Artificial Intelligence
Prof. Mausam
Department of Computer Science and Engineering
Indian Institute of Technology Delhi

Lecture-6
Introduction: Definition of AI Dictionary Meaning, Part-6

Hopefully todays would be the last class on the introduction. And we would spend some time talking about what is AI if you think about where we are, we started giving you some sort of background on the field, we talked about the history of the field. We talked about how this field has become over important in the modern world in the last few years, how suddenly a lot of people have started talking about AI.

And so I guess it is appropriate that so many of you want to understand AI because you know, it is the technology for the present and for the future. And when we start thinking about AI, the first point that we should spend some time on is what is AI? And what is the philosophy of AI? And at least it is my perspective that I will not only talk about the techniques and you know algorithms and so on so forth.

I will also give a broad overview of the philosophy of AI the ways of thinking about the AI the AI mindset, which is actually significant right there is a lot about the AI mindset, which is different from the rest of the computer science mindset and we will try our best to expose that and talk about it. And so, even in the middle, you will find that you know, later down the line when we are looking at specific techniques.

You will find it I will take a detour then talk about something which is more philosophical and you will see that how a lot of things that we talked about in a also relates to how we think about, you know, our psychology or how we make decisions and so on, so forth. So, hopefully these sorts of ideas will get come out in the course as the course evolves. So that, so the goal for today is to define AI and AI is obviously a fairly controversial subject controversial in the sense that a lot of people disagree with each other on what is AI.

So let us first talk about AI as a science, we will also take an engineering and other views. But let us look at what is the science of AI and so as with every scientific discipline, there is a fundamental question that they think about if you think about physics.

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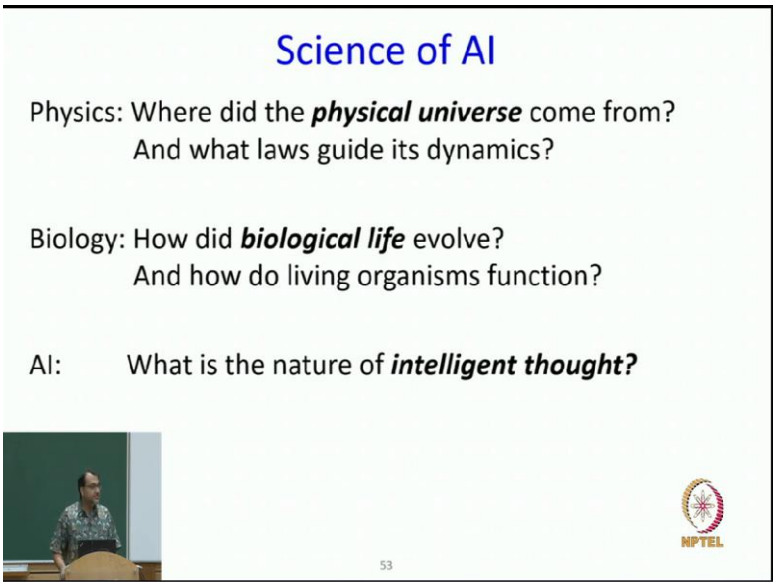
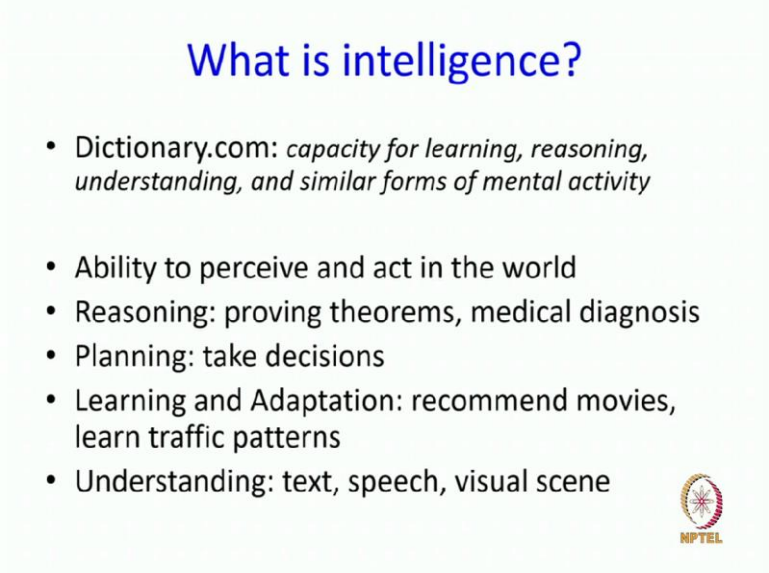


They will think about the question where did the physical universe come from? What laws guide the dynamics of a physical system? Similarly, in biology, if you think about what is something that sort of pervades everything in biology; it is how did the biological life evolved? How do living organisms functions? How do they get specialized in doing specific functions and so on, so forth. And in the same way, we have to sort of define AI and it is going to be a hard exercise.

And so the easiest and you know, the boring way of doing this is to say, what is the nature of intelligent thought? Can I make a nice intelligent thought can I use cannot can I take the idea of how thought happens and put it in a machine. Now, of course, there is an issue with this definition. And the fundamental issue is that in order to define AI, we have said that it is about intelligent thought.

But it is going to be hard to define what intelligent, it is going to be hard to define intelligent of course, if you think about it as composed of AI, and artificial part might be relatively easier. We know about our living organisms, we know what non living organisms, but the I participant is going to be a harder what exactly is intelligence? So let me crowd source the definition. **(Refer Slide Time: 03:43)**



What is intelligence what according to you, is a possible definition of AI of intelligence? Anybody? Please raise your hand. Yes. What is your name? Mita Yes. The rational decisions. So you have read a lot about AI and now he says AI something. Intelligence is about rational decision making what is rational? We dont know. We will probably talk about that in the next few slides because that is sort of the definition that I am trying to get to, but there must be some more simpler definitions of intelligence you have. And yes, intelligence varies according to the goal of the system.

What is your name? Hahi, So high says intelligence varies according to the goal of the system. Now, I am not going to disagree with that. Obviously, if I want to go east, I should not be going west. So obviously, my decisions should be dependent on what my goal is, but that is not that definition for many biological life forms, intelligences survival, and therefore whatever they do for survival would should be called intelligent behaviour. Again, I do not disagree with it, but that is not the definition of intelligence.

And in fact when you start digging this and you will see this again and again in any type of concept you want to define, let say I want to define what is a thing? Or what is a game or what is the chair? You will be lost. I am not kidding you. I remember a humanities course where we spent a lot of time just defining what is a game and we realized that a game need not be to 2 player it need not be multiplayer it need not be adversarial.

It can be you playing with yourself and it need not have cards It need not have any object whatsoever. It is just very complicated to figure out what is game and what is not a game.

What is a chair a chair has 4 legs; well this chair does not have 4 legs that chair there. Well it needs to stand on its own then a table is also a chair. It gets super confusing. It can be used to sit in a bed is a chair. I mean you will get confused then the chair should not be the sofa. Sofa as different chair is different.

You will find defining any set extremely simple concept that you and I understand very well, very, very, very well very intimately we have used it and so on the word, you will find it as soon as you try to put a definition to it, it will become difficult. And so was the case when we started looking at what is intelligence By the way, how do we in humans? Assess if what is the intelligence of a human by the IQ tests exactly.

But we then there you will see pages and pages written on how IQ tests are not the right measures of intelligence. So, there is a lot of contention in how to measure intelligence. So these are difficult concepts and to define them becomes extremely hard, but we will try our best and we will sort of come back to the definition that dinner made ahead. But let is go one step at a time.

So I had a humanities professor who used to say when in doubt, consulted dictionary does a very beautiful statement he said that, you know, to clear your brain It is important clear your mind it is important to have the real meanings of words and dictionary really gives you that. And of course in modern world we should say when in doubt consult Google. So that is how the modern world has world. You need not consult a dictionary anymore. Most people dont even buy a dictionary it said our phones etc, fingertips all the time.

So, I looked at the dictionary definition of intelligence and I was highly disappointed, highly dissatisfied. So dictionary.com definition says capacity for learning, reasoning, understanding and similar forms of mental activity. Now notice that 2 things that this definition did about intelligence. First of all, it gave examples so this is definition by example. It said learning is intelligence reasoning is intelligence.

Basically something like that. And then because wanted to have a definition it ended up by saying and similar forms of mental activity. Now notice that what this definition is saying is that intelligence is equal to whatever happens in our brain, what is mental activity whatever

happens in our brain? And it was implied that this is we are talking about human mental activity and not dolphins mental activity or elephants mental activity.

Though it need not be. So that as I said that 2 issues AI it is not a definition that is operationalized label per se, because it only lists a few examples. And moreover, it is saying that whatever humans do is intelligent, which is not satisfying, So first of all, what are the examples well, ability to perceive the world like say I can look at you guys and figure out where is a face where is not it Where is a chair at in the world? You know I am speaking to you that is my actions in the world reasoning.

Proving theorems medical diagnosis, those are reasoning questions I get some evidence I reason about what might be going on planning taking decisions. So in order to act i need to decide what to do that is called planning. Learning it says right so learning and adaptation so recommend movies, learn traffic patterns, you know that in the morning this particular route is very heavily subscribed so I should take the alternative without I know that this friend of mine recommends me movies, but I dont like those movies.

So I dont like this friends recommendations whenever he recommends the next movie. I know that you know that movie I should not see. So that is called Learning we learn we have we all have friends like this. and, and so on, and understanding right understanding text, understanding speech, understanding vision, understanding what is going on around me. So all of those would be manifestations of intelligence.

But it still begs the question is mental activity intelligence and that is the end of it. What is the relationship between intelligence and humans?

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Are humans intelligent? What do you say arguments intelligent? Come on? Yes, I saw some persons that know. She knows a lot of people we dont. And sure, we can say humans are intelligent. I think that will be fair. But then to her credit, you can also ask the question, are humans always intelligent? And then I am pretty sure most people will say, Well, the answer is no. We all have been in situations where we have done something we feel that is dumb.

But we have friends who realize you know how to become a human. So the point is that we need to somehow dissociate the definition of intelligence from what humans do. Because that is limiting. And moreover, we do know that there is non human behavior which is considered intelligent, you know, there is lot of news you will find on you know, dolphins can do this which humans cannot. Dogs can hear frequencies which humans cannot.

So they can sense things which we could not sense, etc. And all of that makes us believe that there is intelligence out there, which is non human, but, and we need to dissociate intelligence with humans. By the way, the fact that humans are intelligent and the fact that intelligence was in very primitive times A few years ago, few minutes, may be 15 20 is replicating human behavior has traditionally been considered a hallmark of intelligence.

So a simple example is let us say chess. Let us say we are in the 80s. What is our goal in chess? Our goal in chess is to defeat the humans is replicate human behaviour be as good as them. There is nothing wrong in saying that humans are intelligent and I want to build an AI system that is like a human or that is equal to a human or slight or better than humans. But today in the modern world, suppose I say that my goal in chess is to defeat humans.

Will we consider it intelligent anymore? No, because we that boat has sailed, the humans are far worse. If we have if we have to build an AI system that is as good as a human and chess that means that we are dumbing down our AI system, we are doing it only maybe for training so that poor human can, you know, play with my chess machine and become slightly better than he or she is. So that is no longer intelligence.

So you will always find that there is this human line. And your AI systems are right here, and you keep improving them and they keep getting better and better and better and better and better. And then some great news story happens here. The blue defeated chair Garry Kasparov. AlphaGo, defeated lease it all or whatever. And then at some point, the chess or whatever the AI system becomes better.

And it becomes better and better to the extent that human stopped playing with the AI system earlier humans did not play with the AI system was too bad. Then they started playing because it was an equal and then they stopped playing because AI is too good. And by the way, that also leads to a very interesting phenomenon called the mixed initiative system in them.

For example, today it is said that the best chess player is not a human. The best chess player is not a machine. The best chess player? Yes, exactly. It is a combination of a human and machine. It is a team. It is collaboration. And it is a world that you will probably be living more than more than where the AI and No human are going to work together about a task. Very simple things you can still do.

Like you do a to do list, you set at alarm, you set a timer, or you have a to do list which says I have to buy milk from this particular you know, grocery store, and you are driving and suddenly. The cell phone buzzes and says, you know you are very close to that grocery store. It is around the block, go buy milk. That is a joint collaboration between a human and an AI system a very simple joint collaboration. I am not saying it is too deep.

But the point is that the AI system knows what you need to do AI system knows where you are. The AI system figures out all your next appointment has 10 more minutes in the middle than you are driving the traffic the directions. I suggest that you will reach 10 minutes earlier.

Why dont I use these 10 minutes and help you buy milk and get one thing out of off the to do list.

Now this is a world we can easily live in today maybe some people already living in, but more than more such collaborations will be seen in the future in my opinion. So coming back when we define it intelligence, we need to say yes, we can be initially inspired by replicating human behavior in the long run intelligence is more than what just humans do. So that leads us to thinking about how should we define AI? With this background.

And we will come back to the particular point about humans, but the first thing we did, I did not but you know, people who sort of really made these slides they went to the old AI textbooks and said, let us see what the different scholars say about what is AI and behold, we get many different definitions and again, this does not surprise us because we know that defining such things is complicated people have different opinions, etc. This is a philosophy question at this point.

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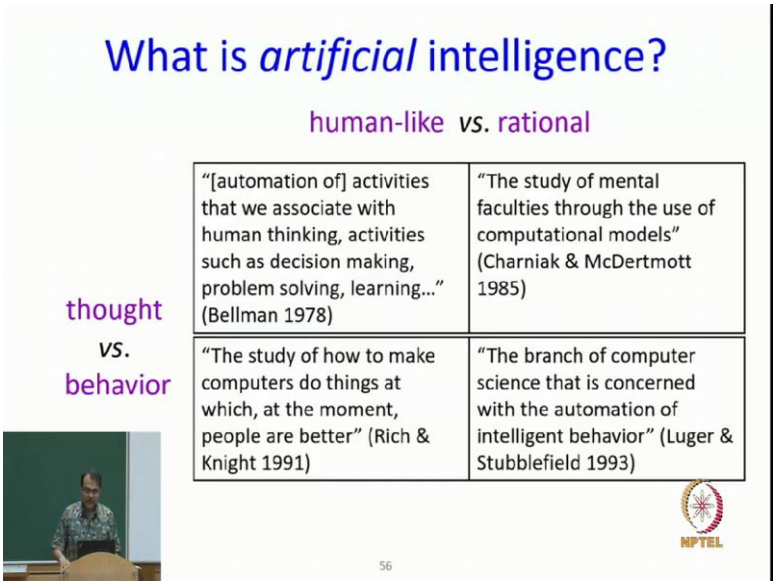

So we suddenly see a slight a set of definitions, which you can put in 4 2 cross 2 great. So, let me read these definitions for you. AI is automation of activities that we associate with human thinking activities such as decision making problem solving learning; this is very similar to the dictionary definition of what is intelligence except that now we have added the automation of part.

Then the other definition is the study of mental faculties through the use of computational models, so, somewhat of a terse and less clear definition, but it says that let us study interest create a computational model that allows us to think in some ways allows us to create mental processes in the machine. The third definition is the study of how to make computers do things at which at the moment, people are better.

Look such and such a complex definition is not even. So, this is exactly if it works, it is not AI kind of a definition because it says at present humans are better and let us try to solve that particular problem then it will be AI now, but tomorrow it will not be AI because then at then point we will not be better and there will be something as the humans will be better in AI will be in the pursuit of that and so, as soon as it works, it stops to be AI ceases to be AI that is exactly that definition.

And the last definition is the branch of computer science that is concerned with the automation of intelligent behavior. Again, it does not even go into intelligence, what is intelligence, it just says anything that is intelligent behavior is AI. So, if we sort of abstract out the specific details and you know, try to reason it at a high level.

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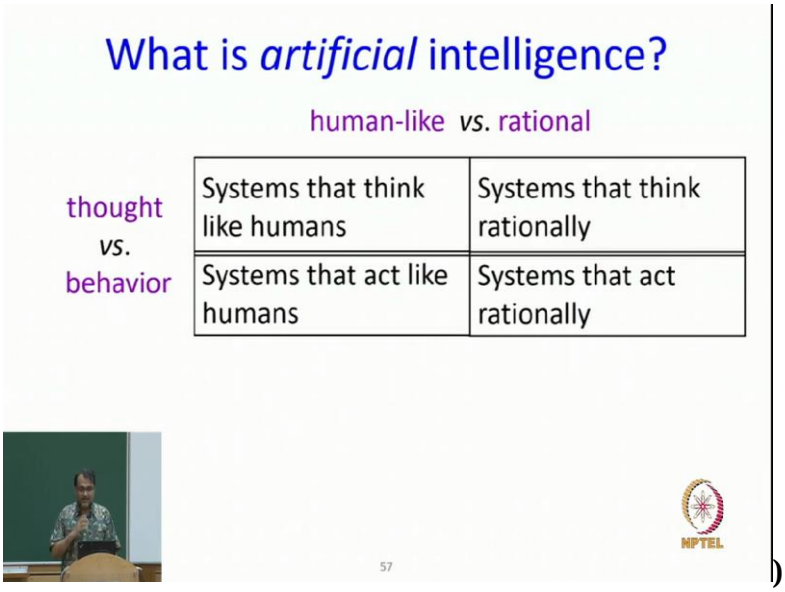

We can say that these 4 definitions fit in approximately these 2 cross to grade were one dimension is human life versus rational. So this is the human like box, or column. And this is the rational column; even the definitions did not use the word rational. And if you look at the laws, it is more about whether you are interested in thought or actions. So, in short, over 4

possible definitions of AI. AI, let is make a system that can think like humans. Let is make a system that can act like humans.

Let is make a system that can think rationally and let us make a system that can act rationally. Everybody with me? Now, I will let you think about it for a few seconds and see if you can feel that one definition feels like the definition of AI for you. This is written by credible researchers in the field. So obviously, we are not going to say that any one of you is wrong, per se. But let us see if you can resonate with one definition more than the other.

So how many of you feel that thinking like humans is the right definition of AI. 1 person to 2 people? 3. How many of you think that acting like humans is a better definition? The definition of acting like humans? 1 2 3 4 5 6 7 8 9 10 13 14. So good, more people think that acting like humans is better than thinking like humans. What about thinking rationally? How do how many to say that thinking rationally finding the competition model, which can sort of, get you to the thought is good one.

Almost the same number as acting humanly very good. And last but not the least, how many of you think that acting rationally is a better definition of AI, maybe slightly more, maybe, let us say 25% 30% of the class 30%. So notice that we have so many philosophers in our group, because they are already starting to disagree. Now, let us see if I can get some credible points of view as to why one definition is a good definition and one definition is not a good definition.

So anybody who thought that acting like humans is a good definition. Can you justify why or can you say why it is? Yes, please what is your name? It is in accordance with the Turing Test very good what is your name? (())(20:51) you know, acting like humans is in accordance with the Turing Test and I believe Turing I mean, he is not putting more thought and effort to Right or not he is just saying about tuning said it has to be true.

And Turing device that Turing Test got to be the right demonstration of AI but his right at one level he said that Turing Test for acting humanly everybody agree with me agrees with me. Let us quickly talk about Turing Test.

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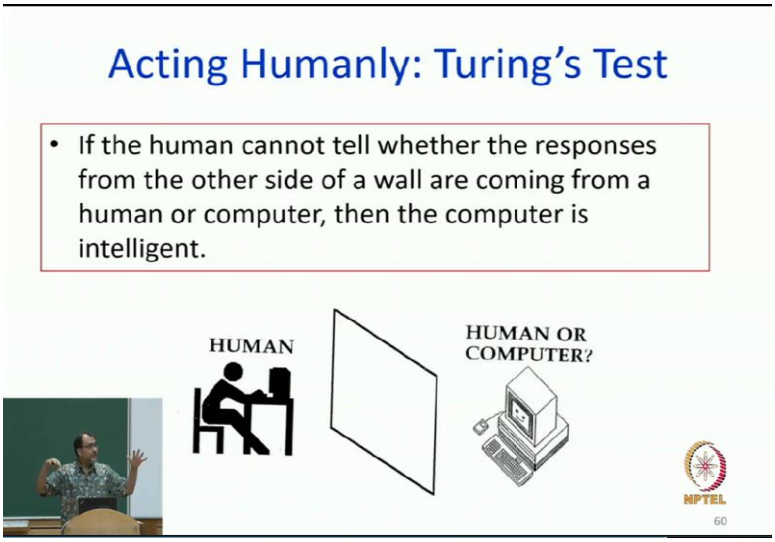

So Turing Test for people who dont know you have a screen and you have a judge, you dont know what is behind the screen. The judge asks questions from the screen, let us say types the questions so let is take the speech recognition part out types the questions and on the screen you get the answers from anything behind the screen which is sending the answers. And now the judges job is to determine whether the pause the thing behind the screen is a human or a machine.

And if the judge feels this is a human, you know, the responses are very smart. And it turns out to be the machine that means the machine has been successful in fooling the judge in believing that it is a human which means that it has become at least as good as a human and therefore, it has become intelligent. And that was to a tooling answer to how would I know that something is intelligent? it Do you realize that Turing Test, so we will talk more about acting humanly part in in a few minutes.

Any other justifications for why one definition was deficient? What about people who think say that thinking rationally is the definition? Yes. What is your name is Hutch. Yes. Arsh. So you are between harsh and Hutch, good. Yes. Very good.

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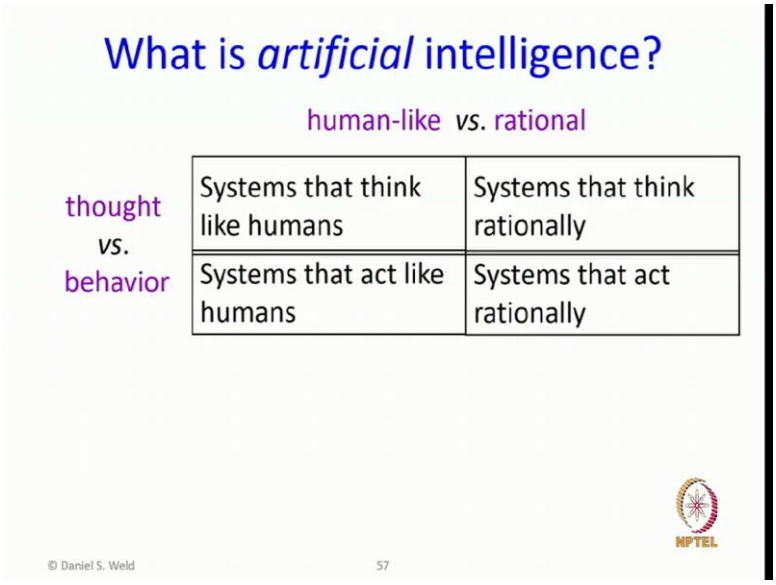

So he says that let it go back, you know whatever millions of years and they are no humans. They are no Palaeolithic people. They are no old people. They are no ancestors of humans. Even when humans are not present, they should be intelligence. How can we define AI says that AI could not have existed before humans came in. I guess he is not just thinking about the past you saying tomorrow if all humans die, AI should still should still exist, in some sense.

AI In other words, his point is let is not restrict our definition of a 2 Humans, How about people who believe acting rationally is a good definition? Why do you say that? Yes. What is your name? Raj beer? Yes. So as he says, How would I know he is asking almost a direct question even if something things How would I know until I can see it act and if I see it and that is the only way I can guess that something is intelligent and I think acting rationally should be the definition. And basically this set of ideas is what we have, which leads to a reasonable definition of a that more people in the field agree with