Revolutionizing Call Center Operations with AI and BI

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Position: AI/ML & Business Intelligence Architect

Nomination Summary

In the modern world, where everything is going fast, customer service excellence can play a significant role in growing any company and lead to enhanced customer loyalty levels, cut down churn and increase brand value. My innovative AI-powered solution transforms conventional call center approaches through incorporation of state-of-the-art technologies such as Google's Speech-to-Text API, BigQuery and Looker Studio that will make customer support executives more effective and help unearth useful business trends and insights from audio data.

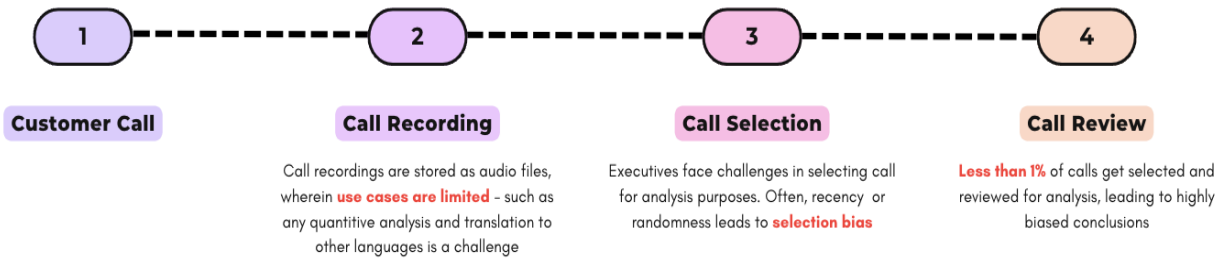
Introduction

Customer service is a decisive part of any enterprise, which can affect customer happiness and loyalty. As much as companies are keen on improving their customer services, there has been little focus on process efficiency via automation and AI/ML technologies. My solution fills this void by automating call transcriptions and sentiment analysis to enable post-call analytics comprehensively and provide actionable insights.

Current Process Flow

The traditional process of a call center involves storing the recorded calls in a database. After which these calls are selected by hand to be reviewed for analysis. However, such an approach poses several problems:

- Quantitative analysis of audio files is not extensive.
- Manual reviewing of calls is unreasonable as less than 1% are analyzed thus leading to bias.

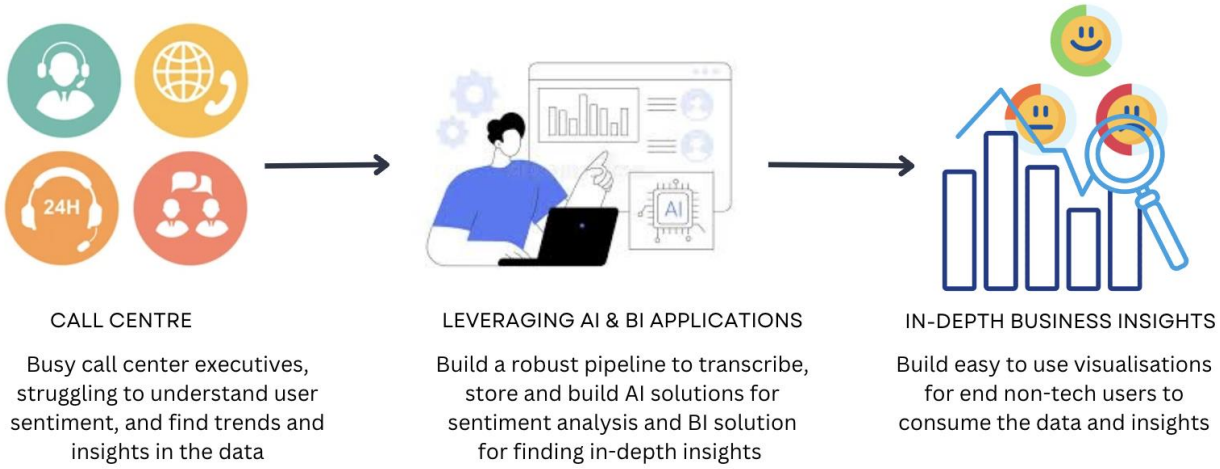


Proposed Solution

My vision of the solution is to use Google Cloud Storage (GCS) and Platform services for efficient storage and analysis of recorded calls. This process entails:

Data Storage and ETL Pipeline: Storing recorded calls as raw data in GCS and building an ETL pipeline for BigQuery consumption using Cloud Dataprep or object tables.

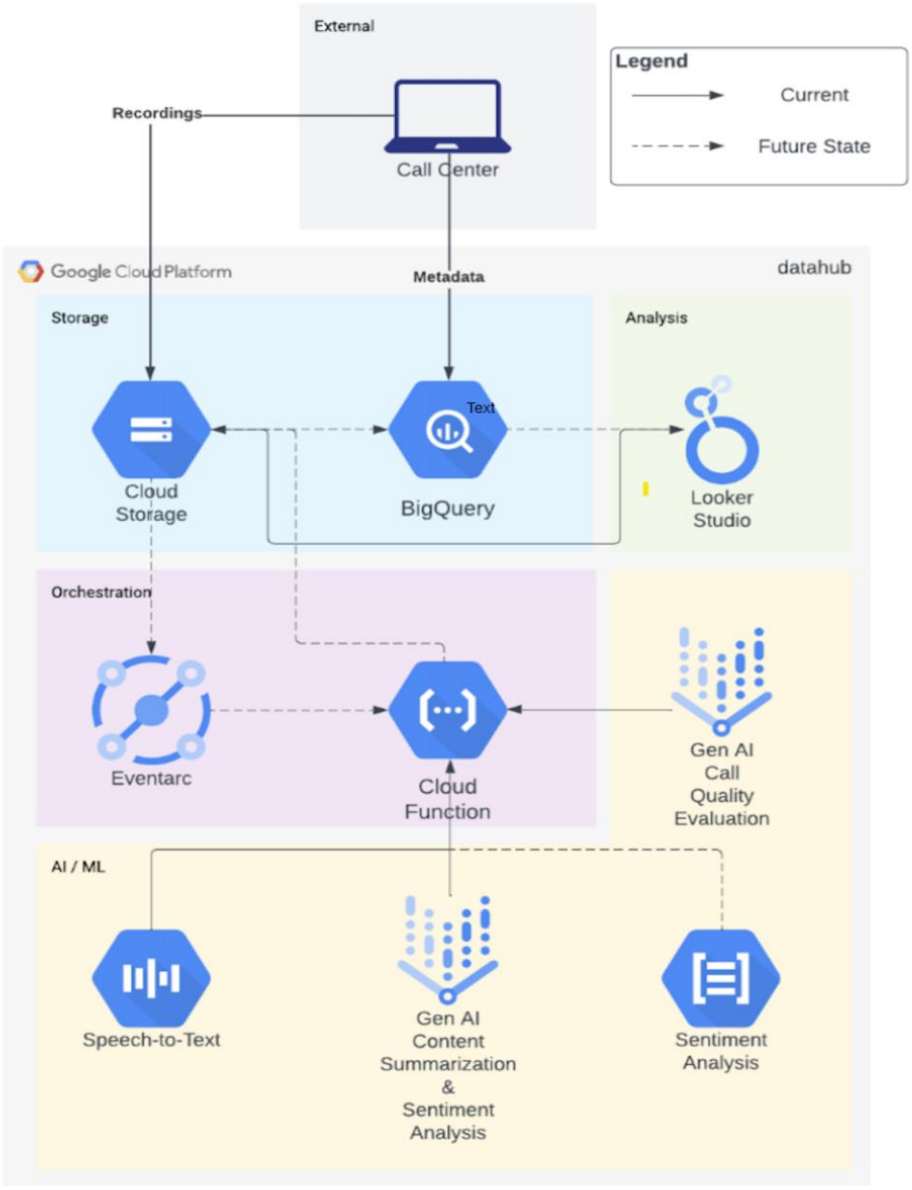
- **Automatic Transcription:** Integrating Google's Speech-to-Text API for automatic transcription of calls.
- **Sentiment Analysis:** Utilizing Cloud Natural Language API for sentiment analysis of transcribed calls.
- **Data Visualization:** Using Looker Studio to visualize key performance metrics and insights.



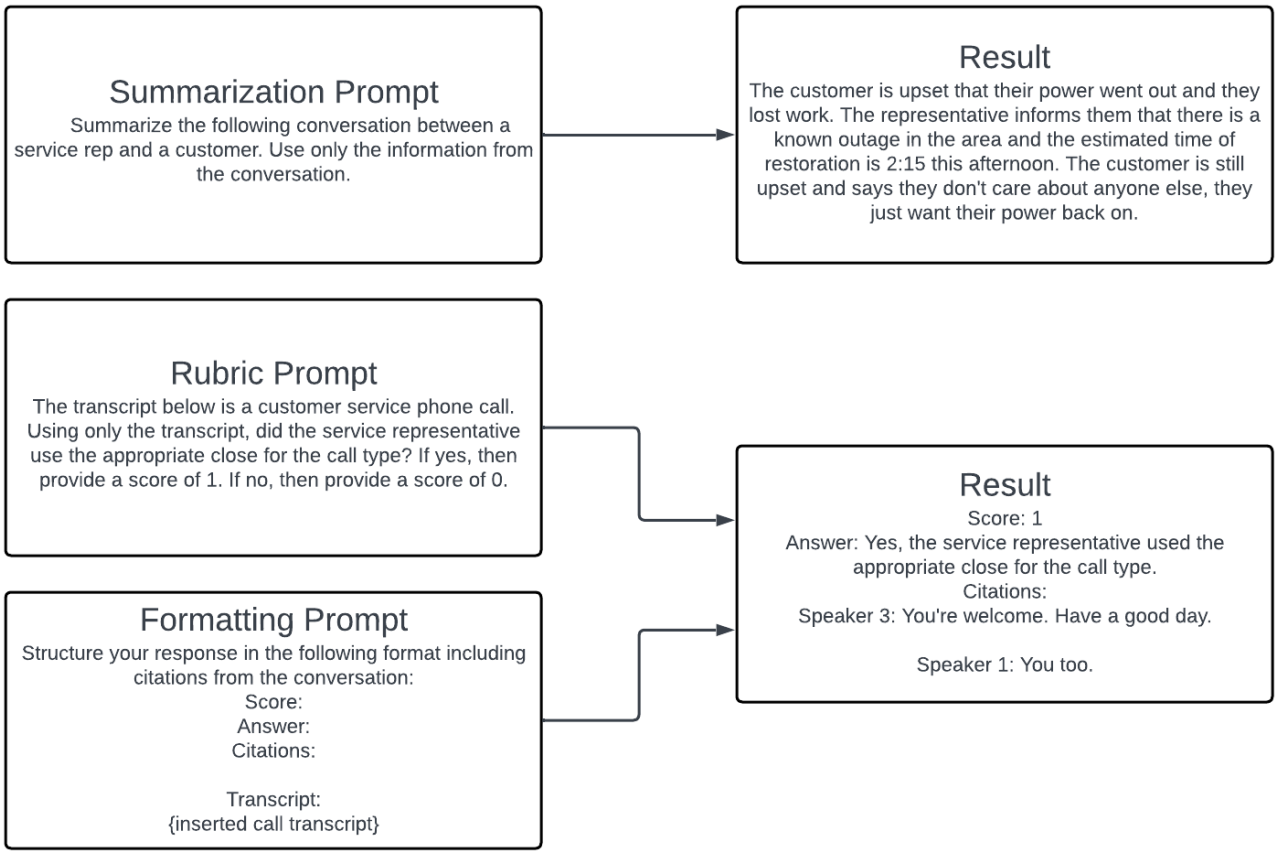
Stated Architecture

- **Conceptualization of BigQuery audio file access:** Employing BigQuery object tables for unstructured data like the direct audio files processing and querying.
- **Integration of Speech-to-Text API:** The usage of pre-trained models that allow transcribing audio files in an accurate way with minimal AI/ML involvement.
- **Sentiment Analysis through NLP:** The use of NLP models to do sentiment analysis on transcribed calls and classifying them as positive, negative, or neutral.
- **Looker Studio Visualization:** Create simple visual dashboards for the interpretation of model outputs by non-technical users.

Architecture Design Diagram



Prompt Engineering



Coding:

1. **How to access audio files in the BigQuery interface?**

I wrote the following code fragment to generate object tables for unstructured data in GCS.

```
--Create an object table
CREATE OR REPLACE EXTERNAL TABLE `name_of_table`
WITH CONNECTION `connection_name` --cloud resource connection
OPTIONS(uris=["gs://mybucket/audio/*"],  -- cloud locationwhere audio files are stored
        object_metadata="SIMPLE");
```

2. **The use of Speech-to-Text API to change audio files into text.**

The following can be utilized in calling a remote model for converting audio call recordings into text.

Before any remote model could be used on BigQuery, there is a need to create a “Vertex AI remote models, remote functions and Big Lake (cloud resource)” type cloud resource connection. This will enable calling of the remote model.

Creating CLOUD_AI_SPEECH_TO_TEXT_V2 instance of the remote model

```
CREATE OR REPLACE MODEL
`project_id.dataset.nlp_model_name` -- GCP project ID and dataset id wherein the model will reside
REMOTE WITH CONNECTION project_id.region.connection_id -- region and connection id of cloud resource connection
OPTIONS (REMOTE_SERVICE_TYPE = 'CLOUD_AI_SPEECH_TO_TEXT_V2')
```

Invoking model in BigQuery SQL

```
SELECT * FROM
ML.TRANSCRIBE(
  MODEL `project_id.dataset.model_name`, --GCP project ID and remote model name
  TABLE `project_id.dataset.object_table`, -- object table with audio data (created in previous step)
  [RECOGNITION_CONFIG => ( JSON 'recognition_config')] --required when no recognizer has been specified for remote model.
)
```

The output of the above-mentioned function can be stored in a structured BigQuery table and can be used for further analysis. This can be joined with other data sources in BigQuery.

3. Integrate NLP API for sentiment analysis.

After all the audio files have been transcribed using Speech-to-text API and the resultant records are saved in a structured BigQuery table, it means that we now have an opportunity to work with call center recordings. Moreover, as we noted earlier on this piece, one of the key obstacles to call center analytics is that only a few calls are being reviewed and rated today. Those calls can be analyzed in BigQuery using natural language processing (NLP) models. Such NLP models will help us tell the sentiment or feeling behind every call. Furthermore, the call can be categorized into groups based on whether it was a positive, negative, or neutral experience. The above process saves time and effort for the call center executives who would rather go through their client’s behavior manually while seeking to understand the voice feedback.

Creating a remote model instance using CLOUD_AI_NATURAL_LANGUAGE_V1

```
CREATE OR REPLACE MODEL
`project_id.dataset.nlp_model_name` -- GCP project ID and dataset id wherein the model will reside
REMOTE WITH CONNECTION project_id.region.connection_id -- region and connection id of cloud resource connection
OPTIONS (REMOTE_SERVICE_TYPE = 'CLOUD_AI_NATURAL_LANGUAGE_V1')
```

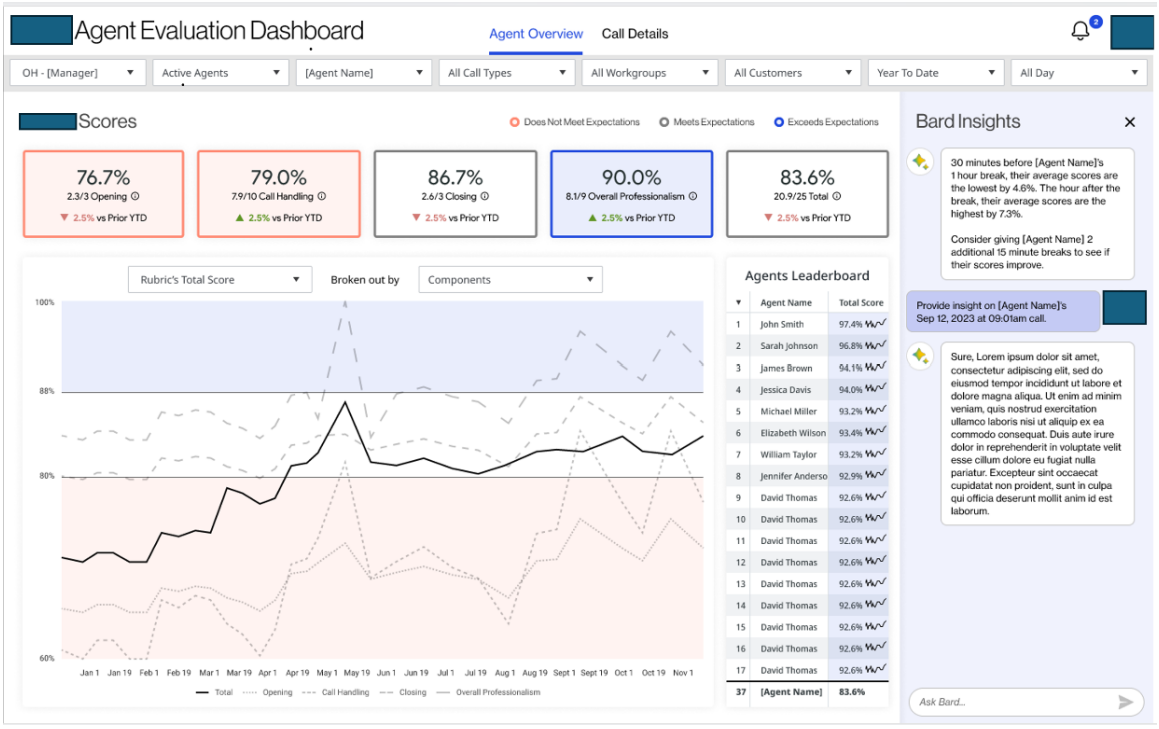
Invoking model in BigQuery SQL

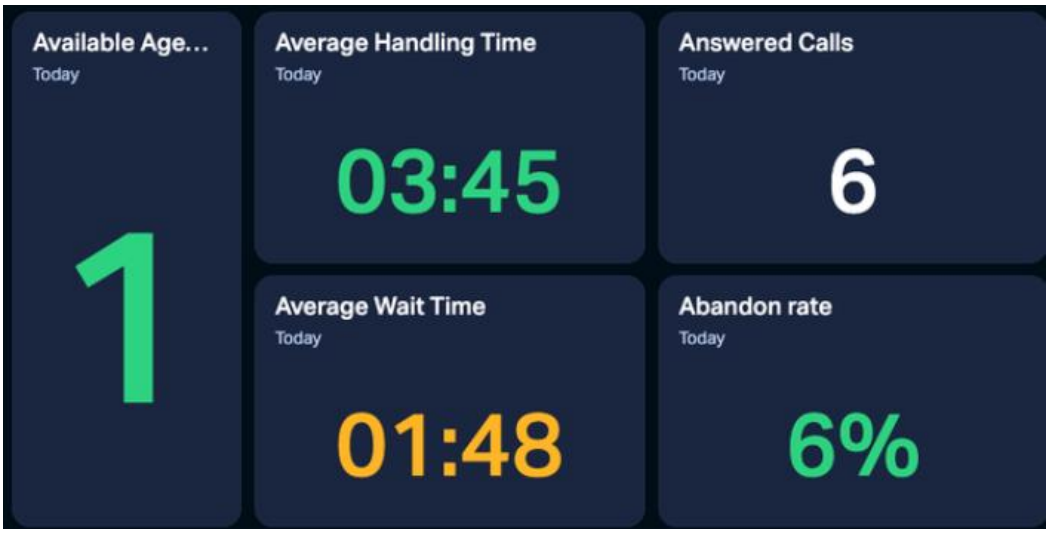
```
SELECT * FROM ML.UNDERSTAND_TEXT(
  MODEL `project_id.dataset.nlp_model_name`, --GCP project ID and remote NLP model name
  TABLE `table_name`, --Bigquery table where transcribed data is stored
  STRUCT('analyze_sentiment' AS nlu_option) --Feature name in NLP model
)
```

It is difficult to analyze the outputs of NLP model since they are referred to as sentiment scores. These can be changed/formulated and converted into understandable buckets/classes. For example, 'positive' if the sentiment score > 0.6 and 'negative' if sentiment_score <= 0.5. Furthermore, SQL allows formatting like this, hence the results will be saved in BigQuery in a structured table format.

Use Cases and Benefits

- **Agent Performance:** Visualizing agent performance metrics, including conversation count, sentiment distribution, and overall sentiment scores.
- **Conversation Overview:** Understanding high-level metrics of call center conversations, such as total conversions, call duration, and sentiment analysis.
- **Word Cloud and Topic Classification:** Identifying key topics discussed in calls to pinpoint areas for improvement.
- **Chatbot:** It is possible to include a chatbot into the Google Looker dashboard that responds with Artificial Intelligence-driven self-help advice for management. The chatbot has automatic response capability, gives explanations for data, points to details or summaries of data and even enables real-time exploration of what-if scenarios.
- **Quality Scoring:** Using NLP models to score and rank audio calls and agents for quality checks.
- **Conversational Forecasting:** AI-driven prediction of the number of future conversations to enhance preparedness and customer experience.
- **Personalized Responses:** Creating personalized answers after listening to speech utterances as done by Large Language Models (LLMs).


Agent Evaluation Dashboard
Agent Overview
Call Details
OH - [Manager]
Active Agents
[Agent Name]
All Call Types
All Workgroups
All Customers
Year To Date
All Day
Scores
Does Not Meet Expectations
Meets Expectations
Exceeds Expectations
76.7%
2.3/3 Opening
2.5% vs Prior YTD
79.0%
7.9/10 Call Handling
2.5% vs Prior YTD
86.7%
2.6/3 Closing
2.5% vs Prior YTD
90.0%
8.1/9 Overall Professionalism
2.5% vs Prior YTD
83.6%
20.9/25 Total
2.5% vs Prior YTD
Rubric's Total Score
Broken out by
Components
Total
Opening
Call Handling
Closing
Overall Professionalism
Agents Leaderboard
Agent Name
Total Score
1 John Smith 97.4%
2 Sarah Johnson 96.8%
3 James Brown 94.1%
4 Jessica Davis 94.0%
5 Michael Miller 93.2%
6 Elizabeth Wilson 93.4%
7 William Taylor 93.2%
8 Jennifer Anderso 92.9%
9 David Thomas 92.6%
10 David Thomas 92.6%
11 David Thomas 92.6%
12 David Thomas 92.6%
13 David Thomas 92.6%
14 David Thomas 92.6%
15 David Thomas 92.6%
16 David Thomas 92.6%
17 David Thomas 92.6%
37 [Agent Name] 83.6%
Bard Insights
30 minutes before [Agent Name]'s 1 hour break, their average scores are the lowest by 4.6%. The hour after the break, their average scores are the highest by 7.3%.
Consider giving [Agent Name] 2 additional 15 minute breaks to see if their scores improve.
Provide insight on [Agent Name]'s Sep 12, 2023 at 09:01am call.
Sure, Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.
Ask Bard..


Available Age...
Today
1
Average Handling Time
Today
03:45
Answered Calls
Today
6
Average Wait Time
Today
01:48
Abandon rate
Today
6%

Conclusion

Conclusively, my AI-driven call transcription and sentiment analysis solution makes customer support operations more efficient by providing deeper insights into their customers. Automating the analysis of customer calls lets clients get an understanding of both customers' attitude and call quality. Timely problem-solving, improved customer interactions, and overall customer satisfaction are among the many advantages that result from identifying areas for improvement. AI/ML models can be used to automate call analysis when it comes to reviewing and scoring calls, which will reduce a lot of manual work involved in this process. This means that all calls rather than only a few evaluations per agent per month can be looked at by this solution as it scales up. Furthermore, future data science projects could make use of transcriptions for topic analysis.