Chapter 25 Dialog Systems and Conversational Chatbots

Dan Jurafsky and James H. Martin. 2014. *Speech and language processing: an introduction to natural language processing, computational linguistics, and speech recognition*, India: Dorling Kindersley Pvt, Ltd.

Conversational agents are software that speak to humans in the language they understand. Task-oriented and chatbot agent are the 2 main types of conversational agents. Conversational agents are used in different fields such as robotic, commercial fields, health, booking flights and many more. Dialog systems vary with the number of turns they can handle. Simple dialog systems handle few turns where user and systems give each other a chance to converse. Task-oriented agents as the name suggests are task driven agents with an agenda to complete its required task for example Siri.

Chatbots are conversational agents that mimic human to human conversations to handle casual conversations. They have a conversational goal to keep the conversation going. Most chatbot are tested using Turing test to determine if their response can be classified as human response or machine response. The one that is classified as human response when it is a machine response is performing well because there shouldn't be a difference between the two.

There are two main types of chatbots which are **rule based and corpus-based systems**. Example of rule-based system is **Eliza**, one of the ancient chatbot created as a psychologist. Eliza would rephrase the user's utterance back to her if she wants the user to say more or if it doesn't understand based on the pattern transform rules. The chatbot Eliza keeps **track** of the last sentence of the conversation. **Parry** is another chatbot that was created in the beginning of chatbot era.

Corpus based or response generation chatbot is the second type of chatbot where the chatbot is trained with human-to human extracted conversation with the aim of giving back correct response. It **has information retrieval and machine learned sequence transduction** architectures that are used. The **information retrieval based chatbot focuses on** giving the user an appropriate response based on its database collection using any retrieval algorithm.

Unlike the informational retrieval based chatbot, **sequence to sequence chatbot** apply **machine learning** to find answers to the questions posed by a user. However, **sequence to sequence** chatbot has its own **downfalls**, the machine translation does not always match with the user response and the system machine does not give responses that allow conversations to continue. Solutions suggested to this problem include allowing the systems to see prior conversations and many more suggestions. Humans evaluate chatbots even though there are models that are being designed for evaluation purposes.

Frame based dialog agents has frames and each **frames** has slots. **Slots** describe and hold the type of information that the system need to know to perform an action. Based on the user question, the system **fills the slot** with answers or appropriate values. Such system where the ystem is in charge of the conversation is called system initiative. **Mixed initiative** is when both the user and the system both have some power of the conversation, one initiates the topic and one controls the conversation. The GUS architecture supports mixed initiative.

In any user utterance, the natural language **extracts domain classification, intent determination and slot filling**. In domain classification, intent determination and slot filling, the systems identify the domain in which the utterance falls, the aim of communicating, the information the user is giving to allow the system achieve a particular goal respectively.

Evaluation standards for **dialog systems** are task completion success, efficiency cost and quality cost.

Dialog system design is done using human computer interaction principles, **voice user interface design which consists of studying the user and task, building simulations and prototypes, testing the designs iteratively.**

There are some **ethical issues** involved with chatbots. For example, for the corpus bits, the **training data** maybe **biased**. An issue **of privacy and gender equality** (most chatbots are named female names).