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Lui, Richard [COMP] 0:03

Before we talk about the lab today, we'd like to introduce some of the AI and his history so that you can get better understanding about the things that we will talk about in the coming lectures.

Lui, Richard [COMP] started transcription

Lui, Richard [COMP] 0:14

OK.
I'll voice AI OK here.
AI is concerned with developing a machine or computer that has the ability that is usually done by human.
The key point is human, right?
So we want human intelligence to be exhibited by computers.
The base of AI we can come back to 1950s.
At that time, there is a very famous mathematicians and computer scientists called Alan Turing.
Alan Turing proposed a test called Turing test, so he uh we have a computer and the computer has AI.
We say that the computer is intelligent if the AI can talk with the person and the person cannot differentiate whether that AI is AI or computer or a person.
In other words, are we give the computer and the person 2 rooms they cannot see each other, they can only communicate with text messages.
If computer can imitate human and talk with human and human cannot identify whether this is computer or another human being, then we say that AI is much alright and in around that time 1958 another psychologist has decided the perceptron and this forms the foundation of later, like deep learning, neural network and around 9060 this is the growth of AI, the first growth AI boom.
There's some significant development of AI, and at that time there are some expert system being developed to simulate human experts.
For example, doctor and the development of neural network machine learning.

Uh.
Ongoing at that time expert system are computer programs that study are huge.
How a human expert work?
For example, we study how Doctor makes his or her decisions.
What they what they do and how they do it and try to capture the thinking and behavior with a set of rule.
OK.
For example, the first one of the first example of Express system is mycin, the first AI medical diagnosis system in 1972.
The objective is to perform diagnosis by asking a number of questions about patients, symptoms, patients tell the doctor the doctor is the AI.
What is?
His or her symptom.
And then the AI will compare the symptom with a known database of infection and then use a rule based approach to make decision.
OK so here I try to use GPT as the GPT to give me an example of how these expert system work.
So GPT give me an example for.
Uh, just as an example, the patients has a numbers of symptoms, fever, coverall and elevated white blood cell, and the AI expert system is going to have a set of rules.
For example, if the patient gets a fever, cough, sore throat and at the same time elevated white blood cell, it will get.
It is predicted that the patient get an infection, streptococcal infection and if it it is as case and then it will recommend a certain antibiotics.
OK, who will give this rule?
Who is coding this rule?
Human.
OK.
In other words, expert system, we need human to capture what the doctor is doing that behaviour and then use this knowledge to program the computer to come up with a set of rules and the computer just follow the rule to make decisions.
And this is how expert system work.
Another, uh.
Another example about expert system is the Eliza.
Eliza is a chatbot.

OK, created in 1964 by MIT.
The purpose is to simulate a psychotherapies and it use rule and to transform input output.
This is also an expert system, and let's see this example video.
Does it happen in the sense that we do?
It's easy to leap to false conclusions, as Professor Weizenbaum discovered when he created Eliza.
Eliza is a computer program that anyone can converse with via the keyboard, and it'll reply on the screen.
We've added human speech to make the conversation more clear.
Men are all alike in what way?
They're always bugging us about something or other.
Can you think of a specific example?
Well, my boyfriend made me come here.
Your boyfriend made you come here?
He says.
I'm depressed much of the time.
I'm sorry to hear that you're depressed.
It's true, I am unhappy.
Do you think coming here will help you not to be unhappy?
The computers replies seem very understanding, but this program is merely triggered by certain phrases to come out with stock responses.
Alright, so this is the how how these legs.
Sorry, Eliza is doing it will be triggered by certain phrases to come up with some stored responses.
Here there is a simulated Eliza program and uh, it will greet me that it is a therapist.
If for example, I, uh input, I am set and it will respond to me, how long have you been said?
OK.
And then I say.
One week and then see what is his response?
He asked me.
Tell me more.
Alright.
And maybe I can ask some question like.

Who is Eliza then?
Can it answer?
What do you think?
Alright, you can see that the response of the checkbox is not so as good as what you see in the chat GPT that we use nowadays.
And how does it come up with the answer?
Basically this is what is shown in the video.
It is by pattern matching.
For example, if the pattern is imsaid then it will respond to me.
How long have you been?
That would OK if I say I am unhappy.
It would say how long have you been unhappy?
OK, there are different responses, but the idea is that this chatbot is trying to respond to me based on some patterns of the users input and what is the problem.
The problem is that maybe I ask some question.
Who is Eliza?
In May, it may not know how to respond.
Why?
Because the at that time, maybe the design doesn't expect the ask a question and there is no such rules, so the chatbot cannot answer.
OK, this is an ELISA which is based on expert system.
OK.
You can also use GPT as if an example about how the equalizer chatbot works and it will give you an example.
I feel sad today and the pattern is I feel X and then you respond.
I'm sorry to hear you feeling X.
OK.
The good thing is that it's simple, but the problem is that it is not so flexible.
It cannot answer most of the question that human are asking.
Alright, at that time 19 around 1970, we have the first robot by Japan Universe, our W Cedar University, the 1st and from Morphic robot the robot looks like human.
It can walk and grab objects.
OK, over the time, uh AI is growing overall the peoples is more and more interest of popularity of the AI increases.
But in the middle there are two drops around 1974 and 1987.

They are called AI winter.
OK, one of the reasons is because at the beginning people feel expect a lot from AI, but it turns out that the xact cannot.
The AI expert cannot build AI system good enough to meet the expectation.
There are numbers of reasons.
The first reason is because at that time the computer is not so powerful as today, and also the early AI model is simple.
It is not powerful enough to do something great as good as good today.
OK.
I'll I'll 11990.
There is another growth of AI and one of the startup at that time, Google.
Google is a startup, OK?
And the Google search engine come up around 19971998 and Google search engine is much better than the existing one like at that time there's Yahoo or others like landscape and so on.
There's different company having similar products, but Google actually regenerates because of the AI that Google used to rank search items for search engine.
The input are search term and it returns a numbers of results.
OK.
But the way that Google do it is called page rank, and it borrow from some mathematics and model to rank the different web pages.
It turns out that the method used by AI method used by Google is doing much better than the others.
So Google window rates and now up to now Google is one of the leaders like Google get 90 / 90 something percent of the search engine market.
No one can beat Google in in terms of search engine.
OK, up to now.
And around that time, 1997 days of super computer called Deep Blue.
The breakthrough is that it can win the world champion for a chess champion in 1997.
OK, no one, no AI has done similar things before.
Alright, so around 2000 and 2210 people is not very excited about AI or although there are still some development, but after 210 people start thinking about AI again because of the deep learning, deep learning and because deep learning can be used to do a lot of advanced AI tasks.

For example, you can understand image, you can understand language and speech and here are some examples health programs that make use of machine learning or deep learning.
For example, Siri, we leased it into one one integrated into iPhone.
You can talk with it and then the series of personal assistant that help you to perform some task with a natural language and Google Assistant is released into 16 integrated into Android platform.
OK.
Another breakthrough is Upper Go 216 or 217.
It wins the Champions using deep learning.
Digits are program AI, AI program developed by DeepMind and start up company and interesting thing or the breakthrough here is that no one can build a machine or AI that can do be doing very good at playing the GO chess.
Even the winning the while champion, because the goal when comp the goal means when HK when compared with other chairs it is much more difficult to get the the rule is more complex, right?
And there are too many COMP different ways to make them move.
OK, that means that the success of the other goal is very important breakthrough in AI.
OK, after that?
Uh, around that time there is something new development related to generative AI.
In the past, AI can only analyze data, but it cannot generate data.
For example, you can analyze an image.
The AI will tell you what is in that image or who is in that photo.
But starting around 215216, people start working on AI that can generate new content.
He is 1 famous example called deep fake.
OK, in this video, this is a Obama video speak.
Uh, making a speech, but the content is fake.
We're entering an era in which our enemies can make it look like anyone is saying anything at any point in time.
Jordan Peele created this fake video of President Obama to demonstrate how easy it is to put words in someone else's mouth moving forward.
We need to be more vigilant with what we trust from the Internet.
Not everyone bought it, but the technology behind such frauds is rapidly improving

even as worries increase about their potential for harm.
This is your Bloomberg quick take on deep fakes.
Deep fakes or realistic looking fake videos and audio gained popularity as a means of adding famous actresses into **** scenes, despite bands on major websites, they remain easy to make and find their named for the Deep Learning artificial intelligence algorithms that make them possible input real audio or video of a specific person.
The more the better and the software tries to recognize patterns in speech and movement, introduce a new element like someone else's face or voice, and a deep fake is born.
Born.
All right.
Have you heard of these?
Related analogy is quite popular when you hear the news.
OK, sometimes you hear some fake video and someone lose money because of that.
All right, this is one of the major kind of breakthrough a numbers of years ago.
You can see that the video is more than 4-5 years.
OK, this technology has been already here for a number of years and it is getting better and better.
So nowadays everyone can create fake video easily.
OK, without are the video quality may be improving and when we see that we will, we don't know actually that we do is fake or real, right.
So in the near future this will pose a very important problem, right?
For example, it may be used to attack some people.
Uh.
During the, for example, political election and so on, and this will create some trucks issue.
OK, people do not trucks videos on the Internet anymore and there's a lot of concern about using this technology.
OK.
In general AI, he's a picture which described machine with intelligence.
We talk a lot about Eliza Mycin.
So these are AI expert system belongs to here.
Alright, there rule based.
The rules are coded by human.

In contrast, most of the machine that sorry most of the AI that we use today are using machine learning.
Machine learning learns from data we don't need to code the rule, but machine will read the data and then try to derive the rule by itself.
In other words, we don't need human to program it.
OK, this is more flexible and more scalable approach because some of the time it is not so easy to describe the rule.
Why not let the machine learn the rule by itself by providing the data and among machine learning, one of the subfield is called deep learning.
Deep learning is using the design of the rain, so expert try to take a look at how brains work and try to mimic the neurons and connection and come up with neural network and we use newer network to build deep learning neural network and this is very powerful because many of the machine learning that we use nowadays including image recognition are speech recognition.
Generative AI are all based on deep learning.
Alright, So what do we we want AI to do?
The first thing is that we want AI to see the world through analyzing images and video.
Secondly, we were almost all communicate using natural language.
For example, we speak Cantonese or we speak English, so we want computer to understand text and spoken language.
And we also want computer to analyze what people is talking about, the speech recognition and of course, machine learning.
Deep learning are also suffer of AI and machine learning and deep learning is often used to achieve the first free items.
Yeah, the first example about using computer vision is healthcare.
Let's take a look at this video.
There's been many innovations over the years that dried science.
If you go back in history, many scientific insights actually derived from new tools that were able to measure new things.
The AI is very, very good at finding new paths that haven't been seen before.
It's almost an enhancement on our ability to sense the world.
The main benefit of machine learning is the ability to learn from lots and lots of data.
We can show a computer a lot of examples and rather than tell a model how to evaluate that data, you can learn actually how to interpret it and figure out what to

do next.
Here at Google, we've been using machine learning technologies and all of our products and things like search, translate, Google Photos, and the assistant people are realizing that learning from examples is a very powerful tool.
So researchers in the healthcare community were looking at some of the work that Google was doing in artificial intelligence and actually reached out to us and said, is there a way that you could apply these same kind of technologies in healthcare?
Doctors today have more artificial intelligence working for them on their smartphone for their personal use than they have working for them in the clinical context.
And as doctors, we've just gotten more information kind of shoved at us in terms of records, in terms of images, think about all the different types of cell that you have 15,020 thousand different diagnosis codes, just a cubic millimeter of tissue.
It's like taking, you know, a billion photos.
You print it out.
They would probably be about as tall as a 10 story building.
Really, any?
All right, this is machine learning.
Learning from data whenever we have applications or we have domain such as healthcare, we are a lot of data.
OK, then we can use machine learning to come out with some thing that in the past only human can do.
But now machine can do.
Let's go on to detect cancer.
Very good help.
Now there's an opportunity to use all our digital technologies that have been developed at Google to really try to help doctors.
Let's take some of these tools that are great for analyzing videos and YouTube and apply them to problems that matter to science.
One of the things we've been working on in medical imaging is in the area of pathology.
Traditionally, pathologists take some tissue sample and they look around and see of the cells looking for the kind of needle and haystack cancerous tissue.
We know that the earlier you detect the cancer, the greater your chance of carrying it and the greater your chance of curing it without chemotherapy or radiation.
So the biggest challenges are speed and accuracy of diagnosis.

So far, we've trained models for breast cancer and prostate cancer.
These technologies can actually identify suspicious areas to direct the doctor's attention.
So one of the things we wanted to do was get this work into the hands of as many people as possible.
So we developed something called the augmented reality microscope, where you can actually see machine learning assistance overlaid in real time as you're looking through the microscope, these units can be attached on to any existing microscope, greatly reducing the cost.
We're really excited to bring machine learning to parts of the world with limited access.
All right.
The first example, which is very important, is cancer.
We all know that cancer is a very dangerous disease, right?
Once we get this very problematic.
So the only way to make it the patient having better chance of improvement is to detect early.
So we want to use machine learning or deep learning so that it can analyze images of herself and if it can help to do better detection than even professional daughter then people may have a better chance of knowing how the disease and and start the treatment faster.
Alright, so this is our very important healthcare application cancer detection using computer vision to analyze medical images so that it is possible to identify the disease earlier and more accurately.
Right.
So the second is about Idcs.
They're tremendous inequities in the way that Healthcare is distributed across the globe.
Any disease or outcome is predicted as much by your ZIP code as it is by your biology.
So what can we do with AI to bring the expertise to where no expertise exists?
One of the complications of diabetes is diabetic retinopathy.
It causes blindness and it's diagnosed by seeing little lesions in the eye.
But in India, there is a shortage of eye doctors and as a result, about half the patients suffer some form of vision loss.

This disease is completely preventable.
This shouldn't really be happening, so we were able to train a model to reach these images and match sports certified off monologist.
We're now figuring out how to deploy this into the clinic in India.
People who did not have access now have access.
OK, this is also important because AI is helping to scale the daughter, so the theme of his scaling daughter.
So it means that if we rely on human doctor, there is usually a limit of the amount of doctor that we get in the world and in many poor location like India we don't have enough doctors, eye doctor, OK.
And the disease mentioned in the video is about the problems faced by India relatively poor with not so good healthcare and are in those locations.
There's a lot of different disease that is difficult to get screening.
For example, the diabetes eyes, which will call blindness if it is not treated properly.
In a short period of time, so machine learning and help to detect this kind of disease so that we can uh Kyle fighter, potential people with potential IDC and they can get treatment faster, right.
So these are all examples of machine learning.
The idea is that we learn we want AI to learn from examples of images, including positive examples, cancer cell and negative example.
Those without cancer?
The computer can learn the pattern and then it can do the prediction and then it for Idcs also.
Similarly, we can ask computer to take a look at the examples of healthy and diseased eye and come up with the rules to determine whether someone get idcs alright.
Uh, of course.
Cancer is uh, one of the most important issue, but here we have a lot of different diseases and different different professions like doctors or radiologists.
Radiologists are those.
Who?
One of the duty is to examine examined X ray and from the X ray determine whether the patient get a certain symptom or disease.
OK.
What question is, is AI doing better or professional human professional doing better

in terms of diagnosis?
But here's the video.
Alright, so I we clicked the video.
This is how a radiologist diagnosis, pneumonia 84 year old, female shortness of breath, period.
Frontal and lateral views of the chest.
Period.
This is an algorithm called checks net that's trained to do the exact same task and this is how it performed against six doctors analyzing 50 chest X rays for pneumonia in a recent test at Stanford.
Technet is one of many projects exploring how artificial intelligence can take over tasks normally done by doctors, and it has some radiologists worried that AI could one day replace them.
That's because algorithms are getting really good at interpreting images and diagnosing disease, sometimes with greater accuracy than humans.
We'll take a picture of this X ray.
The model will then run and within a few seconds to output it.
All these diseases and they're sorted by the order of most likely to least likely checks.
Net was given 10s of thousands of images and told which ones have pneumonia and which don't.
And it trained itself to recognize patterns and identify pneumonia in new X rays.
This is still deep learning or machine learning.
I we let AI learn from a lot of examples of images, including those X rays of the chest, with or without pneumonia, and AI can understand the patterns where the Monia is developing or, uh, an AI can make a decisions based on the images.
This process is called deep learning.
In 2016, computer scientist Geoffrey Hinton, also known as the Godfather of Deep Learning, put radiologists on notice.
People should stop training radiologists now.
It's just completely obvious within five years, deep learning is going to do better than radiologists.
Part of the reason guys like Hinton say radiologists are replaceable is because they often work behind the scenes.
Say you go to the emergency room with a really bad cough.
The ER physician will order a chest X ray, which is then read by a radiologist who

gives a report back to the ER.
All right, this is the original workflow patient visiting.
Our, our our daughter in the hospital and then there's a radiologist behind the scene to analyze the X ray chest Photo X ray.
And the issue is that if AI can possibly do better job than radiologists, yeah, this project has some problem.
We will, yeah.
Show from time to time.
So anyway, yeah, if the radiology is not doing as good as AI, do we still need radiologists?
Do we need some training of this type of of students?
Anyway, their job will be replaced by AI, right?
OK, we don't need radiologist, radiologist anymore.
All right.
Yeah, this is a question with Doctor Matt Lundgren, radiologist at Stanford, who's helping to develop new AI technologies.
As a patient, you're telling me that this process of reading my X ray, which used to be done by a human, is now done by an algorithm?
Why would I want this?
Well, so I don't even I don't feel comfortable with that.
Right.
Would you fly a plane without a pilot?
The situation that that you just described is not one that has no physician in the loop for narrow use cases.
I think it would be a tremendous benefit as a patient to have, you know, my doctor get information from some of these algorithms if they're shown to work.
What happens when the AI misses an important diagnosis?
It's something that comes up all the time, no matter what happens.
If we are saying that we're going to use these algorithms clinically, there will ultimately be a time where an algorithm will make a mistake.
The responsibility for the use of that algorithm ultimately fall.
I'm assuming on a combination of the clinician and the healthcare system that's using this algorithm in that this is important because AI may make mistakes or as long as it is not 100%, it may be 99.8% is accurate, but there is still still .2% that it would make mistake and we may in some domain like healthcare it may lead to

serious consequences.
The patient is dead because of the mistake.
So who should be blamed?
Not AI, right?
But it is the person or the clinician, maybe the daughter who is using the AI, right?
We should a person, but we cannot sue the AI.
So anyway, there should be a person here who should take the responsibility.
We can sue him or her if AI speaking mistake.
Alright, so this is one of the role of the persons, right?
People in the loop.
That way.
Concerns aside, this research has created a gold rush for AI and medicine.
All of it on display here at the annual meeting of the Radiological Society of North America.
So this is a super chill MRI and also uses artificial intelligence to compensate for movement of the body like my breathing and still get an accurate reading.
Do you ever feel like you're training your replacement?
Yes, I hope so.
I think in academically medicine you hope that this algorithm will replace you absolutely.
Doctor Constance Lehmann is a radiologist and Harvard Medical School professor who's also working with AI.
She helped develop a model that measures breast density, a risk factor for cancer in mammograms.
I am constantly teaching the next generation, so I have students come through.
I hope they're smarter than I am.
I hope they're better than I am out.
They're stronger than I am, so in some ways I may have sort of anthropomorphized this machine learning process.
This is your student.
This is my student and she is relentless.
She works 24/7.
She never stops.
She's looked at now over 200,000 mammograms, and that efficiency has worried some doctors in training.

In a recent survey of Canadian medical students, 29% of respondents agreed that AI would replace radiologists in their lifetime, and 68% agreed that AI would reduce the demand for radiologists.
For context, there are an estimated 38,000 radiologists practicing in the US is there a fear that radiologists will be replaced by AI?
There is a fear.
So that's a very limited view of the role of a radiologist, because we do much more than search for patterns on images.
And it's all those other aspects of the radiologist job and our contributions to healthcare that will explode.
AI allows us to expand our impact and expand access to people worldwide.
AI researchers say it will make radiology more accessible, lower costs and save critical time in emergency care.
All right, what is the point in mentioning this part?
The video.
OK, so this video is five years ago.
Four years ago, at that time, the radiologist is not performing as good as AI.
All right.
So it's the radiologist will be all gone in the upcoming year.
OK.
Probably the profession of is feeling this way.
Maybe in certain limited tasks the AI is doing better, but suppose that radiologist has much broader responsibility.
Probably there is something that AI cannot do, but he's only human.
Can do then.
Yeah, they are safe watch and they at the time being maybe there is not enough human power, they can delegate the task to AI and so they don't need to spend so much time on analyzing this image.
They can spend time on other more important things and treat more patient and provide better healthcare.
All right, so this is the pawn made by this video.
I feel that a this is very important for different industry because when AI is growing faster and faster, more and more, this type of question or on different career will be the AI on different carrier will be.
So it means that our AI is going to be better than human than many or in many of

the discipline like whatever those are in computer science.
Computing maybe many of the student need to write program, but what happens if computer AI can write better program than human?
Then in this case we program is be gone.
OK, so the same question is now being asked on different discipline, including those doing marketing, doing programming and so on.
OK.
In other words, uh, the answer is still not clear may or may not be, or maybe in the future we don't need teacher.
Because maybe the computer did teach better than teachers.
Human teacher.
Then I have no job right anyway.
Yeah, I think that every professionals in different fields should think about this problem and be aware of the advancement of AI, right?
Make sure that, uh, AI would not replace your job.
Or you can think about your future in a more careful way when thinking about the impact of the AI right?
Anyway, AI is already good for to five years ago, even better than the professionals in the medical field to in analyzing image.
The next challenge is understanding text is a I understand text better than human.
Alright, so here we are talking about natural language processing and LP and LLP means that we analyze natural language.
The Chinese, Japanese, or Cantonese that we speak every day.
Example of NLP tasks include question answering.
We give a question chat, GPT the answer.
This is an example of question answering summarization.
We give a passage chat.
GPT come up with a numbers of response.
So basically chargeability is a very strong model for doing natural language processing and also translation text generation.
All of these can be done by one single model.
That's the reason why check GPT is so amazing when it comes out and people is amazing.
This is ice strong ability in doing all the NLP task.
One example is language translation.

Before Chargeability, actually Google have done a lot of different research on how to use deep learning to do language translation.
It turns out that Google Translate is one of the best translation program AI before check DBT.
OK, now actually the GPT 4 can do something as good as Google.
Some people have done some study and sentiment analysis is another popular task NLP task which is here for a numbers of year even before chat.
GPT and the idea is that human right a lot of text, for example movie review after watching a movie, say Spiderman.
People will write movie review.
Why not have a way for AI to analyze the movie review and come up with some sentiment analysis expressing the subjective quality of the human?
Say is the person happy and happy?
Positive.
Negative.
OK.
In general, we can define that, uh, it is a positive sentiment.
OK, for example, I give it a score of one negative sentiment.
We gave it very negative.
OK, we give it a -.
One we would like to give it a score between -, 1 and positive one.
If it is covered, mixed comma and neutral comment, then zero mark OK here.
This is an example of Google AI doing analysis of this script.
Here the Google is trying to analyze sentence by sentence for those sentence with positive sentiment, it is labeled with green color.
For example, the movie also has some emotional scene and comedy.
This is an example of positive command and then there will be negative comment, negative sentiment for example here the -, 0.8.
For this sentence, the character development was short to sort.
She two shot and slow pacing.
OK.
And some of the sentences has around 0 score, meaning that they are mixed.
Example, the CG and special effect is a competitor, but the certain character is looking bad.
Yeah, overall it give a score at -.

0.1, this is come from mixed comment for the text.
So sentiment analysis has been here for a number of years, alright?
Of course, check GPT can do.
Also do sentiment analysis and another related task is named entity recognition for the movie review text.
We want to extract some important entities.
Examples of the entities include days, individual places, one application for example.
We have a lot of movie we want to know which person that different is the most popular that people he's talking about.
We want to extract the persons name.
Maybe the person indicates the actor?
Maybe the director of the movie.
Maybe the characters inside the movie so that we can have more understanding about the content of the text for future analysis.
OK.
Of course chatbot is another NLP application because AI needs to understand what human types in the form of a text before.
Are before charge BT we have Google Assistant, Siri and also Alexa from Amazon.
OK, so he this is the Alexa device.
You can buy it from Amazon and then you can place in your home photography.
It can recognize your voice and it can accept some instruction from you.
For example, you can ask it to turn on or turn off your air conditioner or night.
It can integrate with your smart home devices.
Text to speech.
OK, you can input a piece of text.
It can generate a voice, speech, a speech from some human voice.
Nowadays the text to speech is getting better and better.
It can generally very realistic voice.
OK, when you are doing your assignment, you will use the did tool.
There's a text to speech where you can convert your text to someone speaking with a synthesized voice.
OK, you can choose the numbers of options.
I want in UK accent or British American accent.
You can also choose a language that I speak Japanese or English or Chinese sometimes, and also you can indicate the speed of the speech and the pitch or tone.

OK, it is very powerful too.
OK, we have the opposite side.
Suppose we have someone talking like me talking in the lecture.
We have speech to text, OK for Microsoft team there is a feature that when I'm speaking there's an automatic transcription in the real time.
This is not 100%, but the accuracy I feel is quite good.
It capture most of the topics that I talk about in the at the real time and are related tag, sorry, speech to text is in YouTube for example you you upload your YouTube video for your project speaking in English you can observe that after a while it will generate a transcript.
Automatic caption Although this is not 100%, you need to correct the problem in the transcription.
Alright, uh, this technology has been here for a number of years.
And this is already doing quite good.
OK, meanwhile, one of the area that we talked about before is analyzing image image classification is one of the early AI tasks that are computer scientists or AI people is trying to tackle.
Given the image, we want to tell what this image is about, OK?
We want the computer to output some terms or keyword or label and we associate with each with a probability.
For example, this image is 99%, it is food and 91% machine learning model gets.
This is a plant, right?
And then 90% it gets.
This is a natural food which is not.
OK.
So in other words, there is different labels and sociated probability which indicates the computer's confidence in that label.
Are related task related to computer vision?
Is that given the image we want to tag all the location of object.
OK, here we have these one person, two person and on this photo 12344 persons.
OK, that will be multiple objects like person, white, car, bus, cat, dog.
We want to label them with a bounding box indicating the location of that object and the label which indicates the type of objects and the probability.
OK, here's one example of applications.
Suppose we want to build our self driving car.

We need computer vision to understand about the world, get the role condition.
So here this is our camera shooting are at the at the road and the camera will capture the video.
The video will be converted into images for computer to analyze, AI to analyze.
This is object detection because it tries to identify all the different objects, cars, person where the traffic light, whether we have a bus or right.
So this is very important because it helped to understand what's going on around this area.
OK, this is one of the uses automatic autonomous driving, the McAfee Tech Mohawk Cafe.
OK, this this technology has been here for more than 10 years.
People have been developing self driving car, but for some reason it is still not very common.
OK, now the computer AI can drive the car.
OK.
But because there are many concerns like like safety concern and other so these type of technology is not widely used in production but the technology is there.
OK, here the car is driven by AI.
OK, the human do not need to drive, but the AI will drive the car still at a certain angle, decide whether to turn left or right to break or to apply a more speed.
Yeah.
How?
How does it work?
There should be a camera.
The camera will capture the video.
The video is converted to images and we let the computer analyze the image and then do prediction.
For example, here we need to turn left because the role is going to the left, but computer also need to do some similar decisions like here I need to turn right.
Alright, uh here it is using deep learning or neural network to do that.
OK.
And here's one example.
They just similarly we fit in the video computer will give you a number.
The number may be positive or negative.
OK, may be positive means turn right.

Negative means turn left and number indicates to what angle I should turn in.
Essentially, the deep learning is given an image predict whether I should turn left or turn right or the angle of turns.
OK, so this is the end of the first part.
Let's take a break for five minutes and then log into the.

◉ **Lui, Richard [COMP]** stopped transcription