

# Towards Building Large Scale Multimodal Domain-Aware Conversation Systems: Supplementary Material

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## Examples of dialog sessions from MMD dataset

In this section we show some of the sample dialog sessions between a shopper and an agent, where each dialog culminates in either a successful purchase or with the shopper exiting without a purchase.

Shopping Assistant ChatLog	
<p><b>SHOPPER:</b> Good Morning</p> <p><b>AGENT:</b> Hello, please tell me what i can help you with?</p> <p><b>SHOPPER:</b> I want to buy some v-neck shaped casual-jacket in a regular fit that i can buy for my buddy .</p> <p><b>AGENT:</b> May i please ask the gender</p> <p><b>SHOPPER:</b> female</p> <p><b>SHOPPER:</b> she is 45 years of age.</p> <p><b>AGENT:</b> Great!</p> <p><b>AGENT:</b> Ill just take a few seconds to quickly browse through my catalog</p> <p><b>AGENT:</b> Sorry I cant find anything in v-neck but i can show you some in different neck</p>  <p><b>AGENT:</b> What you see in the 1st item, only women 100% cotton solid full sleeves casual jacket. About the third one, only women's 100% cotton 100% cotton egret jacquard regular fit long sleeves round neck casual jacket. And to describe the fourth item, people women's polyester outerwear.</p> <p><b>SHOPPER:</b> Can you show me something in thats like long in type. I dont like the 5th casual jacket.</p>  <p><b>AGENT:</b> The first item, sport this cobalt sheer jacket with your basics.</p> <p><b>SHOPPER:</b> And how about the 3rd result complement? Will it go well with a blue colored jeans?</p> <p><b>AGENT:</b> Yes</p> <p><b>SHOPPER:</b> And sandals that looks brown coloured?</p> <p><b>AGENT:</b> Yes</p> <p><b>SHOPPER:</b> Which of the celebrities usually wear casual jacket similar looking to the one in the 4th image?</p>	<p><b>AGENT:</b> celebrities cel_1627 and cel_2243 and cel_3205 endorse this kind of casual jacket</p> <p><b>SHOPPER:</b> I am here to look for faux leather type sole material contained in sandal that i can gift her .</p>  <p><b>AGENT:</b> To describe the 3rd item, day-to-night style just got easier. these wedge sandals give any look a lift with a strappy vamp and stud details.</p> <p><b>SHOPPER:</b> I like the kind of sandals usually worn by celebrity cel_2036. Can you show more like those?</p>  <p><b>AGENT:</b> In the 1st image, just imagine wearing these shoes showing your moves for everyone to see. And about the 5th item, leave an impression with strappy, gold heels!</p> <p><b>SHOPPER:</b> Does celebrity cel_2036 endorse the kind of sandals in the 4th image?</p> <p><b>AGENT:</b> Yes.</p> <p><b>SHOPPER:</b> Can I have 2nd results images from some possible orientations</p> <p><b>AGENT:</b> Image from the front,right,back and left views respectively</p>  <p><b>SHOPPER:</b> No i think ditch the sandals I want to go back and look at the casual jacket you had shown before</p> <p><b>SHOPPER:</b> Do you think is it style military in the 2nd image?</p> <p><b>AGENT:</b> No. The style in the 2nd image is casual</p> <p><b>SHOPPER:</b> And for the 3rd product as well?</p> <p><b>AGENT:</b> Yes.</p> <p><b>SHOPPER:</b> Will the product in the 3rd result justify the skirt constituted of suede material in this image?</p>  <p><b>AGENT:</b> Yes.</p> <p><b>SHOPPER:</b> And how about pu leather type sole material contained in mocassins in this image??</p>  <p><b>AGENT:</b> No</p> <p><b>SHOPPER:</b> And, how about the style in the 4th image?</p> <p><b>AGENT:</b> The casual jacket in the 4th image has elegant and casual style</p> <p><b>SHOPPER:</b> What about this color ?</p> <p><b>AGENT:</b> The casual jacket in the 4th image has blue color</p> <p><b>SHOPPER:</b> I would like to see wrap-around with rise as mid that she would like .</p>  <p><b>AGENT:</b> For the 1st item, this skirt features a buttoned front and flaunts an a-line silhouette.</p> <p><b>SHOPPER:</b> Does celebrity cel_3187 usually wear the kind of skirt in the 1st image?</p> <p><b>AGENT:</b> No.</p> <p><b>SHOPPER:</b> Can you show me something in having material made in cotton. I dont like the 1st skirt.</p>  <p><b>AGENT:</b> Sure. Thats a great choice</p>

**Figure 1:** Example dialog session between a shopper and an agent(from Dataset Version 1)

## Shopping Assistant ChatLog

SHOPPER: Good Morning

AGENT: Hello please tell me, anything i can help you with today?

SHOPPER: I am keen on looking at some of your best hand-bag that would suit me .

AGENT: It would help to also know your gender

SHOPPER: female

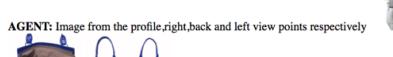
AGENT: Great!Showing you, just a minute



AGENT:

AGENT: Regarding the 2nd image, the mighty purse 2tone clutch is made of high-quality 100% genuine leather that is both fashionable and functional. And the fourth item, a gold pu material hand bag to accessorize your look in style.

SHOPPER: Suggest me images of the 3rd result from all different directions



AGENT: Image from the profile,right,back and left view points respectively



SHOPPER: And how about for the 2nd image?



AGENT: Image from the profile orientation

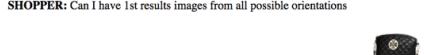
SHOPPER: Which of the celebrities wear similar looking hand bag as in the 2nd image?

AGENT: celebrity cel\_1627 endorses this kind of hand bag

SHOPPER: And as in the 3rd one?

AGENT: celebrities cel\_2555 and cel\_66 and cel\_860 endorse this kind of hand bag

SHOPPER: Can I have 1st results images from all possible orientations



AGENT: Image from the profile,right,back and left view points respectively



SHOPPER: And how about for the 5th product?

AGENT: Image from the profile,right,back and left view points respectively



SHOPPER: I dont like the 2nd result . Show me something in material as in the 3rd image



AGENT:

AGENT: About the first one, be it your intense winter look or a cheerful summer appearance, this black coloured handbag from fino peros will certainly do justice to both. And in the 2nd one, timeless designs, classic fashion, elegant looks are the hallmarks of heels & handles.

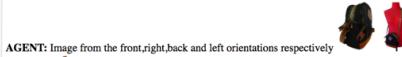
SHOPPER: I want to see more in the material similar to the 2nd image



AGENT:

AGENT: The 2nd item, carry your essentials in style with this red coloured handbag from the house of puma.

SHOPPER: Can you list images of the 1st result from all orientations?



AGENT: Image from the front,right,back and left orientations respectively



SHOPPER: What will pair well along with the 4th image?

AGENT: It can go well with aviator and cat-eye rimmed sunglasses and with black or silver coloring stilettos and with canvas sole,canvas and rubber material footware

SHOPPER: And with the 4th one?

AGENT: It can go well with oxford and synthetic fabrics bag

SHOPPER: I would like to look for a few of your best ethnic styled bag .



AGENT:

AGENT: What you can see in the first item, this hobo bag is made of cotton.

SHOPPER: I like the kind of bag usually worn by celebrity cel\_1991. Can you show more like those?



AGENT:

AGENT: To describe the 5th one, it has many categories of functions pockets, can meet all your daily needs.

SHOPPER: How about a few more options in the material as in the 5th image?



AGENT:

AGENT: Regarding the third item, good and convenient for storing travel accessories or daily life or study gadgets. The fifth image, fill these totes with books or work out clothes or whatever you want, and become one of the many people using these stylish drawstring bags!

And to describe the second item, 1 front pocket 2 side pockets , 2 handles on top for carry.

SHOPPER: I would like to look at your collection of velcro type closure shoe containing soles made out of suede of about INR 3200.0 for myself .

AGENT: Sorry I cant find anything in suede but would you like something in lace



AGENT: The first one, the lucky brand, rezdah platform wedge is incredibly lightweight and chic. The 3rd item, this fashionable synthetic leather high top lace up sneakers velcro strap comfortable high hidden heel and round toe wedge trainers in luxuriously. And what you see in the fourth image, the dr. comfort victory is and athlete shoe that has extra lightweight mesh and leather trainer with arch stabilizer for enhanced support.

SHOPPER: I like the sole material in the 4th product but not the fit. Please show me some more



AGENT: What you can see in the second image, padded collar and tongue offer additional support and comfort. And the fifth image, lightweight, man-made leather upper, all rubber traction spikes.

SHOPPER: I think I want to buy the 3rd one

AGENT: Absolutely, that's a great footwear

Figure 2: Example dialog session between a shopper and an agent(from Dataset Version 1)

## Shopping Assistant ChatLog

SHOPPER: Hi

AGENT: Hi, anything i can help you with?

SHOPPER: I am very much keen on looking at a few of your best regular styled casual jacket in the range INR of 3700.0 - 4200.0 that i can buy for my son .

SHOPPER: he is 12 years of age.

AGENT: Great! Now ill be able to help you better

AGENT: Got it. Showing in a minute



AGENT:

AGENT: About the first one, exuding elegance and class, this black jacket by quiksilver will lend you a sophisticated look in no time.

SHOPPER: Show me images of the 4th result from all possible directions

AGENT: Image from the profile,right,back and left viewpoints respectively



SHOPPER: Can you show something similar to the 2nd image?



AGENT: The similar looking ones are



SHOPPER: Can you show me some more. I dont like the collar in the 5th image.



AGENT:

AGENT: In the 1st image, jordan boys slim fit polyester solid casual jacket.

SHOPPER: How about something similar to the 4th image?



AGENT: The similar looking ones are

SHOPPER: Does celebrity cel\_1635 usually wear the kind of casual jacket in the 1st image?

AGENT: Yes.

SHOPPER: What pocket would be suited for casual jacket in 1st and 2nd images ?

AGENT: The casual jacket in the 1st and 2nd images will suit well for multicoloured pocket

SHOPPER: What other apparels and accessories are usually endorsed by celebrity cel\_1001?

AGENT: navy coloring, embroidered patch neck, fibre/fabric or ceramics peacock mostly

SHOPPER: And what about celebrity cel\_7685?

AGENT: celebrity cel\_7685 usually wears bomber fit crewneck

SHOPPER: How about something similar to the 2nd image?



AGENT: The similar looking ones are

SHOPPER: I liked the 1st casual jacket. Can I see something like it but in hooded type

AGENT: Sorry I don't think I have anything in 100% polyester but I can show you in poly cotton



AGENT: About the first one, your style score will certainly deck up as you wear this grey coloured sweatshirt from the house of burton.

SHOPPER: Can I have images of the 1st result from all orientations?

AGENT: Image from the front,right,back and left view-points respectively



SHOPPER: This casual jacket will be suited by what style?

AGENT: It will suit well for fashionable and solid and military style

SHOPPER: Do you think that regular style be suited by casual jacket in the 1st image?

AGENT: Yes

SHOPPER: Will sports shoes go well with any of these?

AGENT: Yes

SHOPPER: Which of the celebrities usually wear similar looking casual jacket as in the 1st image?

AGENT: celebrity cel\_356 endorses this kind of casual jacket



AGENT:

AGENT: About the first one, a pair of round toed cockpit sport shoes for men, has central lace up and low top styling . The second one, modi brothers is a well-known firm for selling all type of brands in footwear which includes sports shoes, slippers, floaters & sandals for both men & women. And what you see in the 4th one, this is a high performance pair of shoes meant for everyday use in running , walking , gymming.

SHOPPER: Id like to see something similar to the 1st image but in a different style



AGENT: The similar looking ones are

SHOPPER: Thanks all this was very helpful

AGENT: Absolutely

Figure 3: Example dialog session between a shopper and an agent(from Dataset Version 1)

## Examples of Text Responses generated by the proposed Multimodal HRED model

This section enumerates some of the examples taken from the test set, of the model generating the agent's text responses. In each figure, the last row (in red) is the predicted output of the system and directly above it is the

<b>Shopping Assistant ChatLog</b>	
<b>SHOPPER:</b> Hi	<b>AGENT:</b> Image from the front,right,back and left directions respectively
<b>AGENT:</b> Hi, please tell me, anything i can help you with?	
<b>SHOPPER:</b> I am looking to buy for my brother who is 26 years of age.	<b>SHOPPER:</b> And for the image 2nd?
<b>AGENT:</b> Thanks for the information	<b>AGENT:</b> Image from the front,right,back and left orientations respectively
<b>SHOPPER:</b> I am keen on going through your collection of casual jacket holding mid rise for him .	
<b>AGENT:</b> Absolutely. Ill just take a few seconds to quickly browse through my catalog of items	<b>SHOPPER:</b> Can you show me something in regular styled type. I dont like the 1st casual jacket.
<b>AGENT:</b>	<b>AGENT:</b> To describe the 1st image, add a touch of definition to an otherwise solid look with this coffee coloured casual jacket from the house of okane. And for the 4th image, score a dapper look in a snap with this red coloured casual jacket from the house of okane.
<b>AGENT:</b> Regarding the second item, gain some edge with this brown coloured casual jacket from the house of locomotive.	<b>SHOPPER:</b> I dont like the 3rd image . Show me something in material as in
<b>SHOPPER:</b> Can you show something similar to the 2nd image?	
<b>AGENT:</b> The similar looking ones are	
	<b>SHOPPER:</b> this image
<b>SHOPPER:</b> The 1st casual jacket looks catchy. Can I have something like it but that is somewhat khaki in color	
<b>AGENT:</b>	<b>AGENT:</b> For the first one, add a touch of definition to an otherwise solid look with black casual jacket from locomotive.
<b>AGENT:</b> Regarding the second image, upgrade your layered look with this casual jacket from the house of duke.	<b>SHOPPER:</b> Can you show similar to what celebrity cel_529 usually wears?
<b>SHOPPER:</b> Did you check the collar in the 1st image? What is it?	
<b>AGENT:</b> The casual jacket in the 1st image has regular collar	<b>AGENT:</b> What you can see in the 4th image, give your casual look a varsity inspired update with this navy blue nylon coach jacket completed with traditional collar, hem and elasticated cuff detailing. The first item, stack up your style against the rest with this black coloured casual jacket from the house of puma. And the 3rd image, look stylish and trendy wearing this dark grey coloured winter jacket for men from breakbounce.
<b>SHOPPER:</b> Does celebrity cel_356 wear the kind of casual jacket in the 1st image?	<b>SHOPPER:</b> Which of the celebrities usually wear similar looking casual jacket as in the 5th image?
<b>AGENT:</b> Yes.	
<b>SHOPPER:</b> From all orientations, show me few images of the 1st result	
	<b>AGENT:</b> Image from the front and back viewpoints respectively
	<b>SHOPPER:</b> By the way, how about the material in the 5th image?
	<b>AGENT:</b> The casual jacket in the 5th image has solid material
	<b>SHOPPER:</b> Thank you for showing me all this, i guess i will leave
	<b>AGENT:</b> Do provide us a feedback on your experience. Bye

**Figure 4:** Example dialogue session between a shopper and an agent(from Dataset Version 1)

true response from the original dialog in the dataset. The multimodal content appearing above is the context fed into the model to generate this response.

### Examples of Target Images Ranked by the proposed Multimodal HRED model

Here, we similarly enumerate some of the example outputs for the Image Response Selection task taken from the test set. The model is given a multimodal context of an ongoing dialog and a set of target images, which it has to rank in order of their relevance as a response, given the context. The target images are shown in the bottom row for every example, and the true positive response and the true negative response (according to the dataset) is demarcated by a green or a red box respectively. The model internally scores each of these images based on the likelihood of the image being a response, given the context. In the figures, the target images have been sorted by the cosine similarity score given out by the model, where a higher value of similarity implies a higher confidence of the model in that image being a relevant response.

## Shopping Assistant ChatLog

**SHOPPER:** Hello

**AGENT:** Hello, please tell me what can i help you with today?

**SHOPPER:** I would love to look for a few cotton material voberry branded sports shoes fabricated with leather upper material .

**AGENT:** Absolutely. Showing you in just a minute

**AGENT:** Sorry i dont have any in voberry but would you like something in



**AGENT:** In the 1st image, great for playtime, school...whenever. And what you can see in the fifth one, men's lace up sneaker.

**SHOPPER:** Can you show something similar to the 5th image?



**SHOPPER:** Which of the celebrities wear similar looking sports shoes as in the 5th image?

**AGENT:** celebrities cel\_69 and cel\_2644 endorse this kind of sports shoes

**SHOPPER:** Suggest me images of the 2nd result from few different directions

**AGENT:** Sorry i couldn't find any other orientations for this image

**SHOPPER:** And for the product in the 4th result?

**AGENT:** Image from the profile,right,back and left point of views



respectively

**SHOPPER:** I am keen on seeing something similar to the 3rd image but in a different material



**AGENT:** The similar looking ones are



**SHOPPER:** Show me images of the 2nd result from few possible orientations

**AGENT:** Image from the profile,right,back and left orientations respectively



**SHOPPER:** What about the image in 1st?

**AGENT:** Image from the profile,right,back and left view points respectively



**SHOPPER:** So, do you think that a rucksack made in standard size go with any of these

**AGENT:** No none of the products here will go well with it

**SHOPPER:** And what do you think about running shoes containing the suede type soles?

**AGENT:** No none of the products here will go well with it

**SHOPPER:** And do you think that the sports shoes having casual style in the 1st result pair well with pink pocket in bottoms?

**AGENT:** Yes

**SHOPPER:** And the sneaker styled sports shoes in this image with mid jeans?

**AGENT:** Yes

**SHOPPER:** Will a classic fitting slip ons go with atleast one of these

**AGENT:** No none of the products here will go well with it

**SHOPPER:** What other apparels and accessories are usually worn by celebrity cel\_69?

**AGENT:** artificial silk or mesh pu fabrics casual shoes usually

**SHOPPER:** And what about celebrity cel\_2644?

**AGENT:** regular size-fit, denim canvas upper material, chic-electic style slippers mostly

**SHOPPER:** I want to buy chappals of delebao brand for myself .

**AGENT:** Sorry I cant find anything in delebao but would you like to see

some in crocs



**AGENT:** To describe the third image, the company offers several distinct shoe collections with more than 300 four-season footwear styles. And for the fourth image, looking for a basic flip? check out the chawaii.

**SHOPPER:** Which of the celebrities endorse similar looking slippers as in the 4th image?

**AGENT:** celebrities cel\_486 and cel\_2644 endorse this kind of slippers

**SHOPPER:** What material is it in the 1st image?

**AGENT:** The material in 1st image is rubber

**SHOPPER:** And in the 2nd image?

**AGENT:** The material in 2nd image is rubber

**SHOPPER:** I like the 1st one. I think ill buy that one

**AGENT:** Absolutely. I think that's a fabulous choice

Figure 5: Example dialog session between a shopper and an agent(from Dataset Version 1)

## Shopping Assistant ChatLog

**SHOPPER:** Hello

**AGENT:** Hi, please tell me what can i help you with today?

**SHOPPER:** show me few of your top large sized rubber type upper material clogs that is mostly light pink in colored that i would like .

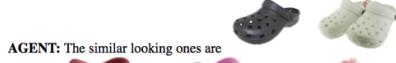
**AGENT:** Of course. Just wait a few seconds while i browse through my catalog

**AGENT:** Sorry i dont have any in pink but would you like to see some in



other color

**SHOPPER:** Please show me something similar to the 1st image but in a different upper material



**AGENT:** The similar looking ones are



**SHOPPER:** I like the 4th result . Show me something like it but in material as in the 1st image from what you had previously shown me in clogs



**AGENT:** About the 1st one, they have an optional back strap that can be worn either forwards over the foot or back at the heel. And in the 4th image, the clarks colony clog is perfect for those casual days when comfort is key.

**SHOPPER:** I dont like the 4th image . Show me something in style as in this

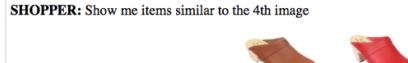


image



**AGENT:** About the second one, a beautiful pair of classic swedish wooden clogs in thick wax tan leather.

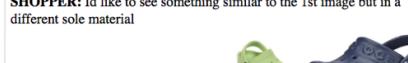
**SHOPPER:** Show me items similar to the 4th image



**AGENT:**

**AGENT:** To describe the first one, happy feet and a stylish you is the promise that crocs makes with these 'classic clogs' in white.

**SHOPPER:** Id like to see something similar to the 1st image but in a different sole material



**AGENT:** The similar looking ones are



**SHOPPER:** What style would be suited for clogs in 3rd and 5th images ?

**AGENT:** The clogs in the 3rd and 5th images will suit well for classic style

**SHOPPER:** Will clogs be ideal for gorgeous style?

**AGENT:** Yes

**SHOPPER:** What do you feel about the silver coloured clogs in the 5th image? Will it go with footwear?

**AGENT:** Yes

**SHOPPER:** And how about with knitwear?

**AGENT:** No

**SHOPPER:** I like the style in the 2nd product but not the material. Please show me some more



**AGENT:** About the third one, we've updated a favorite with a new look, but kept the same crocs comfort inside.

**SHOPPER:** Can you show me shoe having outsole type tip that i might like .



**AGENT:** About the fourth image, expertly crafted from canvas and leather, these veranda a-line espadrilles from tory burch are the perfect refresher for your shoe collection. And the 2nd image, the air jordan 12 retro big kids' shoe is a hardwood original with radiant style.

**SHOPPER:** What is the color, upper material and sole material in the 4th result?

**AGENT:** the footwear in the 4th image has ivory color canvas upper material rubber sole material

**SHOPPER:** Which of the celebrities usually wear similar looking footwear as in the 4th image?

**AGENT:** celebrities cel\_1491 and cel\_2036 and cel\_2715 endorse this kind of footwear

**SHOPPER:** And how about as in 5th?

**AGENT:** celebrity cel\_2728 endorses this kind of footwear

**SHOPPER:** I think ill buy the 5th one

**AGENT:** Great. I think that's a great choice

Figure 6: Example dialog session between a shopper and an agent(from Dataset Version 1)

## Shopping Assistant ChatLog

**SHOPPER:** Good Morning  
**AGENT:** Hi, tell me how i can help you?  
**SHOPPER:** Can you show me acrylic material benie designed with hand type patterns .  
**SHOPPER:** I am a female, 24 years old  
**AGENT:** Oh. Good  
**AGENT:** Ill just take a few seconds to search quickly through my catalog  
**AGENT:** Sorry i dont think i have anything in hand but would you like something in chain  
  
**SHOPPER:** Show me images of the 1st result from all possible directions  
**AGENT:** Sorry i couldnt find any other orientations for this image  
**SHOPPER:** What print is it in the result 1st?  
**AGENT:** The beanies in the 1st image has chain print  
**SHOPPER:** Can you show me something similar to the 1st image but in a different fit  
  
**AGENT:** The similar looking ones are  
  
**SHOPPER:** I did not find it much interesting. Show me more.  
  
**AGENT:**

**SHOPPER:** These look awesome. How about few more in the material as in the 3rd image?

**AGENT:** Sorry i dont think i have any 100% acrylic but i can show you in knit



**SHOPPER:** Show me something similar to the 4th image but with the material different

**AGENT:** The similar looking ones are



**SHOPPER:** I like the material in the 3rd one but not the color. I want to see a few more which match that criteria

**AGENT:**



**SHOPPER:** I like the 1st image . Show me something like it but in style as in this image

**AGENT:** Sorry i dont think i have anything in trendy but would you be interested in seeing some in punk



**SHOPPER:** can you sort these by best seller ranking



**AGENT:**

**SHOPPER:** Show me something similar to the 1st image but with the style different



**AGENT:** The similar looking ones are



**SHOPPER:** Does celebrity cel\_2715 usually wear the kind of beanies in the 3rd image?

**AGENT:** No.

**SHOPPER:** And what about celebrity cel\_1558 for the 2nd one?

**AGENT:** No.

**SHOPPER:** Does celebrity cel\_103 usually wear the kind of beanies in the 1st image?

**AGENT:** No. But Celebrities cel\_11 and cel\_45 endorse this type of beanies

**SHOPPER:** And what about celebrity cel\_1104 for the 4th?

**AGENT:** Yes.

**SHOPPER:** This was great, i guess i am done

**AGENT:** Sure. Bye

Figure 7: Example dialog session between a shopper and an agent(from Dataset Version 1)

## Shopping Assistant ChatLog

**SHOPPER:** Good Morning  
**AGENT:** Hello, what i can help you with today?  
**SHOPPER:** I want to look at a few of your best black coloured denim jacket above USD 200.0 .  
**AGENT:** It would help to also know your gender  
**SHOPPER:** male  
**SHOPPER:** I am 28 years of age.  
**AGENT:** Thanks, this helpful  
**AGENT:** Sorry i dont think i have anything in black but would you like something in light blue  
  
**AGENT:** See the third one, zshow men's denim bomber jacket aims to provide good fashion product to every customer.  
**SHOPPER:** I dont like the 2nd image . Show me something in fit as in this image  
  
**AGENT:**  
**AGENT:** In the fifth item, score a dapper look in a snap with this navy blue coloured denim jacket from the house of ripfly. And to describe the fourth one, look cool and trendy by wearing this denim jacket for men from pepe jeans.  
**SHOPPER:** These results will be matched by what all items?  
**AGENT:** It can go well with printed fabrics, blue burgundy coloured t-shirt and with black coloured, slim jeans

**SHOPPER:** Show me something like the one in 1st image

**AGENT:** The similar looking ones are



**SHOPPER:** What is the fit in the 6th and 5th images?

**AGENT:** The fit of the denim jacket is regular in the 5th and 6th image

**SHOPPER:** Which of the celebrities usually wear denim jacket similar looking to the one in the 7th image?

**AGENT:** celebrities cel\_777 and cel\_6 endorse this kind of denim jacket

**SHOPPER:** Show me something similar to the 8th image

**AGENT:** The similar looking ones are



**SHOPPER:** I would like to see a few of your best coverage patterned tee that is mostly vivid orange in colored .

**AGENT:** Sorry i couldnt find anything in coverage but would you be interested in seeing some in hand



**AGENT:** The 1st one, fall in love with the soft texture adorning this orange coloured t-shirt from the house of invincible.

**SHOPPER:** These doesnt seem interesting. Show me more with rise as mid



**AGENT:**

**AGENT:** The 3rd item, 5500 chouinard adult ring-spun mid-weight tee choose your dyed-to-perfection style.

**SHOPPER:** What do you think about the 4th result? Is it suited for unique design style?

**AGENT:** No

**SHOPPER:** how about for regular wash cleaning?

**AGENT:** Yes

**SHOPPER:** What is the print and material in the 3rd result?

**AGENT:** the t-shirt in the 3rd image has ribbed print 100% cotton material

**SHOPPER:** And what about neck and type in the 1st one?

**AGENT:** the t-shirt in the 1st image has round type round neck

**SHOPPER:** What other apparels and accessories are usually endorsed by celebrity cel\_777?

**AGENT:** pink blue-dreamy colors henley

**SHOPPER:** I like the 2nd t-shirt. Show me something like it but in blended material type. Can you please show within my budget



**AGENT:**

**AGENT:** In the 3rd item, puma offers this blue coloured t-shirt that will be a stylish pick for urban men.

**SHOPPER:** I think i want to buy the 3rd one

**AGENT:** Absolutely. I think thats a fabulous choice Thank you for shopping with us

Figure 8: Example dialog session between a shopper and an agent(from Dataset Version 1)

<b>Shopping Assistant ChatLog</b>	
<p><b>SHOPPER:</b> Good Morning</p> <p><b>AGENT:</b> Hi, please tell me, anything i can help you with today?</p> <p><b>SHOPPER:</b> I need to look for some of your best regular fit anarkali that i can gift my ma .</p> <p><b>SHOPPER:</b> she is 44 years of age.</p> <p><b>AGENT:</b> Ok. This helpful</p> <p><b>AGENT:</b> ill just quickly search through my catalog of fashion items</p>  <p><b>AGENT:</b> The third item, hand block printed anarkali kurti. What you see in the fourth item, trishaa by pantaloons womens casual churidar kurti dupatta. And in the second one, mustard coloured suit set, tailored from polyester, this set comprises a flared kurta with a band collar and 3/4th sleeves.</p> <p><b>SHOPPER:</b> What is the fit in the 2nd image?</p> <p><b>AGENT:</b> The fit in 2nd image is regular fit</p> <p><b>SHOPPER:</b> And how about the material?</p> <p><b>AGENT:</b> The material in 2nd image is polyester</p> <p><b>SHOPPER:</b> Which of the celebrities usually wear similar looking kurta as in the 4th image?</p> <p><b>AGENT:</b> celebrities cel_22 and cel_41 endorse this kind of kurta</p> <p><b>SHOPPER:</b> Show me more images of the 1st product in some different orientations</p>	<p><b>AGENT:</b> Image from the right and back directions respectively</p>  <p><b>SHOPPER:</b> And for the result in the 4th image?</p> <p><b>AGENT:</b> Image from the profile,back and left viewpoints respectively</p>  <p><b>SHOPPER:</b> I like the material in the 2nd image but i dont like the fit. Can you show me some more</p>  <p><b>AGENT:</b> About the 1st item, sparkle this festive season by wearing this suit set for women from biba. To describe the 3rd item, lime green coloured suit set, tailored from polyester, this set comprises a sleeveless kurta with a band collar and button placket. And what you see in the 4th image, gorgeously mesmerising is what you will look at the next social function as you wear this suit set from the house of juniper.</p> <p><b>SHOPPER:</b> Can you show something similar to the 1st image?</p>
	<p><b>AGENT:</b> The similar looking ones are</p>  <p><b>SHOPPER:</b> These doesnt match my taste. Please show me more thats somewhat hip length</p>  <p><b>AGENT:</b></p> <p><b>AGENT:</b> For the 2nd item, pull together a chic look by wearing kurta salwar set by souq. And about the 5th image, be the cynosure of all eyes when you wear this red coloured suit set by faireno.</p> <p><b>SHOPPER:</b> please show sorted by review rating</p> <p><b>AGENT:</b> Sorry i do not have the review rating information for these</p> <p><b>SHOPPER:</b> This was great, i guess i am done</p> <p><b>AGENT:</b> Glad to know it was helpful</p>

**Figure 9:** Example dialog session between a shopper and an agent(from Dataset Version 1)

<b>Shopping Assistant ChatLog</b>	
<p><b>SHOPPER:</b> Hi</p> <p><b>AGENT:</b> Hi, is there anything i can help you with?</p> <p><b>SHOPPER:</b> I would like to look at a few of your best mid rise churidar with a comfort fit .</p> <p><b>AGENT:</b> Of course. Just wait a few seconds while i take a quick scan through my catalog</p> <p><b>AGENT:</b> Sorry i dont seem to have anything in comfort fit but i can show you some in other fit</p>  <p><b>AGENT:</b> See the 5th image, keep everyday glamour handy with this ecru pin tuck kurti that can astutely wander from being classy work wear to understated party wear when paired rightly.</p> <p><b>SHOPPER:</b> I dont like the 3rd result . Show me something in rise as in the 4th image</p>  <p><b>AGENT:</b> What you see in the 2nd item, keep everyday glamour handy with this fuchsia pin tuck kurti that can astutely wander from being classy work wear to understated party wear when paired rightly. And the 3rd image, the soulful hues of beige and pink coupled with a stylish layered silhouette weave a magic of elegance and poise.</p> <p><b>SHOPPER:</b> I like the material in the 4th one but not the rise. I want to see a few more which match that criteria</p>  <p><b>AGENT:</b></p>	<p><b>AGENT:</b> To describe the 1st item, multi colour georgette &amp; velvet salwar kameez with anarkali style and amazing embroidery work on kameez.</p> <p><b>SHOPPER:</b> What is the style and weave in the 3rd result?</p> <p><b>AGENT:</b> the kurti in the 3rd image has party style chiffon weave</p> <p><b>SHOPPER:</b> From all orientations, show me few images of the 1st result</p> <p><b>AGENT:</b> Sorry i couldnt find any other orientations for this image</p> <p><b>SHOPPER:</b> And for the result 3rd?</p>  <p><b>AGENT:</b> Image from the front direction</p> <p><b>SHOPPER:</b> Will kurti in the 4th image go with multicoloured pocket?</p> <p><b>AGENT:</b> Yes</p> <p><b>SHOPPER:</b> And how about for cargo?</p> <p><b>AGENT:</b> No</p> <p><b>SHOPPER:</b> Do you this it weave georgette in the 2nd image?</p> <p><b>AGENT:</b> Yes.</p> <p><b>SHOPPER:</b> And material georgette ?</p> <p><b>AGENT:</b> Yes.</p> <p><b>SHOPPER:</b> I dont like the 2nd result . Show me something in weave as in the 3rd image</p>  <p><b>AGENT:</b></p>
	<p><b>AGENT:</b> What you can see in the first item, gorgeously mesmerising is what you will look at the next social function as you wear this suit set from the house of juniper.</p> <p><b>SHOPPER:</b> I do not like these. Show me more</p>  <p><b>AGENT:</b></p> <p><b>AGENT:</b> What you see in the third one, unstitched long anarkali party ethnic anarkali style pakistani suit indian salwar? kameez for all party needs.</p> <p><b>SHOPPER:</b> Can you list images of the 5th result from all orientations?</p> <p><b>AGENT:</b> Sorry i couldnt find any other orientations for this image</p> <p><b>SHOPPER:</b> What is the material in the 3rd and 1st images?</p> <p><b>AGENT:</b> The material of the kurti is net in the 1st image; georgette in the 3rd image</p> <p><b>SHOPPER:</b> And what care?</p> <p><b>AGENT:</b> The kurti in the 5th and 4th images will suit well for machine and normal and regular care</p> <p><b>SHOPPER:</b> Do you think that the product in the 3rd image pair well with jeans?</p> <p><b>AGENT:</b> Yes</p> <p><b>SHOPPER:</b> And what about with sandals?</p> <p><b>AGENT:</b> Yes</p> <p><b>SHOPPER:</b> I like the 3rd one. I think ill buy that one</p> <p><b>AGENT:</b> Absolutely! Thank you for shopping with us</p>

**Figure 10:** Example dialog session between a shopper and an agent(from Dataset Version 1)

<b>Shopping Assistant ChatLog</b>		
<p><b>SHOPPER:</b> Good Morning</p> <p><b>AGENT:</b> Hello, is there anything i can help you with?</p> <p><b>SHOPPER:</b> I am very much interested in shopping for xl sized culotes that would suit me .</p> <p><b>AGENT:</b> Absolutely. Just give me a few seconds to browse through my catalog</p>  <p><b>AGENT:</b></p> <p><b>SHOPPER:</b> What style would be suited for dungaree in 2nd, 3rd and 4th images ?</p> <p><b>AGENT:</b> The dungaree in the 2nd and 3rd and 4th images will suit well for these style</p> <p><b>SHOPPER:</b> What is the material and print in the 5th result?</p> <p><b>AGENT:</b> the dungaree in the 5th image has hand print 100% polyester material</p> <p><b>SHOPPER:</b> I am keen on seeing something similar to the 4th image but in a different print</p>  <p><b>AGENT:</b> The similar looking ones are</p> 	<p><b>SHOPPER:</b> Will dungaree be complementary for soft cleaning?</p> <p><b>AGENT:</b> No</p> <p><b>SHOPPER:</b> what about urban life style?</p> <p><b>AGENT:</b> No</p> <p><b>SHOPPER:</b> Show me more images of the 2nd product in some different orientations</p> <p><b>AGENT:</b> Sorry i couldnt find any other orientations for this image</p> <p><b>SHOPPER:</b> And what about the 1st result?</p> <p><b>AGENT:</b> Image from the profile,back and left point of views respectively</p>  <p><b>SHOPPER:</b> I like the fit in the 5th one but not the material. I want to see a few more which match that criteria</p>  <p><b>AGENT:</b></p> <p><b>SHOPPER:</b> Show me more in the type as in the 2nd image from what you had previously shown me in dungaree</p> <p><b>AGENT:</b> Sorry i dont seem to have anything in regular but would you like to see some in others</p> <p><b>SHOPPER:</b> Which of these are in my size?</p> <p><b>AGENT:</b> Sorry none of the products satisfy your constraints from the old set</p> <p><b>AGENT:</b> Here are some new results.</p>	 <p><b>AGENT:</b></p> <p><b>SHOPPER:</b> Can you give the color in the 4th image?</p> <p><b>AGENT:</b> The dungaree in the 4th image has solid and black color</p> <p><b>SHOPPER:</b> Which of the celebrities usually wear similar looking dungaree as in the 5th image?</p> <p><b>AGENT:</b> celebrities cel_100 and cel_2126 endorse this kind of dungaree</p> <p><b>SHOPPER:</b> Will dungaree be complementary for unqiue style?</p> <p><b>AGENT:</b> No</p> <p><b>SHOPPER:</b> Does celebrity cel_68 endorse the kind of dungaree in the 1st image?</p> <p><b>AGENT:</b> Yes.</p> <p><b>SHOPPER:</b> I want to buy the 1st one</p> <p><b>AGENT:</b> Sure. Thats a great dungaree Thanks for shopping with us.</p>

Figure 11: Example dialog session between a shopper and an agent(from Dataset Version 1)

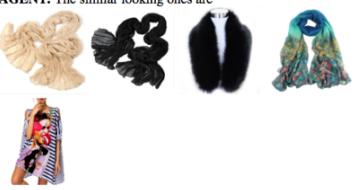
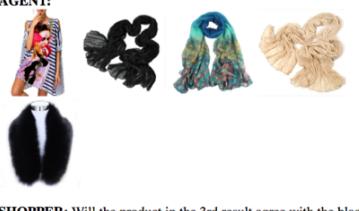
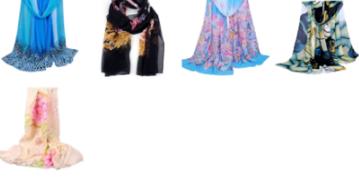
<b>Shopping Assistant ChatLog</b>		
<p><b>SHOPPER:</b> Hi there</p> <p><b>AGENT:</b> Hello, what i can help you with?</p> <p><b>SHOPPER:</b> Hi, Can you show me some party styled muffler that would suit me .</p> <p><b>AGENT:</b> May i please ask your gender</p> <p><b>SHOPPER:</b> female</p> <p><b>SHOPPER:</b> I am a woman 25 years of age</p> <p><b>AGENT:</b> Ok great! this helpful</p> <p><b>AGENT:</b> let me just quickly scan through my catalogue</p> <p><b>AGENT:</b></p>  <p><b>SHOPPER:</b> Can I have 3rd results images from all possible orientations</p> <p><b>AGENT:</b> Image from the profile,back and left orientations respectively</p>  <p><b>SHOPPER:</b> And for the result in the 2nd image?</p> <p><b>AGENT:</b> Image from the profile,right,back and left orientations respectively</p>  <p><b>SHOPPER:</b> Will scarf in the 3rd image complement outdoor style?</p> <p><b>AGENT:</b> Yes</p> <p><b>SHOPPER:</b> What style would be suited for scarf in 5th, 4th and 2nd images ?</p> <p><b>AGENT:</b> The scarf in the 4th and 5th and 2nd images will suit well for chic and ethnic and vibrant style</p>	<p><b>SHOPPER:</b> I dont quite like the style in the 3rd one. Can you show me some more</p> <p><b>AGENT:</b></p>  <p><b>SHOPPER:</b> I want to see something similar to the 5th image but in a different material</p> <p><b>AGENT:</b> The similar looking ones are</p>  <p><b>SHOPPER:</b> can you show these sorted by best seller ranking</p> <p><b>AGENT:</b></p>  <p><b>SHOPPER:</b> Will the product in the 3rd result agree with the black colored thermal in this image?</p>  <p><b>AGENT:</b> No</p>	<p><b>SHOPPER:</b> And with the classic fit footwear in this image?</p>  <p><b>AGENT:</b> No</p> <p><b>SHOPPER:</b> Show me items similar to the 1st image</p> <p><b>AGENT:</b> The similar looking ones are</p>  <p><b>SHOPPER:</b> Show some more in the style as in the result 4th?</p> <p><b>AGENT:</b></p>  <p><b>SHOPPER:</b> Im interested in buying the 5th one</p> <p><b>AGENT:</b> Great choice Hope you had a great shopping experience</p>

Figure 12: Example dialog session between a shopper and an agent(from Dataset Version 2)

## Shopping Assistant ChatLog

**SHOPPER:** Hi there

**AGENT:** Hi, anything i can help you with today?

**SHOPPER:** I am here to shop for tapered type casual trousers that my brother would like .

**SHOPPER:** he is 26 years of age.

**AGENT:** Oh. Good

**AGENT:** let me just make a quick search through my catalogue

**AGENT:**



**SHOPPER:** Are the products in the 5th, 1st and 2nd images suited for multicoloured pocketed?

**AGENT:** Yes

**SHOPPER:** And for melange?

**AGENT:** No

**SHOPPER:** Show me more images of the 3rd product in some different directions

**AGENT:** Sorry i couldnt find any other orientations for this image

**SHOPPER:** I dont like the 4th image . Show me something in fit as in this image



**AGENT:**



**SHOPPER:** I like the 4th image . Show me something like it but in material as in this image



**AGENT:**



**SHOPPER:** Does celebrity cel\_4362 wear the kind of casual trousers in the 5th image?

**AGENT:** Yes. Celebrity cel\_529 also endorses this type of casual trousers

**SHOPPER:** And what about celebrity cel\_646 for the 5th?

**AGENT:** Yes.

**SHOPPER:** Show me images of the 3rd result from all possible directions

**AGENT:** Sorry i couldnt find any other orientations for this image

**SHOPPER:** Show me something similar to the 2nd image but with the style different

**AGENT:** The similar looking ones are



**SHOPPER:** Does celebrity cel\_1241 endorse the kind of casual trousers in the 1st image?

**AGENT:** No. But Celebrities cel\_1916 and cel\_1216 endorse this type of casual trousers

**SHOPPER:** I dont like the 3rd result . Show me something in fit as in the 2nd image

**AGENT:**



**SHOPPER:** No i dont like the 4th casual trousers. Show me something in chino material type

**AGENT:**



**SHOPPER:** please sort these by price

**AGENT:**



**SHOPPER:** Thanks for showing me, bye

**AGENT:** You are most welcome

**Figure 13:** Example dialog session between a shopper and an agent (from Dataset Version 2)

**SHOPPER:** And what about celebrity cel\_334 for the 5th one?

**AGENT:** No.



**SHOPPER:** I dont like the 1st image . Show me something in material as in this image



**AGENT:**

**SHOPPER:** How about the trackpants in the 4th image? What will go well with it?

**AGENT:** It can go well with casual style, cotton fabrics t-shirt

**SHOPPER:** And what about with the 4th one?

**AGENT:** It can go well with lifestyle, silver colouring footwear and with sports style, white coloring, casual-sports type t-shirt  
**PREDICTED:** it can go well with casual style

**Figure 14:** Example text response generated by the proposed multimodal HRED model

**SHOPPER:** I like the 4th image . Show me something like it but in brand as in this image . Can you please show within my budget



**AGENT:**

**SHOPPER:** Are the products in the 3rd and 5th images suited for casual style?

**AGENT:** Yes

**SHOPPER:** And what about the ones in the 2nd, 1st and 4th images?

**AGENT:** Yes

**PREDICTED:** Yes

**Figure 15:** Example text response generated by the proposed multimodal HRED model

**SHOPPER:** I like the 2nd sandals. Show me something similar to it but in suede soled type



**AGENT:**



**SHOPPER:** I dont like the 4th image . Show me something in material as in this image



**AGENT:**

**SHOPPER:** What is the 2nd images material ?

**AGENT:** The material in 2nd image is mesh

**PREDICTED:** The material in 2nd image is synthetic

**Figure 16:** Example text response generated by the proposed multimodal HRED model

**SHOPPER:** Show me items similar to the 3rd image



**AGENT:** The similar looking ones are



**SHOPPER:**

I like these. Show me more in the color as in the 3rd image from what you had previously shown me in maxi dress



**AGENT:**

**SHOPPER:** What is the fit, collar and color in the 5th result?

**AGENT:** the maxi dress in the 5th image has grey color regular collar regular fit

**SHOPPER:** And what about weave and color in the 3rd one?

**AGENT:** the maxi dress in the 3rd image has grey color georgette weave

**PREDICTED:** the maxi dress in the 3rd image has black color georgette weave

**Figure 17:** Example text response generated by the proposed multimodal HRED model

**SHOPPER:** Will the product in the 2nd result come in terms with the high tops of resin sheet material in this image?

**AGENT:** No



**SHOPPER:** And with the dresses that's ankle length in this image?

**AGENT:** No



**SHOPPER:** Can you show me some more. I dont like the jeans style in the 1st image.



**AGENT:**

**AGENT:** About the second one, stylish and comfortable are these black coloured jeggings from lara karen. What you see in the 3rd item, unlock the secret of ultimate comfort wearing khaki coloured jeggings by bella rosa. And in the fourth image, stay comfortable and look stylish by wearing these blue coloured jeggings for women from rattrap.

**PREDICTED:** the first image , 'flyjohn ' men 's denims jeans quality

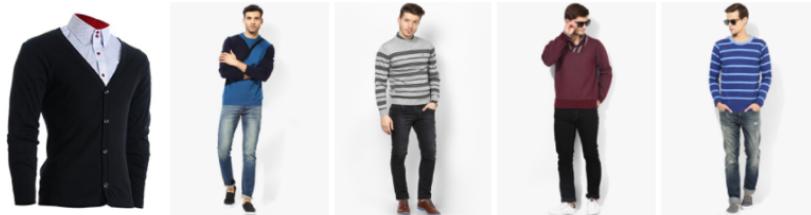
**Figure 18:** Example text response generated by the proposed multimodal HRED model

**AGENT:** The cardigan in the 4th image has basic style

**SHOPPER:** And in the 5th image?

**AGENT:** The cardigan in the 5th image has casual style

**SHOPPER:** No i dont like the 1st cardigan. Show me something in thats somewhat round in type



**AGENT:**



**SHOPPER:** Will the product in the 4th result go with the one in this image?

**AGENT:** No

**SHOPPER:** I dont like the 1st result . Show me something in print as in the 3rd image

**AGENT:**

Target  
Images



Cosine  
Similarity

0.95

0.92

0.89

0.83

0.2

0.18

-0.1

-0.19

-0.3

-0.39

**Figure 19:** Example target images ranked by the proposed multimodal HRED model

**SHOPPER:** What is the color and print in the 3rd result?

**AGENT:** the coat in the 3rd image has black color lace print

**SHOPPER:** And fit and color in the 1st one?

**AGENT:** the coat in the 1st image has blue color slim fit

**SHOPPER:** I like the 2nd image . Show me something like it but in material as in this image



**AGENT:**

Target Images



Cosine Similarity

0.87

0.52

0.41

-0.61

-0.78

-0.84

**Figure 20:** Example target images ranked by the proposed multimodal HRED model

**SHOPPER:** Hello

**AGENT:** Hi, How can i help you today?

**SHOPPER:** I am buying for my buddy. she is 33-yr old.

**AGENT:** Great!

**SHOPPER:** I am interested in going through hand bag within INR 1400.0 that i can buy for her .

**AGENT:** Good!Got it. Just showing you in a minute

**AGENT:**

Target Images



Cosine Similarity

0.92

0.63

0.75

0.74

0.63

0.6

0.58

-0.56

**Figure 21:** Example target images ranked by the proposed multimodal HRED model