

Anthea Batsakis: Are we ready to put our lives in the hands of artificial intelligence? Progress in machine learning, AI, and sensing technologies have shown we're safer on roads navigated by autonomous vehicles than when we, as humans, take the wheel. With around 90% of car accidents in Australia due to minor mistakes like fatigue and distraction. How many crashes might be avoided by eliminating human error?

Anthea Batsakis: My name is Anthea Batsakis and you're listening to a podcast from the Australian Academy of Technology and Engineering. Today I'm talking to Professor Eduardo Nebot, the director of the Australian Center for Field Robotics. He has a number of projects running that will see intelligent transport systems revolutionize what we know about mobility. Eduardo, what is the Australian Center for Field Robotics? Tell me about some of the landmark projects.

Eduardo Nebot: Thank you very much for the introduction. Yes, I would be very pleased to talk about the centers. We started out, funded the centers almost 15 or 17 years ago and main objective at that time was to bring the automation industry to Australia. Australia is recognized all around the world for their use of big machinery. Big machinery in the stevedoring, in mining and many other in construction. At that time we said that we believed there was a significant need for automation. We needed to create a significant technology in order to achieve our goals and I can say that the first landmark project was the full automation of straddle carriers. Straddle carriers are machines that move containers in the port, and basically these machines are actually moving 30 to 60 tons containers and at that time - 1997, 1996, all these machines were manually operated.

Eduardo Nebot: In order to automate this machine we had to do significant research because we needed to create new technology that was nonexistent, and by 2005, we demonstrated what was at that time, probably the most sophisticated autonomous operation in the world with the 25 to 28 straddles working completely autonomous in the port, and the way that this operation was working was that you had the ship, the ship was sending the manifesto with all the containers that they had, and at that time you could do all the planning and you knew that at 3:50 AM a particular container was going to be placed in a particular point at the yard. Then, the other significant outcome in this area was the full deployment of automation in the port of Sydney. The port of Sydney was fully automated in 2015 and everybody that is living in Sydney or in Australia can actually go and see something that is fascinating. I mean, the summation is that the port is completely autonomous and you have a tower like in any airport and everything is controlled from this tower.

Eduardo Nebot: The next major area that the center has been involved is in mining automation, and we've been working with the Rio Tinto since 2007. Actually, Rio Tinto funded the Rio Tinto Center for Mining Automation that this is hosted at the ACFR, and with Rio Tinto, we developed all the concepts of a mine of the future.

Again, this involved automation and many other things and this is a project that still continues today and this is very heavily funded by Rio Tinto.

Anthea Batsakis: Sorry, it sounds like you worked on really cutting edge projects in the past. So, what are you researching at the moment?

Eduardo Nebot: Well, this is very interesting that you mention this. All this work... This is probably for engineers or mathematicians was... The work that they describe was done based on a statistical model, something that the model processes and senses, and at that time, probably 10, 15 years ago, we started asking the question - can we obtain this model from that, and this is where we start applying machine learning in order to learn models, and the major application of this technology initially was in agriculture. In agriculture, we started to initially demonstrate that, for example, we can teach an algorithm to recognize the crop from the wheat, and if we do this then we can eliminate the wheat so also we can be more specific in order to recognize a particular plant with a very difficult shape, and do something with the shape.

Eduardo Nebot: This [inaudible 00:05:37]... We are working at second or third stage of this technology, in which we are demonstrating a long term of agriculture with automation in all the different areas. Particularly myself, I am currently involved in intelligent transport systems. This is very generous, and we are working on one aspect. It's in vehicle automation, in which we use vehicles and we design algorithms in order to process the information from the sensors in order to be able to recognize and classify everything that moves around the vehicles. For example, I can show you videos of the vehicle crossing the bridge and then being able to detect and classify all the vehicles there, the cycles, the people that they are moving in close proximity with the vehicle. The other very interesting project that... This is something that is also interesting to all of us is the project involved in a small city.

Eduardo Nebot: These days, there are three fundamental concepts that are actually an object of significant research. One is electrification. You can see that many cars are starting to be electric, and another concept is automation. We are realizing that automation is possible, and the third concept is ride or car sharing. People are starting to think that they don't have to own a car, so then, if you combine the three concepts together, the ones that can have a profound impact in the way we move, a profound effect with respect to congestion... And congestion not only in pollution...

Eduardo Nebot: Imagine that you are driving on Military Road in Sydney and all of a sudden, instead of hearing all the noise of all the buses, it would be silent. This would be quite amazing. And then, in addition, when you combine the concept of automation and ride sharing, that you can request a car in order to go to a particular destination, all of a sudden the utilization of the car, it will go from the standard 2 to 3% that you are using your car, to 98%. So, it means that you can reduce the number of cars that are going to be cramming the city. This

could be something that is going to be really impressive. This is the future that we can see. For example, one of the things that we are discussing here at the university, and probably most of the universities in Australia, they are expanding, they are spending billions of dollars in the buildings that are going to last for the next seventy to hundred years... Huh?

Eduardo Nebot: We are not taking into account that this technology is going to be available in the next ten years. So when you think about how parking lots are not going to be needed at the university, but at the same time you need to design all the buildings taking this technology into consideration. Okay, you can think about this technology just being on campus moving people during the day, and the machines transform with themselves in order to clean the campus at night, moving goods, delivering post. So, all of a sudden, you are eliminating a big majority of the vehicles on campus, no?

Anthea Batsakis: That's very impressive. One thing I found really interesting is that you're saying that the cars and buses and trucks could be silent? I can imagine that would be really beneficial for the wildlife and it would have a number of benefits. So, in an ideal world, how might we drive to work in fifty years?

Eduardo Nebot: That's an interesting question, and I think that the way we drive to work, the way we move... We are not going to be needing to wait another fifty years. I should say that this technology will have a dramatic change in the next ten to twenty years. Okay, and there is some very basic prediction that the problem that, in many cities around the world, you already have a fleet of cars that are completely autonomous and they are actually being tested.

Eduardo Nebot: You can tell that probably in the next three or four years, you are going to start seeing some fleet of cars operating autonomous in particular areas, and in the next thirty years or fifty years, you are going to have a large number of them, and at that point, your cost in order to move is going to be cheaper than having a car, okay? And at that point, the majority of the people will basically, at least in urban scenarios, cities like Sydney or similarly sized cities where you have this deployment of the fleet... You are going to be basically hiring an autonomous car, probably sharing with some other people, but your objective is going to be like the objective that you take today. When you take a bus from point A to point B, you go, you sit in the car, you share with three people, two people, or perhaps ten people, and then you get to the final destination.

Eduardo Nebot: This is the future and this future is most likely in the next ten years.

Anthea Batsakis: That seems really soon.

Eduardo Nebot: Okay.

Anthea Batsakis: It sounds like there's a lot of infrastructure that needs to be changed. Just to be devil's advocate, is it worth it? There must be so much money that has to be

invested into changing infrastructure and changing the roads and building up these vehicles, smart systems. Why can't we just stick with what we've got already?

Eduardo Nebot: Well, it's... It's interesting that, and I can't recall the fear exactly... But probably within these days that in safety alone, I believe that Australia is spending around more than twenty billion dollars due to fatalities or accidents in the road. Imagine that you can reduce it by 90%. This is significant, and when we talk about fatalities you also need to consider that the other people are badly insured and would need to spend a significant amount of money and if you think about how this could be eliminated, this is a significant breakthrough and with just this outcome we would be better off.

Eduardo Nebot: In addition to that, there is a price that we are paying for pollution these days. People don't consider this, but a lot of people get sick and this is the price that we decided to pay in order to have the current technology, okay? So, in addition to safety, you have this. And then you say, well, yes, we are going to need some other infrastructure, but the other infrastructure will provide many other benefits, because all of this [inaudible 00:13:34] we are going to have vehicle to vehicle communication, vehicle to infrastructure communication. So, we are going to be able to have a much better control of the traffic, and then we are also going to get additional benefits in addition to safety.

Anthea Batsakis: Well, I'm convinced. So, you were just discussing safety. Can you tell me a little bit about your experience working in that sector?

Eduardo Nebot: Okay, well, this is very interesting. This is part of my history of working in mining. I started working in mining and in particular in the safety area. What happened in mining is that you have a combination of very large pieces of equipment and very small cars. For example, you may have a truck that is four or five stories high, and you could be up to five hundred or six hundred tons, and it could be operating in close proximity to a four wheel drive, and what happens is that, just to give an idea, if this truck happened to run over the four wheel drive, the driver of the truck would not even notice that he drove over this car. It doesn't happen very often, but this accident happens.

Eduardo Nebot: There are collisions, and then we've been working for almost ten years in order to develop the technology and introduce new technologies in order to make the operator of each vehicle very aware of what's happening around them. And this is very interesting, because in mining it's not like driving in the city. Usually, you drive in the city when there are good conditions but in mining, since it's a very capital intensive industry, you have more expensive trucks, very expensive pieces of machinery. They usually work with very adverse weather conditions, so their visibility is very poor. Sometimes it's raining, sometimes there is a lot of dust. So, if we can provide the operator with all of the information, we can save many lives, and this was my work for almost eight or nine years, and we

deployed this technology probably in many places around the world from South America, U.S., and many places around Australia.

Anthea Batsakis: So, other than mining, what industries are showing the most promise in terms of progress in automation and robotics?

Eduardo Nebot: These days, robotic automation is very popular, and as you said, most of it... All of the large corporations are very interested in automation, and while in the past, we managed to recruit our own PhD students and we mentored them in order to become very good academics and leaders at the university. These days, this is not the case, and most of our students are being interviewed by the Apple's, the Uber's, the Google's, the Ford's, and they all get in wonderful jobs with the state-of-the-art technology. Everybody believes in robotics and A.I, so if it is not robotics it will be A.I, and the students that we are forming are very appealing to all of these new industries.

Anthea Batsakis: That's it. Thank you so much. [crosstalk 00:17:36]