**Modified**

All right, let's look at some of the important applications of machine learning that are making a very important impact in the technology world.

We are familiar with all the buzzwords around autonomous cars that have been rolled out in commercial vehicles, including Tesla and Mercedes, and have also been developed by Google and many car companies in China. This just goes to show you how machine learning has contributed to this important technology. Some technologies rely only on videos taken from the cameras of the car, for instance the one deployed by Tesla, although some other technologies also combined with other technologies including LiDAR and radar as well.

So in the case of utilizing videos from the cameras, deep learning has been used in order to enable the computer vision to allow the car, the autonomous car, to recognize the terrain on which it travels and then align the terrain with the path according to the map that is currently used in order to travel to the destination. And with that, it is able to determine whether it should maneuver to move left, move right, whether it can speed up, whether it needs to slow down and so on and so forth. And then for the car to actually perform the correct maneuver to safely control the car to go along the path towards the destination, then deep reinforcement learning has been used in order to incorporate the feedback that the human uses when they drive the car through the same terrain, through the same path, and make the decisions in terms of steering, in terms of speeding, slowing down, accelerating, and so on and so forth. And by using such human feedback that certain human instructors like Sebastian or Stanley use, the car is able to develop its own policy for controlling the autonomous car.

Moving on, remember from the last slide, we talked about autonomous cars using computer vision technologies enabled by deep learning to recognize the areas that they are traveling within, including the terrain, the areas belonging to the path, and the areas outside the path. The particular technique that has been developed by researchers and then commercialized by companies. Deep learning technologies enable recognizing a photograph like the one here and then being able to recognize the areas and label them with the appropriate label. So for instance, this is a car and then these are sun areas and then this is a road and so on and so forth. These are the road and these are the cars. The red dots here are the wheels and so on and so forth. Deep learning allows achieving this level of computer vision impressively.

Now you can see that deep learning has become more and more pervasive and becomes really important to large companies as well. Companies like Microsoft, like Facebook, and Google, they are all competing for experts in deep learning and seeing them as critical assets to make competitive advantages in this important area of technology.

Another impact of deep learning in speech technology is to allow companies to develop virtual assistants that can have conversations with humans. So when you're asking Alexa or asking Google by saying "Hey Google," the speech recognition of the system is able to recognize what you're saying, understand the questions or the requests, and then being able to correspondingly respond to such requests or questions.

Furthermore, recent advancements in technology include ChatGPT and Google's Bus AI. And so here we can see that behind these impressive technologies like ChatGPT is a lot of machine learning, including supervised machine learning with human feedback, to supervised machine learning in order to produce the policy for ChatGPT to deal with a particular prompt when a user introduces a prompt. And then using this policy, now ChatGPT is able to produce a particular answer to questions that a user may be entering into ChatGPT.

That is on the development that's happening in the world. Now, as Windburn, we also utilize AI and machine learning heavily to develop solutions for industry partners and for a number of companies that require our expertise. So in this case, you can see that we are working with VicRoads and then looking into data sets collected from their sensors, underground sensors and intersections. You can see that through such data, deep learning allows us to predict traffic conditions in networks such as the Melbourne network. With the predictions of traffic congestions, the information will be sent back to VicRoads' control center to allow them to make decisions on the traffic signals so that they reduce traffic flow to a particular area to avoid congestion in that particular area. Because of the prediction that if there's no such intervention, then soon enough the area will be flooded with a lot of vehicles, causing a heavily congested area.

And so this is one of the important applications of machine learning that we have used to develop traffic congestion prediction. In looking at a higher overview of the entire applications area, you can see that the problem is not just to predict the traffic but also to assist VicRoads in making a decision in terms of what traffic control they should provide.

This prediction needs to be encoded as mathematical equations so that the optimization strategies can solve. And so how do we actually convert these deep learning-based predictions to those mathematical equations-based predictions for traffic in the network? This is a question that we are currently working on. If you have interest or if you're keen to look into this problem, you're very welcome to talk to me to explore how we can work together to solve this problem.

**Summarise**

Machine learning is making a significant impact in various technological applications. Autonomous cars, such as those by Tesla and Mercedes, demonstrate how machine learning is integrated into driving technologies. Using videos from car cameras, deep learning enables recognition of terrain and alignment with maps, guiding decisions. Deep reinforcement learning incorporates human driving feedback to develop autonomous driving policies.

Deep learning is also prominent in speech technology, powering virtual assistants like Alexa and Google Assistant. These assistants interpret speech and respond accordingly, enhancing human interaction.

Recent advancements like ChatGPT and Google's Bus AI highlight the role of machine learning. ChatGPT uses supervised learning to respond to user prompts, showcasing its capabilities in generating answers.

Windburn uses AI and machine learning extensively, collaborating with VicRoads to predict traffic conditions using sensor data. Deep learning predicts congestion, aiding traffic signal decisions. Optimization algorithms suggest strategies for optimal traffic control based on these predictions.

Translating deep learning predictions into equations for optimization is an ongoing challenge. This conversion bridges the gap between advanced prediction capabilities and their application in optimization strategies.

If interested in this problem or collaboration, feel free to explore solutions together.

***Important***

**MACHINE LEARNING'S IMPACT IN THE TECHNOLOGY**

Deep learning is making very important impact in the technology world. From autonomous cars to predicting traffic congestion. Another impact of deep learning in speech technology is to allow company to develop virtual assistants. Windburn also utilize AI and machine learning heavily in order to develop solutions.

**HOW TO ENCODE NEURAL NETWORK PREDICTIONS INTO MATHEMATICAL EQUATIONS**

The next question is clearly link up between these two piece of research here. These predictions need to be encoded as mathematical equation so that the optimization strategies can solve. How we actually converting these deep learning based predictions to those mathematical equations based predictions for traffic in the network?

**Original**

All right, let's look at some of the important applications of machine learning that are making very important impact in the technology world. So we are familiar with all the buzzwords around autonomous car that have been rolled out in commercial vehicles including Tesla and Mercedes and also been developed by Google and many cars company in China. So this just to show you how machine learning contributed into this important technology. You can see that some of the technologies rely only on videos that taken from the cameras of the car, for instance the one deployed by Tesla, although some other technologies also combined with other technologies including LiDAR and radar as well. So in the case of utilizing videos from the cameras, deep learning has been used in order to enable the computer vision to allow the car, the autonomous car, to recognize the terrain on which it travel and then align the terrain with the path according to the map that is currently used in order to travel to the destination. And with that is able to determine whether it should maneuver to move left, move right, whether it can speed up, whether it need to slow down and so on and so forth. And then for the car to actually perform the correct maneuver to actually safely control the car to go along the path towards the destination. Then deep reinforcement learning have been used in order to incorporate the feedback that the human use when they drive the car through the same terrain, through the same path and making the decisions in term of steering, in term of speeding, slowing down, accelerating and so on and so forth. And by using such human feedback that certain human instructor like Sebastian or Stanley use, the car is able to develop its own policy for controlling the autonomous car. So remember, in the last slide we talked about autonomous cars using their computer vision technologies enabled by deep learning in order to recognize the areas that is traveling within, including the terrain, including the area belonging to the path, and the area may be outside the path. So the particular technique that has been developed by researchers and then commercialized by companies. And so here you can see that the technologies and the computer vision technologies enabled by deep learning allow you to actually recognize a photograph like the one here and then being able to recognize the areas and label them with appropriate label. So for instance, this is a car and then these sun areas and then this row and so on and so forth. So these are the row and these are the cars. The red dots here are the wheels and so on and so forth. And so you can see that deep learning allow you to achieve this level of computer visions in a very impressive way. And now you can see that deep learning is become more and more pervasive and becomes really important to large company as well. So companies like Microsoft, like Facebook and Google, they all competing for experts in deep learning and seeing them as the critical assets to allow them to make competitive advantages in this important area of technology. Another impact of deep learning in speech technology is to allow company to develop these virtual assistants that can have a conversation with humans. So when you actually asking Alexa or you asking Google by saying hey Google, then the speech recognition of the system is able to recognize what you're saying, understand the questions or the request and then being able to correspondingly respond to such a request or question. And finally we all know about the most recent and exciting advancement in technologies with Chat GPT and Google Bus AI. And so here we can see that behind these impressive technologies like Chachi PT is a lot of machine learning including supervised machine learning with human feedback to supervised machine learning in order to produce the policy for Chachipt to deal with a particular prompt when a user introduced a prompt. And then using this policy now Chat GPT is able to produce a particular answer to questions that a user may be entering into Chat GPT. So that is on the development that's happening in the world. Now as Windburn we also utilize AI and machine learning heavily in order to develop solutions for industry partners and for a number of companies that require our expertise. So in this case you can see that we are working with Vicros and then looking into data set collected from their sensors, underground sensors and intersection and then you see that through such data deep learning allow us to actually predict the traffic condition in networks such as the Melbourne network. So with the predictions of the traffic congestions then the information will be sent back to Vicros control center in order to allow Vicros to make the decisions on the traffic signals so that they reduce the traffic flow to a particular area to avoid congestion in that particular area. Because of the prediction that if there's no such intervention then soon enough the area will be flooded with a lot of vehicles and then causing heavily congested area. And so this is one of the important application of machine learning that we have used in order to develop traffic congestion prediction. In looking at higher overview of the entire applications area then you can see that the problem is not just to predict the traffic but also to assist Vicros in making a decision in term of what traffic control they should provide, they should make as well. And so here, traffic perishance is performed in order to allow Big Rows engineers to understand conditions in the network. But at the same time, they also need certain assistance in order to allow them to not only understand about the traffic, but also answer the questions of whether there is a way to actually optimize the traffic flow in this network. And so this is another area that we have developed the technology as well. So our optimization algorithm allow Vicros to look into different control strategies of the traffic signals around the network. And then depending on the strategies now with the predictions multiple steps into the future, these strategies will have certain impact into different segments of the network. And then with those impact, then what would be the optimal control strategy that they should have for the intersections, for different intersections of the network. Now, currently, we already mentioned that with the massive data that Vicro provided us, the deep learning network allow us to actually make some rather accurate predictions of the traffic conditions and then depending on the peritions of the traffic conditions, and then we also have been able to provide optimization strategies in order to choose optimal traffic control strategies for the network. The next question is clearly link up between these two piece of research here. And so on the one side this the prediction outcome based on the deep learning network and then on the other side there is a requirement of predictions that this control strategy require. These predictions need to be encoded as mathematical equation so that the optimization strategies can solve. And so how we actually converting these deep learning based predictions to those mathematical equations based predictions for traffic in the network? This question that we are currently trying across and again, if you have interest or if you're keen to actually look into this problem, then you are very welcome to talk to me in order to explore how we can work together to solve this problem.