Deep Learning
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Lecture – 01
(Partial/Brief) History of Deep Learning

Hello everyone welcome to lecture 1 of CS7 015, which is the course on Deep Learning. In today's lecture is going to be a bit non technical we are not going to cover any technical concepts or we only going to talk about a brief or partial history of deep learning.

So, we hear the terms artificial neural networks, artificial neurons quite often these days. And I just wanted you take you through the journey of where does all these originate from and this history contains several spans across several fields, not just computer science we will start with biology then talk about something in physics then eventually come to computer science and so on right. So, with that let us start.

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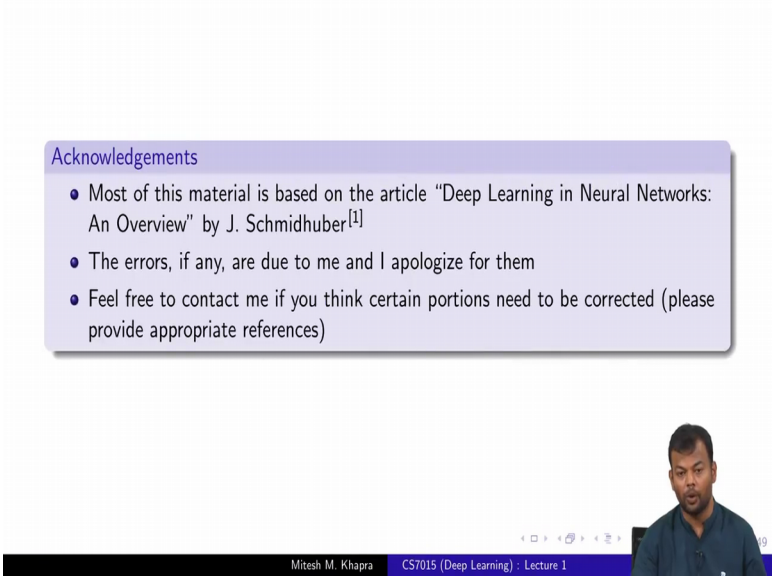

So, just some acknowledgments and disclaimers, I have taken lot of this material from the first people, which I have mentioned on the bullet and there might still be some errors because its dates as back as 1871. So, maybe I have got some of the facts wrong. So, feel free to contact me if you think some of these portions need to be corrected and it would be good if you could provide me appropriate references for these corrections.

So, let us start with the first chapter, which is on biological neurons as I said its spans several fields, will start with biology.

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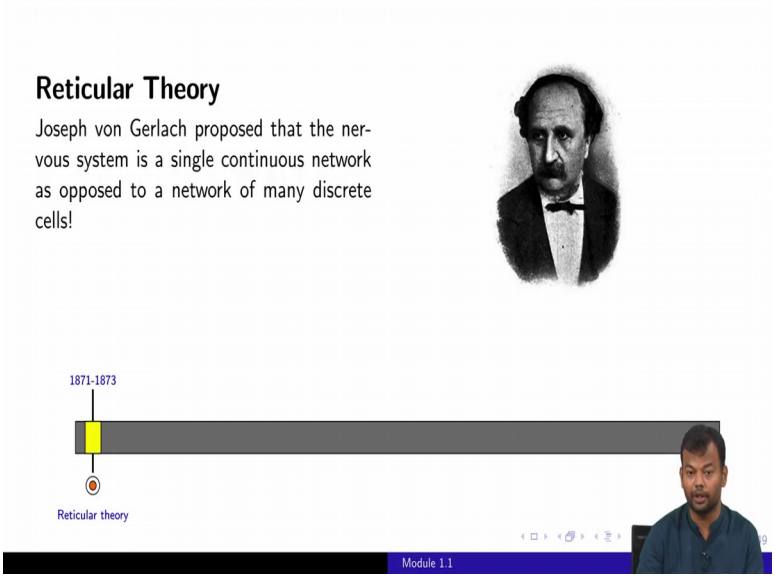

And we will first talk about the brain and neurons within the brain. So, way back in 1871, 1873 around that time, Joseph von Gerlach actually proposed that the nervous system our nervous system is a single continuous network as opposed to a network of many discrete cells right.

So, his idea was that this is one gigantic cell sitting in our nervous system and it is not a network of discrete cells. And this theory was known as the reticular theory right.

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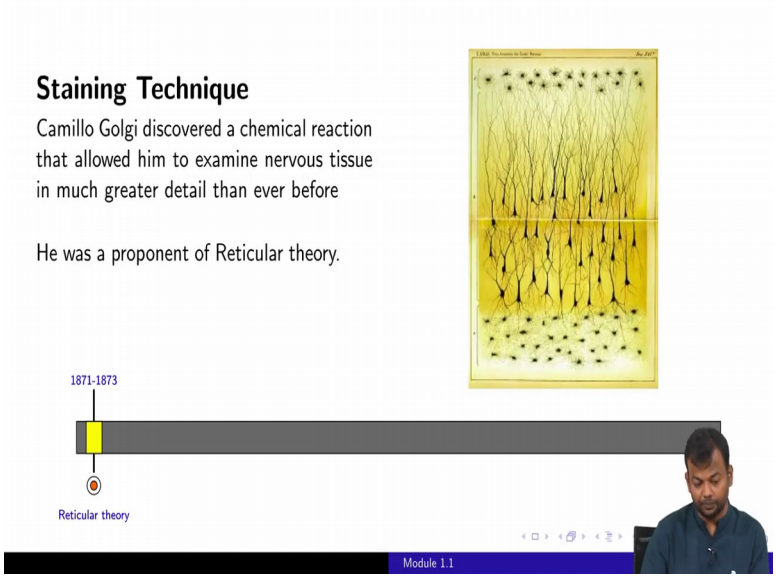

And around the same time there was the some breakthrough or some progress in staining techniques, where Camillo Golgi discovered that a chemical reaction that would allow you to examine the neurons or the nervous tissue right.

So, he was looking at this nervous tissue using some staining technique and by looking at what you see in this figure on the right hand side the yellow figure, even he concluded that this is just once single cell and not a network of discrete cells right. So, he was again a proponent of reticular theory. So, this is about Camillo Golgi.

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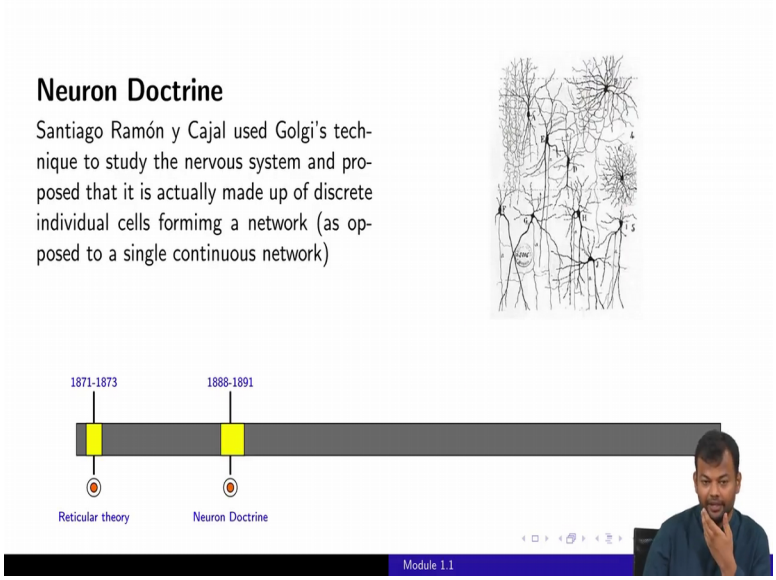

And then interestingly Santiago Cajal he used the same technique which Golgi proposed, and he studied the same tissue and he came up with the conclusion that this is not a single cell this is actually a collection of various discrete cells, which together forms a network. So, it is a network of things as opposed to a single cell there right. So, that is what his theory was; and this was eventually came to be known as the neuron doctrine.

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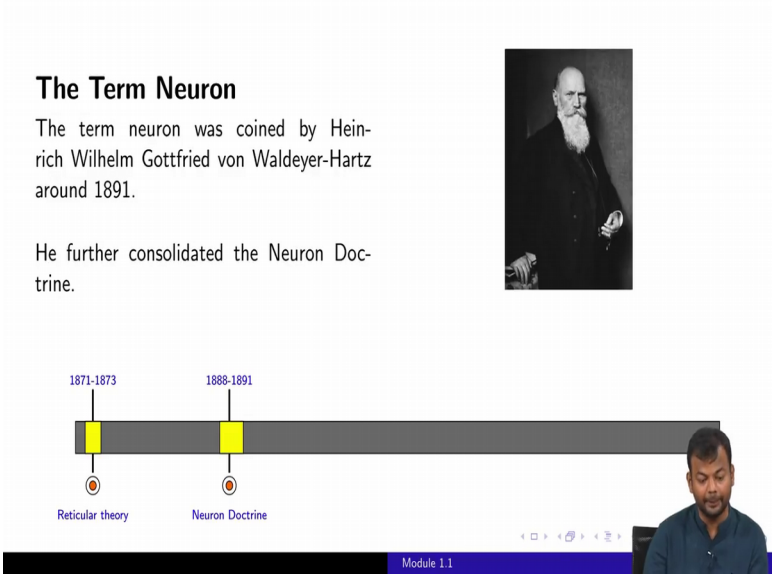

Although this was not a consolidated in the form of a doctrine by Cajal, that was done by this gentleman. So, he coined the term neuron. So, now, today when you think about art here about artificial neural networks or artificial neurons, the term neuron actually originated way back in 1891 and this gentleman was responsible for coining that.

And he was also responsible for consolidating the neuron doctrine. So, already as you saw on the previous slide Cajal had proposed it, but then over the years many people bought this idea and this guy was responsible for consolidating that into a neuron doctrine. Interestingly he is not only responsible for coining the term neuron, he is also responsible for coining the term chromosome. So, two very important terms were coined by this one person right.

So, now here is a question right. So, around 1906, when it was time to give the Nobel Prize in medicine, what do you think which of these two proponents? Say there are two theories one is reticular theory, which is a single cell and then there is this neuron doctrine which is a collection of cells or collection of neurons, that a nervous system is a

collection of neurons. So, what do you think which of these two guys who are proponents of these two different theories, who would have got the actual Nobel Prize for medicine.

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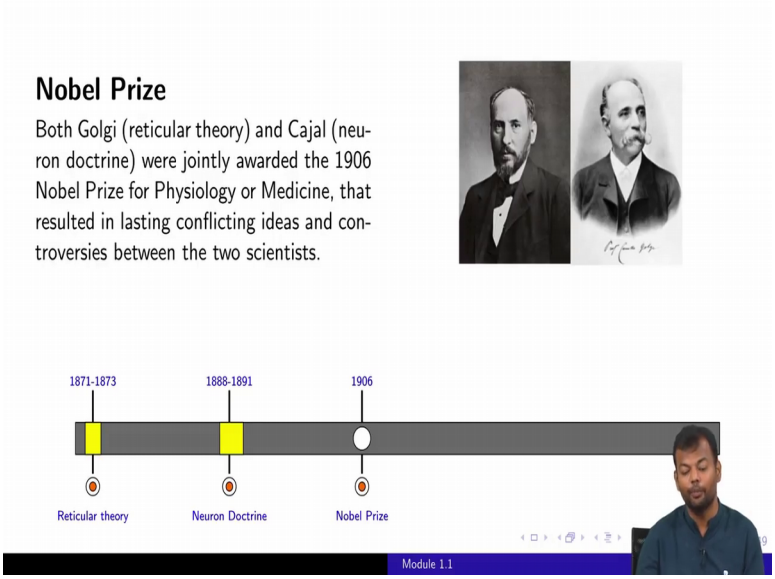

So, interestingly it was given to both of them. So, till 1906 in fact, way later till 1950 also this debate was not completely set settled and then the committee said both of these are interesting pieces of work, we yet do not know what really actual what the situation is actually, but these conflicting ideas have a place together. And so, the Nobel Prize was actually given to both of them, and this led to a history of a some kind of controversies between these two scientists and so on.

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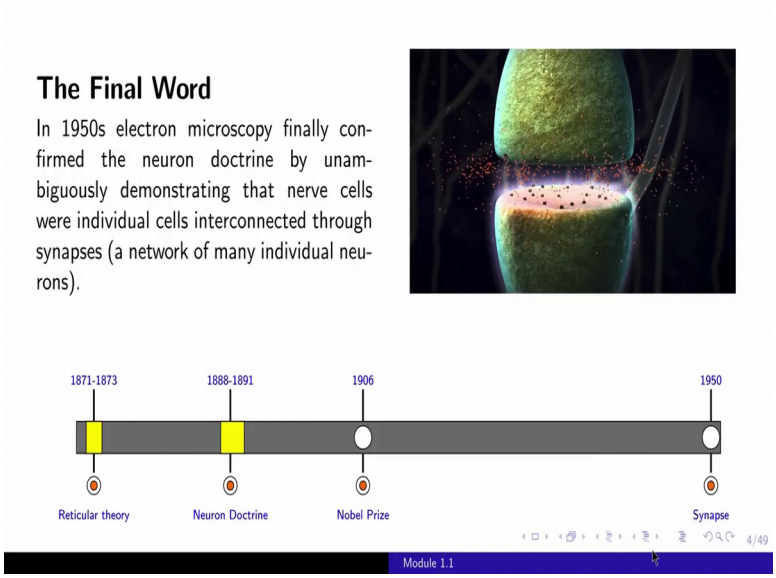

And this debate surprisingly was settled way later in 1950 and not by progress in biology as such but by progress in a different field.

So, this was with the advent of electron microscopy. So, now, it was able to see this at a much better scale and by looking at this under a microscope it was found that actually there is a gap between these neurons and hence it is not a one single cell, it is actually a collection or a network of cells with a clear gap between them or some connections between them, which are now known as synapses right. So, this was when the debate was settled.

So, now why am I talking about biology why am I telling you about biological neuron and so on right. So, this is what we need to understand. So, there has always been interested in understanding how the human brain works from a biological perspective at least. And around this time the debate was more or less settled that we have this our brain is a collection of many neurons and they interact with each other, to help us do a lot of complex processing that we do on a daily basis right from getting up in the morning and deciding what do we want to do today, taking decisions performing computations and various complex things that our brain is capable of doing right.

Now, the interest is in seeing if we understand how the brain works, can we make an artificial model for that right. So, can we come up with something which can simulate how our brain works and what is that model, and how do we make a computer do that or

how do we make a machine do that. So, that is why I started from biological neurons to take the inspiration from biology.