Pipeline for XAI based Automatic Audio Call Audit

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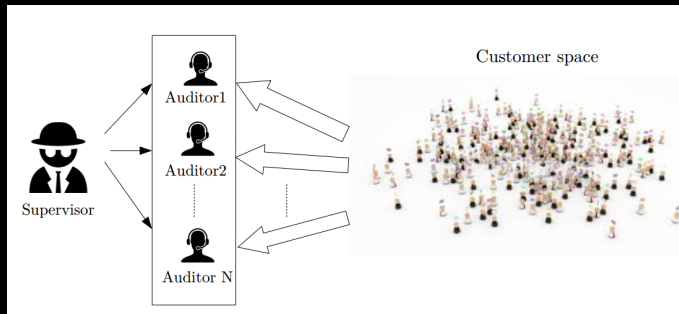
Call Audit

What?

A metric to define how well the customer interactions are being handled by call-center agents.

Why?

- ▶ To ensure the **call-quality**
- ▶ Identify the concerned areas in call center operations $\longrightarrow$ take the preventive steps to improve the **customer satisfaction index**.
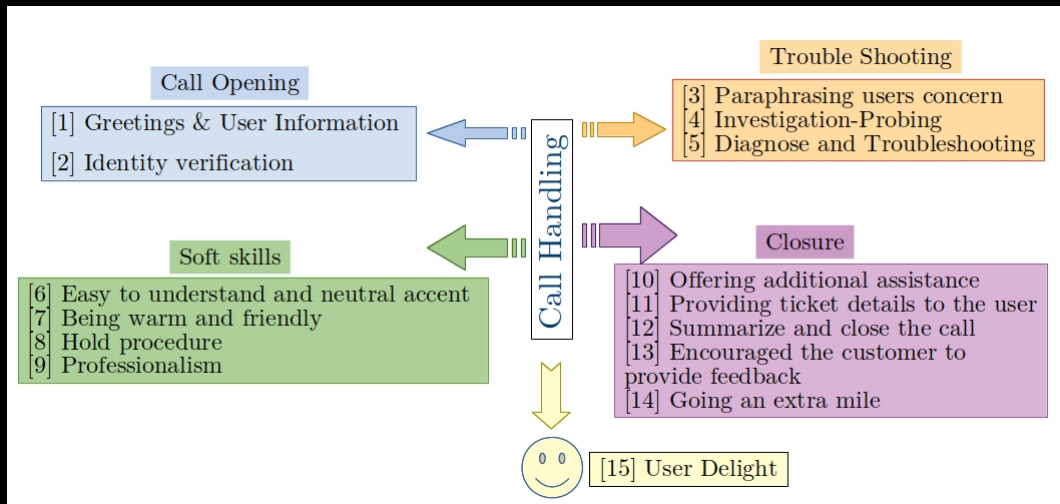
Limitations of Manual Audit

- Manual audits address only **~6%** of the total volume coming to the service desk

- Time complexity: **20-30 mins/call !!**

- (Manual) Auditor assessments are **prone to human bias** $\longrightarrow$ uniformity in audit?
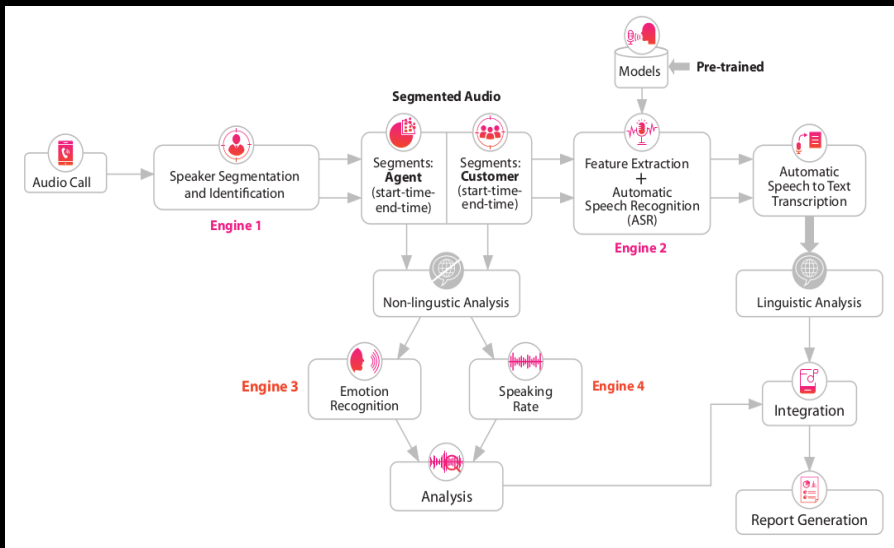
Objective

Automate the call audit process so that :

- ✓ Bulk amount of calls could be handled (**faster process** and **less complexities**)
- ✓ Uniformity in handling: better call handling management and enhanced user experiences
- ✓ Reducing human interventions and bias
- ✓ Provide better and explainable insights to reliably identify user concerns : XAI
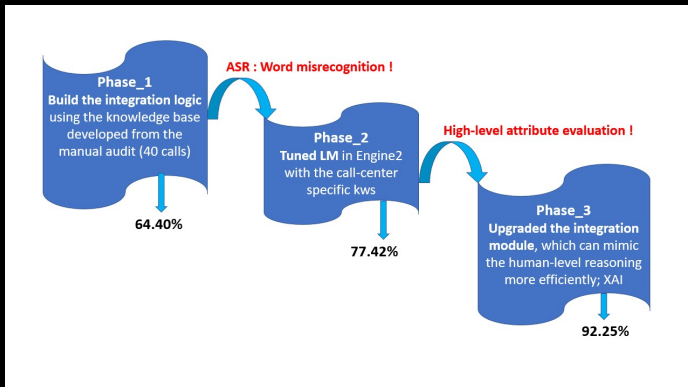
Call Handling Attributes

Call Opening

[1] Greetings & User Information

[2] Identity verification

Trouble Shooting

[3] Paraphrasing users concern
[4] Investigation-Probing
[5] Diagnose and Troubleshooting

Call Handling

Soft skills

[6] Easy to understand and neutral accent
[7] Being warm and friendly
[8] Hold procedure
[9] Professionalism

Closure

[10] Offering additional assistance
[11] Providing ticket details to the user
[12] Summarize and close the call
[13] Encouraged the customer to provide feedback
[14] Going an extra mile

[15] User Delight

Framework: Automatic Call Audit

PoC with Customer Calls (from a Pharma Industry)

Development Phases

- ► Attributes addressed: 15
- ► Test bed : 80 calls
- ► Output format : Yes/No for each attribute
- ► Model (except **LM) adaptation/tuning $\longrightarrow$ target environment : ✗

Phase_1
Build the integration logic using the knowledge base developed from the manual audit (40 calls)

64.40%

ASR : Word misrecognition !

Phase_2
Tuned LM in Engine2 with the call-center specific kws

77.42%

High-level attribute evaluation !

Phase_3
Upgraded the integration module, which can mimic the human-level reasoning more efficiently; XAI

92.25%

Performance : Automatic Audit

Manual Vs Automated: Parameter wise agreement (%)

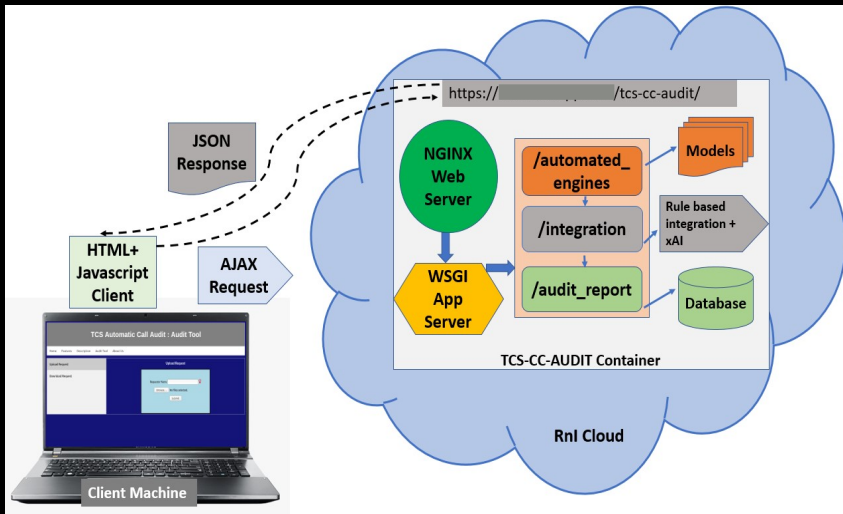| ID	Parameters	phase#1	phase#2	phase#3
P1	Greeting & User Information	67.5	98.75	98.75
P2	Identity Verification	87.5	100.00	100.00
P3	Paraphrasing user's concern	51.25	65.00	95.00
P4	Investigation - Probing	78.75	92.50	98.75
P5	Diagnose & Troubleshooting	75.00	91.25	95.00
P6	Easy to understand and neutral accent	65.00	67.50	86.25
P7	Being warm and friendly	96.25	97.50	97.50
P8	Hold Procedure	51.25	72.50	72.50
P9	Professionalism	90.00	91.25	91.25
P10	Offering additional assistance	76.25	85.00	85.00
P11	Providing Ticket details to the user	55.00	67.50	88.75
P12	Summarize and close the call	70.00	92.50	92.50
P13	Encouraged the customer to provide feedback	50.00	57.50	95.00
P14	Going an extra mile	21.25	25.00	91.25
P15	User Delight	30.00	57.50	96.25
	Average Performance	**64.33**	**77.42**	**92.25**

Performance Analysis

- Phase#2 : LM tuning resulted into improved performance of 77.42%, from 64.33% (absolute improvement of 13.09%)

- Phase#3, upgraded integration further improved the performance to 92.25%, from 77.42% (absolute improvement of 14.83%)

- Time complexity : $\sim (0.6*\mathrm{call\_duration}) << \mathrm{Manual\_audit}$

Number of attributes	Agreement (%)
11	>90%
3	80-90%
1	<80%

Table: Phase#3 : Number of attributes with corresponding agreement (%)

Audit Platform Design

**URL : https://intranet.cloud/tcs-cc-audit/

Demonstration

Audit Tool: Request Upload

Audit Tool: Report Download

Audit Tool: Overview

TCS Automatic Call-center Call Audit version2

Audio & Speech Processing Research Group@TCS RnI, Mumbai

| Audit Tool | Overview | Features | Description | XAI Evaluation | About Us |

Overview

Call audit is a process to ensure the call-quality, a metric to define how well the customer interactions are being handled by call-center agents. The audits are essential, and generally conducted to identify the concerned areas in call center operations of an organization, and to take the preventive steps to improve the customer satisfaction index. Many of such organizations are relying on specialized partners to carry out the audit process and evaluate that. However, manual audit is time-consuming and complex process, thus makes it costly. In fact, manual audits are always prone to human-bias, and becomes less consistent (having lower inter-auditor agreements).

TCS Automatic Call-center Call Audit

We demonstrate an automatic call audit process, mainly to reduce the time complexity and the human-bias in manual auditing. The automated call audit process generates the quality report (marked as Yes/No) against the **15 parameters** Call audit automation has been done by integarting several automatic engines (e.g. **Speaker diarization, Automatic Speech Recognition (ASR), Speech Emotion Recogntion (SER), Speaking Rate**), which are researched and developed in-house by Speech-Team@TCS Research and Innovation-Mumbai.

Audit Tool: Features

TCS Automatic Call-center Call Audit version2

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Audit Tool | Overview | Features | Description | XAI Evaluation | About Us

System Capabilities

- Automatic audit of bulk amount of calls
- Generates quality report marked as 'Yes/No' against 15 attributes
- Time complexity : ~ (0.6*call duration) << Manual audit
- Implicit conversion of GSM to PCM encoding of input call.

Input format

- Input : An audio call
  - File extension : '.wav'
  - Sampling frequency : 8kHz
  - Precision : 16 bit
  - Channel : mono

Audit Tool: Descriptions

TCS Automatic Call-center Call Audit version2

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d attributes to avail description

Greetings & User Information	**Investigation–Probing**
Identity verification	To check whether the questions asked by the agent provided the necessary information to identify what the issue was about.
Paraphrasing users concern	
Investigation–Probing	
Easy to understand and neutral accent	

Audit Tool: XAI Evaluation

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Audit Tool | Overview | Features | Description | XAI Evaluation | About Us

XAI Interface : Attributes Evaluation

Attributes	Explanation		Evaluation	
	Integration Logic	Explainable Insight	Output	Confidence Score
Greeting & User Information	Kws=['welcome','**helpdesk**','thank you','how may I help you','please','**mud**','**id**'] Logic : Kws searching	Kws spotted : ['welcome','**helpdesk**']	Yes	0.5
Identity Verification	kws=['one','two','three','four','five','six','seven','eight','nine','**id**','name','contact','number','**mud**','**may I have your**'] Logic : Kws searching	kws spotted : ['two','four','mud', 'id','may I have your']	Yes	0.7
Paraphrasing user's concern	Kws= ['login','password','problem','no connection','understood','correctly']; Cond1 : Agent speech following the longest Customer speech; Cond2 : Two consecutive Agent's speech chunk; Cond3 : Agent spoke more than a Customer; **Cond4 : Kws searching** Logic : Cond1 OR Cond2 OR Cond3 OR Cond4	Cond1=False Cond2=True Cond3=False Cond4: True ; kws spotted = ['login', 'password', 'problem', 'correctly']	Yes	0.6
Investigation - Probing	Kws= ['ticket','hold','check','troubleshoot']; **Cond1 : kws searching** Cond2 : Agent spoke more than a Customer Logic : Cond1 OR Cond2	Cond1 : True; kws spotted : ['hold', 'check'] Cond2 : False	Yes	0.75
Diagnose & Troubleshooting				
Easy to understand and neutral accent	Cond1 : Agent's speaking rate in 50 to 150 words per minute; Cond2 : Agent's overall emotion ='Neutral' Logic : Cond1 OR Cond2	Cond1=False Cond2=True	Yes	0.5
Being warm and friendly	kws=['sorry','thank you','help','please','understand','inconvenience'] Cond1 : Agent's overall emotion != 'Anger' ; **Cond2 : kws searching** Logic : Cond1 OR Cond2	Cond1=False Cond2=True; kws spotted = ['sorry', 'thank you', 'help', 'please']	Yes	0.75
Hold Procedure	kws=['hold'] Logic : kws searching	kws spotted : ['hold']	Yes	1
Professionalism	Cond1= presence of "Being warm and friendly" Cond2= presence of "Easy to understand and neutral accent"	Cond1 : True Cond2 : True	Yes	1

Thank You!!