

# AirConcierge: Generating Task-Oriented Dialogue via Efficient Large-Scale Knowledge Retrieval

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## A Appendices

### A.1 Data Statistics

For the data records in the KBs, each of them is generated using the prior distributions defined in Table 1. In section 4.5, we conduct experiments under different scales of the KBs, where the newly augmented records are generated according to these prior distributions. The original AirDialogue dataset contains 30 records in the KBs, and we augment the KBs to “10x.”, “50x.”, and “70x.”. That is, we additionally add 270 records, sampled according to the prior distributions, into the “10x.” KBs. Similar things are done to the “50x.” KBs and “70x.” KBs.

### A.2 Qualitative Analysis

We provide samples of dialogues generated by our agent and the user simulator under the self-play evaluation. The user simulator has a pre-defined intent that belongs to one of the three: “book”, “change”, “cancel”, as well as a list of travel constraints. On the other hand, responses provided by the agent may result in one of the five actions: “booked”, “changed”, “cancelled”, “no flight found”, “no reservation”. The user intent “book” could lead to the agent action “booked” or “no flight found”, while both “change” and “cancel” may lead to “no reservation”. However, the user intent “change” could be successfully achieved, and result in the agent action “changed”. Similarly, “cancel” could lead to “cancelled”.

We show several samples according to the agent’s action. First, Table 2 shows the two samples of the agent action “booked”. We see that the user tends to provide the destination and return airport codes spontaneously, followed by the agent requiring the travel dates. After the ticket is found, the agent informs the user about the flight details, which is a human-like behaviour. Finally, the ticket

is confirmed by the user, and both the user and agent ends the dialogue through the thankfulness.

Table 3 shows the samples for the action “changed”. At the beginning, the user and the agent greets with each other. Then, the user not only expresses the intent to change the flight, but also gives a reason for changing. We see that the agent learns to judge whether the user has provided his/her name. In the first, or say upper, sample, the user mentioned his/her name right after greeting, and hence the agent go through to check the KBs. However, in the second, or say lower, sample, the agent identified that the user hasn’t told his/her name yet, so the agent requires the name before querying the KBs.

For the action “cancelled”, samples are provided in Table 4. We observe similar patterns to the action “changed”. The user first describes the need to cancel the ticket, and followed by the agent asking the name if necessary. Lastly, the agent found the ticket and confirm the cancellation with the user.

Table 5 provides the samples of the action “no flight found”. Similar to the samples of “booked”, the user describes the travel constraints and ask to book a ticket. The difference is that the agent could not find a matched flight, and thus responds with no flight available. One thing special is that the agent responds no matching flight along with a reason. For instance, the agent in the upper sample mentions that no matching flights found is due to the mismatching dates.

For “no reservation”, Table 6 shows the corresponding samples, where the upper sample is with the user intent “change” and the lower sample is with the intent “cancel”. We see similar patterns to samples of “changed” and “cancelled”. At the beginning, the user says the intent of changing, or cancelling, the ticket with some reason. The agent asks for the name if needed, and confirm the action of changing, or cancel, with the user.

feature	dep./ret.city	dep./ret. month	dep./ret. day	dep./ret. time
range	categorical	1-12	1-31	00-23
prob.	uniform	uniform	uniform	uniform
feature	class	price	connections	airline
range	business,economy	0-5000	0,1,2	categorical
prob.	economy (7%)	≤200 (25%)	0 (7%) 1 (90%)	standard fare (5%) UA, Delta
	business (3%)	≤500 (25%)		
	any (90%)	≤1000 (25%)	any (3%)	AA, Hawaiian any (95%)
		any (25%)		

Table 1: Flight features of the AirDialogue dataset.

Samples of dialogues with state “booked”.	
<b>Usr</b>	Hello .
<b>Agt</b>	Hello . How can I help you ?
<b>Usr</b>	I am Dennis Carter . I am planning to visit Detroit , can you please book me a ticket from AUS to DTW ?
<b>Agt</b>	Sure , I will help you to book a flight ticket . Can you please share me your travelling dates ?
<b>Usr</b>	My preferable journey dates are from 03/19 to 03/21 .
<b>Agt</b>	Ok , give me a moment .
<b>Usr</b>	Sure , take your own time .
<b>Agt</b>	Here , I found a flight for you with single connection . flight number is <fl_1020> .
<b>Usr</b>	Please book my ticket with this airlines .
<b>Agt</b>	Your ticket is booked .
<b>Usr</b>	Thank you for booking my ticket .
<b>Agt</b>	Welcome .
<b>Usr</b>	Hello .
<b>Agt</b>	Hello , how may I help you ?
<b>Usr</b>	I am Andrew Young . I want to book a flight ticket from DCA to MSP . Could you help me in booking ?
<b>Agt</b>	Sure , may I know your trip dates please ?
<b>Usr</b>	My travelling dates are from May 10 - 12 .
<b>Agt</b>	Do you have any other requirements ?
<b>Usr</b>	I need a connecting flight .
<b>Agt</b>	Ok , please wait .Ok , please wait .
<b>Usr</b>	Sure .
<b>Agt</b>	Thank you for waiting and we have found a flight in economy class with 1 connection in Spirit airlines and the fare of your flight will be 200 . Do you like me to proceed your booking with this flight ? flight number is <fl_1026> .
<b>Usr</b>	Please proceed .
<b>Agt</b>	Ok , your ticket is booked .
<b>Usr</b>	Thank you .
<b>Agt</b>	Most welcome .

Table 2: Samples of dialogues with state “booked”.

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Samples of dialogue with state “changed”.

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**Usr** Hello .  
**Agt** Hello . How can I help you ?  
**Usr** I am Jeffrey Miller . I want to change my existing reservation due to postpone of my exams . Can you please help me with this ?  
**Agt** Sure , please wait for a while .  
**Usr** sure .  
**Agt** I found your reservation , can you please share your travelling dates ?  
**Usr** My travelling dates are July 28 and July 30 .  
**Agt** Can I know your airport codes ?  
**Usr** My airport codes are PHL and MSP .  
**Agt** Do you have any other specifications ?  
**Usr** No .  
**Agt** Ok , please wait for a while .  
**Usr** Sure .  
**Agt** There is a flight with single connection in UA airlines and the ticket fare is 200 only . Can I book the ticket for you ? flight number is <fl\_1025> .  
**Usr** You can proceed .  
**Agt** Your ticket is confirmed in economy class .  
**Usr** Thank you .  
**Agt** Thank you for choosing us .

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**Usr** Hello .  
**Agt** Hello . How can I help you ?  
**Usr** I want to change my existing reservation due to postpone of my exams . Can you please help me with this ?  
**Agt** Sure , I will help you to change your reservation .  
**Usr** Thank you .  
**Agt** May I know your name please ?  
**Usr** My name is David Martinez .  
**Agt** Ok , please wait a moment .  
**Usr** Sure .  
**Agt** Thank you for waiting , I have found your reservation and cancelled it successfully .  
**Usr** Thank you for your help .  
**Agt** Thank you for reaching us .

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Table 3: Samples of dialogue with state “changed”.

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Samples of dialogue with state “cancelled”.

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**Usr** Hello .  
**Agt** Hello . How can I help you ?  
**Usr** I am Amy White . I want to cancel my recent reservation due to sudden cancellation of my trip . Can you help me ?  
**Agt** Sure , I will help you to cancel your reservation .  
**Usr** Thank you .  
**Agt** Happy to inform you that we found a reservation on your name . Shall I cancel it ?  
**Usr** Yes , please cancel it .  
**Agt** Your ticket has been cancelled .  
**Usr** Thank you for your help .  
**Agt** Welcome .

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**Usr** Hello .  
**Agt** Hello . How can I help you ?  
**Usr** I am Jacob Clark . I want to cancel my recent reservation due to sudden cancellation of my trip . Can you help me ?  
**Agt** Sure , I will help you to cancel your reservation .  
**Usr** Thank you .  
**Agt** Please give me a moment .  
**Usr** Sure .  
**Agt** I found your reservation and I have successfully cancelled your reservation .  
**Usr** Thank you for your help .  
**Agt** Welcome .

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Table 4: Samples of dialogue with state “cancelled”.

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Samples of dialogue with state “no flight found”.

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**Usr** Hello .  
**Agt** Hello , how may I help you ?  
**Usr** I am Paul Phillips . I am planning to attend music concert at CLT , can you please help me with booking a flight ticket from BOS ?  
**Agt** Sure , may I know your trip dates please ?  
**Usr** Sure , I would like to take off on Mar 10 and return on Mar 12 .  
**Agt** Do you have any other requirements ?  
**Usr** Yes , I need a connecting flight .  
**Agt** Please wait .  
**Usr** Sure , take your time .  
**Agt** Sorry , there are no flights available on your preferred dates .  
**Usr** Ok , no issues . Thank you for checking .  
**Agt** Thank you for choosing us .

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**Usr** Hello .  
**Agt** Hello , how may I help you ?  
**Usr** I am Robert Lee . I am planning to visit Atlanta , will you help me in booking the flight ticket from PHL to ATL ?  
**Agt** Sure , can I know your travelling dates ?  
**Usr** My travelling dates are 10/03 and 10/05 .  
**Agt** Sorry , there is no flight available on your route .  
**Usr** That 's ok , thank you for checking .  
**Agt** Most welcome .

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Table 5: Samples of dialogue with state “no flight found”.

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Samples of dialogue with state “no reservation”.

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**Usr** Hello .  
**Agt** Hello . How can I help you ?  
**Usr** I am Steven Allen . I want to change my existing reservation due to some health issues , can you please help me with that ?  
**Agt** Sure , I will help you to change your reservation .  
**Usr** Thank you .  
**Agt** Please give me a moment .  
**Usr** Sure .  
**Agt** Sorry , there is no reservation found on your name .  
**Usr** Ok , no problem . Thank you for your information .  
**Agt** Welcome .

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**Usr** Hello .  
**Agt** Hello , how may I help you ?  
**Usr** I am Karen Gonzalez . I want to cancel my recent reservation due to sudden cancellation of my trip . Can you help me ?  
**Agt** Sure , please wait for a moment .  
**Usr** Ok .  
**Agt** Sorry , there is no reservation found on your name .  
**Usr** No problem , thank you for the information .  
**Agt** Thank you for reaching us .

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Table 6: Samples of dialogue with state “no reservation”.