

CityTalk: Robots that talk to tourists and can switch domains during the dialogue

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HOW MAY I HELP YOU?

With CityTalk, talking robots give information for tourists about hotels, restaurants, and other places of interest, based on interactive clarification of the user's preferences. The novel feature is the ability to switch domains during the dialogue. In the example interactions, the robot first uses a hotel database then switches to a restaurant database, or vice versa, in both cases using a domain-specific ontology to ask questions appropriate for the domain. The user can change domains at any time, to any domain that is available in the system.

We believe CityTalk is the first system to use robots with PyDial, a statistical dialogue systems research toolkit from University of Cambridge. PyDial facilitates innovative research on deep learning methods such as deep reinforcement learning for statistical dialogue systems.

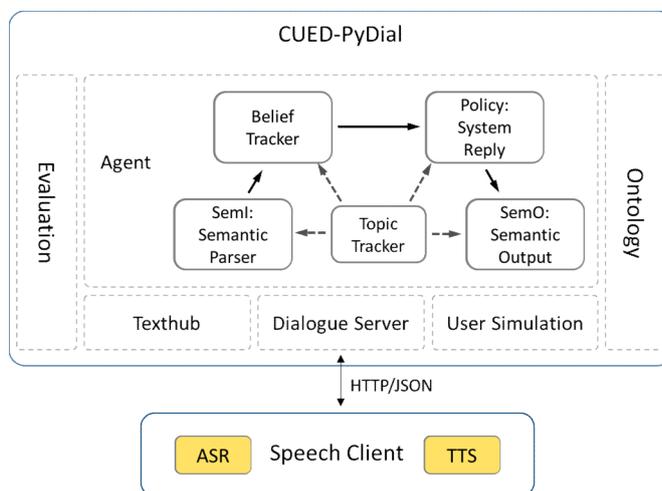
Current robots in Japanese shopping centres use touch-screen tablet computers hung round the robots' necks. When the user wants to switch domains, the new domain must be selected from a menu on the tablet screen. By contrast, CityTalk detects the domain switch from what the user says, and no tablet computer is required.

CityTalk integrates:

- the *speech processing* modules of the robot,
- the *dialogue processing* modules of PyDial,
- new *domain databases and ontologies* including Tokyo Waterfront hotels and restaurants,
- new *natural language generation* components,
- new *multilingual localizations* (under development).

REFERENCES

Stefan Ultes, Lina M. Rojas Barahona, Pei-Hao Su, David Vandyke, Dongho Kim, Iñigo Casanueva, Paweł Budzianowski, Nikola Mrkšić, Tsung-Hsien Wen, Milica Gasic, and Steve Young. 2017. *PyDial: A Multi-domain Statistical Dialogue System Toolkit*. Proceedings of ACL 2017, System Demonstrations, 73–78. <http://aclweb.org/anthology/P17-4013>



The general architecture of the PyDial toolkit.

PYDIAL TOOLKIT

PyDial is an open-source Python toolkit for statistical dialogue systems from Cambridge University Engineering Department.

PyDial includes a dialogue system pipeline with four modules:

- *Semantic Parser* performs natural language understanding to identify the user's dialogue act,
- *Belief Tracker* updates the dialogue state,
- *Policy module* decides the dialogue act for the system response,
- *Semantic Output* performs natural language generation.

To support multi-domain dialogues, a *Topic Tracker* module identifies the required domain based on the user's utterances. PyDial then loads domain-specific instances of the four pipeline modules. New domains can be added by providing an ontology and a database for each new domain.

ACKNOWLEDGEMENTS

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SHORT INTERACTION: CAMBRIDGE

Robot: *Hello. Welcome to the Cambridge multi-domain dialogue system. How may I help you?*

User: First tell me about hotels in Cambridge.

Robot: *What part of town do you have in mind?*

User: Somewhere near the centre of town.

Robot: *Would you like the place to have parking?*

User: Yes, please.

Robot: *Would you like a hotel in the cheap, moderate, or expensive price range?*

User: I don't suppose there's anywhere cheap?

Robot: *I am sorry but there is no place, with parking, is a hotel, in the cheap price range and in the area of centre.*

User: Hmm. Er, how about the moderate price range?

Robot: *I am sorry but there is no place, in the area of centre, in the moderate price range, is a hotel and with parking.*

User: Hmm. So, expensive then, I guess.

Robot: *Gonville Hotel is a nice place. It has parking, it is in the expensive price range, it is a hotel and it is in the centre of town.*

User: Can you tell me the phone number, please?

Robot: *Gonville Hotel is a nice place. It is in the centre of town, it is in the expensive price range, it has parking and it is a hotel.*

User: Phone number?

Robot: *Gonville Hotel is a nice place. It is in the centre of town, it is a hotel, it has parking and it is in the expensive price range.*

User: OK. Can you recommend a restaurant?

Robot: *What part of town do you have in mind?*

User: Near the centre.

Robot: *What kind of food would you like?*

User: Chinese or Japanese.

Robot: *Wagamama is a nice place. It is in the centre of town, and it serves Japanese food.*

User: Is it cheap?

Robot: *I am sorry but there is no place, serving Japanese food, in the area of centre and in the cheap price range.*

User: Hmm. Is there a moderate restaurant, moderate price restaurant?

Robot: *I am sorry but there is no place, serving Japanese food, in the area of centre and in the cheap price range.*

User: What about the moderate price range?

Robot: *I am sorry but there is no place, in the moderate price range, in the area of centre and serving Japanese food.*

User: Oh, OK. What about, er, Chinese food?

Robot: *Shanghai Family Restaurant is a nice place. It is in the moderate price range, it serves Chinese food and it is in the centre of town.*

User: Aah, er, what about the phone number?

Robot: *Shanghai Family Restaurant is a nice place. It is in the centre of town, it serves Chinese food and it is in the moderate price range.*

User: Tell me their phone number, please?

Robot: *Shanghai Family Restaurant is a nice place. Their phone number is 01223 301761.*

User: Oh, thank you. Erm, goodbye!

Robot: *Shanghai Family Restaurant is a nice place. Their postcode is CB1 1DT.*

User: Er, goodbye!

Robot: *Thank you. Goodbye!*

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SHORT INTERACTION: TOKYO WATERFRONT

Robot: *Hello. I can tell you about hotels and restaurants. How may I help you?*

User: I'd like to know about restaurants.

Robot: *What part of town do you have in mind?*

User: In Tokyo Waterfront, please.

Robot: *What kind of food would you like?*

User: How about Italian?

Robot: *Would you like something in the cheap, moderate, or expensive price range?*

User: Ah, expensive, please.

Robot: *Would you like something in the cheap, moderate, or expensive price range?*

User: Are there any expensive restaurants in Tokyo Waterfront?

Robot: *Would you like something in the cheap, moderate, or expensive price range?*

User: Expensive!

Robot: *I am sorry but there is no place, serving Italian food and in the expensive price range.*

User: Oh. What about moderate?

Robot: *I am sorry but there is no place in the expensive price range and serving Italian food.*

User: Right... Moderate? How about moderate?

Robot: *Cafe La Boheme is a nice place. It is in the moderate price range and it serves Italian food.*

User: Oh, that's nice, OK. Erm, what about er...

Robot: *Cafe La Boheme is a nice place. Their address is Aquacity Odaiba 4F, 1-9-1 Daiba, Minato-ku, Tokyo.*

User: Oh, thank you! Thank you. Hmm, what about ...

Robot: *Cafe La Boheme is a nice place. It serves Italian food and it is in the moderate price range.*

User: What about hotels?

Robot: *What part of town do you have in mind?*

User: Again, Water..., Tokyo Waterfront.

Robot: *Would you like the place to have parking?*

User: I don't mind, really.

Robot: *Would you like the place to have parking?*

User: I don't mind.

Robot: *Would you like a hotel in the cheap, moderate, or expensive price range?*

User: Ah, I'd like an expensive hotel.

ACKNOWLEDGEMENTS

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LONG INTERACTION: TOKYO WATERFRONT (1)

Robot: Hello. I can tell you about hotels and restaurants. How may I help you?

User: Tell me about hotels, please.

Robot: What part of Tokyo do you have in mind?

User: Tokyo Waterfront would be good.

Robot: Would you like a hotel with parking?

User: Yes, please.

Robot: Would you like an expensive, medium, or cheap hotel?

User: How much is expensive?

Robot: Hilton Tokyo Odaiba is in the expensive price range. It is in the Tokyo Waterfront area and it has parking.

User: And how much does it cost?

Robot: The price information for Hilton Tokyo Odaiba is single rooms from 16,400 yen.

User: And how much is a cheap one?

Robot: Ariake Bay Hotel is in the cheap price range. It is in the Tokyo Waterfront area and it has parking.

User: And how much does it cost?

Robot: The price information for Ariake Bay Hotel is a capsule unit with TV for make or female only is 31 euros.

User: Ah, capsule unit, hmm.... Erm, medium price?

Robot: Ariake Bay Hotel is in the cheap price range.

User: Hmm..., a medium price hotel?

Robot: Ariake Bay Hotel is in the cheap price range. It is in the Tokyo Waterfront area and it has parking.

User: What about a medium hotel?

Robot: Tokyo Bay Ariake Washington Hotel is in the medium price range. It is in the Tokyo Waterfront area and it has parking.

User: And how much does it cost?

Robot: The price information for Tokyo Bay Ariake Washington Hotel is single rooms from 61 euros.

User: OK, tell me their address, please.

Robot: Their address is 3-7-11 Ariake, Koto-ku, Tokyo.

User: Oh, sorry! Er, sorry, tell me their address again?

Robot: Their address is 3-7-11 Ariake, Koto-ku, Tokyo.

User: Thank you. Erm, and their phone number?

Robot: Their phone number is 03-5564-0111.

User: OK. Now, can you tell me about restaurants as well please?

Robot: Their phone number is 03-5564-0111.

User: Tell me about restaurants, now?

Robot: What part of Tokyo do you have in mind?

User: Tokyo Waterfront, again.

Robot: What kind of food would you like?

User: Japanese food is fine.

Robot: Would you like an expensive, medium, or a cheap restaurant?

User: Medium, probably.

Robot: Would you like an expensive, medium, or a cheap restaurant?

User: Medium, please.

Robot: Tsukiji Sushiko is a medium Japanese restaurant in the Tokyo Waterfront area.

User: Oh, good! What's their address?

Robot: Tsukiji Sushiko is a medium Japanese restaurant in the Tokyo Waterfront area.

User: Tell me their address, please.

Robot: Their address is Aquacity Odaiba First Floor, 1-9-1 Daiba, Minato-ku, Tokyo.

User: And their phone number?

Robot: Their phone number is 03-5564-0505.

User: And what about a cheap restaurant?

Robot: Ringer Hut is a cheap Japanese restaurant in the Tokyo Waterfront area.

User: And what kind of place is it?

Robot: The description of Ringer Hut is "Nagasaki Champon noodles".

User: "Nagasaki Champon noodles"? Hmm...

Robot: Ringer Hut is a cheap Japanese restaurant in the Tokyo Waterfront area.

User: OK, tell me their address, please.

Robot: Their address is Aquacity Odaiba First Floor, 1-9-1 Daiba, Minato-ku, Tokyo.

User: OK, erm, what about an expensive Japanese restaurant?

Robot: Tokyo Bay Ariake Washington Hotel is in the medium price range. It is in the Tokyo Waterfront area and it has parking.

User: No, I just want to know about restaurants.

Robot: Ringer Hut is in the cheap price range.

(Continued...)

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LONG INTERACTION: TOKYO WATERFRONT (2)

(Continued...)

User: No, I just want to know about restaurants.

Robot: *Ringer Hut is in the cheap price range.*

User: Hmm. Er, is there a seafood restaurant?

Robot: *Ringer Hut serves Japanese food.*

User: What about seafood restaurants? ... Seafood?

Robot: *Nande-Ya is a cheap seafood restaurant in the Tokyo Waterfront area.*

User: Ah! What's their address?

Robot: *Their address is Aquacity Odaiba First Floor, 1-9-1 Daiba, Minato-ku, Tokyo.*

User: Oh, it's basically the same. Erm, what kind of place is it?

Robot: *I am sorry. I do not know any cheap seafood restaurant in the centre area.*

User: Ah, no, I don't want centre. Tokyo Waterfront!

Robot: *I am sorry. I do not know any cheap seafood restaurant in the centre area.*

User: Tokyo Waterfront area, please!

Robot: *I am sorry. I do not know any cheap seafood restaurant in the centre area.*

User: Tokyo Waterfront!

Robot: *Nande-Ya is a cheap seafood restaurant in the Tokyo Waterfront area.*

User: Good. Erm, what about medium?

Robot: *Nande-Ya is a cheap seafood restaurant in the Tokyo Waterfront area.*

User: Can you tell me a medium seafood restaurant?

Robot: *Tsukiji Shokudo Genchan is a medium seafood restaurant in the Tokyo Waterfront area.*

User: Oh, good! What's their address?

Robot: *Tsukiji Shokudo Genchan is a medium seafood restaurant in the Tokyo Waterfront area.*

User: Hmm. What's their address, please?

Robot: *Their address is Aquacity Odaiba Fifth Floor, 1-9-1 Daiba, Minato-ku, Tokyo.*

User: And what kind of place is it?

Robot: *The description of Tsukiji Shokudo Genchan is "seafood restaurant and pub".*

User: "Seafood restaurant and pub". And what's their phone number?

Robot: *Their phone number is 03-6457-1297.*

User: Oh, good. What about, er, Italian food? ... Italian food?

Robot: *Tsukiji Shokudo Genchan serves seafood food.*

User: (laughs) Yes, er, Italian restaurant, somewhere?

Robot: *The description of Tsukiji Shokudo Genchan is seafood restaurant and pub.*

User: Italian, please.

Robot: *Cafe La Boheme is a medium Italian restaurant in the Tokyo Waterfront area.*

User: Aah! Er, and what kind of place is it?

Robot: *The description of Cafe La Boheme is "Italian food".*

User: Hmm, OK. And what's their address?

Robot: *I am sorry. I do not know any medium French restaurant in the Tokyo Waterfront area.*

User: (laughs) I want Italian food.

Robot: *Cafe La Boheme is a medium Italian restaurant in the Tokyo Waterfront area.*

User: And what's their address?

Robot: *Their address is Aquacity Odaiba Fourth Floor, 1-9-1 Daiba, Minato-ku, Tokyo.*

User: And what's their phone number, please?

Robot: *Their phone number is 03-3599-4801.*

User: OK. Thank you. Er, goodbye!

Robot: *Thank you. Goodbye!*