Artificial Intelligence
Prof. Deepak Khemani
Department of Computer Science and Engineering
Indian Institute of Technology, Madras

Lecture - 01
Artificial Intelligence Introduction

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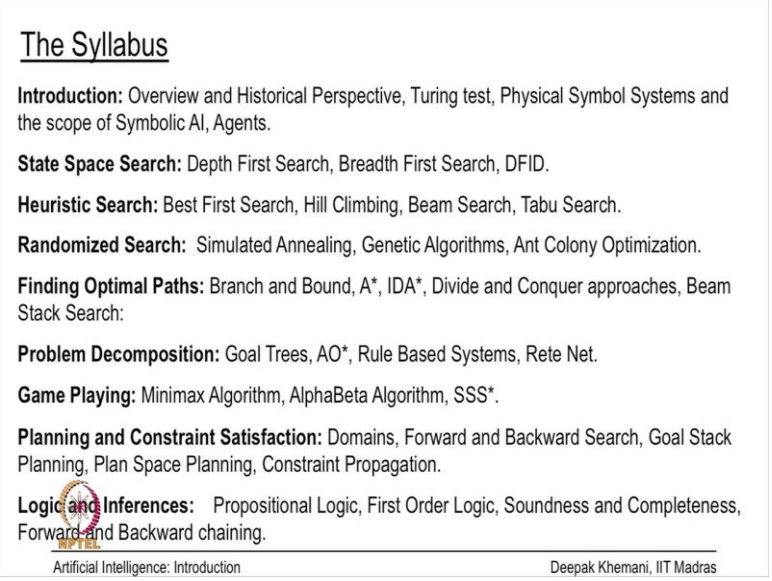

Welcome to this course on A I, as we mentioned let me first start, today with the syllabus that we are going to cover, and within the little bit of this in the last class, towards the end, and I am just repeating this for continuity. So, will spend, the first few weeks, not two or three lectures, on the first part of the course, which is the history and philosophy of A I. And we as we will see, goes back quite a bit in time, and this is qualitatively going to be, very different from the rest of the course, which is going to be mostly algorithms.

And will start with the simplest algorithm like, depth first search, breadth first search and so on, move on to heuristic search, in which we look at how search can be guided, towards the solution that we are trying to find, and we look at algorithm like hill climbing, and tabu search, and ((Refer Time: 01:12)).We will find that even that is not going to be good enough, so we will try some randomized approaches like simulated annealing, genetic algorithms, and ant colony optimization.

These are basically optimization techniques, but we will try to see them from the search perspective, when we will look at, very well known algorithm called A star and it is variations, which we will see. Then as I mentioned earlier that we will look at, something called goal trees or problem decomposition that if you want to solve a problem, and you want to break it up into parts, and solve each parts separately, that technique is called problem decomposition.

Let to an area called rule based systems which we will look at, will also do game playing, may perhaps not as late as this, may be somewhere here. So that, I can give you one assignment, to start off with which is to implement the game playing program? And finally, depending on how much time we have left, we should have, something on planning and constraint satisfaction, which is kind of preview of the course that we offer next semester.

In which we will study this algorithm like alphabeta algorithm, minimax algorithm, and a heuristic version called S S S star. And then depending upon how much time we have will spend some time on, these two topics planning and constraint satisfaction, in which we look at, general algorithms for planning. And we will see, by planning essentially we mean finding a sequence of actions, which does something useful for you, and we will also look at logic and inferences. Because it is not that we are just solving problems, of how to do things, but we also making inferences, that if we know something, then we know something else.

So, that is a process of making inferences, and the language that we use for representation is logic, and we will spend some time that. So, these two topics are actually covered independently, and completely in two different courses that we offer next semester. One is called planning and constraint satisfaction, and the other one is called knowledge representation reasoning, which is not the title we are using here.

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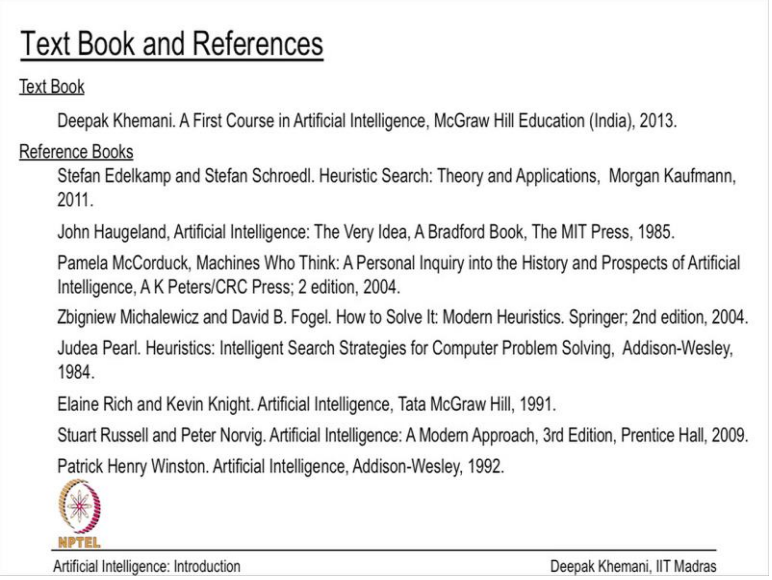

So, the text book that we will follow is, the book which I have just published, it is just about come out and, there are some text books in A I which have been, very popular and, earlier I was using a lot of a material from here. So, rich and knight book on A I, Russell and Norvig, which is probably the most, well known text book at this point of time, and a book by Winston which was written earlier.

Then there are certain specialized books, so these two books by Fogel and Michalewicz is on certain aspects that we will cover, and this book by Judea pearl is something we will use while game playing essentially. And these two books which I will just mention again, deal with the history and the philosophy part of A I essentially.

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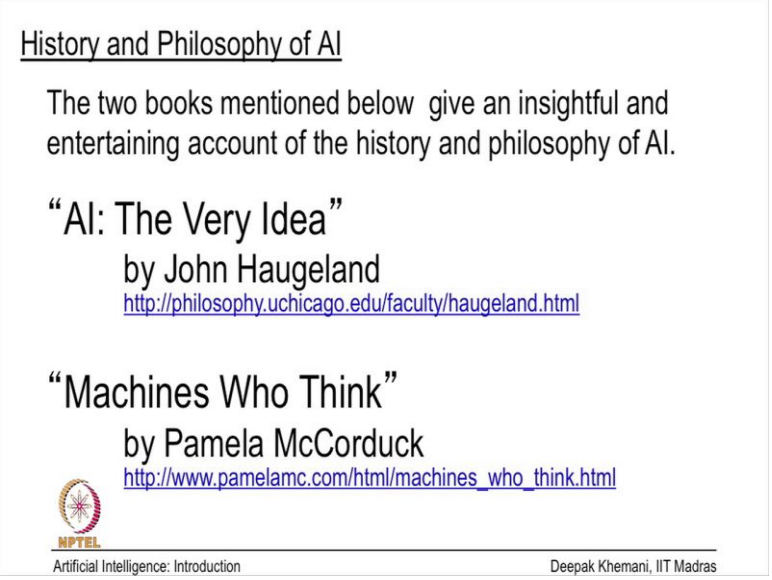

So, these two books that I mentioned, and this is going to be the subject matter of the first few lectures, the historical and the philosophical perspectives to A I. And you can see that, is a topic, because we use this word intelligence here, and that is something which has concerned people over a lot of time essentially. And we want to see, what has been the thought, behind what is A I essentially. So, these two books are, and I would recommend that you, read at least portions of this, there is the book called A I the very idea.

And we will discuss shortly, why this book is different from the rest, John Haugeland is a philosopher by profession, not computer scientist, and he is looking at the philosophical side of things that, one of the key questions we will ask. And today we will start doing that is, can machines think, I wanted to start already thinking about this question. And today we should discuss some of these basic concepts, what is intelligence for example, and Haugeland looks into the philosophy behind this, Pamela McCorduck is also from the social sciences, and she wrote this book quite, long time ago, actually 1974 or something like that.

And I hope you will notice that the title is, if nothing else at least a little provocative, because she uses the pronoun, who for machines. So, she has machines who think, and who is something that we normally, use for peoples essentially, human beings and so on and so forth. So, she is talking about machines, who think not machines which think for

example, and therefore, already there is a suggestion, that her own intimations is to believe that, yes it is possible that machines can think.

And these two books, we will follow in the slides that I have prepared, are mostly from these two books and a little bit from Wikipedia, so I will give you all those sources, from the rest of the course I will not use slides very much, I we will just discuss things on the board essentially. So, I want today's class to be little bit interactive, well not just today's class, but today's class will be more interactive. And I wanted to start thinking about question of what is intelligence, and we will discuss that, but before we do that, let us just look at, what are the classical definitions that people have given, for this field of artificial intelligence.

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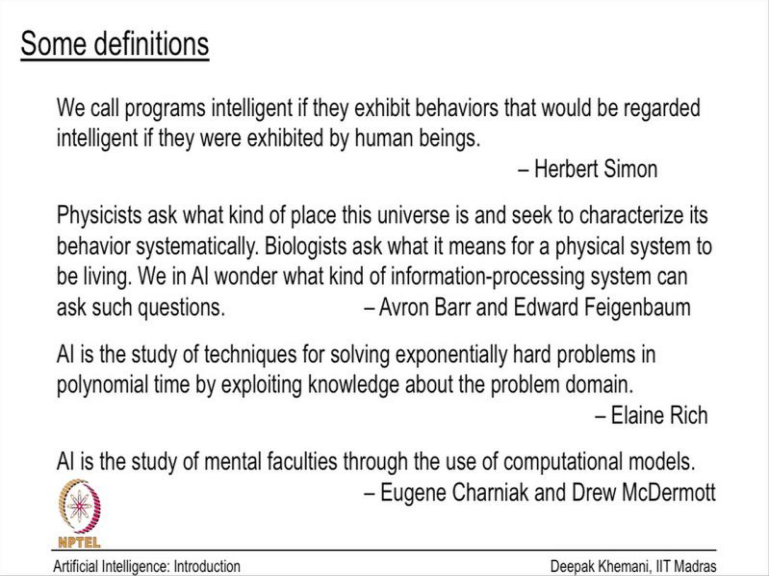

So, let us see first, what Herbert Simon has to say, Herbert Simon was one of the founding persons in this area of A I, starting in the 1950s, he and his collaborator Allen Newell, they founded the school at Carnegie Mellon university. And we will see, their contribution as we go along, Simon also one of the few people, who works in A I, whose got a Nobel prize. As you know, we do not get Nobel prize in computer science, but Simon got one for economics, and he was the multifaceted person, he did many things, as people used to be earlier.

So, his definition is we call programs intelligent, if they exhibit behaviors that would be regarded intelligent, if they were done by human beings. So, this is the most common

definition of A I that people use, that it is concerned with lighting programs or making machines do things, which should be considered intelligent by, if they were done by human beings essentially. So, what are the first things that A I people got into was, things like chess playing essentially, because chess playing was always considered to be a hallmark of intelligent behaviors essentially. It is only the bright, and the intelligent people who could play good chess.

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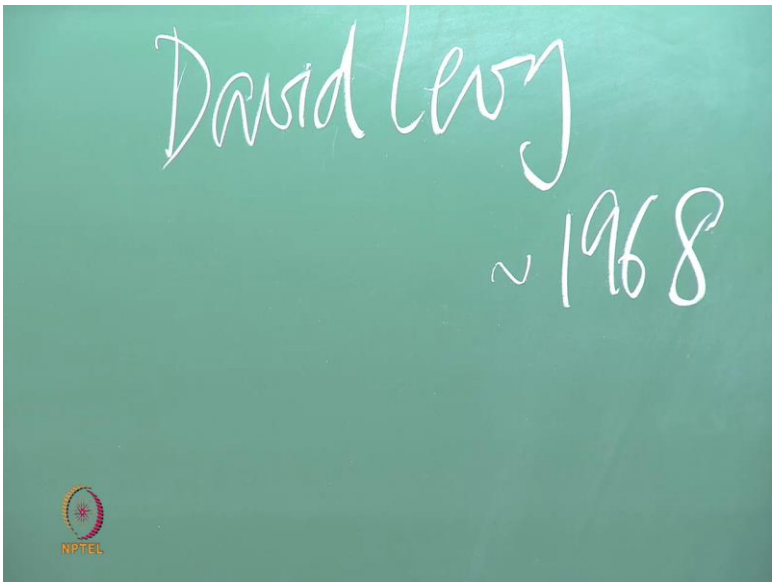

There is a long story of chess playing, the first programs were written in 1950's, one of the first outline of the game was given by pone Neumann in the 60's grand master called David levy, I do not know whether I have it in my history, but may be it will come later. So, let us write it here, around 1968 also, he wagered the bet that to chess program, cannot beat him for the next ten years. Because, chess was considered to be something which is very intellectual in nature, well luckily for him, he won his bet, which is because it ended in 1978.

But, many of you would know that, in the mid 90s, late 90s the then world champion Garry Kasparov was beaten by chess playing program essentially. Chess in fact, it is not so, intellectual in the sense that we tend to, talk about you know, philosophical sense. Yes, it requires lot of computing machinery, and we will see that, if you have a lot of computing machinery, you can play good chess.

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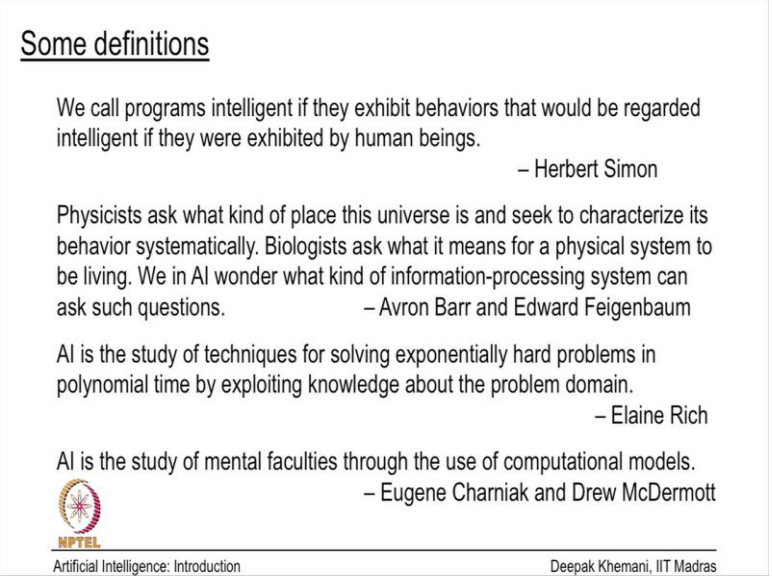

Let us look at another old definition; this is by Barr and Feigenbaum, also two old timers in A I, so his frictions says that, physicist ask what kind of place is universe is, and seek to characterize the behavior systematically. Biologists ask, what it means to be a physical system to be living, and he says we in A I wonder, what kind of information processing system can ask this such questions essentially. So, in other words, he asking about, talking about intelligence, that physicists are asking questions about the physical world, biologists are asking questions about the living creatures, what kind of information processing system, could ask such questions.

So, essentially saying what kind of system would be intelligent, in that sense of the world essentially, when Elaine Rich as I mentioned one of the popular books in A I, she wrote one in eighty three or something or eighty six. And she gives a computer science flavor to the definition; she says that, A I is the study of techniques for solving exponentially hard problems in polynomial time essentially, by exploiting knowledge, about the problem domain.

Of course, those of you, who are diehard theory people, would immediately object, saying that you cannot solve a hard problem in polynomial time, because by definition, it is a hard problem. But there are two counters to this, one is that, we may not necessarily, be looking for solving them in polynomial time in the worst case. In certain situations like, we will see travelling salesman problem, is one of the hardest problems, that people

have encountered. But given some constraints on the problem, of how the edges are connected, what are the weights on the edges, you can have much faster solutions.

The second counter to this, objection that you cannot sign, that you cannot solve problems in polynomial time is that we are not seeking to find optimal solutions. And this is something, which many, many people have observed, that human beings are not optimizers, we do not necessarily find, what solutions? The solution that we considered to be optimal, we are what some people called as satisfiers, satisfiers essentially, which says, that you are happy with the good solutions essentially, you does not have to be optimal essentially.

So, just an example, with sort of strikes me once in a while, living in Chennai, that if you have walking along one of the roads in I I T, may be one thing that you want to optimize on, the amount of shade that you walk through, but we do not have such dense ((Refer Time: 12:47)) at everywhere there is shades, so you have to choose a path essentially. And even if, one is conscious of the fact, that one wants to walk through shade and with one does not mind walking a little bit longer. So that, our objective function is to maximize shade, and not worry too much about the length of our path, even then, we do not go into zigzag path that we would, if we want to really follow the shade essentially.

So, we do not optimize in that sense, even when you want to be away from the sun, you are happy that if the path that we are following, as enough lot of shade, not necessarily the maximum amount of shade essentially. So, in that sense we do not solve, hard problems completely, we do not find optimal solutions, but we tend to find good solutions essentially, and that is what we do all the time. We go shopping; you do not, check in ten places then find the minimal cost price, and then buy your product. Even though on the web nowadays you can do that sort of a thing, but in general if you think that the price is reasonable, we go and buy this stuff essentially.

And one more definition, which is due to Charniak and McDermott, who also wrote a very famous book, on A I very popular book which, I use for part of my session, I do not think I mentioned it may be I should added to the list there. They talk about A I, being the study of mental faculties, through the use of computational models. So, we had said earlier that, there are two approaches to A I, one is the cognitive approach which says, which I, we are trying to understand intelligence.

And the other is the engineering approach which says that, we want to build smart systems or smart apps if you want to say nowadays essentially. So, what this definitions says is that, we want to study mental faculties, and to do that we will be computational model, and use them for the studies actually, where definition, which I like most, before I come to that, look at these definitions. They are saying, if a human being does this, then it is intelligent, and we want to sort of do something similar, so we want to mimic human intelligence.

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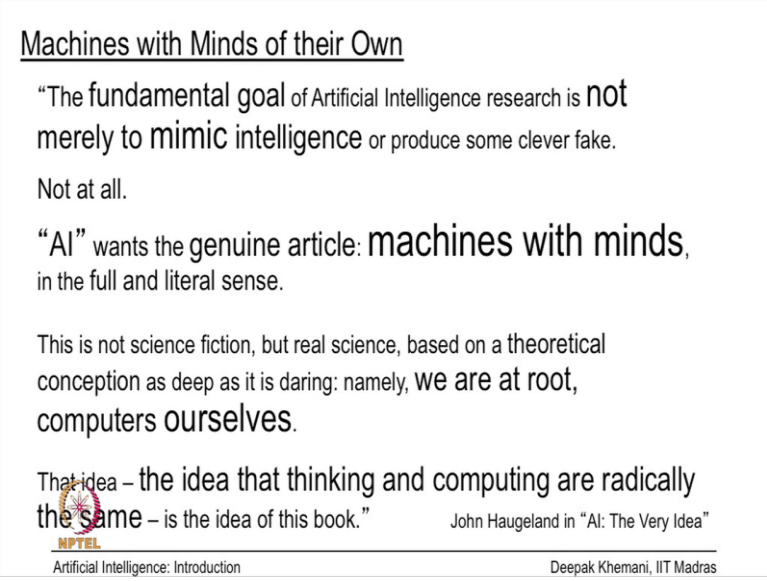

So, the definition which I like most is come from not a computer scientist, but from a philosopher, that we mentioned John Haugeland in the book A I, the very idea. He says, that the fundamental goal of A I, is not merely to mimic intelligence or produce some cleaver fake of intelligence, he says that not the goal at all. A I wants the genuine article, machines with minds, of their own in the full and the literal sense. Now, it is a very interesting question, and we would debate it today a little bit, in the class, as to what we mean by intelligence and can machine have machines have it.

And then you goes on to say, and all this is in this book here, that this is not science friction, but real science based on the theoretical conception, as deep and daring, namely that we are at the root computers ourselves, essentially. So, if you are at the root, computers ourselves, which means if you are at the root machines ourselves, then to answer the questions can machine think has been ((Refer Time: 16:01)) solve essentially,

because yes, human beings can think and therefore, machines can think essentially. But the idea that we want to pursue, is that the idea that thinking and computing are radically the same, is idea in his book, which is A I the very idea, it is very interesting book.

And for those of you of philosophically inclined, should go and have look at it, and this idea, that thinking and computing are kind of tied up together, goes back much before Haugeland. And we will see, either in today's class or in the next class, that the British philosophers Thomas Hobbes, was one of the first person through, put forward this idea. Hobbes of course, was not a computer scientist, in those days, there was no computer science, he was a political scientist, and this kind of stuff.

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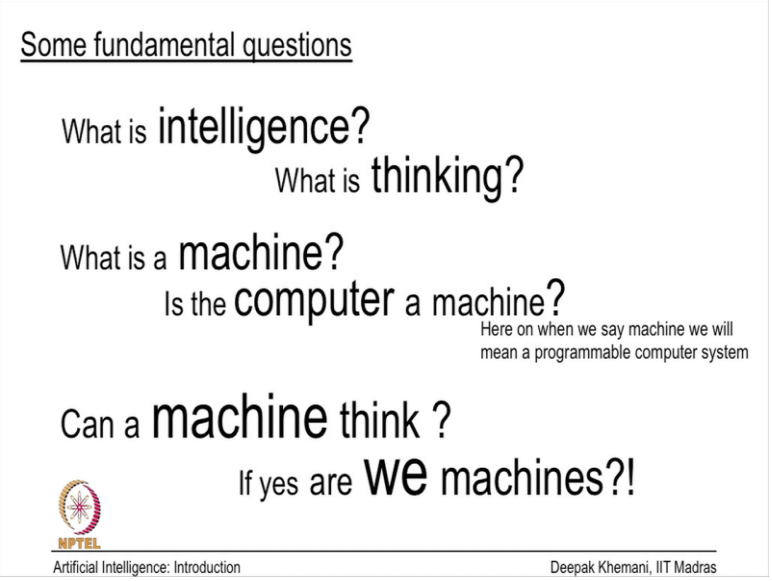

So, let us, get to the fundamental questions, and this is the part that, I want you to, give answers to or what do you think about this question? So, I have not written any answers for this. I have just written the questions, and I will write the answers on the board as an when, they come out from, the class essentially. So, the question you want to ask is, what is intelligence? I mean if there is going to be ever a debate about whether machines can be intelligent or not machines can think on are, first we should be clear is to, what do we mean by intelligent, I mean if I write a program is, let say the singular value decomposition of a matrix, would that is a program intelligent, well I do not know.

So, can I have some responses from the class, what is intelligence, what is let us forget about what is thinking? Let us say, because thinking is this thing, but when is, when

would something be call intelligent, what is intelligence, what would you require in a system or in agent, for you to call it intelligent, what are the fundamental characteristic of intelligent behavior?

Student: Ability to take decisions.

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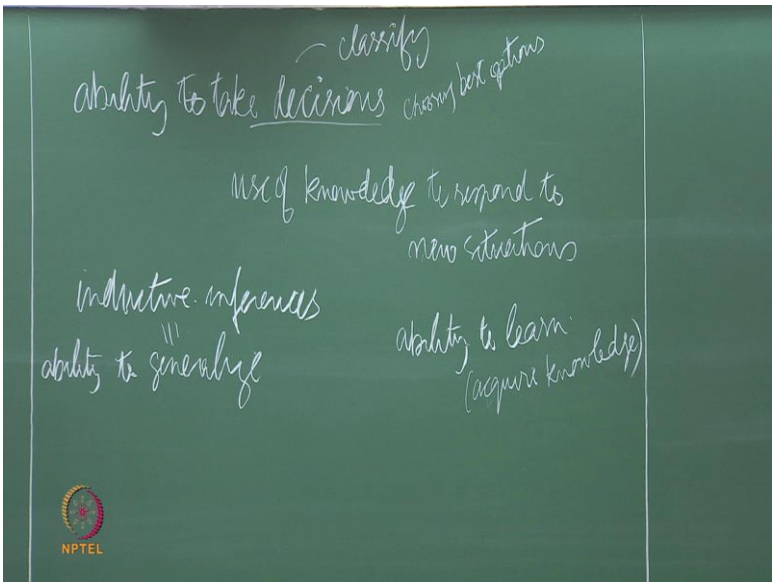

That is very generic, yes definitely a part of intelligence, but may be if you could expand on that, from a little bit. Example is you know you have a small program, which says if something, then something else, it is also doing taking some decision, by looking at some data; obviously, you are looking at something and taking a decision.

Student: Use of knowledge to respond to new situations.

Use of knowledge of course, you will have to tell me, what do you mean by knowledge. And this definition has a little bit of inconsistency, built into it, in the sense that, most of the time when you use knowledge or experience, exploit experience we use them in situations, which are similar, which are not entirely new in that sense. Well if by new situation, you mean a new problem, then one has to ask the question, what do you mean by that essentially? You know there is the ((Refer Time: 19:38)) saying which says that, you can never step into the same river twice, essentially, that is never the same thing.

But of course, nevertheless I will, I am not disputing, what you are saying, I am just trying to get people to respond more, we do as human beings, you make extensive use of

knowledge, and we spend close to, what should I say, twenty two years, twenty five years, acquiring knowledge ((Refer Time: 20:05)) will later use, essentially in our lives essentially. Human being, humans have a very different kind of a species I think, I mean we are the only species, which has schools up to twelfth standard, and then college four years after that and then, masters and may be you know p h d in some cases. No other species spend so much time, acquiring knowledge essentially.

Student: Sir, we able to make inductive inferences, and something which others senses just follow from your input, but to be able to make some new.

Ok

Assumptions

So, I will just use a term inductive inferences or in other words to generalize, ability to generalize. So, you go to the some hotel and you ate masala dosa, and you are happy, you come back. Next time you go there, and you have something else, let us say oottapam and you come back, and then you generalize, that this hotel, gives you good food or you might say that, you know, south Indian food is very good.

These kind of inferences that we come to, is making inductive inferences, you we look at a few instances of something, and then from where, we generalize, that you know, it holds for a certain class of things essentially. I see, a few leaves, and all of them are green, then I conclude that all leaves are green essentially, which of course, does not true at least not all the time, may be in Chennai yes, when they, when we have leaves, but not in the rest of the world.

Student: Basically, spending that definition applicable, generalize and classify.

Classify would come in this making decisions, what else have is that all that we do as human beings, is that all we lay our claim to for being intelligent.

Student: Choosing the best available of ((Refer Time: 22:10))

Well when that comes here, choosing best options.

Student: Ability to learn.

Ability to learn yes, which is a little bit difference from here, and we can say by learn we mean acquire knowledge, one can learn from once own experience, you do to something with gives a little bit of a pain. So, maybe you touch a hot stove or something like that, two, three times, and then you learn, that is again inductive inferences essentially, but to learn all kinds of things to learn facts.

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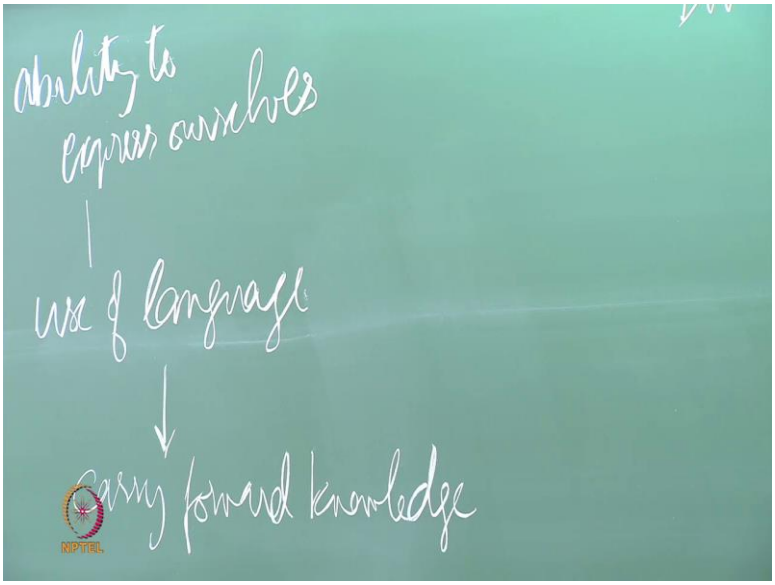

To learn relations between things, is something that, we do quite effectively. So, what do you mean by this? Communication.

Student: not

So, but there is a more fundamental thing, to I mean, expressing well something, incidentally is something which is a feedback, we get from all the companies which come to higher people here. Let us say that our students are not good at communications essentially, but that is not the idea, even that is not about your talking about I think, the very fact that we can, communicate something. So, let me go to the fundamental thing, what does this lie on, something which if is specific to the human species.

Student: speech

Speech, the speech, before speech use of language, language is something which is unique to; at least we think it is unique to our species. There are doubts that you know may be, whales communicate over long distances, and dolphins can communicate, and

that cannot stop, but we are not quite sure. And we do see that, there are other creatures which make sounds, which are; obviously, aimed or directed at least towards their own species, but it is not clear to us, what they are proving actually.

So, it is a use of language, which us enabled us to carry forward knowledge. So, if you have a brilliant scientist like Newton, whose thinking about the universe, and the world around him, and coming to conclusions, and arriving at some understanding of how the world operates, the fruit of his effort is available to us, and it is available to us, only through the medium of language essentially. Because, we can talk to other people, because we can write books, so printing of course, was another invention which help this process, but this simply be able to communicate, to tell stories, this whole idea ((Refer Time: 25:52))

You know that is stories are passed on from one person to the next, like all the stories that we hear in our subcontinent, the Ramayan the Mahabharat and so on, where sort of overly conveyed from generation to generation. And all that is possible, entirely through the use of language, it is language, which has allowed us, to hold down to whatever knowledge we get from, our interactions with the world, and pass it on to other people essentially, anything else, can one think of. So, will take this, as part of thing, and then we will see, whether machines can be intelligent.

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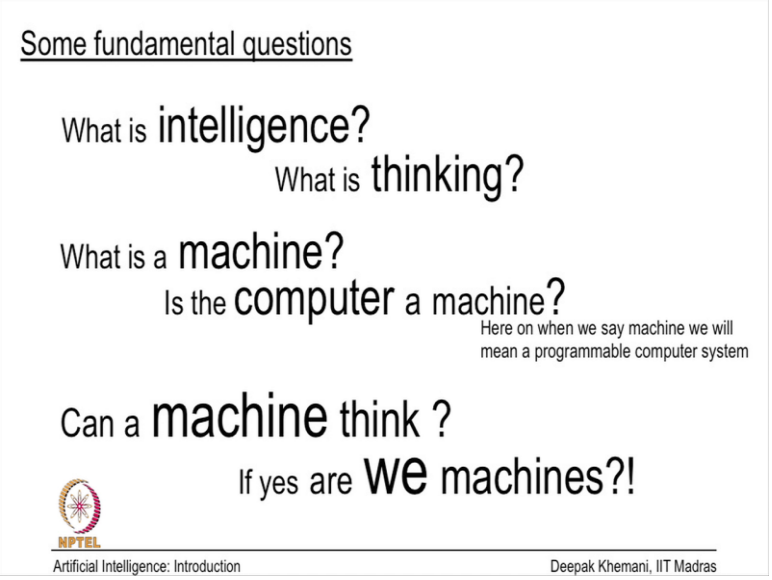

So, let me move on, a little bit and ask the next question, this is not the very complicated question; I just want to be sure that we are all on the same page, because I need talk of machines thinking and so on. So, what do you mean by a machine, otherwise we will be stuck with trying to answer a question, 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 is what do we mean by that essentially.

Student: Why which does a particular task repeated.

A device which does the particular task repeatedly.

Student: However.

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

Student: Device that has reduces human effort.

A device that reduces human effort, what about an exercising machine? Treadmill or something.

Student: Computations

Something that there is computation, but computation is only, one kind of activity that we consider, we have a machine which grains coffee beans for you, I do not know that is doing computation. Now more fundamentally, when will I call something a machine that is what I mean by the questions essentially? So, if it is not a machine, what can it be?

Student: It follows the cable instructions; you instructed and do the work for you. Does not think on it is own.

He says, does not think on it is own says ((Refer Time: 28:31)) get the answer to the question that can machines think. So, machines are thinks, 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 the machine, there are instructions given to a machine. So, but if I have a air conditional like in this room or thermostats somewhere, it is not really following instructions.

But ((Refer Time: 28:56)) some coding or something.

Yes some that is what I say, that some stages it is life, some instructions were given to it, but then I can say the same thing about you as a person, that you are following instructions, your parents said go and attend lectures, do not bunk classes, that is why you are sitting here in this class ((Refer Time: 29:16)) more fundamentally, what is this, when would I call something on machine.

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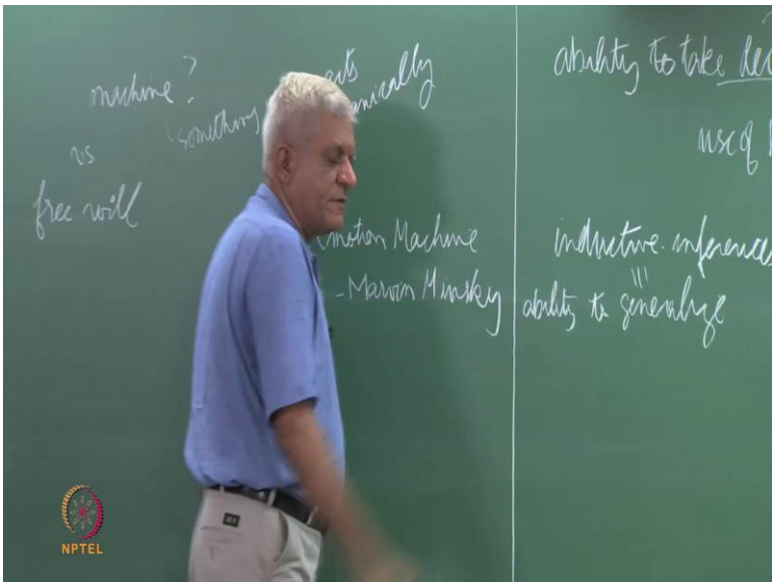

So, let me give a circular definition, something which acts mechanically; of course, as ((Refer Time: 29:37)) it is a circular definition, that is using the term machine and mechanical, they are related to each other. So, it is not really a good definition in that sense, but it gives us an idea, what 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 a something, which happens at a different level all together 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 fixed set of rules. So, the question that one ask is, and will come to that in a moment, so this is the question which has raised. So, just to be cleared is a computer a machine, it does operate according to some very 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 store program, which we discovered? It is discovered, not quite discovered, but at least, brought forward by Charles Babbage which says that, you can have a same machine, and you can put in a different program. And it will do something different for you essentially, make it a very flexible machine, but nevertheless, it is the machine, because at the base, there is something which is very repetitive which is going on.

And whenever we say, machine in the rest of this course, basically we will mean a program in 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 is thinking, as this. So, this is a question that is fundamental in the sense, there was a edging debate as we will see some arguments against thinking, in the next slide. In the last fifty years, sixty years people have been talking about, whether machines can think or not.

So, 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 computers, so it is a thinking machine, is that possible at all. 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 ((Refer Time: 32:30)) situation here. So, does anyone have a opinion either ways, there is anyone strongly feel that yes machines can think, there is nothing fundamentally against it or there anyone have a opinion which says, no machines cannot think, only we human beings can think essentially.

Student: ((Refer Time: 32:53)) did not tell what is thinking?

Well, I that is the first question I started asking you will. So, we wrote all this stuff by saying that if you are using this.

Student: intelligence.

So, we sort of say that they are closely correlated, thinking is the process how to of which intelligence arises, we might say. So, no one has the strong opinion I take it essentially. So, that is fine, there is nothing either ways, and finally, as Haugeland said, I mean, I that the and to what Haugeland thinks about this question, that are we machines

is already here, in his answers essentially, he thinks that we are machines. But, is 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 would 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, the people ask, there 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 give is that, you have a 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 and 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 b j p all the time essentially. So, but anyway, what is this thing called free will, basically says that we make choices, that we have, the ones who decide, how our lives will be, how what we will do in the next instant, and thinks like that. You know, your open philosophy is like existentialism dealt quite a bit, in the post what period, about this notion of free will, and you know making choices think ((Refer Time: 35:35))

So, if you want 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 free decided, like this say, whatever have to happen will happen essentially. Of course, then we are all machines, and then, there is no second thought about it, but if I want to sort of deconstruct 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 will our bodies, what color to of eyes to have, all kind of things.

And then essentially, we build ourselves using 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, may be 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, ten to hundred billion neurons, all of them operate in by a very simple mechanical procedure. So, our brains are mechanical in nature, and therefore, since a brains control us we are mechanical in nature, I could give argument like this. So, what will you say against it, I mean if you were to say anything against it.

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

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

Student: We are biased to our emotion.

But how do you know, it is not in the machine.

Student: Suppose, I turnoff my computer.

Suppose you are system patches, can we say it is angry with you, I mean it may not display it in other ways I think, no more seriously, why should we say that, machines cannot have emotions. So, I will pointed to a book, it is called the emotion machine, and it is written by a guy called Marvin Minsky, was also one of the founders of A I. As we will see the history of A I, as we go along, he founded the m i t A I lab, along with John McCarthy, and he has it is in the last five, six years odd, he is written this book called, the emotion machine essentially.

So, it actually goes ((Refer Time: 38:36)) again the slightly longer divide as so 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 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, 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

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 bacteria, then you have virus. So, at which point, you stop essentially. We will we are not here to answer this question, 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 small cartoon I got from, so our, if we were machines yes then, I suppose our admiration would be mutual happy or if you want to call as admiration.

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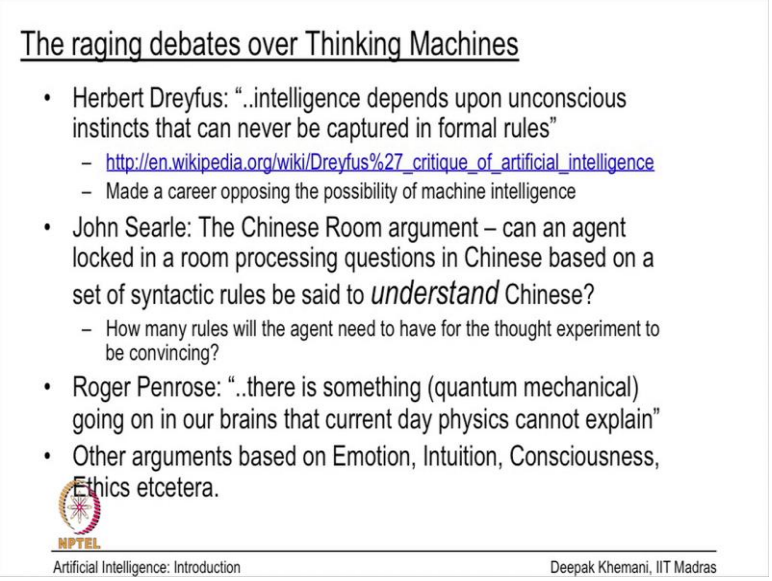

So, let me give you some arguments, which are well known in literature, which claim that machines can, the question we asking is, can the machine think, can machine think. So, what are the objections, the first ((Refer Time: 40:40)) guy call Herbert Dreyfus says that, intelligence depends upon unconscious 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, whether basically a Wikipedia page, which is critiques of A I, essentially.

Dreyfus spent, he has made a carrier out of saying that A I is not possible essentially. So, at least he is made a carrier out of it, what you think about these unconscious instincts that can never be captured in formal rules. So, this is one of the arguments which people say these kinds of arguments which say 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 together argument by 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, is an, it is a thought experiment which John Searle proposes, it is a very famous argument, just lookup the Chinese, whom argument on the web, when 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, you all locked up in the 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 an instructed, to loop match a pattern, and send out a response based on that. And you are there somebody; from outside below the door slipping, sending you slip 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? What it turns out apparently at the end of this, is that somebody is asking questions in Chinese, and you are giving them answers in Chinese. So, John Searle says, and this is the Chinese room experiment, thought experiment, says that supposing this were to happen, would you say that, the person whose answering you, those 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 he said really intelligence, he says no essentially.

And of course, there is a little bit of an operational trap there, which is what I 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, one more objection from the celebrated mathematical physicist John Roger Penrose, you must have heard about him, those who have Nobel laureate, he wrote this

book with, which became quite a hit essentially, it was called the emperors you mind essentially.

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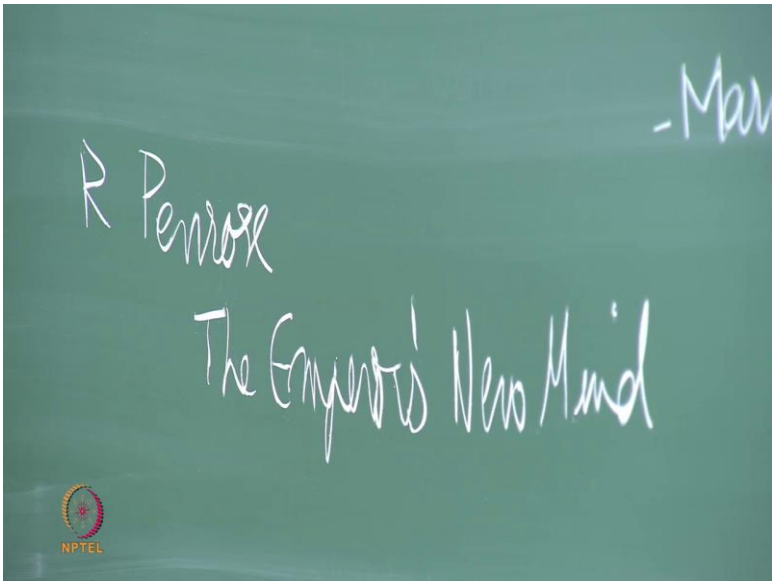

If you write the name, you know, so parading the emperor's new clothes, and he is also asking this question about, can one we can machines think or not, his answer is that, no machines cannot think. We are the only thinking creatures, and he says that there something happening in our brains, which current day physics cannot understand, cannot explain essentially. And that is something he says respective quantum mechanical, if you want to go into the details, you should look up the web, and read his book essentially, which is not so easy to read.

But still, he wrote a later book, I forgot it is name, which is the 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 intelligent. Now, this is kind of round about argument which says, it would be bad for, I do not know who, so we cannot have intelligent machines essentially. Of course, we are very ethical people, and we go around suspending twenty eight year old IAS officers, because of some small residues that we have against them.

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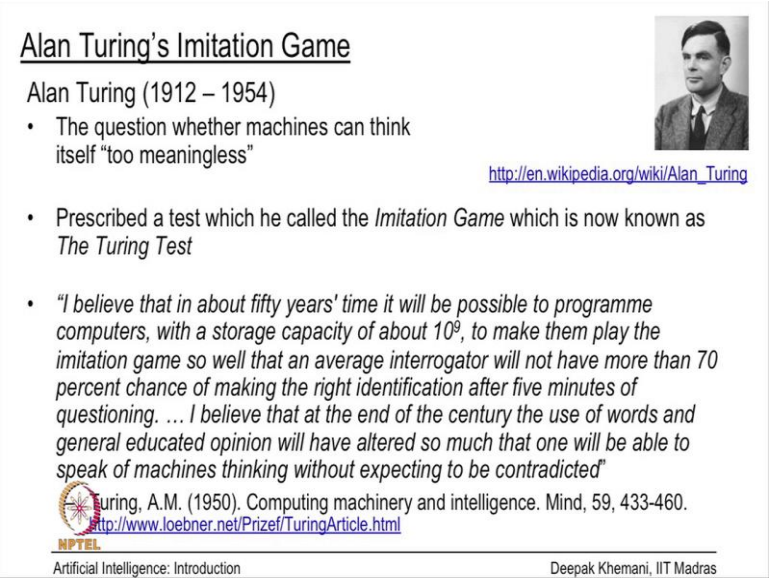

So, there are many arguments, which a co ordination and they have been many counters to the argument which I have not talked about, because he wants to get on, to what Turing said. So, you all know Alan Turing, he was very instrumental in tracking codes, during world war, this thing, what he says, that he would have been one hundred and one years old. If he were alive today, what he says last year was his birth centenary and lots 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 with we made an attempt here, to say what is thinking, but it not very clear to say, what is thinking I mean I keep ((Refer Time: 47:07)) and thinks like that are of course, meaningless essentially. As his I guess g e and certain essentially, what he did, was that, let us not get into this raising debate of, can a machine think or not. He says I will give you a test, which is called as a imitation game, which we will see in the next slide, which is now known as the turing test, then nothing to do with turing machines, of this he says, about this turing test, we will see in a moment.

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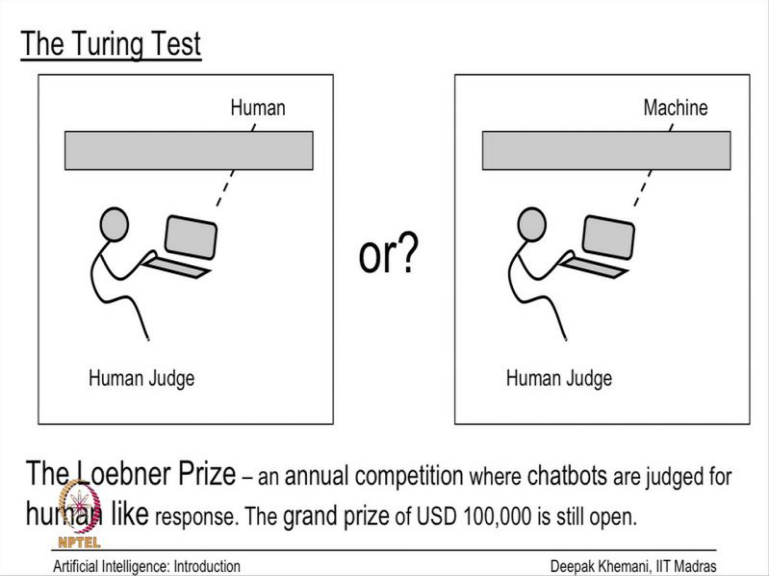

Let us first see the test, and then come back. The turing test is like this, that there is a human judge, in this something has happened to this anyway, there is a human judge sitting on in those is a teletype, in current they were in may be on a mobile phone chatting with someone. So, you are chatting with someone, you type in something, and somebody else types backs something and so on and so forth. So, he imagines that teletype, connected to a machine on the other side, but there is a wall in between, so you do not know whether it is a machine or whether it is a human being essentially.

And what turing said, was that if he gave a figure like, seventy percent of the time, the machine can fool the judge into thinking that the judge is talking to a human being; then the machine is intelligent. We will come back to, the test again, so what it turing feel, he felt and this was in 1950, when he wrote this paper, called computer machinery and intelligent, it is available on the web, if you go to many places, you will just get the paper directly. He says that in about fifty years of time, which is 2000 in year, 2000 will be possible to program computers with a storage capacity of 10 is to 9, so 10 is to 9 was considered to be a big number, and histories repeat with these kind of example.

Bill gates apparently had one said that, who on earth will need the memory more than sixty four k essentially. So, he said that, with the capacity of 10 is to 9 to make them, play the imitation game, the game that we do describe. So well, that an average interrogator, will not have more than 70 percent chance of making the right

identification, after five minutes of questioning. And many says, that I believe that the end of the century, which is at the end of fifty years, use of words and general educated opinion will be altered so much, that one will be able to speak of machines thinking without expecting, to be contradicted.

Very difficult to make predictions, in these kind of matters, David levy said that, he no machine can beat him, Alan Turing says that, all machine the machines will ((Refer Time: 50:05)) pass turing test, both was wrong in the sense, that we still cannot say that, you know, we have machines which pass turing test. So, currently there is something called a Loebner prize, which has been instituted by Agricola Loebner as a name suggest, it is an annual competition, where they are judged by for human like response.

So, it is not as here fooling something, but for human like response, and there is a grand prize of 100000 dollars, in case who interested in some pocket money, I mean say it is still open essentially. So, there are two, so there is a question which I want to, ask a few week do not have too much time, will have to stop soon. And we will start with this in the next class, is to what you think of the turing test, as a test of intelligence remembers, now he himself said that do not talk about thinking and all, but just accept this test.

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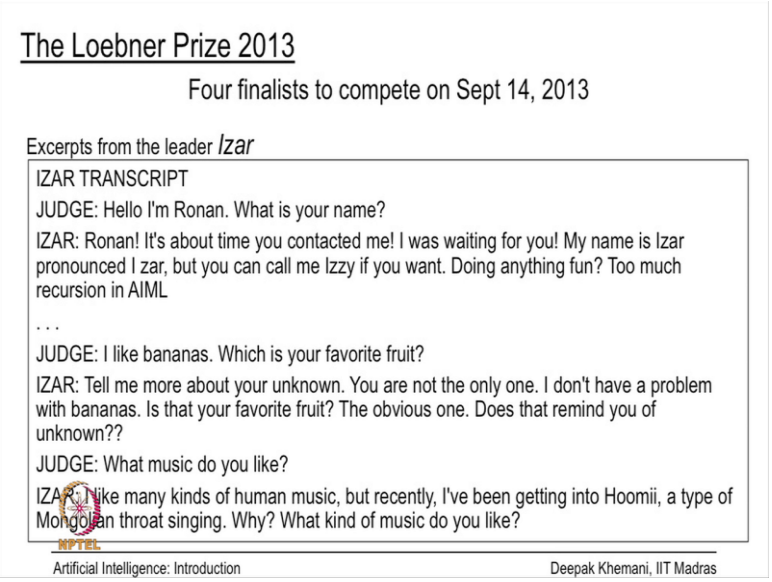

Let me just show you, some examples of this year's competition, which I got from the web, so this year, there are four finalist, who are going to compete on September 14, this finalist have been selected based on some earlier rounds, and this is the transcript from,

the leader of those four best one. So, let me just read it out, so there is a judge and there this program called izar. So, the judge says hello, I am Ronan, that is the name of the judge, what is your name, the program response, I am just try to imagine, how would you write a program, which would respond like this.

This is the output of this program, which is called izar, it is says Ronan, it is about time you contacted me, I was waiting for you, my name is izar, pronounced I zar, but you can call me izzy if you want, doing anything fun, too much recursion in A I M l and so on and so forth. Judge says, at some later point I have just not I have not given you the full essentially, I like bananas, which is your favorite fruit. He says tell me more about, your unknown, this is the trick, which the program is employing, to answer a question, which is it cannot answer very easily, you are not only one. So, you have to build in this kind of tricks, human being also do that, if you are taking a viva about something, you know, I do not have a problem with banana, is that your favorite fruit the obvious one and so on. Then he says, I have been getting into hoomii, a type of mongolian throat singing. So, you have to put in certain amounts of knowledge in your system, to be able to convince the listen, so he is trying to impress.

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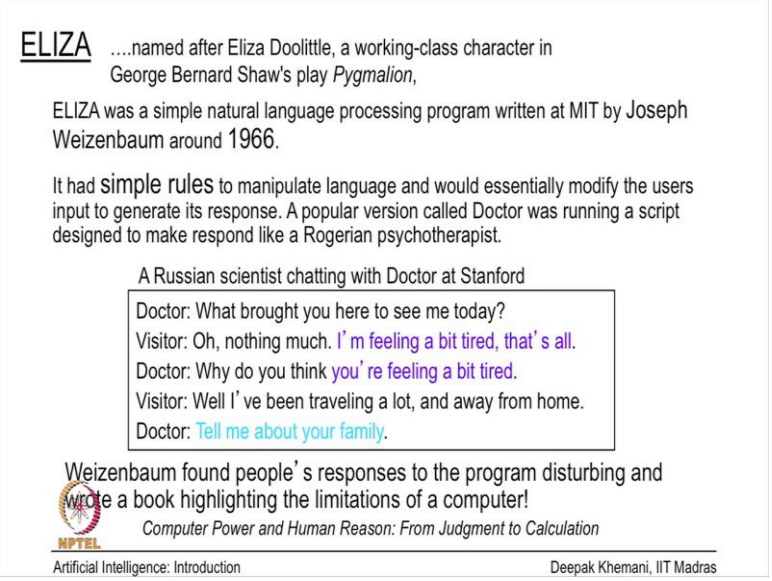

So, let me leave you with a program which was written in1960 or something, this program is called eliza, you must might have heard about it, it was named after eliza Doolittle, who was a character in Bernard Shaw's play called Pygmalion, and we will

visit Pygmalion again later, it was a very simple n l p program written, at m i t by weizenbaum in 1966. It use simple rules to manipulate language, it would read what the users written, manipulated little bit, and throw it back.

So, it says, if you go and say for example, somebody will say, so for example, if you want to say, I like bananas, if it simply say, why do like bananas. So, it just twist that, and send it back to you. And there popular version called doctor, which I am sure you might have seen, it runs a script which makes it looks like psychotherapist essentially. It of course, makes it easy to ask questions, it can always one of the standard questions these program ask is, tell me more about your family. You know, if they cannot say anything else, ((Refer Time: 53:58)) tell you more about your family, and as a human being, you would so this program is doing some deep analysis, ((Refer Time: 54:05))

So, here is the Russian scientist, who was visiting Stanford, who was running a version of this, we just read this. So, I have colored these things to show you that you know, it just twisting that sentence, in this thing. So, these are, this is, so there was a scientist apparently, after this conversation he started pouring out, all his words to this program and so on and so forth. And Weizenbaum found that his secretary was all the time talking to this program, and apparently she was quite furious, when she found out that Weizenbaum had access to those conversations essentially.

And nowadays of course, you know prism, and everything, Weizenbaum actually found that peoples responses, words are disturbing that he wrote a book, which says that no, no computers cannot do all this kind of thing essentially. So, we are gullible, and I think we will take it up, in the next class, with some even older examples of how, we look at something, and we believe that it is doing something in the intelligence for us essentially. Meanwhile I would like you to think about this turing test, in the next class on Wednesday, we will start discussing, what we think about the turing test essentially.