

PROF SARAH BROUGH:

Hi, everybody. Good morning and welcome. I very much hope that you enjoy our time with us today on this first day of Spring. I'm Professor Sarah Brough. I'm the Associate Dean of Equity, Diversity and Inclusion in the Faculty of Science at the University of New South Wales. And I'm delighted to be hosting today's conversation on Inclusive Science, on Gender and Data Science. But first, I begin by acknowledging the Bedegal people who are the Traditional Custodians of the land on which the university is built and the Cammeraygal people on whose land I join you from today. I would like to pay my respects to the Elders past and present and to extend that respect to other Aboriginal and Torres Strait Islanders who are with us here today.

I'd like to acknowledge the role of the Traditional Owners and Indigenous people of Australia as the very first knowledge creators and their very deep understanding of the land, the sea and the sky that forms a very important source of understanding of Australia, which should feed into all of our scientific understandings. That is something we are committed to, as well as the Faculty of Science, with our strategic plan and our UNSW Indigenous strategy.

To let you know, today's session will be recorded. So if you need to leave the presentation early or miss any part, you can watch this again at your convenience as the link to the recording will be emailed out to everyone who registered. We encourage live audience participation and welcome any questions you may have. Please use the live Q&A chat function throughout the discussion and we will address as many questions as possible as we progress. I'm very pleased to be hosting today's discussion topic as we will be addressing the importance of inclusive science, acknowledging gaps in our practices and working with our communities to create inclusive spaces. So first, I'd like our panel to introduce themselves. So I'll start with Yanan Fan, Associate Professor in the School of Maths and Stats.

YANAN FAN:

Alright. OK, so my name is Yanan Fan and I'm an Associate Professor in Statistics at the School of Mathematics and Statistics. And a bit about myself, so I've been working with data for most of my professional life and am currently involved in a number of data science initiatives across UNSW. And my research that I'm interested in has been primarily in the area of Bayesian statistics and computational statistics where I have been developing... where I develop computational tools like that of Markov chain Monte Carlo or approximate Bayesian computations for really complex models that we use to model real data, real world data. And so my - I think I have a strong interest in using these methods to look, to help with gender studies and to help with gender equity. So particularly in that sphere where we could use data to help us look at where - to help us achieve equity. And I'm also - I have to mention I'm also very proud to be a member of the Athena SWAN project at the UNSW, which is a team led by Professor Lucy Marshall. We're at UNSW working towards gender equity across all the aspects around the university. Yeah. So that's all for me.

PROF SARAH BROUGH:

Thanks, Yanan. Let's go to Fiona.

FIONA KIM:

Hi, everyone, I'm Fiona Kim, and I'm a second year PhD candidate in the School of Mathematics and Statistics working under the supervision of Yanan Fan and Emma Johnston. So my research is very much in the applied... (AUDIO DISTORTS) (INAUDIBLE). I'm using advanced machine learning techniques combined with statistical models to actually try and tackle some of the problems society is facing at the moment. So prior to this, I was as Analytics and AI Consultant with Deloitte Consulting. And formally, my background's in business. So I completed my Bachelor's degree majoring in Economics and Marketing. Thank you.

PROF SARAH BROUGH:

And finally, Scientia Professor Toby Walsh.

PROF TOBY WALSH:

Thank you, Sarah. So I'm a Laureate Fellow and a professor of Artificial Intelligence at the School of Computer Science and Engineering. I've spent my whole life dreaming about trying to build more intelligent machines with artificial intelligence ever since I was a young boy reading too much science fiction. But in the last few years, I've been seeing some really, I think, quite spectacular advances in AI. And a lot of that's been driven by data and by the fact that we're collecting more data and we're using tools like machine learning that was mentioned just now on that data. And that's thrown up a host of problems, some of which are connected to gender, about biases that I'm sure we're gonna talking about shortly. And also within the field itself of AI and computer science more generally, we do have a real gender challenge. We don't have women represented in the numbers that we should have. I've been a scientist in my local girls' school to try and help do my little bit to improve the flow into the subject. But there's a lot more we should be doing and I'm sure we'll be touching on in the rest of the talk today.

PROF SARAH BROUGH:

That's great. Thank you all. Firstly, I'd like the audience to hear about data science and the rapidly growing importance of this in science, in our community, as you all kind of touched on in your introductions. Yanan, what do you mean by data science? Where has the term come from and what does it relate to?

YANAN FAN:

OK, so the term data sciences to me is a relatively new term, I think. And there might be... might mean slightly different things to different people because it's really quite a multi-faceted discipline. And I think it's an emerging interdisciplinary science. Where primarily, the way I see it is, is at a cross between statistics, mathematics and computer science. It's the main driving force behind it. And statistics is - so the classical statistics is about making sense out of data, making statements in terms of probability and in terms of quantifying how... quantifying. So the main thing about statistics is we're interested... we're focused on quantifying the uncertainty that comes out of the information that the data contain. But then nowadays, there's this huge amount of data and traditional statistical tools that we have been working with isn't quite able to catch up with the amount of data that's out there. And then we need computer science to come in to help us out. And that probably includes anything from having faster computers and more powerful computing tools. And then there's that overlapping area where we all develop algorithms. So I think that it's a new field of where we

combine our strength in both how to analyse the data and using really powerful computers to help us get there.

PROF SARAH BROUGH:

And Toby, how does the data science relate to artificial intelligence or AI?

PROF TOBY WALSH:

The two overlap but have parts that are disjointed. So there are parts of artificial intelligence that are data science, like machine learning. Equally, there are parts of AI that are data science, like all the stuff that we do with robots is particularly connected to data science. And then there are parts of data science that perhaps AI shouldn't be claiming, like old-fashioned statistics that has a long, venerable history within the Maths Faculty. But the two are very closely related. And I think the question is these days, Which is the sexiest job title? Is it data scientist or AI researcher?" It's hard to know what the answer is.

PROF SARAH BROUGH:

And we always want the best job title.

PROF TOBY WALSH:

They're certainly two of the best paid jobs around at the moment.

PROF SARAH BROUGH:

Toby, you've written a recent blog post on the finding that women see fewer advertisements about entering into science and technology professions than men do. How does data science, AI, play a role in that discrepancy?

PROF TOBY WALSH:

Yes. This is a very worrying discovery that women got shown fewer job adverts than men on search engines. And doubly so because actually the adverts that they did see were less well-paid than the ones the men were seeing. This is one of the problems when you have data-driven decisions. So this is algorithms making decisions for us. You can't serve up adverts on Google or Facebook with humans. You do it with algorithms. And it was one of these unintended consequences. It turned out that women's clicks were more expensive to buy than the men's. And the algorithm was optimised to the number of eyeballs that it was gonna show the adverts to. And so since men were cheaper than women, it showed more adverts to men than to women, which was not what the advertisers wanted and one of these unintended consequences that you have to worry about when we're handing over decisions to machines.

PROF SARAH BROUGH:

So that's a really fascinating entanglement of the problem and definitely kind of why one of the reasons why I was really keen to have this conversation with you all today. So thank you both for that introduction to data science and an example of how it intersects with gender in kind of positive and negative ways. I'd like to transition now to talking about current research, asking a question of Yanan. Last year, you used data science to undertake research into whether the gender or native language of lecturers impacted their grades in UNSW myExperience Surveys. These are the surveys

that capture student feedback on their experience of their courses. What led you to investigate that question?

YANAN FAN:

The myExperience data is the surveys done by students at the end of every course they do to either evaluate how they felt the course went and or evaluate how they felt that their lecturers performed or how effective their lecturers were. And this has been done for really, you know, 20, at least 20 years, as far as I know. It's always been there in as part of the university life. And so private - So around about a couple of years ago, there was some research done that were carried out overseas that it found that they could find that there is a gender bias in these student surveys. So that really got me really excited because this is about data and this is about maybe potentially a gender bias. And it's something that I never thought that data could actually potentially help us point to. So that was really quite exciting. And then at the same time, I think that there's being around that or even continuing this conversation about unconscious bias. There's a huge noise in the media that's been talking about unconscious bias and proving - I mean, maybe we have all heard anecdotal stories about these things or we have suspicions about them. But proving that within data was - with data was something that would be quite, quite a lot harder. Firstly, you need to have this amount of data available and then be able to see it to sort of get rid of all the other noises in the data and be able to say for sure that there is something that's attributable only to that particular effect. And that effect might be very small. So that was quite exciting to me to as a project. And we were very lucky at the UNSW there's a lot of support from the leadership from the UNSW to carry out this research. And we actually have very, very good data all the way going back to 2006 when we started collecting them electronically. So everything was there and we ended up with millions of surveys to dig through. So this is a huge amount of data to be able to dig through. And but it's a noisy data because there are - it's not an experiment. It's a retrospective study. There's a lot of other factors that could be driving the... how students evaluate. So it was a big challenge just to try to tease out all the well, throw out all the other effect and tease out just the gender effect in that dataset.

PROF TOBY WALSH:

Could I emphasise there the unintended and corrosive impact that that has? Because it's well, those surveys are used as part of the decision-making in people's promotions. And so if we're not careful, if we don't try and correct these biases, we will come back to the same point in the example I was saying. Which was women will end up being paid less than men and we don't want that to happen.

YANAN FAN:

Yeah. Yeah. And not only that, I think that to together to be evaluated less for, you know, the same thing that you do, I think it has an effect on the individual and on their own confidence. And then maybe it's a negative cycle all the way through.

PROF SARAH BROUGH:

Particularly, I was going to add if that person doesn't necessarily realise that they are one of many who are suffering, that you get your student comments and your student grades and you think you might be the only one. So this kind of research is fascinating for that understanding where we all sit in the feedback. I'm interested in knowing as well what tools you used to undertake that research.

YANAN FAN:

So this was a retrospective study and we had to go down to the very basic level of looking at each individual student and how they evaluated. So there are over a million individual student surveys that we have. And it's complex because there are many confounding factors. For example, the students own whom is known to affect how they perceive teaching in a lot more than many other factors... probably a lot more than many other factors, which was what we sort of suspect. And these are also, I mean, there are other things. Large class size and different - There are courses that are just not popular that always gets a lower rating. And there are also a lot of repeated measurements. So one lecturer is being evaluated by lots of different students and one course is being run several times by different. So it's really, really complex. And so to tease out those gender effects in fact, it turned out that there was a gender and a culture effect. By culture, we mean people with non-English speaking background. People who've come from a different culture or have a different... have an accent maybe. And what we did with what we used, what we call an ordinal regression model to model this data. And because the response we have so what we're linking these - we're linking - what we're looking at is the that last rating from the student in the very last part of the student survey, which asks the student whether they are happy with the course or not. Overall, are you are you OK with the course or not?" And it's an ordinal value that you get. A rating out of one to one out of... one up to six.

Yeah. So it turned out that it's complicated because it wasn't - so because, UNSW, I guess Australia has a large population of people who are who've got the degree... who got their doctorates overseas and then came here. And there's just a huge and there's also a complication with a large population of international students as well. So when we looked at that all together, you can't really see what's happening. And when we looked a bit deeper and it looked as there is a gender difference in how the students evaluated their lecturers. But there's also they are also rating people who've got a who are not native English speakers, if that's how we classify them, lower. And that could be due to a number of different reasons, I think. It could be that... it could be that the accent is so strong they couldn't understand it. Right? So or it could be that there's a cultural difference in the way that you speak or the way that you connect with your students. So that's really complicated to know exactly what. Or it could be the teaching style as well. So it's really complex. It's complex to know exactly what is driving that lower rating for those, for that group of people.

And we've also found that so overall, we found that male lecturers were more likely to receive higher scores than female lecturers. And that people with a non-English speaking background were also less likely to receive a lower scores. And in fact, the gender effect is washed away when you are looking at the English and non-English speaking background. It's not as evident. But that we... The two worst faculties were Science and Business School. But it happens across - you can see it across the entire university. And additionally, I guess those local students are also quite hard, harsh on the... they're harsher than the international students. And male students are... male students are - I think Fiona could tell you a bit later, male students are quite harsh as well in general. So it's an interesting gender differences. So I think, I guess it's always been suggested that men and women are evaluated differently. And women are often evaluated on, you know, how approachable they are or their nurturing skills. And men are, maybe students look to men particularly, maybe particularly

so in - well, I shouldn't say that but it feels like it's particularly so in the fields of STEM fields where men are the, you know, how brilliant they are, how smart they are. And so now we're sort of going taking that analysis before there's a huge amount of text response that we get from the surveys as well. And it's again, we need to use some kind of a machine learning method to do that. Because there are literally millions of comments and we can't process that just by reading that and doing word clouding doesn't work because whatever comes up the largest isn't necessarily what is important in terms of how they affect the ratings from the students. So yeah, just trying to look at the what we're getting, what students are commenting on by and large, and how that affects the way that they score, they give scores will give us some idea of how or what is the difference in the way that male and females are being evaluated. And that would hopefully give us a better idea of what to do and how to go, what to do next to address these issues.

PROF SARAH BROUGH:

That's so interesting, Yanan. So if you hadn't done this research, then women and non-native English speakers may have judged themselves more poorly. And as Toby mentioned, been marked down on promotion applications as a result of not considering underlying differences in the data. So that's very much a non-ideal consequence of capturing lots of data and not considering the differences within it. Fiona, I'd like to turn to you. You're building on the research that Yanan started. Can you tell us about where you're taking this project now?

FIONA KIM:

Yes, thanks, Sarah. So I am following in on from the research that that Yanan conducted. So I'm taking the exact same data set but I'm exploring the gender bias and cultural bias issue from a slightly different angle. So many studies before like Yanan have found there to be an unexplainable difference between the scores that female versus male lecturers are receiving. But what I want to do now is try and understand what are the drivers that are causing that difference. So what actually is the cause behind it? So to do this, I'll be using a rich source of data, which is the student comment. So every time a student completes an evaluation of the teaching, they're given free text fields where they can input some commentary on the best features of the lecturers or areas for improvement. But as this is a free text field, it's quite unstructured in its nature and that makes it more complex to analyse. So a lot of previous studies have neglected using this information. So I'll be incorporating the student comments into the analysis. And to do this, I'll be using a technique known as natural language processing. So that is getting a machine to interpret and understanding the meaning behind the comments. And the exact technique I'm currently looking at is known as aspect-based sentiment analysis. So what that is is from a comment, we can extract the key aspects. So what is the student talking about? Are they discussing the course? Are they discussing the staff or assessment? So what is the key theme of their comment? And then from there, we can also get a sentiment score. So are they quite positive in their commentary, negative or neutral? And the goal there is to have a better understanding of what is driving these differences in rating. And once we can understand the key things involved in that decision-making process, we'll be able to better develop techniques to help mitigate this bias.

PROF SARAH BROUGH:

So.

Fiona, I really wanted to ask what really interested you in working on this particular project?

FIONA KIM:

Yeah, so I was first drawn to this project because I very much enjoy working in the applied space. So as much as I love the technical machine learning techniques or advanced statistics, I really want to see real world application and implications for my research. So I like having... (BACKGROUND NOISE) (INAUDIBLE)

..and having a problem that I can work on to solve. But if I'm completely honest, when I first picked up the project exploring gender and cultural bias, I was quite ignorant to the magnitude of the problem. I think growing up in the time that I did, I didn't really see it as that big of an issue and I thought it wasn't as bad as it was. But the more I researched on the area and the more I read about previous studies as well, the more I sort of realised how these minority groups are really being disadvantaged and I think then the more research done, the more my passion for it actually grew. And I really wanted to, you know, see this project to the end and actually help drive some change in this area.

PROF SARAH BROUGH:

That's super exciting. You start to see the elephant in the room and it's really hard not to see the difficult side effect of working in this particular area. What - so with the project, what are you finding so far within your data?

FIONA KIM:

Yes. So from the aspect-based sentiment analysis technique as protocol, we're able to quantify the students' comments. So for each student comment, we're able to flag what theme they're talking about and assign a sentiment score to understand the magnitude of that theme they're discussing. So how positive is it? How negative it is. And we use those as features into our model. Once again, using an ordinal regression model to actually see how these things are impacting the final ratings that the lecturers are receiving. And we can also interact these themes and sentiments with the gender of the lecturer and see whether the gender of the lecturer, whether that has interacted with the themes, whether that influences the final set score. And with the preliminary findings we have we're conducting the analysis faculty-by-faculty. So in terms of the Science faculty, we have seen that there's a slight significance when the lecturer of the gender is interacted with the themes associated with staff quality and teaching methods. So staff quality and teaching methods are the themes that most correspond to the person themselves, the lecturer themselves, the individual characteristics. And we find that that has a negative estimate when interacting with gender. So what this is saying is that for the same sentiment increase in the theme of staff quality, the female lecturers' final ratings is not increased as much as the male lecturers'. So essentially, the students may express the same level of sentiment for both male and female lecturers. But this then translates, unfortunately, to a lower rating for the female lecturers.

PROF SARAH BROUGH:

That's terrible. Sorry. That's the first time I've obviously heard the outcomes of your research. And that's... it's really dispiriting as a female lecturer to hear that. But also good to hear that the research is being done so that I, you know, I personally I can - obviously, I see the value across the university but also it has a personal meaning to me. I can hear that and go, OK, it's not just me. It is an aspect, a

sociological aspect coming through the data." And I can let some of those concerns go whilst also obviously being focused on trying to provide the best teaching possible. So thank you, Fiona, so much for that description of your research, but also undertaking it. I think this is - Yanan and Fiona, this is such a valuable piece of research.

I now want to move over to artificial intelligence. And Toby, so we're really seeing that there can be this kind of underlying bias for minority groups in data. And what does that mean for artificial intelligence applications which really require that known data on which to train their outcomes?

PROF TOBY WALSH:

Yes, this is a really important point that we're discovering now is that data by its very nature is historical. And it captures the biases, underlying biases of the system in which that data was captured. And in the case of course evaluations we're discovering that there are subconscious and other biases that the students have when they're rating their lecturers. And if we're not careful, we will then just be perpetuating those biases in the systems moving forward. And actually, it's worse than when we have humans doing the evaluation. If we're handing it over to algorithms, machine learning algorithms, they're not very transparent. They tend to be black boxes and we can't get them to explain their decision-making. They're looking perhaps at datasets that are too large for humans to conceivably look at. And there's plenty of evidence that, unfortunately, people trust what the computer says too much. And so we will end up we will spend 50, 100 years trying to actually eliminate some of these biases from our systems and try to make them fairer to people. And if we're not careful, we'll hand over decisions to machines that will be perpetuating those biases into the future.

PROF SARAH BROUGH:

So what can the people working now to develop AI, what can they do to resolve those underlying biases?

PROF TOBY WALSH:

That's a really important question. I mean, first and foremost is we have to ask these sorts of questions. We have to realise that we may be building systems that may unintentionally in most cases, be perpetuating these biases. And so, we have to begin by asking those right questions. But then it poses some fundamental challenges. And we don't have perfect answers to some of these. I mean, what does it mean, ultimately, to be fair? Is that equality of outcome or equality of opportunity? We - there is actually 21 mathematically different definitions we now have for what it means to be fair. And we could also prove mathematically that many of those definitions are incompatible with each other. You can have one but you wouldn't have the other. And so we have to make some difficult societal choices. What does it really mean to make the system a fairer place? And I'm optimistic that in the long-term, we can actually address many of these unconscious biases that humans have and machines could be made to make better decisions. But that's only if we're very careful in the design of those machines and the datasets that we train them on. And then the final really important point to realise ultimately is there are many settings in which there is not an unbiased answer. I'll give an example. There was - Amazon built a system using machine learning to select people to call for interview. They get hundreds and thousands of people sending them CVs. Too many to look at by hand so they built a machine learning system to do that. And after they spent

a year building the system - and they're very smart people - they discovered that it was irretrievably sexist and biased against women. They had included gender as one of the inputs but they didn't want it to be biased against women. But it learnt various other clues in the CVs that were correlated with gender. And because the data it was trained on was historically biased towards men being more promoted and men being called for more interviews, it ended up perpetuating these biases. And they found that it was almost impossible to eliminate that despite that they knew it was a problem and they were trying to get rid of it. And eventually, they threw the system away. Because at the end of the day, ultimately, you're calling, you're selecting a small number of candidates to call for interview - that's a bias. A bias towards having the people who are most... best qualified for the job. Who are going to do the job best. But, you know, is it - we don't want it to be biased to gender or age or race or all the other things that actually, we even have in many cases have laws against. But it is a bias. So it's worth remembering at the end of the day, there are many settings where it's not... there's no unbiased answer. It's just... is it biased towards those characteristics, those who are best qualified for the job, (AUDIO FADES) (INAUDIBLE)
...the person we should be promoting most that should be selected to be shortlisted?

PROF SARAH BROUGH:

Yeah, that's clearly a really challenging scenario in which to be working. I was wondering, do more diverse teams help ensure that AIs, you know, creating those tools help ensure that they answer the right question? Although you're making it very clear that there may not necessarily be a right question.

PROF TOBY WALSH:

There were 100% diversity in the teams building the software. There's plentiful evidence that shows that diversity results in people asking those questions early on. There's a classic example when the Google - sorry, the Apple Watch first came out. For the more than the first year, the iOS, the operating system for it, didn't include gender and the woman's menstrual cycle as part of the health statistics it captures. And you can't understand a person's health, a woman's health, certainly, if you ignore that really important thing. And they hadn't thought - presumably, the team building it hadn't thought it was important enough to put in the first release. And so there's plentiful evidence that we should have more diverse teams, that they build more inclusive product, that they make fewer of these mistakes. And of course, that goes back to something that we discussed at the start, which is that the field struggles with its diversity. And so that is in some sense perpetuated some of these problems.

PROF SARAH BROUGH:

So I was curious to hear how Computer Science as well, and I'd love to hear from Yanan, how Computer Science and Math are working to increase the diversity working in these fields. So, I hear from Toby first and then Yanan afterwards.

PROF TOBY WALSH:

Sure. There are lots of initiatives to do this. I mean, it's very well recognised as a significant problem. And one way is... there's 100,000 unfilled jobs in IT in Australia today. And we could fill those jobs if we had a greater representation of women. But equally, there are efforts to support undergraduates, to support postgraduate students. I just joined the Board of Women in AI. We're bringing an award scheme for women in AI to Australia for the first time now. But actually, if you

look at the statistics - and I've looked at the statistics - it's a problem that starts at an incredibly young age. As soon as girls can start selecting subjects at school, unfortunately, the evidence is they start selecting away from Maths and Computing and towards other subjects. And as a consequence, I think actually, that ultimately we can try and address some of these issues later on. But ultimately, we have to make sure that the input that flow in to the universities has a greater representation of women. I am actually a scientist in my local girls' school trying to put up, bring robots in and keep girls interested by the fields that they don't select out at too young an age. So there's a lot of parents in schools and many colleagues, a huge amount of the universities trying to support and encourage women throughout every level of their careers.

PROF SARAH BROUGH:

Thank you, Toby. Yanan, I'd love to hear on the Maths side too.

YANAN FAN:

Yes, so there's been lots of things happening in the last few years. As Toby mentioned, there's sort of a leaky pipe issue where we start to lose females at a reasonably young age. I think it probably starts after their PhD and then going on. And there's also very few women at the higher hierarchies of academia. And last year - I think it was last year - we just had three of our very first females being promoted to the professor level, which is an amazing achievement, I think. And across the board, females are being so - people are consciously including women in decision-making processes, so in committees, hiring committees. And that, I really feel, it does make a huge difference. Because as I guess you could see, that men and women are evaluated differently. They're also evaluated differently by women or by women and men that evaluates men and women differently. And I'd just like to give the Athena SWAN group a bit of a plug here. The group at UNSW is trying to increase the female representation at the leadership level. It's working with the university. The university is very, very committed to this. So lots of things are happening across Engineering, as well... in fact, across all disciplines to try to get to that 40% representation at all levels across the university to have male or to at least have 40% women in most roles.

So I'm hopeful.

PROF SARAH BROUGH:

I think that's always the best place to stay. In that position of hope and from there, we can undertake the changes necessary. So with that thought in mind, I'd love to hear from all of you and actually I'm going to Fiona first, what else could Data Science do to help diversity, gender equity?

FIONA KIM:

Yeah, so I think there's two parts, first, before we start using data science to tackle these issues - And I really want to echo the points made earlier from Toby - first, we need to make sure we are at least aware that there is the potential for biases within these algorithms and tools and techniques we're using in this field. So like being aware of possible bias from the programmer's perspective or bias in the data that's being used to train the model, we can actually help make sure that the outcomes of the studies actually have significant impact. And then from there, we can actually use data science to tackle many of the issues faced by society and help add more weight to the argument that

previously in this field could be quite easily or too easily dismissed when purely just looking through a qualitative one.

PROF SARAH BROUGH:

Cool. And from Yanan, I'd love to hear your perspective on this.

YANAN FAN:

I think that there is a lot of... there's actually a lot of data, and I think data, a proper analysis of those data could help in our conversation about gender equity. And I think we need more transparency from governments, from big institutions and grant agencies, for example. They sit on a huge amount of data and they're probably worried about, you know, other things than - there are probably many other things that they are worried about, I guess, in terms of releasing the data. But I think that all those data, if they were made transparent, we could learn a lot about inequality, I guess, from them. And then a lot more people will be looking at these data as well to help analyse them. Because I think that a bias, as Toby says, is not a simple... it's not like you recognise it's there and you can easily do something about it to make it go away. So the first step is to have that conversation and to see to what extent it's a problem. And maybe hopefully, a quantifiable way, because I think people listen to numbers more than they listen to - they tend to listen to numbers, I guess. And then, you know, think about what we could do to move forward and then keeping those records and monitoring progress with the help of data science. Yeah. So and probably I should just add that not yeah - so we've actually done a little experiment with trying to mitigate some of those biases and it's not been easy to do... to have that, to achieve what we hoped to achieve. Because we're really looking at changing people's views. And that's not easy. Or changing people's minds.

PROF SARAH BROUGH:

That is a really difficult problem and kind of obviously, a kind of much slower term solution, changing people's minds. I'm certainly excited by the idea of analysing grant feedback for biases. And I'd love to see those data being opened up for obviously, anonymous analysis. Toby, I'd also love to hear from you on this. What do you think data science, AI could do to help, you know, what would be your next focus to help on that front?

PROF TOBY WALSH:

I think well, actually, all of us are saying is this data science is actually shining a harsh light on things that in many cases trace back to deep societal biases that actually we've been spending the last couple of hundred years trying to address. And AI often puts those questions on steroids. But ultimately, I think it does offer us the potential with work and facing up to all the challenges that we've talked about this morning, it does offer us the potential to end up with a fairer, more just society where everyone, irrespective of their gender or their race or their age, gets a fair chance at these things. And so, whilst there are many, many challenges still to be addressed, actually, I think this is the... these are the tools that will actually help us deal with the subconscious biases and societal biases that have plagued us for decades.

PROF SARAH BROUGH:

That's a really important wrapping up of what we've heard here and a really nice segue now into the Q&A session. So looking over at the published questions, I think we've had a look at the first question of how can we make the algorithms less sexist? And I think that's really consideration of

the data that goes in, the questions that are being asked, and kind of thorough transparency analysis. Although yeah, Toby, what would you like to add? PROF TOBY WALSH: So, I mean, one obvious thing that - and data scientists often do this is that this work, if you don't want to be sexist, don't include gender as one of the inputs. And that's a common trick that people would do. But as we're discovering, that is not adequate. That is not enough just to remove that protect... what we call a protected variable from the input. Certainly, if you include it, then if you're not very careful, you will end up with sexist decisions. But there was a wonderful example last year. Apple released a new trendy credit card. I mean, a big PR disaster when it was discovered that the credit limits it was offering women were much less than men with all things being considered. They hadn't included gender as one of the inputs but it had picked up other clues in the data, in past people's applications that were correlated with gender. And then then because women had traditionally been offered lower credit limits than men in the past when the historical data was trained, it perpetuated those biases. So just... so even a very switched-on company like Apple can make big mistakes like that. And so these are not easy things to fix, just eliminating the variable. And there are lots of other things that are correlated with the protected variable.

PROF SARAH BROUGH:

It's fascinating. Next question. If these surveys have been shown to be biased - in my experience, surveys have been shown to be biased against women and culturally and linguistically diverse people - what ethical implications does that present when they are used in promotions or any kind of performance review? Doesn't this mean they should be scrapped? Yanan, love to hear your take on this.

YANAN FAN:

Oh, that's a hard question. I think to... there's two ways you can look at these surveys. I do see that they have a purpose in keeping the - by and large they do keep us on our toes and try to make us perform better in terms of giving the students the best that we can. So I'm not 100% convinced that these surveys don't do that. But there are obviously issues that as we see that are there. So it may be, I think we are trying to look at different ways of overcoming this bias problem or potential bias problem. And it's not an easy way to solve. It may be that we just... we could just look at rather than, you know, have a benchmark based on the average, which if you only have 30% women in the average, it is going to be dominated by men's behaviour. Then it will be very hard for females to get high...better scores. But maybe we could get to the stage where we maybe would just evaluate women and men differently just because there may be evidence that they are evaluated differently anyway. So that might be a way of solution. But I'm not sure scrapping these surveys completely would be beneficial for students either. But there isn't - Maybe we need a better way to do this. Yeah.

PROF SARAH BROUGH:

I think I would agree with you there that there is value in the surveys and hearing... there is a lot of value in hearing from our students and what they think of the courses. And we get valuable feedback on ways to improve the course that you can't see standing at the metaphorical front. But yeah, considering those biases, I think it's going to be an ongoing and important task to work out how they get included in assessments of efficacy, ability. So moving on to the next question, the

methods used for analysing comments. Have they been shown to be significantly better than traditional, less technological methods such as grounded theory, content analysis or thematic analysis? Now, I'm going to go to Fiona on this one.

FIONA KIM: So with the method selected - it's known as aspect-based sentiment analysis - I haven't directly compared how that technique goes at categorising and determining the sentiment of a comment compared to those traditional methods. One of the key reasons we opted for this method was because of the volume of the data that we had. It's quite large. And we just don't have the resources to actually categorise these sorts of (UNKNOWN) and sort of build this supervised model from it. So we're looking for a more unsupervised technique to explore it. But definitely as part of the robust (UNKNOWN) of this, we're definitely making sure that the categorisations and the sentiments are tailored to a higher education domain. But there's been no direct comparison with these previous methods.

PROF SARAH BROUGH:

Thank you, Fiona. Got a really interesting and important question from Jan Zika. In term two, of the students that dropped out of my course early in the term, a disproportionate number were female. I teach a higher level second year Maths course. So this is of particular concern, especially if the students are dropping out of the advanced stream. How would the panel suggest I explore whether this effect was significant and if so, whether it's a broad COVID issue? Is there more evidence regarding certain groups being more likely to drop out or if it's an issue with the course and how it's taught? Go. I'm happy for anybody to jump in.

YANAN FAN:

Tough question. Yes. So I think that the COVID aspect, the effect of that, maybe it's a psychol...there's psychological, we can see psychological effects coming from COVID, especially since... especially if the lockdown goes on for a long time. It's an interesting issue. And whether that affects male and female students differently, probably, I would... there might be something there. How would you go about looking for why the girls are dropping out?

So if you suspect that that's happening across - yeah, maybe if you have a lot of data from the same course over the years, you could probably look at how many female students are dropping out of the advanced stream and perhaps look at what other factors might have influenced that. And then once you've accounted for all the other potential effects, maybe what's left over would be just it's affecting female students more so. As long as it's not disproportionate. It's not a disproportionate number of girls dropping out then that you could see an effect there. Yeah, it's really interesting to - It's I think it's a really nice idea to have a look at why female students are, you know, they're not being looked after. That we should look after them a bit more.

PROF TOBY WALSH:

It's clear that the pandemic is having a disproportionate impact on the two genders. And there's evidence, not just amongst students, but amongst women in general, that they're bearing the brunt of the pandemic. They tend to have caring roles. They tend to have both the elderly and children.

And that's having a significant effect. And we're gonna have to address that in the years to come because the long-term effects of that are going to be severe.

PROF SARAH BROUGH:

There was some wide nodding on the panel to that one, Toby! Moving on to that, I'm aware that we're running out of time a bit. The next comment is having interviewed hundreds of high-achieving high school students applying for a higher ATAR course, when asked, what was their favourite subject? 90% replied Maths, both male and female applicants. However, I have a ten-year-old boy who does robotics, Rubik's Cube, chess and soccer, and these are already boy-focused at such a young age with few girls participating apart from the soccer. Mums and dads are on the side-lines, cheering their girls on at soccer. It would be great to better educate, support parents, to feel empowered to cheer their girls on in Maths, robotics and chess, etc. I absolutely agree. I have one of those boys who very much meets that criteria and would love to see more girls obsessed, focused on those things as well. I'm going to move just to the last question really quickly and see if we can answer this in one minute. Do researchers have to access to the code algorithm to find a bias? What happens if it's proprietary code? I think, Toby, that might be a good one for you.

PROF TOBY WALSH:

Excellent question. And it is more challenging. And there have been a number of cases where the code has been proprietary and they've refused to release it. And so people like to try and reverse-engineer to work out what the biases are. But you know, these... we end up in legal questions as to whether we're gonna have to regulate that there is more transparency available to the code because it is much harder to do that if you don't actually have access to the data and the code itself.

PROF SARAH BROUGH:

OK, with one minute to go, let me wrap up our event. So we've really now reached the end. I would like to thank you all for joining us virtually. We focused on women and gender in this webinar. But Yanan's research and Fiona's research really points to the importance of intersectionality of culturally and linguistically diverse people, as well as gender being hugely important in these subjects. In Science, we are working hard to try and increase the gender diversity with a level-up promotional support program. Achievement relative to opportunity guidelines allow people to express any difficulties COVID-related. Toby mentioned that they may caring duties that they may have experienced during their period of being assessed for promotion. There's also an important Girls Do the Math Program. And we also have a new UNSW Faculty of Science Data Science Hub that will hopefully, as a new program, really kind of bring much more diversity to the Data Science group. On that Science side, Yanan and I are both involved in that hub. I'd also like to extend a sincere thank you to Fiona Kim, Yanan Fan, and Toby Walsh for sharing their expertise today, as well as the event producers behind the scenes, Andrew Addie, and Mikaela Viray. This presentation has been recorded and will be made public and shared with everyone who's registered for the event. And thank you and have a lovely rest of your first day of Spring. Thank you.