for the
   direct movement of money from one bank account to another. Wire transfer will cost you for domestic
   Incoming wire 5 USD.
```

Генерируем используя контекст

User хочет узнать ответы на несколько

```
1 for step in range(10):
2     # encode the new user input, add the eos_token and return a tensor in Pytorch
3     new_user_input_ids = tokenizer.encode(input(">> User:") + tokenizer.eos_token,
4                                         return_tensors='pt')
5     # print(new_user_input_ids)
6
7     # append the new user input tokens to the chat history
8     bot_input_ids = torch.cat([chat_history_ids, new_user_input_ids], dim=-1) if step ==
9     new_user_input_ids
10    # generated a response while limiting the total chat history to 1000 tokens,
11    chat_history_ids = model.generate(
12        bot_input_ids,
13        max_length=1000,
14        pad_token_id=tokenizer.eos_token_id,
15        no_repeat_ngram_size=3,
16        do_sample=True,
17        top_k=100,
18        top_p=0.7,
19        temperature=0.8
20    )
21    # pretty print last ouput tokens from bot
22    print("Bot: {}".format(tokenizer.decode(chat_history_ids[:, -bot_input_ids.shape[-1]:],
skip_special_tokens=True)))
```

Телеграм Бот

Создаем ChatBot для финансовой сферы

```
1 @bot.message_handler(commands=['start'])
2 def send_welcome(message: types.Message):
3     cid = message.chat.id
4     bot.reply_to(message, "Hello, welcome, type /faq")
5
6 @bot.message_handler(commands=['faq'])
7 def send_welcome(message: types.Message):
8     cid = message.chat.id
9     msg = bot.reply_to(message, "Hello, how can I help you?")
10    bot.register_next_step_handler(msg, process_loop)
11
12
13 def process_loop(message: types.Message):
14     try:
15         chat_id = message.chat.id
16         mes = message.text
17
18         ...
19
20         bot.send_message(chat_id, answer)
21         msg = bot.reply_to(message, "Anything else I can help
you with?")
22         bot.register_next_step_handler(msg, process_continue) # pass to
confirmation process
23
24     except Exception as e:
25         bot.reply_to(message, 'error1')
```

Главная команда для
активации чатбота

Продолжаем диалог

```
1 def process_continue(message: types.Message):
2     try:
3         chat_id = message.chat.id
4         mes = message.text
5         pred_tags = ner_continue(mes)
6         print(pred_tags)
7
8         if(pred_tags == 'continue'):
9             msg = bot.send_message(chat_id,"Sure let's try again")
10            bot.register_next_step_handler(msg, process_continue)
11        else:
12            bot.send_message(chat_id,'feel free to ask again
@otus3_bot')
13            bot.send_message(chat_id,'thank you for using
our service!')
14
15
16     except Exception as e:
17         bot.reply_to(message, 'error2')
```

Главное содержание чатбота

Выход из чатбота

Тестируем NER

Создаем ChatBot для финансовой сферы

Продолжительность диалога

Обучаем модель которая классифицирует тэги в предложении

Используя BIO тэги

```
1 ''' Vectorisation '''
2
3 # define encoder
4 encoder = CountVectorizer()
5
6 # fit the encoder on our corpus
7 X = encoder.fit_transform(lst_data)
8 y = np.array(lst_tags)
9
10 ''' Modeling '''
11
12 # try our different models
13 # model = LogisticRegression()
14 model_confirm = RandomForestClassifier()
15
16 # train model
17 model_confirm.fit(X,y)
18 y_pred = model_confirm.predict(X)
19 print(f'accuracy: {round(accuracy_score(y_pred,y),3)}')
```

```
1 ['that', 'will', 'be', 'all', 'thank', 'you', 'I', 'got', 'my',
  'answer', 'yes', 'it', 'does', 'yes', 'I', 'got', 'my',
  'answer', 'Im', 'fine', 'I', 'didnt', 'get', 'my', 'answer',
  'I', 'need', 'more', 'information', 'no', 'more',
  'information']
2 ['B-END', 'I-END', 'I-END', 'I-END', 'O', 'O', 'B-END', 'I-
END', 'I-END', 'I-END', 'B-END', 'I-END', 'I-END', 'B-END',
'O', 'B-END', 'I-END', 'I-END', 'B-END', 'I-END', 'O', 'B-
CONTINUE', 'I-CONTINUE', 'O', 'O', 'O', 'B-CONTINUE', 'I-
CONTINUE', 'O', 'B-CONTINUE', 'B-CONTINUE', 'I-CONTINUE']
```

Размеченные данные

```
1 question,annotated
2 that will be all,[end : that will be all]
3 thank you I got my answer,thank you [end : I got my answer]
4 yes it does,[end : yes it does]
5 yes,[end : yes]
6 I got my answer,I [end : got my answer]
7 Im fine,[end : Im fine]
8 I didnt get my answer,I [continue : didnt get] my answer
9 I need more information,I [continue : need more] information
10 no,[continue : no]
11 more information,[continue : more information]
```

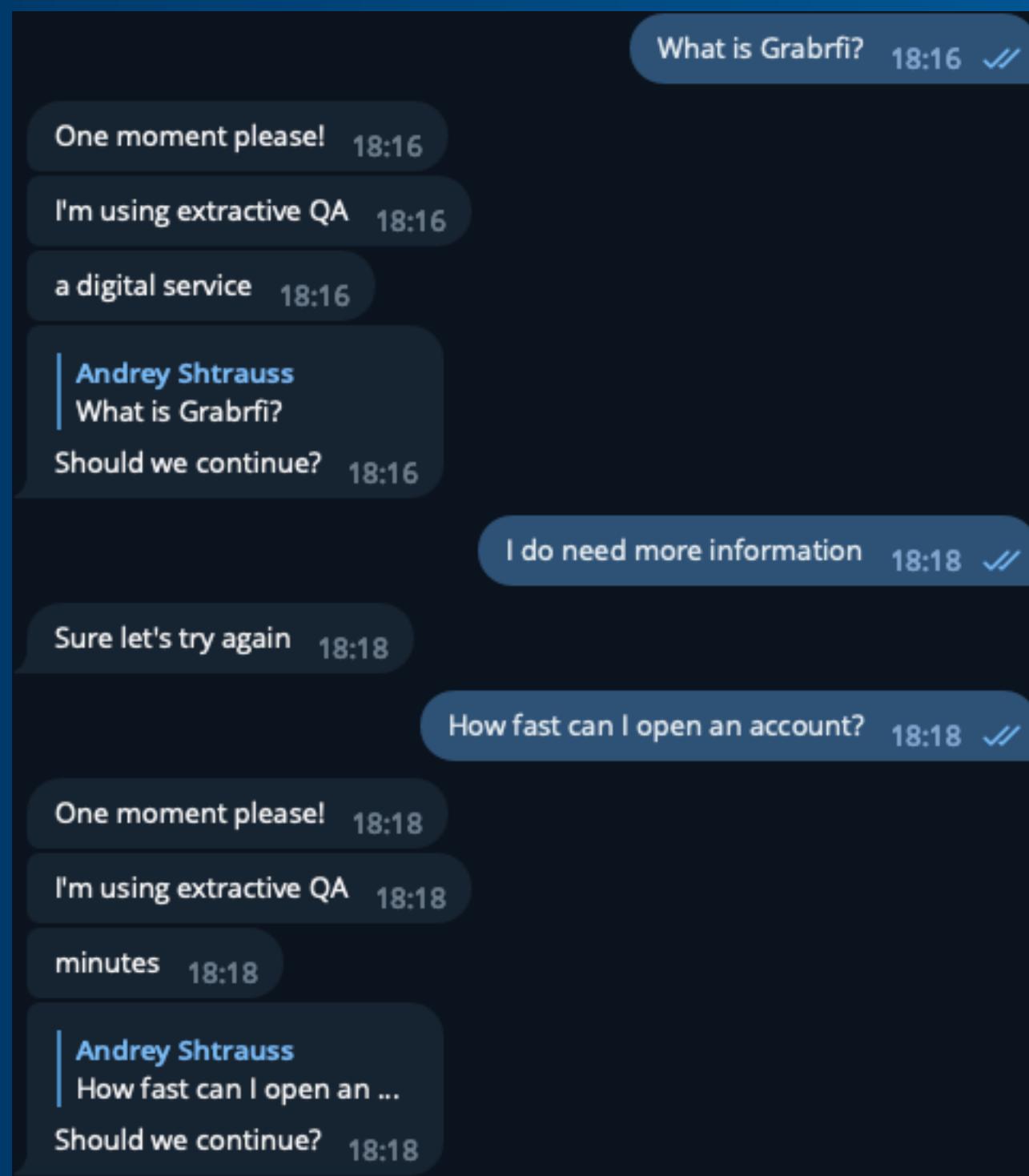
Продолжаем или нет?

```
1 # test our model
2 def ner_continue(inputs):
3
4     tokens = word_tokenize(inputs)
5     y_pred_test =
6         model_confirm.predict(encoder.transform(tokens))
7     keys = Counter(y_pred_test).keys()
8
9     CONTINUE = 0; END = 0
10    for i in keys:
11        if('-CONTINUE' in i):
12            CONTINUE+=1
13        elif('-END' in i):
14            END+=1
15
16    if(CONTINUE > END):
17        return 'continue'
18    else:
19        return 'end'
```

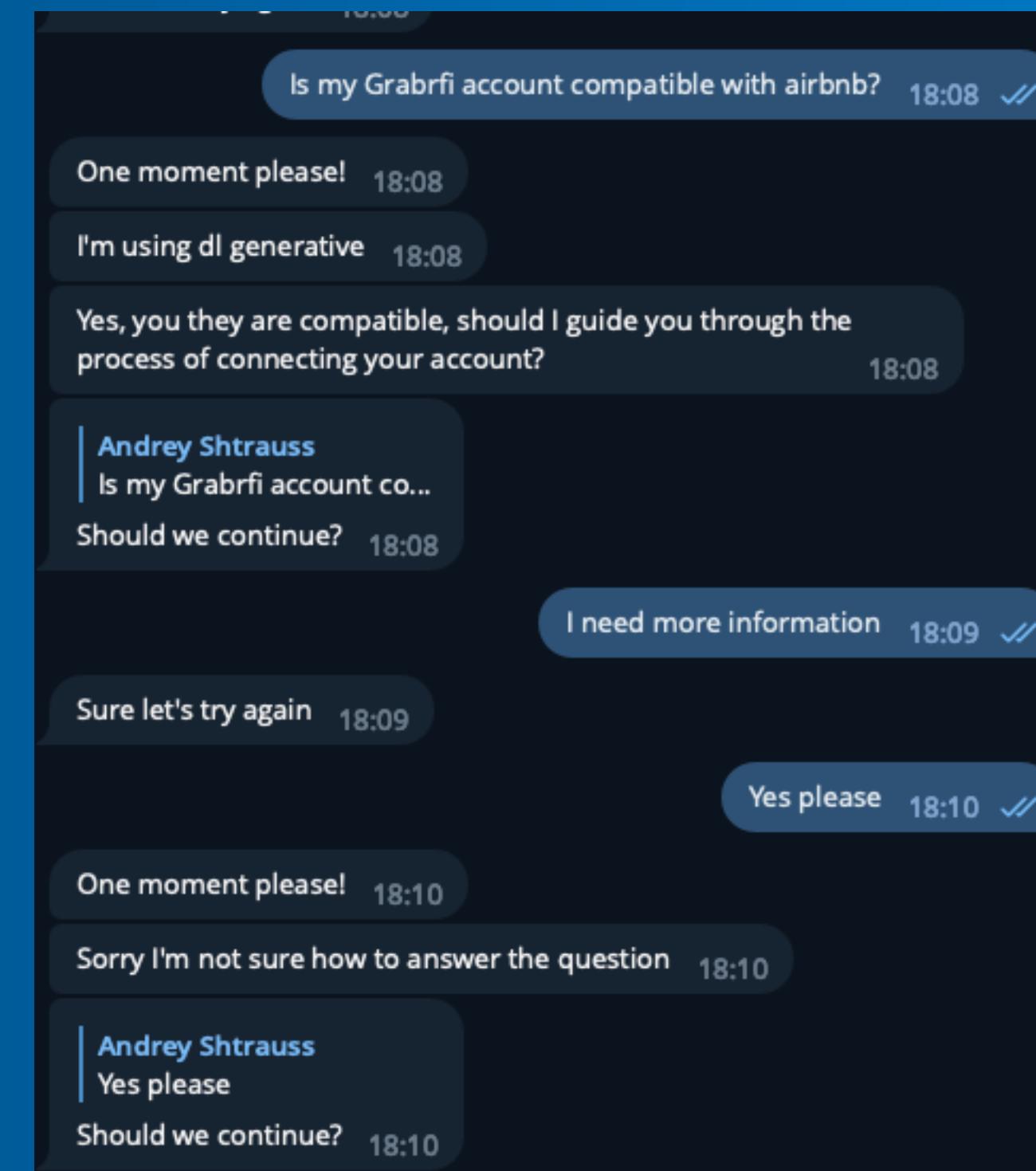
Примеры с NER

Создаем ChatBot для финансовой сферы

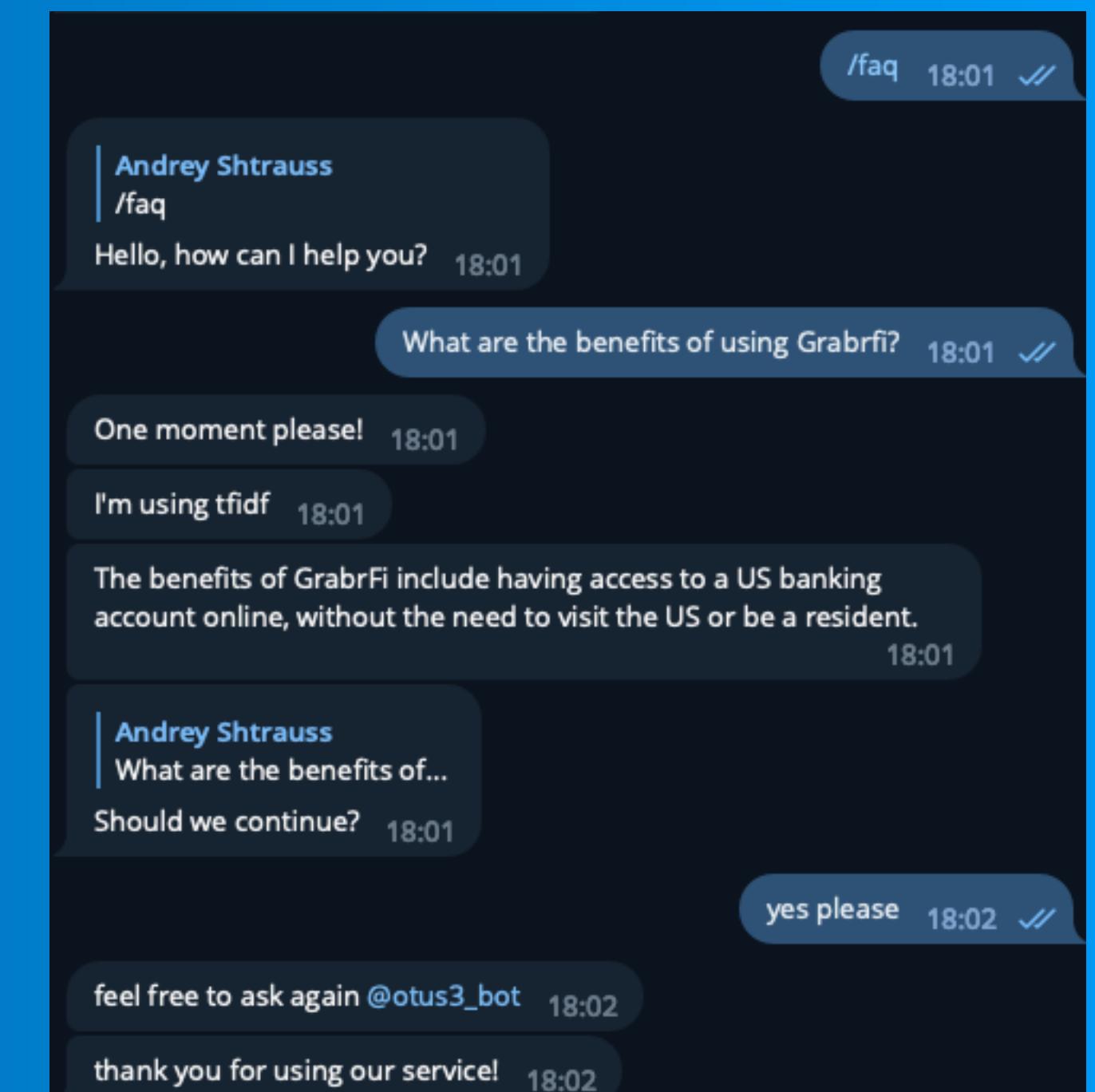
NER требует четких ответов



NER + Генеративная модель



NER метод



Взаимодействие всех подходов

Создаем ChatBot для финансовой сферы

```
category = classifier_QA_test(mes)

if(category != 'transaction'):

    # (1) TFIDF Approach
    tfidf_answer = faq.reply(mes)
    if(tfidf_answer != 'cant find question/answer in database'):
        tfidf_flag = True
    else:
        # (2) Extractive QA
        ...
        extractive_answer = extractive_qa_bert(mes,answer_text)
        if(extractive_answer != 'cant find answer in text'):
            extractive_flag = True
        else:
            # (3) ml classifier
            ml_answer = ml_approach(mes)
            print('ml_answer',ml_answer)
            if(ml_answer != "I don't understand"):
                ml_flag = True
                print('ml_answer',ml_answer)

    '''Select relevant reply'''

    if(tfidf_flag == True):
        answer = tfidf_answer
        got_answer = True
        bot.send_message(chat_id,"I'm using tfidf")
    else:
        if(extractive_flag is True):
            if(extractive_flag is True and tfidf_flag is True):
                answer = tfidf_answer; got_answer = True
                bot.send_message(chat_id,"I'm using extractive QA")
            ...
        else:
            if(ml_flag is True):
                answer = ml_answer; got_answer = True
                bot.send_message(chat_id,"I'm using ml approach")
            else:
                answer = "Sorry I'm not sure how to answer the question"; got_answer = False
    else:
        # (3) dl generative
        bot.send_message(chat_id,"I'm using dl generative")
        answer = generative_test(mes)
```

Пробуем TF-IDF подход

Пробуем QA подход

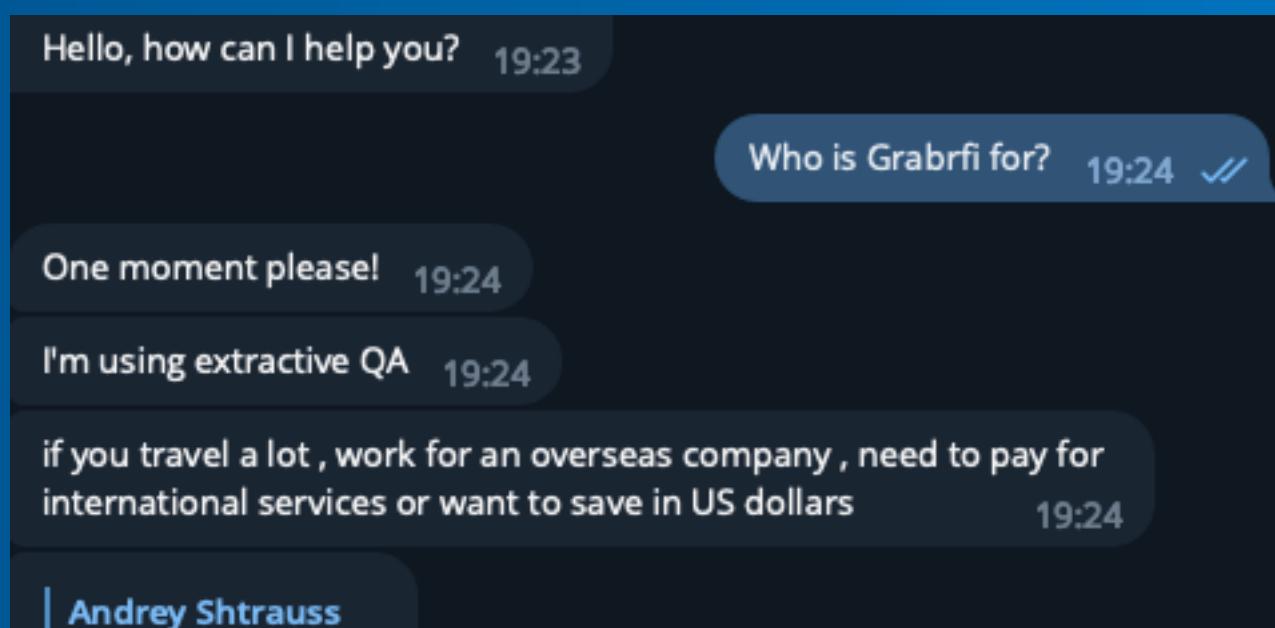
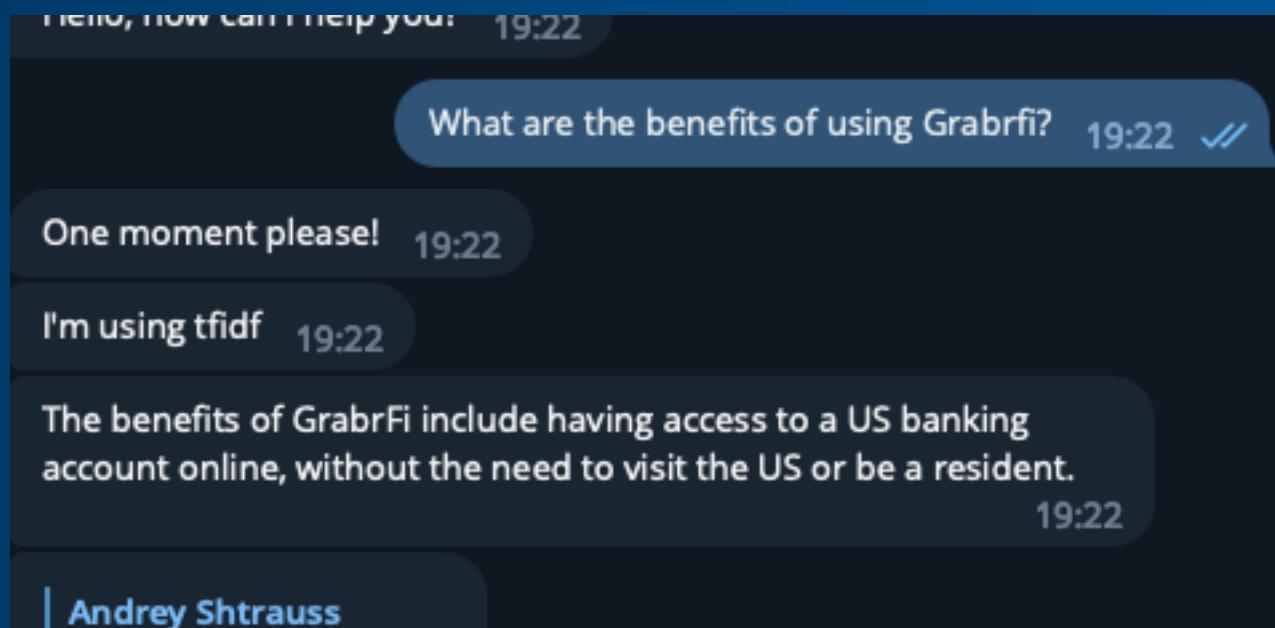
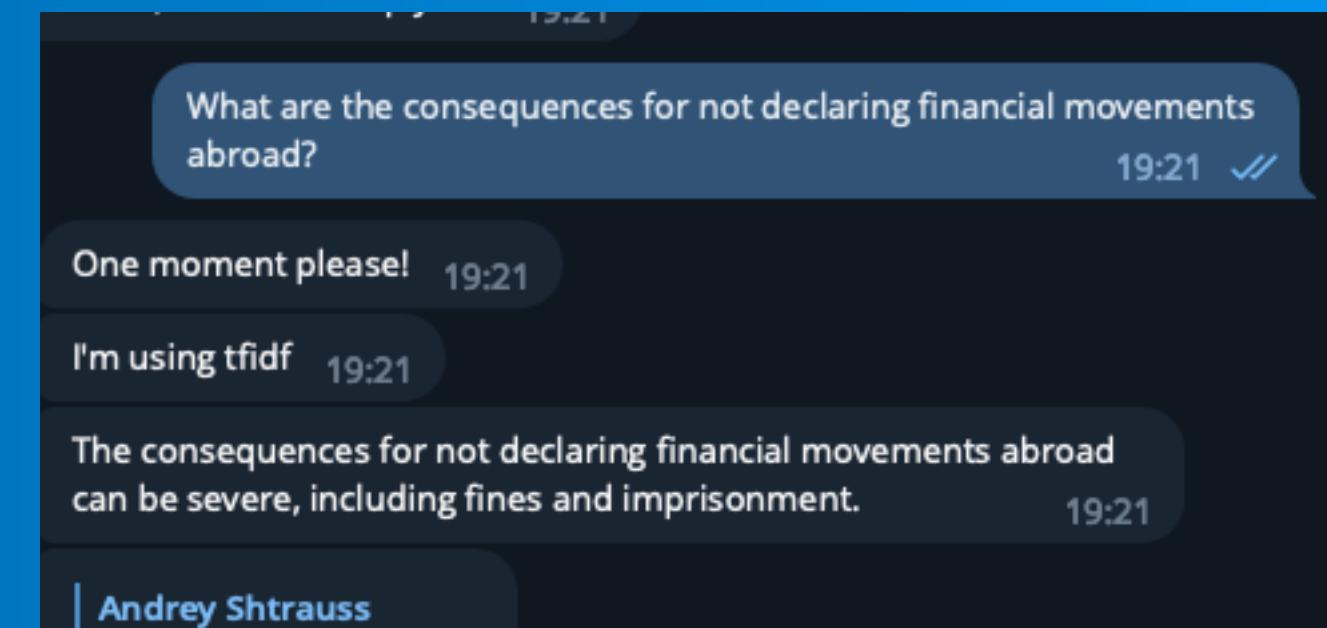
Пробуем ML подход

Логика выбора метода

Выбор генеративной модели после классификации

Примеры из Чатбота

Создаем ChatBot для финансовой сферы



Примеры Чатбота (Генеративная)

Создаем ChatBot для финансовой сферы

Способы зачисления средств

```
>> User: What bank transfers do you offer?  
Bot: Several bank transfer options are available to you, ACH and wire transfers  
>> User: Are there any differences between these two?  
Bot: A ACH transfer is completed through a clearing house and can be used to process direct payments or  
bank account to another. Wire transfer will cost you for domestic Incoming wire 5 USD, and for domestic  
>> User: How do I add funds to my account?  
Bot: You can add US dollars to your GrabrFi account by bank transfer, withdrawing money from another pla  
>> User: I'd like to transfer funds using a wire transfer  
Bot: You do, here are the steps: **wire_transfer**  
>> User: Can I also add funds using an international transfer?  
Bot: Yes, you can add funds from another US account to your PayPal balance and your GrabRFi account for  
>> User: Is my account compatible with SWIFT?  
Bot: Sure, should I guide you through the process of connecting your GrabrinFi account?  
  
deposits may take up to 3 business days to verify you own the account and verify it.  
>> User: yes that would be greate  
Bot: Okay, let me know which country you are subject to taxation in.  
>> User: Argentina  
Bot: You own your account and your PayPal account and paypal will be returned to the account.  
>> User: |
```

Способы зачисления средств

```
>> User: Can I add funds to my account via an international transfer?  
Bot: We offer the ability to add funds using SWIFT, would that interest you?  
>> User: Yes please  
Bot: Sure, please familiarise yourself with the instructions: **swift_transfer**  
>> User: Are there any other ways to top up my account?  
Bot: You can add US dollars to your GrabrFi account by bank transfer, withdrawing money from another  
ecoins) and cash top ups (in Argentina and the US only).  
>> User: Tell me how to top up my account using cryptocurrency  
Bot: Sure I'll walk you through: **binance_topup**  
>> User: Do you offer any other alternatives to Binance?  
Bot: Unfortunately not, only the built in cryptocurrency can be used to topup your account, hence  
>> User: |
```

Выводы

Создаем ChatBot для финансовой сферы

- ▶ Подходы TF-IDF можно использовать с высоким порогом; когда запрос попадает в точку
- ▶ ML подход дает возможность учитывать разные варианты одного и того же запроса
- ▶ QA подход дает нам возможность искать ответы на вопросы которые есть в различных документах
- ▶ Генеративные модели хорошо могут учитывать разные варианты развития диалога и учитывают контекст диалога
- ▶ NER для определения продолжительность разговора оказался не нужен