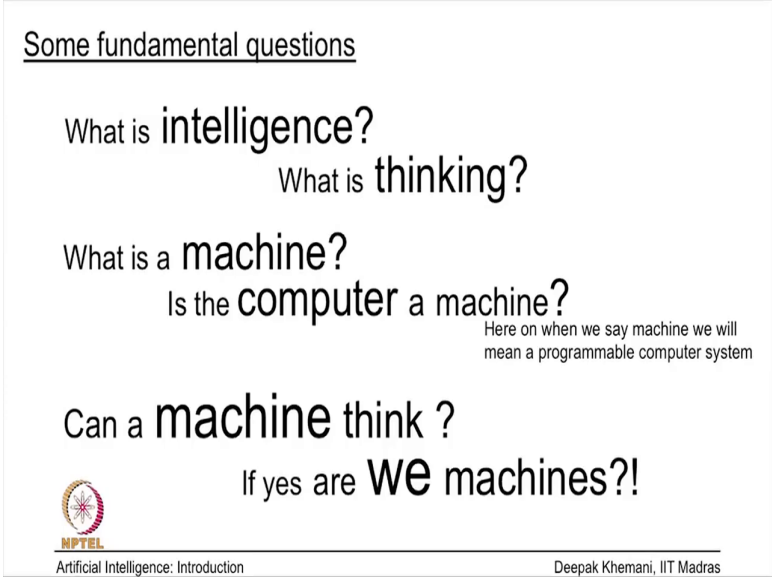
Artificial Intelligence: Search Methods for Problem Solving
Prof. Deepak Khemani
Department of Computer Science & Engineering
Indian Institute of Technology, Madras

Lecture – 04
Introduction (2013)
Can Machines Think?

(Refer Slide Time: 00:17)



So, let me move on a little bit and ask the next question, this is not a very complicated question I just want to be sure that we are all on the same page because when we talk of machines thinking and so on. So, what do we mean by a machine? Otherwise we will be stuck with trying to answer a question that can machines think without knowing what we mean by thinking and without knowing what exactly we mean by machines essentially. So, both these terms we should know that so what do we mean by that essentially

Student: Device which does a particular task repeatedly.

A device which does a particular task.

Student: Yeah.

Repeatedly.

Student: (Refer Time: 00:53) of how (Refer Time: 00:53).

I am not going to write this here. Is that a complete enough definition of a machine?

Student: A device that is reduces a human effort.

A device that reduces human effort essentially; what about an exercising machine? A treadmill or something that.

Student: Sir there is computations.

Something that there is computation, but computation is only if.

Student: One kind.

One kind of activity that we consider, we have a machine which grinds coffee beans for you I do not know whether it is doing computation. Now, more fundamentally when will I call something a machine that is what I mean by the question essentially.

Student: So, it obviously.

So, if it is not a machine what can it be?

Student: It follows the given instructions you instructed and it will do the work for you.

Student: Does not think on it is own right.

So he says it does not think.

Student: (Refer Time: 02:00).

On its own so he is trying to give the answer to the question that can machines think. So, machines are things which cannot think on their own.

Now, this bit about following instructions I do not know I mean, there are of course at some stage in the life of a machine there are instructions given to a machine. So, but if I have a air conditioner like in this room or a thermostats somewhere it is not really following instructions.

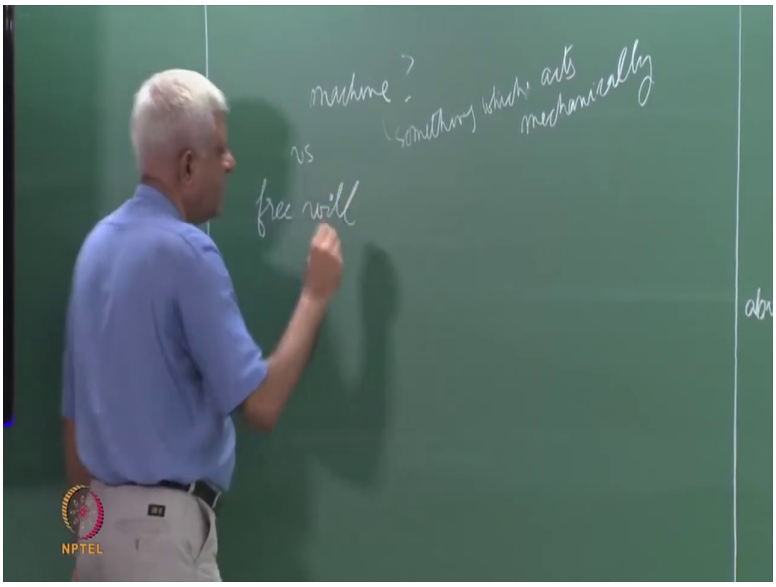
Student: No, but you some coding or something.

At some yeah that is what I say that some stage in it is life some instructions were given to it.

Student: Yes sir.

But then I can say the same thing about you as a person right. That you are following instructions your parents said go and attend lecture, do not bunk classes. So, you are sitting here obviously yeah. Now, more fundamentally what is this when would I call something a machine?

(Refer Slide Time: 02:55)



So, let me give a circular definition something which acts mechanically. Of course, as I said it is a circular definition it is using the term machine and mechanical they are related to each other. So, it is not really a good definition in that sense. But it gives us an idea of what I am trying to convey essentially, because we can express this more easily. When do you say that something is acting mechanically? And I do not want the answer that without thinking.

Because thinking is something which happens at a different level altogether as we will see. Basically in a well defined manner according to certain rules let us say laws of physics, if it is a physical machine or some other mathematical laws if it is some computing machine something which operates according to a fixed set of rules.

So, the question that one asks is and we will come to that in a moment. So, this is a question which has this; so just to be clear. Is the computer a machine? It does operate according to somebody well defined laws and so on.

Of course, a computer is a very special kind of a machine it is a very flexible kind of a machine, which says. So, this whole idea of stored program which we discovered it was discovered not quite discovered, but at least brought forward by Charles Babbage which says that you can have the same machine and you can put in a different program and it will do something different for you essentially.

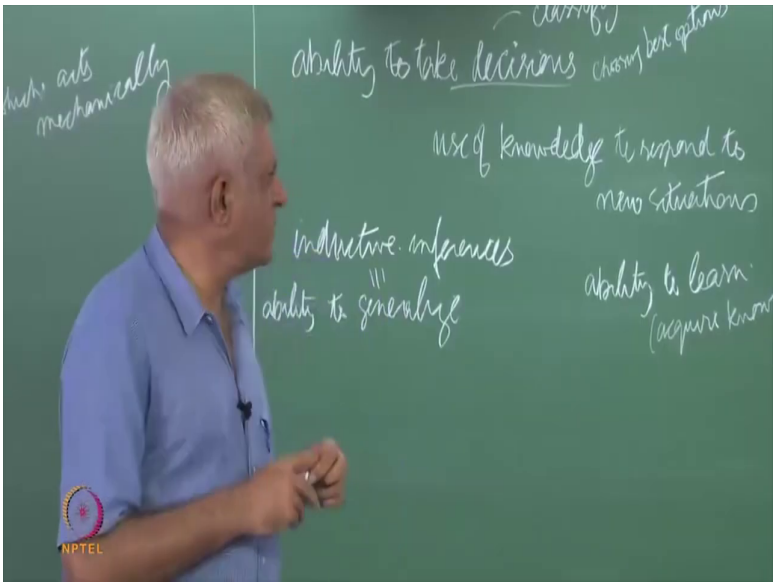
Makes it a very flexible machine, but nevertheless it is a machine, because at the base there is something which is very repetitive which is going on. And whenever we say a machine in the rest of this course basically we will mean a programmable computer. So, when we say can a machine think then it means can we program a computer, so that it appears to be thinking or always thinking as the case.

So, this is a question that is fundamental in the sense, there was a raging debate as we will see some arguments against thinking in the next slide. In the last 50 odd years people 60 years people have been talking about whether machines can think or not. Now, what does.

So, does anyone here have a strong opinion either side? So, when I say by this time I mean a computer program, can I program a computer; so that it is a thinking machine is that possible at all?

Student: Yes.

(Refer Slide Time: 05:45)



And we try to find some aspects of what we call intelligent behavior or is there something missing that we have not mentioned here we forgot to mention here, which the computer cannot do can never do; is there something like the halting problem situation here?

So does anyone have a opinion either ways does anyone strongly feel that yes machines can think there is nothing fundamentally against it or does anyone have a opinion which says no machines cannot think only we human beings can think obviously.

Student: Sir, but you did not tell what is thinking?

Well I that is the first question I started asking you with it. So, we wrote all this stuff by saying that if you are (Refer Time: 06:32) in this.

Student: (Refer Time: 06:33) intelligence right?

Yeah, so we sort of say that they are closely correlated, thinking is the process out of which intelligence arises you might say. So, no one has a strong opinion I take it precisely I take it ok. So, that is fine there is nothing either ways and finally as Haugeland said I mean I that the to what Haugeland; Haugeland thinks about this question that are we machines is already there in his answer essentially, he thinks that we are machines.

But is there anyone here who feels that strongly about this that yes we are machines or no we are not machines we are flesh and blood creatures of carbon, we are not made of silicon any strong views. So, supposing I were to say let us try and put forward the idea that we are machines. What is the argument that you would give to say that yes we are also machines?

So, one of the fundamental objections that people ask is that you know machines versus whatever it is which is called as free will. So, when I asked you little while ago as to what would be if you were not a machine, then the answer that some people gave is that you have your own free will. So, in some sense a machine does not have it any free will essentially. A machine operates according to fix set of instructions and fix set of laws and always obeys those instructions in laws essentially. Whereas, free will which you do not understand.

We do not know whether we have free will or not. I mean people claim that human beings have free will, but they all go and vote for some Congress and BJP all the time. Essentially so but anyway what is this thing called free will right.

Basically says that we make choices that we are the ones who decide how our lives will be or what we will do in the next instant and things like that. You know you are upon philosophy is like existentialism dealt quite a bit in the postwar period about this notion of free will and you know making choices and things like that.

So if you we machines then we would not have something called free will or is that a contradiction. Or if we are machines do we like some of the Indian thought says that

everything is pre decided, like they say whatever had to happen will happen essentially. Of course, then we are all machines and then there is no second thought about it.

But if I were to sort of deconstruct and say we are machines because of this reason, I could sort of give you an argument which says that we grow out of a single cell to start with instructions written in our genetic code about how to build our bodies, what color to of eyes to have all kind of things.

And then essentially we build ourselves using the this thing and therefore we become human beings and just like computers are flexible and they can do different things at different times. We also flexible maybe a little bit more than the current day computers. But we are in the end we are machines essentially.

Or I could give you an argument which says that see our brain is made up of a 10 to 100 billion neurons all of them operate in very simple mechanical procedure. So, our brains are mechanical in nature and therefore since a brains control us we on mechanical in nature. I could give a arguments like this. So, what is what would you say against it, I mean if you were to say anything against it?

Student: We have are something called emotion that is not in machines.

We have something called emotion that is not in machine essentially.

Student: (Refer Time: 11:01) as do we our emotion.

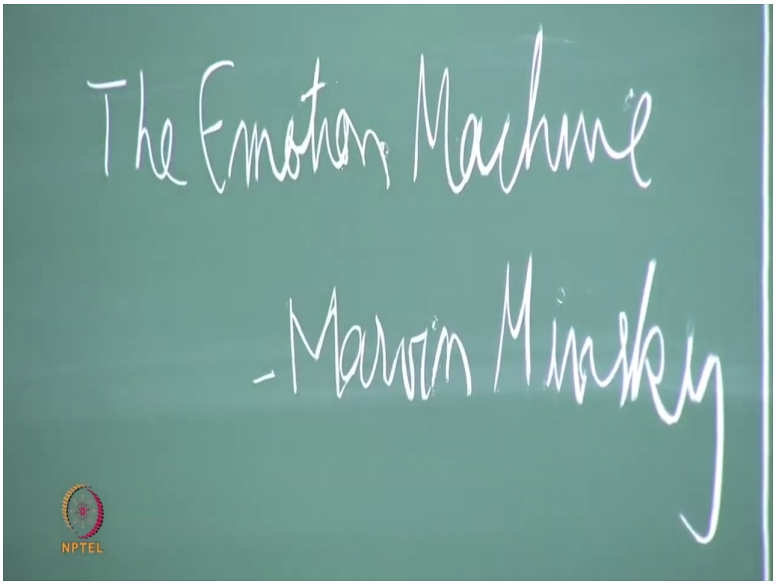
But how do you know it is not in the machine?

Student: Suppose I turn off my computer.

Supposing your system crashes can we say it is angry with you. I mean it may not display it in other ways like you, no more seriously why should we say that machines cannot have

emotions I think? So, I will point you to a book it is called the Emotion Machine and it is written by a guy called Marvin Minsky.

(Refer Slide Time: 11:30)



Student: (Refer Time: 11:46).

Marvin Minsky was also one of the founders of AI, as we will see the history of AI as we go along he founded the MIT AI lab along with John McCarthy and he has his in the last 5 6 years odd he has written this book called the Emotion Machine essentially. So, it actually goes takes that into an again a slightly longer debate as to what do you mean by emotion and so on and so forth.

I could try to characterize emotion by saying that you have memories and then you have some value labels attached to memory memories, that some memories are good some memories are

bad and then you have states which are attached to those value labels. So, you are happy or you are sad. So, one could talk about things like that, but is it something which is exclusive to us? I do not know. And do creatures like dogs and cats have emotions?

Student: Yes.

They have.

Student: Humans.

But are they also intelligent or that is another question, is intelligence the prerogative of human beings only or do we allow dogs and cats and deer and monkey to be intelligent or not.

Student: Yes (Refer Time: 13:00).

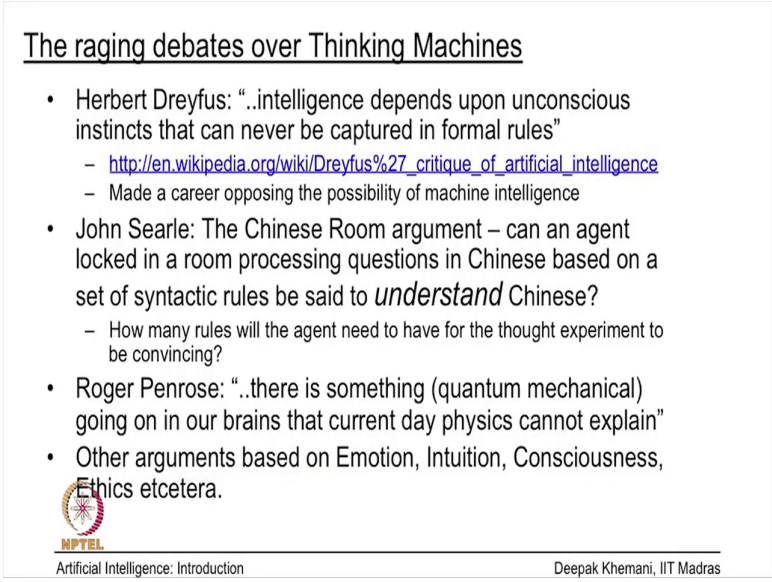
Yeah, but if you go down this ladder of life so to speak then you have dogs and cats, then you have mosquitoes somewhere here then you have a bacteria then you have virus. So at which point do you stop? Obviously, it has some interesting (Refer Time: 13:17).

Student: [FL].

We will we are not here to answer these questions, we are here to keep in mind that these questions have been asked by many people and this is not the goal our goal to you know it is not a course on philosophy, but still we should be aware of it.

So, here is the small cartoon I got from. So, above if we were machines yes then I suppose our admiration would be mutual I think or if you want to call it admiration.

(Refer Slide Time: 13:51)



So, let me give you some arguments which are well known in literature which claim that machines, can the question we are asking is can a machine think; can machines think?

So, what are the objections? The first by guy called Herbert Dreyfus says that intelligence depends upon unconscious instincts that can never be captured in formal rules essentially. So, you cannot read this I did not know how to make this a bit stronger, darker was a basically a Wikipedia page which says it takes off AI essentially.

Dreyfus spent he has made a career out of saying that AI is not possible essentially. So, at least he is made a career out of which. What do you think about this unconscious instincts? That can never be captured in formal rules. So, this is one of the arguments which people say, these

kind of arguments which says that that we often do not know what we are doing. Why we are doing something I did this? But I did not know why I did this?

But does this say that I was doing something really mysterious which I cannot reproduce in a machine. Let us look at the argument where philosopher John Searle it is called the Chinese room argument, he says can an agent locked in a room processing questions in Chinese based on a set of syntactic rules be said to understand Chinese. So, it is a thought experiment which John Searle proposes it is a very famous argument.

Just look up the Chinese room argument on the web and you will get all these descriptions. So, the idea is that supposing you as a English speaking person or whatever Hindi or Tamil speaking person were locked up in a room and you are full of these slips of paper which have these syntactic rules; which says if you see this pattern then send out this response.

If you see this pattern then send out this response. You do not know what that thing is about you see some patterns and you have been instructed to do match a pattern and send out a response based on that. And you know there is somebody from outside below the door slipping sending you slips of paper with some patterns.

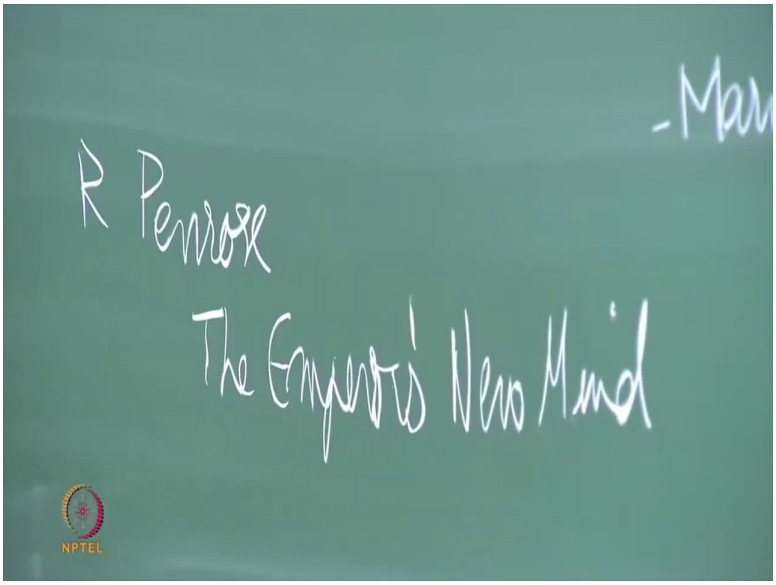
Then you make some other patterns on slips of paper and send them back essentially. You do not know what is happening, but it turns out apparently at the end of this is that somebody is asking you questions in Chinese and you are giving them answers in Chinese.

So, John Searle says and this is his Chinese room experiment thought a experiment, says that supposing this were to happen would you say that the person who is answering you knows Chinese? And he says no because the way that experiment has been described. And he says that therefore, but his behavior looks like intelligent behavior, because he is giving you all the answers; but is that real intelligence he says no essentially.

And of course there is a little bit of an operational trap there which is what I have written here how many rules will an agent need to have for the thought experiment to be convincing essentially. And we will see this idea again in a different form as we go along ok. One more

objection from the celebrated mathematical physicist John Roger Penrose you must have heard about him also a Nobel laureate.

(Refer Slide Time: 17:57)



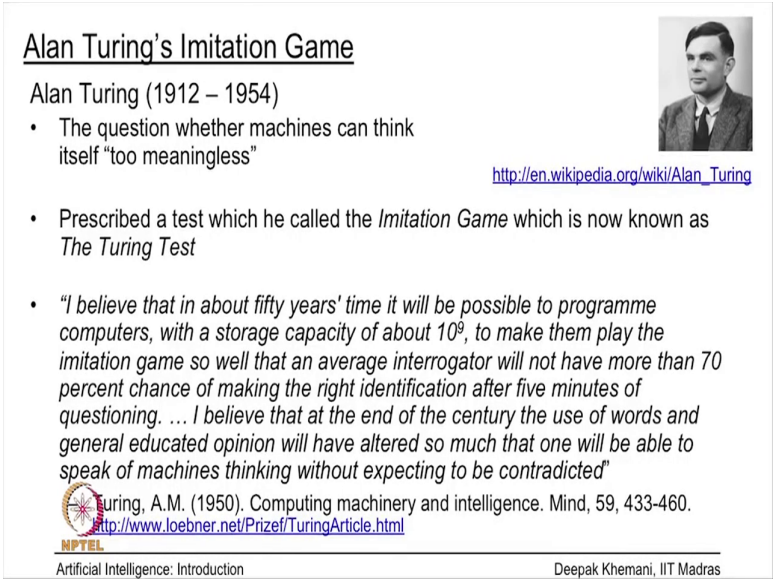
He wrote this book which became quite a hit essentially, it was called the Emperors New Mind essentially let me write the name here. So, (Refer Time: 18:11) the emperor's New clothes and he is also asking this question about can one be can machines think or not?His answer is that no machines cannot think we are the only thinking creatures.

And he says that there is something happening in our brains which current day physics cannot understand cannot explain essentially and that to something he says is respect to quantum mechanical. If, you want to go into those details you should look up the web or read his book essentially, which is not so easy to read. But still he wrote a later book I forget it is name which is a shorter version of this book.

So that is another argument, then there are arguments like he mentioned emotion intuition consciousness ethics. So, some people say it would not be ethical to have intelligent machines, so they cannot be; so they cannot be intelligent. Now, this is kind of a roundabout argument which says it would be bad for by a bad for I do not know who. So, we cannot have an intelligent machine essentially.

Of course we are very ethical people and we go around suspending 28 year old IAS officers, because of some small prejudice that we have against them. So, there are many arguments which occurred in nation and there have been many counters to the argument which I have not talked about.

(Refer Slide Time: 19:46)

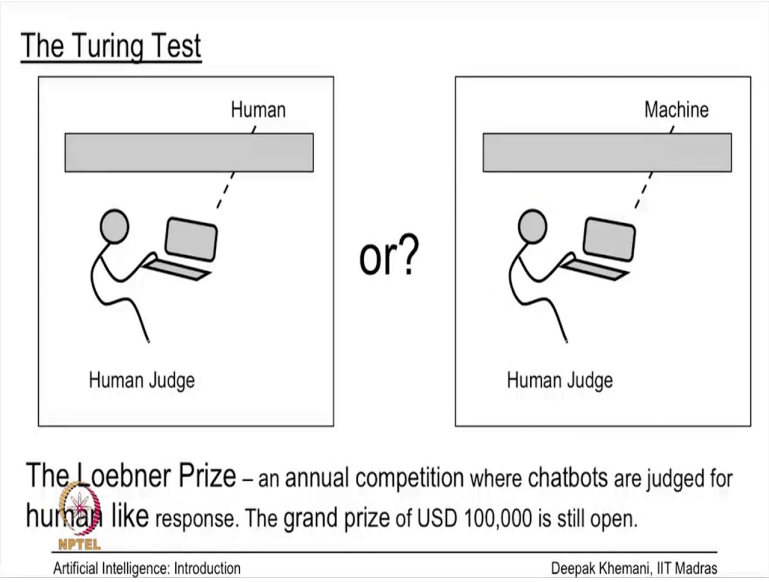


Because we want to get on to what Turing said right. So, you all know Alan Turing, he was very instrumental in cracking codes during world war this thing. What he says that he would have been 101 years old if he were alive today.

What he says last year was his birth centenary and a lot of things were going on. He says that the question whether machines can think is just a meaningless question because, we are not able to even describe we made an attempt here to say what is thinking. But it is not very clear to say what is thinking, I mean IQ test and things like that are of course meaningless essentially. As his I guess JEE and SAT and something.

What he did was that let us not get into this raging debate of can a machine think or not. He says I will give you a test which he called as a imitation game which we will see in the next slide, which is now known as the Turing test. Nothing to do with Turing machines. Of this he says about this Turing test we will see in a moment or let us first see the test and then come back.

(Refer Slide Time: 21:15)



That Turing test is like this, that there is a human judge you know this something has happened to this anyway, there is a human judge sitting on in those is a teletype in current day world maybe on a mobile phone chatting with someone. So, you are chatting with someone.

(Refer Slide Time: 21:35)

Next

The Turing Test