

Q1: Sentiment Analysis and Action Extraction

Set up Instructions

To install dependences and run this notebook:

```
poetry install
```

To update delta files with your own experiment (optional):

1. Deploy Azure AI Studio/ Azure Machine Learning
2. Deploy gpt-4o model, and increase token limits to reduce throttling
3. Update .env file
4. run "poetry run s_a"

```
poetry run s_a
```

Display Results from Sentiment Analysis and Action Extraction

```
In [2]: from deltalake import DeltaTable
df_delta = DeltaTable(' ../../data/sentiment_analysis/delta').to_pandas()
df_delta.head(10)
```

	file_name	file_content	sentiment	actions
0	transcript_0.txt	Member: Hi, I'm calling to get a case pre-auth...	neutral	{'actionItems': [{'owner': '', 'actionItem': '...'}
1	transcript_1.txt	Member: Hi, I'm calling about a denied claim I...	negative	{'actionItems': [{'owner': 'Customer Support', ...}
2	transcript_10.txt	Member: Hi, I'm calling to schedule an appoint...	positive	{'actionItems': []}
3	transcript_100.txt	Member: Hi, I'm calling about a denied claim I...	positive	{'actionItems': [{'owner': 'Customer support', ...}
4	transcript_101.txt	Member: Hi, I'm calling to schedule an appoint...	positive	{'actionItems': [{'owner': 'Customer Support', ...}
5	transcript_102.txt	Member: Hi, I'm having trouble registering and...	neutral	{'actionItems': [{'owner': 'Technical Support', ...}
6	transcript_103.txt	Member: Hi, I'm calling about a claim that was...	positive	{'actionItems': [{'owner': 'Policy update team', ...}
7	transcript_104.txt	Member: Hi, I'm calling to get a case pre-auth...	neutral	{'actionItems': []}
8	transcript_105.txt	Member: Hi, I'm calling about a denied claim I...	neutral	{'actionItems': [{'owner': 'Customer Support', ...}
9	transcript_106.txt	Member: Hello, I'm having some trouble registe...	positive	{'actionItems': []}

Granular view of sentiment and actions

```
In [3]: from data.visualize import get_granular_view_sentiment_and_actions

num_conversations = 5 # Number of customer conversations to inspect
get_granular_view_sentiment_and_actions(num_conversations=num_conversations, df
```

Conversation no.: 1

File Content: Member: Hi, I'm calling to get a case pre-authorized. My name is MEM456789.

PA Agent: Hi Emily, thank you for calling PA customer care. Can you please provide verification purposes?

Member: It's March 12, 1985.

PA Agent: Thank you, Emily. Can you please provide me with some details about pre-authorization for? What's the nature of the treatment or service you're requesting?

Member: I'm scheduled to undergo an MRI scan for a knee injury. My doctor's request, but I wanted to confirm the status and ensure that it's covered under my plan.

PA Agent: I apologize for the delay, Emily. Let me just check on the status for just a moment?

Member: Sure, thank you.

PA Agent: Thank you for holding, Emily. I've located your request and I'll confirm the name of your doctor and the facility where the MRI scan is scheduled.

Member: My doctor's name is Dr. Smith and the facility is Oakwood Medical Center.

PA Agent: Thank you, Emily. I've verified the information and I'm checking the status. Please hold for just another moment?

Member: Okay.

PA Agent: Thank you for holding, Emily. I've checked your eligibility and the MRI scan is under your plan. However, I need to escalate this request to our medical review team for evaluation.

Member: Okay, what does that mean?

PA Agent: It means that our medical review team will review your case and provide pre-authorization. I apologize, but I won't be able to provide a decision until the next 3-5 business days to let you know the outcome.

Member: Okay, that sounds good. Can you give me a reference number for this request?

PA Agent: Yes, certainly. Your case number is PA001234. You can use this number for your request.

Member: Great, thank you for your help.

PA Agent: You're welcome, Emily. We'll be in touch soon. Is there anything else I can help you with?

Member: No, that's all. Thank you.

PA Agent: You're welcome. Have a great day.

```
{
  "actionItems": [
    {
      "owner": "",
      "actionItem": "Inform Emily Wilson of the decision regarding her MRI scan pre-authorization request.",
      "dueDate": "3-5 business days",
      "status": "Open",
      "notes": "The request has been escalated to the medical review team for evaluation."
    }
  ]
}
```

Predicted Sentiment: neutral.

Conversation no.: 2

File Content: Member: Hi, I'm calling about a denied claim I received for that my policy doesn't cover it, but I'm certain it should be covered under MEM123456.

Customer Support: I apologize for the inconvenience, MEM123456. Can you please provide more information about the denied claim, such as the claim number and the date of service?

Member: The claim number is CLM789012, and the date of service was February 1st.

Customer Support: Thank you for providing that information. I've located your policy. Can you provide more information about the new policy you're referring to? When did you switch policies?

Member: I switched policies on January 1st. I was told that the new policy would cover the claim, but the denial letter says it's not covered.

Customer Support: I understand your concern. Let me check on the status of your claim. (pause) I apologize, but it appears that your new policy has not been updated yet. This is the reason why your claim was denied.

Member: That's frustrating. How can we get this resolved?

Customer Support: I'm going to go ahead and connect you with our policy update team. They will be updating your policy and reprocessing your claim. Please hold for just a moment. (pause)

Customer Support: You're now connected with our policy update team. They'll be working on getting your claim approved. Is there anything else I can assist you with?

Member: No, that's all. Thank you for your help.

Customer Support: You're welcome, MEM123456. We apologize again for the inconvenience. Our policy update team will be in touch with you shortly to confirm the status of your claim.

Member: Thank you.

Customer Support: You're welcome. Have a great day.

Call duration: 9 minutes

```
{
  "actionItems": [
    {
      "owner": "Customer Support",
      "actionItem": "Connect member with the policy update team",
      "dueDate": "",
      "status": "In Progress",
      "notes": "Member ID: MEM123456, Claim Number: CLM789012,"
    },
    {
      "owner": "Policy Update Team",
      "actionItem": "Assist and confirm the claim status with the member",
      "dueDate": "",
      "status": "Open",
      "notes": "Member expressed frustration, ensure to provide a timely response"
    }
  ]
}
```

Predicted Sentiment: negative.

Conversation no.: 3

File Content: Member: Hi, I'm calling to schedule an appointment with a sp
member ID is MEM123456.

Customer Support: Hi Emily, thank you for calling. Can you please confirm
account information?

Member: It's June 12th, 1985.

Customer Support: Great, thank you Emily. I have your account information
of specialist you're looking to see and what date you're hoping to schedul

Member: I'm looking to see a dermatologist, and I was hoping to get in as
availability this week?

Customer Support: Let me check the schedule. (pause) Okay, it looks like D
PM. She's one of our top-rated dermatologists and has excellent patient re
appointment for you?

Member: That sounds great, thank you. What's Dr. Smith's specialty within

Customer Support: Dr. Smith specializes in skin cancer treatment and cosme
excellent bedside manner and takes the time to thoroughly explain treatmen

Member: That sounds perfect. Go ahead and schedule the appointment for Wed

Customer Support: Okay, I've scheduled the appointment for you. You'll rec
details shortly. Is there anything else I can assist you with today?

Member: No, that's all. Thank you so much for your help!

Customer Support: You're welcome, Emily! It was my pleasure to assist you.
to make any changes to your appointment, don't hesitate to give us a call.

Member: You too, thanks again!

Customer Support: Bye for now.

Member: Bye.

(pause)

Customer Support: Emily, just a quick follow-up to confirm that the appoin
You should receive the confirmation email within the next 10 minutes.

Member: Sounds good, thanks again.

Customer Support: You're welcome. Is there anything else I can help you wi

Member: No, I think that's all.

Customer Support: Alright then. Have a great day, and we'll see you on Wed

Member: You too, bye!

Customer Support: Bye!



```
{  
  "actionItems": []  
}
```

Predicted Sentiment: positive.

Conversation no.: 4

File Content: Member: Hi, I'm calling about a denied claim I received for was denied in error.

Customer Support: I apologize for the inconvenience, MEM123456. Can you provide me with more information about the claim, such as the date of service and the type of service?

Member: The date of service was January 10th, and it was for a physical therapy session. My policy doesn't cover this type of service.

Customer Support: I understand. Can you please confirm your policy number?

Member: My policy number is MEM123456, and I purchased it on December 1st.

Customer Support: Thank you for providing that information. I'm going to check the policy details. (pause) Ah, I see the issue. It appears that our system has not yet been updated to reflect the new policy, and the new policy does cover physical therapy services.

Member: Exactly! I switched to the new policy because it covered physical therapy. I was able to find the issue.

Customer Support: I'm glad we could resolve the issue. However, I need to refer your claim to our claims processing team to get the claim reprocessed. Can you please hold for just a moment?

Member: That sounds great, thank you. I appreciate your help.

Customer Support: You're welcome, MEM123456. I'm going to transfer the call to the claims processing team. (pause) Okay, I've transferred the call. You should be speaking with the claims processing team shortly. They will assist you with getting the claim approved.

Member: Thank you so much for your help. I really appreciate it.

Customer Support: You're welcome, MEM123456. We apologize again for the inconvenience we may have caused. We'll get this resolved for you as soon as possible.

Member: Great, thank you. I'll wait for the claims team to assist me.

Customer Support: Sounds good. We'll follow up with you within the next business day once the claim is resolved.

```
{
  "actionItems": [
    {
      "owner": "Customer support",
      "actionItem": "Follow up with the member to ensure the issue is resolved",
      "dueDate": "Within 24 hours",
      "status": "Open",
      "notes": "Apologized for the inconvenience caused"
    },
    {
      "owner": "Claims processing team",
      "actionItem": "Reprocess the denied claim for the physical therapy session",
      "dueDate": "",
      "status": "In Progress",
      "notes": "Claim was denied due to system error not updating policy"
    }
  ]
}
```

Predicted Sentiment: positive.

Conversation no.: 5

File Content: Member: Hi, I'm calling to schedule an appointment with a sp member ID is MEM234567.

Customer Support: Hi Emily, thank you for reaching out. Can you please con your account?

Member: It's March 12, 1985.

Customer Support: Okay, thank you. What type of specialist are you looking for the appointment?

Member: I need to see a cardiologist. I'd like to schedule it for next Wed

Customer Support: Okay, let me check the availability of our cardiologists for next Wednesday. We have Dr. Smith at 9:00 AM or Dr. Johnson at 2:00 PM

Member: Can you tell me a bit more about both doctors?

Customer Support: Absolutely. Dr. Smith has over 10 years of experience in from our patients. Dr. Johnson has over 15 years of experience and a 4.8-s qualified, but Dr. Johnson has a slightly higher rating.

Member: That sounds great. I think I'd like to schedule with Dr. Johnson a

Customer Support: Okay, I've scheduled the appointment for you. You'll rec details. Is there anything else I can assist you with?

Member: No, that's all. Thank you for your help.

Customer Support: You're welcome, Emily. We'll follow up with you before y any other questions or concerns, feel free to reach out.

Member: Sounds good. Thanks again.

Customer Support: Have a great day, Emily.

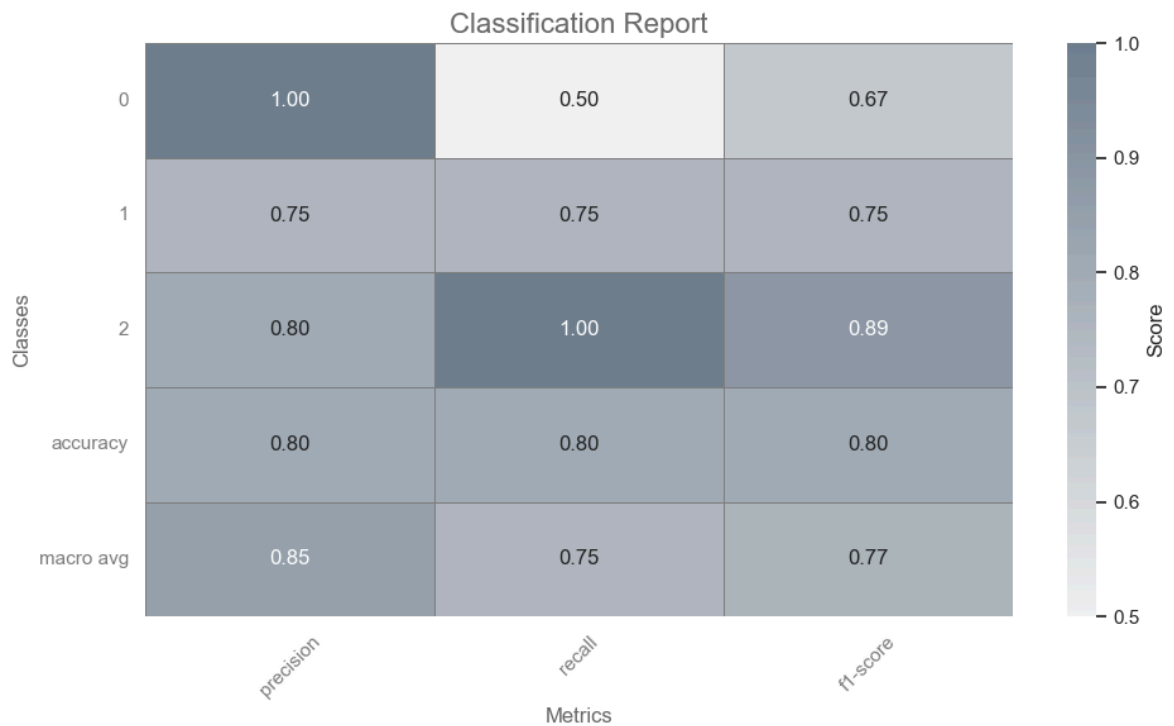
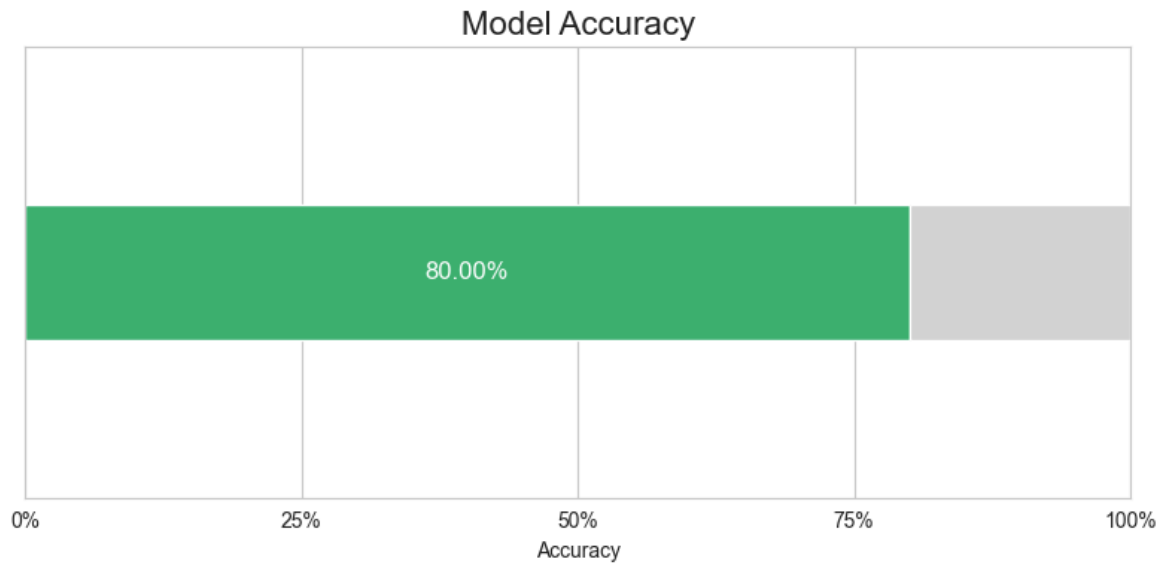
```
{
  "actionItems": [
    {
      "owner": "Customer Support",
      "actionItem": "Send a confirmation email to Emily Wilson",
      "dueDate": "",
      "status": "Closed",
      "notes": ""
    },
    {
      "owner": "Customer Support",
      "actionItem": "Follow up with Emily Wilson before the app",
      "dueDate": "",
      "status": "Open",
      "notes": ""
    }
  ]
}
```

Predicted Sentiment: positive.

Sentiment Evaluation

```
In [6]: from llmops.eval import run_evaluation_metrics

run_evaluation_metrics(
    df_delta_path = '../data/sentiment_analysis/delta',
    df_ground_truth_path = '../data/sentiment_analysis/ground_truth/ground_tru
)
```



Evaluation of Actions

- Evaluation of Actions would require a more sophisticated approach, given it must interpret whether something is correct taking into consideration semantics. This could be achieved using capabilities within Prompt Flow or MLFlow.
- Once the evaluation framework is in place, it allows a more principled approach to improving system performance from prompt engineering and model selection

Other Considerations

- Outputting results to Delta will allow for data versioning. Allowing LLMOps, namely reproducibility of results.