Lecture – 83
Introduction to Conversation Modeling

(Refer Slide Time: 00:15)
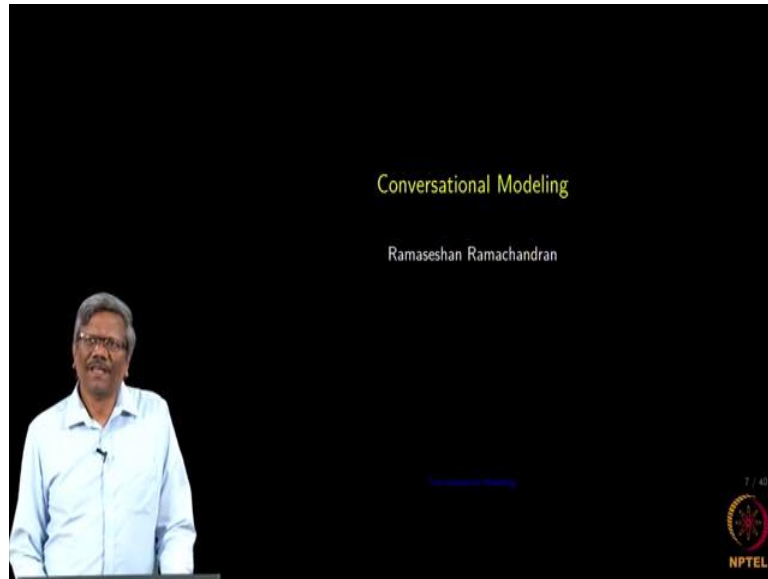
I am going to be talking about a new topic today, is going to be on the conversational modeling, ok. As you all know very well that conversation is an important aspect of any human being. So, without this it is going to be very hard to survive right. So, we do hundreds of conversations every day and then every conversation if we look at it there will be some context attached to that.

And you will have some global knowledge attached to that. And then maybe it is related to a very small area of discussion and so on. But it is always engaging and it is always an intellectual task right for any human being. So, without understanding the context without understanding the topic that you are talking about it is very difficult for us to have a fruitful conversation.

How do we really start the conversation, right? So, normally when you want to start a conversation with a stranger. In India it definitely works very well when there is a cricket match that is going on we can start with what the score right. Immediately you know the person next to you would give an answer I am sure 90 percent of the folks in India would

know that there is something going on with respect to T 20 or 50 over the match and so on and good respond to that.

It would be a surprise if that person did not know anything about cricket that is my assumption. But in general you know when you want to have a conversation with the known person we pick up a topic or over a cup of coffee you start the conversation. And then it becomes engaging based on what that subject is all about. You probably would be talking about something which happened even yesterday.
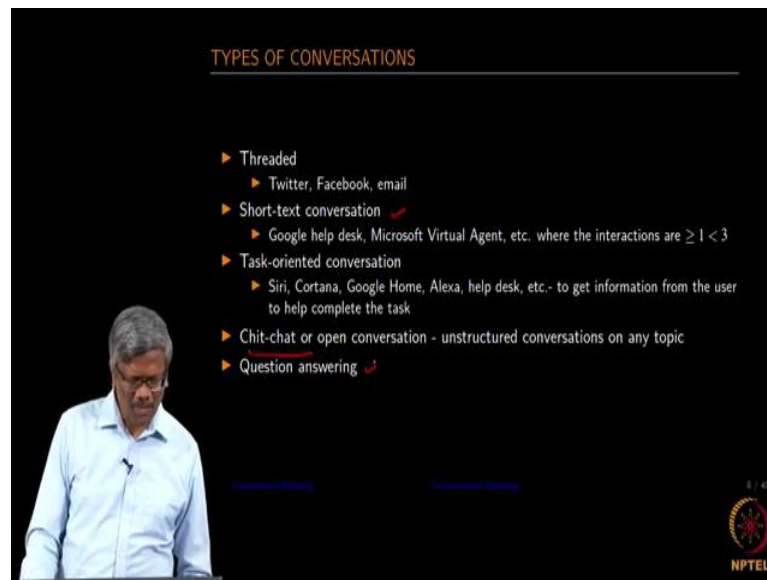
And you start the conversation or start to continue the conversation even after 1 day, ok. Is it going to be that we would like to have the machine to engage with you in a similar way? You want the machine to respond to you in a way that your friend would respond to for any question or can it respond to what is the score when you ask the system.

So, how do we start having a conversation with the machine? How do we know that the machine knows everything? How do you know that the machine has all the worldly knowledge? How does the machine understand that you are posing a question to prove it? How does it know that? When you ask a question and you are asking for some description related to that or some definition related to that keyword?

So, what are various mechanisms through which we can make the machine understand the conversation? So, the idea of this lecture is to really break various pieces of the conversation and then see, how can we achieve each one of those. So, I am not going to be covering the entire and see a lot of what is available in the conversation modeling.

I will be picking up a few of those and then try to present to you how those ideas can be extended. So, that machine can understand the conversation, then the machine can understand the questions and so on right, ok.

(Refer Slide Time: 03:56)

You know well that the conversations are of different types. If you look at the conversation especially from the social media perspective we have threaded conversation in a twitter facebook email and so on. We all have a threaded conversation among ourselves, but if you look at social media these are all are defined in this fashion.

And then there is a short text conversation, where there is a help desk and then you just ask a question. And there is a response coming for your posted question or so, which is about two sentences or the interactions are not more than 2 or 3 in that case. And then there is a task-oriented conversation you tell this Siri that wake me up at 5 o'clock tomorrow, ok.

So, lastly whether it going to be in the morning or in the evening, because you are even mentioned am or pm to that. Or I am not sure based on the time of your command it might be able to set an alarm for tomorrow at 5 o'clock or next available 5, ok. And then we have a chit chat which is going to be an open conversation which is going to be totally unstructured and difficult to achieve. And it will involve any topic and then there is a question answering. Did you post a question and the answer comes back based on the question that you have posted, ok?

So, these are all the types of conversations that we are going to be talking about its not just going to be yeah a chat-bar or anything.

So, we are going to be looking at all of this. And I will pick this and this for showcasing you; what kind of ideas that are emerging into these areas and then how researchers are trying to solve this problem by breaking this into various small pieces, ok.

(Refer Slide Time: 06:09)
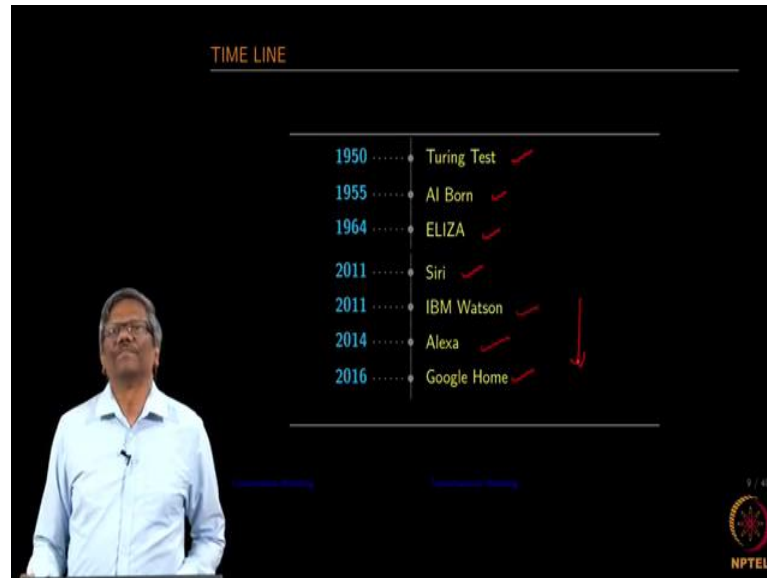
So, it all started with the Turing test, I am sure you would know what Turing testers. And then the a was born in 1955 the word was coined the artificial intelligent phrase was coined in 1955 by John McCarthy. And then in 64, the professor at MIT created an application that emulated a psychiatrist, ok.

In 2011 apple bought a conversation engine from Siri international and then called it Siri. IBM Watson won the jeopardy prize in 2011 so, we will talk about that little later. And then 2014 from Amazon we have Alexa and then 2016 we have Google home ok. These are all interesting engines that perform certain tasks for you right, ok.

So, let us look at the conversation modeling at a very high level. Modeling conversation is one of the active research problems is in AI. As I mentioned earlier it is still an ongoing research problem. We do not have a complete solution yet, we do not have any bot that is 100 percent successful in doing everything that we are expecting.

This involves natural language understanding reasoning and the utilization of common sense knowledge. So, this is the one which is very difficult to achieve, right. The goal is to build a conversation model that generates responses automatically that is a keyword automatically is the keyword there. And these responses are linguistically indistinguishable from human responses there bypassing the Turing test.

On the right side, you have a diagram, ok. So, to give you an idea of what a Turing test is with respect to the conversational modeling. I assume that there is a person who is sitting on the other side of the room, ok. And that person does not know whether there is a person sitting on the other side answering his question or the machine answering that person's question, ok. So, that is the idea.

So, this person does not know who is giving the answers. So, this person poses a question, and then we have answers coming in from here. And this person does not know who is responding to his question or her question. So, when this person does not realize that these questions are the questions or answered by a machine, ok. And if that person

kept thinking that the answers are coming from the human, then we can claim that that particular conversation set has passed the Turing.

So, it is going to be very difficult for you to have a very lengthy conversation and claim that it had passed the Turing test. So, we need to prove that, right. So, we need to have a lengthy conversation like you know one and a half hours, 2 hours, 3 hours.

And then the person sitting on the other side of the wall did not realize that these questions are coming from the machine and kept on thinking that these question answers are coming from the human; then we have then this particular conversation had passed the Turing test, ok. So, this is one important test that we have to perform, ok.

(Refer Slide Time: 10:16)

Let us take some example you know they may look very trivial. But I want you to go through this and then see what we have internally assumed and then how we take the conversation forward ok. So, this is one or multiple conversations that we have on the left side. So, would you like some coffee ok? Yes please right. So, immediately the person who is asking the question I understand that this person requires coffee and then he delivers it you know.

And then there is another question Mega would you like to dance. So, the person mega is asking a question is that floor slippery? In there is a context attached to that right. So,

this is going to be a dance exercise and then Mega is asking whether this floor is slippery maybe Mega had seen that somebody mopped the floor.

And it is still wet or when she left that room she saw somebody who is mopping the floor and she might be thinking that the floor is still wet. So, she is asking the question of whether the floor is slippery. And then the response is no, it is fine. So; that means, you can assume so many things after that correct. So, there are things that are not said in this conversation, ok.

Let us take a look at the other one it is between a student and the teacher. The teacher is asking a question will you tell us the answer to question four? Mike's response is that one on-page and there is a past six or seven. Then I would be happy to, ok. And then the teacher says six oh ok, the answer is factorial to see the context starts from here right. And then you have to remember the context until the end. So, that is true with all the conversation right.

Even for a short conversation there is a context and there is a set of things that are not said. But, people understand the conversation very well understand the context very well, and then they respond to each question correctly and they take the conversation forward.

So, again in this case if you look at the question from the teacher and then the instead of the answer the student is asking a question again, correct. Assuming that we are going to be making the system respond to each of these, let us assume that this is an automated tutor. So, this automated tutor is sending a or person a person to this student will you tell us the answer to question four.

And then if mike responds in this fashion what all things that the automated tutor should understand? What all things that the automated tutor should know in order to respond six, right. You see that it is small bits and pieces that are missing right and that we need to input, say for the machine to do this it should understand that the person who is asking the question or Mike is asking the question whether the question that you are asking is in on-page six or seven, right. Then he says I would be happy to.

So, how would you expect the machine to respond to this question, right? So, in the same fashion as the teacher will it that is what we want to or try to attempt in this case, right. In terms of the conversation modeling, we want to attempt whether the automated tutor is

able to really follow the question asked by the student and then take the conversation forward and so on.

(Refer Slide Time: 14:45)

So, it is all about understanding what is not said as well. So, not everything is going to be made available correct during the conversation that is how we converse. So, in order for the machine to converse is it possible for you to give every piece of context every time when you pose a question. Our mission should be able to grasp the context that you are in and then start responding to that.

And then when will it change the context. For example, during the conversation we keep changing the topic, right. So, will it be able to follow the context along where the human what should we do for that? So, it is an open research topic and we should continue to evolve the natural language processing and the other areas in order for us to move beyond this.

Analysis of the language beyond this sentence that is spoken, identification of the relationship among all of the context across the sentence boundaries, right. So, as I mentioned across these sentence boundaries we still have to keep the context alive in order to take the conversation forward, ok. So, one way you can do this is by using knowledge-based conversation modeling.

You can start representing a conversation in some form, ok. So, in this case we can represent the entities and also have a set of conditions representing the entities for example, in this case a former owns a donkey. So, we have two here right and then former is x and donkey are here there are two entities and then we have the verb that connects those two right using this form.

So, I am not going to go into the details of this and if you are interested to understand how the conversation analysis is done. It is a separate topic by itself; you may want to look at this I just want to mention here. So, that if those who are interested in the knowledge-based a conversation model can go in this direction, ok.

So, in this case we can have the representation and condition and then have a relationship that connects those two, ok.

(Refer Slide Time: 17:32)

So, now having said so many important details about the conversation and they know answers that we have when you have the conversation. So, how do we define the (Refer Time: 17:49), we cannot just have an open-ended system initially. So, we need to start with something that works for a certain knowledge base or it works for a certain small context and so on, then a start moving it towards the next goal.

We need to be able to make the system comprehend the text that is given, right. This is a task, that we had done during our English classes and you know in the 5th to 11th to 12th

and so on, right. There is a paragraph given and you have to comprehend respond to the questions and so on. So, we want the machine to do the same, right.

Learn the conversation; obviously, yes how do we learn the conversation, how do you train the system. So, that it learned the conversation. A learn to summarize or encode the connotation yeah, we have encoded the word right using the word vectors and embeddings. We have encoded sentences using the recurrent neural network, correct. And then we have tried to use the encoded model to do the translation and so on.

So, in the same fashion can we encode a conversation or summarize the conversation. That means the just of the conversation has to be encoded in some form. Predict the meaning of the conversation. So, what if the conversation is all about? Is it about the kinematics talking about or it is going to be about conversational modeling? That we are having today? What is it about? What is the semantics of that, at a very high level?

So, it should be instead of meaning it should be the context. Produce substantiative and useful conversation yes, otherwise it is going to be boring. And people will move out of that if you do not have a good and engaging conversation. Produce a sentence with good fluency yeah; when you start the conversation with a human, the mission should be able to produce sentences with good fluency adequacy not good enough in many cases, right.

We cannot just respond with some keywords it should have a complete syntactically the right sentence and also mean or provide some useful response to the human queries. Detect hypocrisy abuses flirting threats etcetera automatically. You know the lot of conversation that we see on the social network, we want those systems to be able to catch these abuses flirting threats automatically. And then stop the conversation or block the user or at least inform the officials with respect to threats and so on right.

I assuming that the system knows where the let us say if it is a tweet where that tweet is coming from and who is tweeting indefinitely it will know who it is who is tweeting it and so on. So, is not that a way that we can figure out the threats in the conversation that is going on or if there is to say an abuse that you find and you automatically block the user based on the series of abuses that we had captured from that particular user and so on. And then maybe you know somebody can create a hypocrisy meter and then say that, this is the kind of hypocrisy that I see on the social web from this particular person.

So, it will be one interesting bot that we can create which he can spot the hypocrisy based on the previous conversation that the person had. The learned task-oriented conversation this is something that we can quickly build an improve. So, for a given set of tasks you know the knowledge is limited; it is not going to go beyond a certain level, right.

So, if you have such a set of task it is possible for you to train the system to do for certain operations and then probably it can engage with you on a certain conversation like the example I gave, right. Wake me up at 5 am tomorrow, right; it is a very simple task-specific conversation; that I can have the machine learn to identify questionnaire it is very important, right.

So, in any question answering system, we need to figure out where the question is. And then try to find out what that question is all about, correct. So, we will talk about that little later. And then learn the question answering as a whole ok, like what we had done in the case of machine translation is it possible for us to do the question answering as well.

So, you remember in the case of the machine translation, we have an encoder and then we have a decoder, right. So, you provide the input sentence, and then it outputs the translated version of that. So, we use some kind of alignment models based on the corpus we try to align phrases words and so on. And use that as a feature to encode and decode write or translate from one language to the other.

In the case of question-answering so, the question is going to be in English and the answer is going to be in English. So, what is the kind of encoding and decoding that you would have in this case? Right. So, in the case of at least in the translation, the sentences are equivalent, right. So, it is possible for you to align those phrases, in this case, or rather in the case of question answering.

There is a question maybe there are certain keywords that you will find in both the question and the answers. So, that you could probably align and then learn that alignment in the question answering system. And maybe utilize a translation-based model for the question answering as well. So, these are all the tasks that we would like the system to do. And we are in the process of taking one step at a time in terms of making the machine understand the text.

So, hopefully in the next 5 to 10 years we may have a good conversation agent; that would have a wealth of world knowledge and be able to converse with you freely in every aspect of life.