

# ESD Fall Newsletter 2023



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## Welcome

### Message by Rakesh Nagi, Professor and Head of Pillar, ESD

Dear ESD Community,

It is indeed a tremendous honor to join the SUTD/ESD family and serve at the helm as Head of Pillar! I am super excited about the opportunities that lie ahead and how we can collectively take the Pillar higher to its next level of excellence, for/by our students, employers, and all constituencies.

SUTD is a one-of-a-kind institution in the whole world, and it is very alluring to me. I had previously visited in September 2015 as part of a delegation from the University of Illinois, Urbana-Champaign (UIUC), USA. When the opportunity to join SUTD materialized, I couldn't resist being a part of something truly exciting in engineering education and impactful research. I characterize SUTD as a small, elite, student-focused, highly innovative institution that provides a unique blend of coursework with design thinking that is producing the techno-entrepreneurs and leaders of today and tomorrow. SUTD students will propel Singapore (or wherever they choose to work) to an exceptional level by disrupting the state of normal, continuously innovating, and spreading an infectious spirit of innovative excellence.



The excellence in ESD is not by chance – we are tall because we stand on the shoulders of giants. On behalf of all of us at ESD, I would like to express our thanks and gratitude to Associate Professor Lynette Cheah, for her invaluable contributions towards ESD as Acting Head of Pillar last year. Professor Cheah will return to her academic duties of teaching and conducting research in the ESD pillar. Before her, Professor Peter Jackson headed ESD while serving as Director of Aviation Studies Institute (ASI). We also owe him a great deal. The line of previous head and faculty continues and let's thank them for their immense contributions that situates us in a stellar position today.

In this issue of our ESD newsletter, we continue to celebrate our community activities. We feature our ESD curriculum and celebrate the vibrant students' life, faculty, and alumni achievements.

We are pleased to share that we have re-launched our Aviation Systems Specialisation Track in response to the career opportunities in the aviation industry post-COVID-19 pandemic. We now offer four specialisation tracks: Aviation Systems, Business Analytics and Operations Research, Financial Services, and Supply Chain and Logistics. We will also be launching a new course 40.230 Design for Sustainability in support of the new Minor in Sustainability by Design.

I look forward to engaging you and building a thriving, learning community together!

## Mark These Dates

### ESD Info Session (Fall 2023)

20 Sep 2023, Wednesday  
2.30pm to 4pm @ MPH

### Ask ESD / Study Plan Consultation Booth

Sep to Oct 2023  
Outside Canteen

### Chat with ESD Alumni

Sep 2023

### ESD Consultation on GEXP-Minor

Oct 2023

### Welcome Event 2024

Jan 2024

# ESD Programmes

## Undergraduate Term 4 Core Subjects



Prof. Ying Xu

### 40.011 Data and Business Analytics

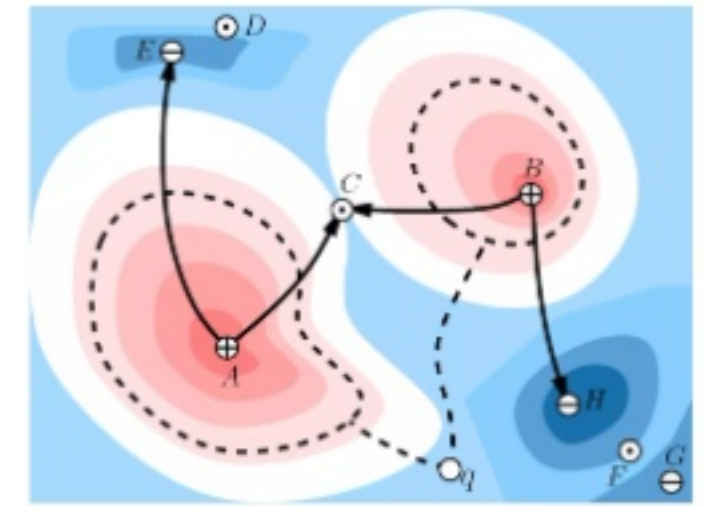
The course stands out for its emphasis on hands-on experience, requiring all students to engage in a team-based, semester-long project for an external client. By connecting students with industrial clients and exposing them to consulting projects during their second year, the course offers valuable insights into real-world business scenarios. In the course, students will focus on learning and applying data and business analytics skills to identify opportunities for business improvement and estimate their value to clients. Students also gain proficiency in applying data analysis techniques to practical challenges and develop essential soft skills, such as team coordination, time management, expectation management, and client-facing techniques. These skills play a crucial role in preparing students for their future studies, internships, and long-term careers, laying a strong foundation for their professional success.



Prof. Antonios Varvitsiotis

### 40.002 Optimisation

How can we find the ideal asset allocation to maximize future returns? What is the most cost-efficient approach to deliver parcels while considering customer availability? In this class, you will embark on an exciting journey to master the science of optimization—a powerful toolbox that enables you to discover the best solutions within given constraints. Whether your interests lie in finance, business operations, or any field involving informed decision-making, this course equips you with essential skills to tackle complex problems head-on. Get ready to unlock the full potential of optimization and elevate your decision-making capabilities to new heights!

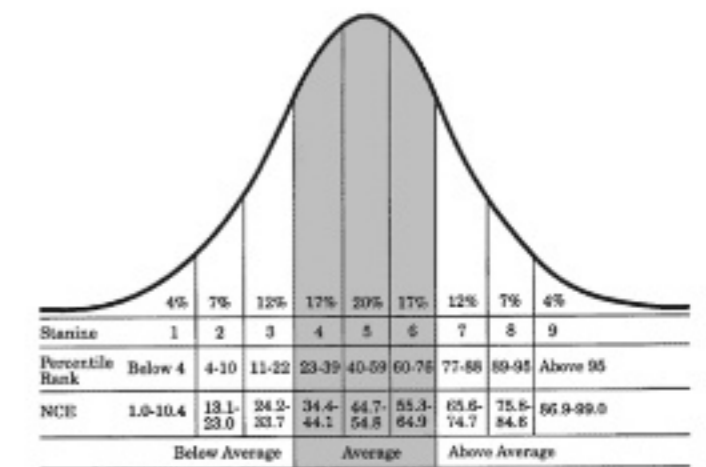


Dr. James Wan

### 40.017 Probability and Statistics

In this course, we will answer questions such as:

- Is GPA correlated with salary, and is salary correlated with job or life satisfaction?
- Is it likely that there are 3 students in the incoming ESD batch who share the same birthday?
- To conduct an opinion poll to accurately predict the US election results, how many respondents do you need?
- If vaccinated people can still get sick, then how can we conclusively know whether a vaccine is effective?
- By simply staring at a company's ledger, is it possible to detect accounting fraud?
- Are games of chance, such as lottery or random events in computer games, truly random?
- Is weather prediction for Singapore better than random guessing?



If you find any of the above questions interesting, then ESD is definitely the right pillar for you.

## Relaunch of Aviation Systems Specialisation Track



Prof. Nuno Riberio, Aviation Systems Specialisation Track Lead

As the aviation industry bounces back from the unparalleled challenges of the COVID-19 pandemic, we find ourselves once again confronted by the persistent issues of delays and congestion that hinder efficient operations. Alongside these long-standing problems, we now face new pressing challenges propelled by the global climate crisis. It is imperative that we construct a sustainable future, one in which aviation systems prioritize environmental responsibility. Therefore, we are thrilled to reintroduce our **Aviation Systems specialisation track**, designed to equip students with the necessary expertise to design, analyze and optimize aviation systems that are not only highly efficient but also environmentally conscious. Join us as we prepare the next generation of aviation professionals to forge a path towards a sustainable and resilient aviation industry.



### New ESD Undergraduate Course Offered in Spring 2024

In support of the new minor in Sustainability by Design, ESD will be launching a new course 40.230 Design for Sustainability in Spring 2024.

[MORE DETAILS HERE](#)

## ESD Project Showcases 2023



The **40.011 Data and Business Analytics (DBA)** course is our flagship offering in our client-facing curriculum. This course provides our students with an exceptional opportunity to directly engage with industry players and business owners from diverse sectors, tackling real-life business scenarios.

In April 2023, we successfully hosted our physical DBA project showcase. Our Term 4 students collaborated on 17 industry projects, sponsored by 15 distinct companies. We extend our heartfelt gratitude to the following organizations for their invaluable support: BASF Southeast Asia, Buddha Tooth Relic Temple Singapore, Changi Airport Group, Health Promotion Board, Infineon Technologies Asia Pacific, International SOS, Lam Hong Renewables, Rockwell Collins Southeast Asia, SGP Foods, SHINGDA Trading, Supermec, The Right Move Singapore, TSH Group, Vaisala and Aviation Studies Institute, YHS (Singapore). Their involvement has enriched the learning experience of our students and provided them with real-world insights and challenges.



## 2D PROJECT SHOWCASE 2023

**ESD Term 5 students** are challenged to create online educational games using the programming and system design skills they learned in **40.014 Engineering Systems Architecture** to solve problems in **40.012 Manufacturing and Service Operations**

**AUG 07 Monday** **1pm to 4pm**

**Campus Centre Level 2**

Our Term 5 students were required to complete a 2D project which is a marriage of our core courses in **40.012 Manufacturing and Service Operations** and **40.014 Engineering Systems Architecture**. We challenged our students to create online educational games to engage future students in the problems of designing and operating manufacturing and service systems. Our students rose to the challenge, tackling problems such as movie theatre scheduling, perishable inventory management, vehicle routing, and more. All the problems were motivated by human need and, in many cases, by social concerns such as blood bank supply, solar power usage, and frivolous emergency calls. They applied a formal design process from storyboarding to rapid prototyping and mastered project management skills. A total of 20 teams displayed their entertaining games and project videos at the showcase. It was exciting to see the outburst of creativity and accomplishment at this milestone event.



## ESD Graduate Programme

The **ESD Graduate Programme** aims to produce the next generation of leading engineering systems researchers and thinkers. It provides students with a strong technical foundation and puts an emphasis on interdisciplinary and collaborative research. The programme hosts a healthy mix of students from Singapore and abroad pursuing Master's (by research) and PhD degrees on topics in analytics, data science, decision science, optimisation, operations research, operations management and their various applications in economics, finance, information systems, networks, supply chains, transportation and more.



*I was admitted as a PhD student in ESD in September 2020 and later a NUS-SUTD joint PhD student from August 2021. My time as a PhD student in ESD has been really enjoyable. I've had the opportunity to work with my excellent advisors, learn new things, and do research into the problems that I've spent years thinking about. In the past 3 years, I was given the time and freedom to explore the things that interested me and got help, support and encourage from all my advisors whenever I met difficulties. The ESD Graduate Programme also equipped me with a strong technical foundation through its core courses. Moreover, the program places a strong emphasis on inter-disciplinary and collaborative research, allowing me to engage in exciting interdisciplinary endeavors. Being part of such a program is a wonderful experience.*

**Ruan Yanqiu, ESD PhD Student**

## Student Life

### Why Students Choose ESD?



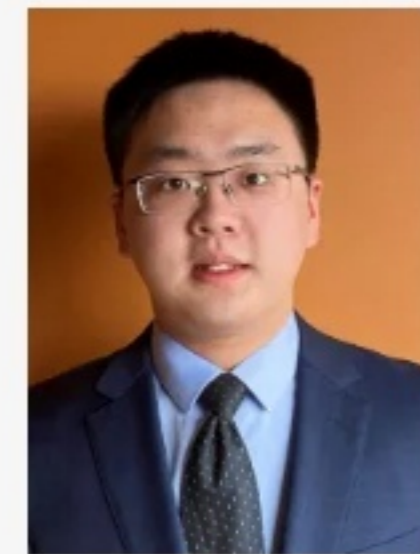
*Generally, I like optimisation and problem solving is something that fascinates me. I joined ESD because I like how the different specialisation tracks allowed us to work with different industries and we are able to provide more efficient solutions through analysis and optimization.*

**Chloe Ong, ESD Senior**



*Everything can always improve, and I think businesses are always looking for people who can improve their business, and they are never going to stop wanting to improve. So, joining ESD is a stepping-stone into a career where I know I will be wanted.*

**Lim Azib Bin Adam, ESD Senior**



*I love math and coding, and ESD allows me to apply both of these subjects, on both the theoretical and applicational fronts. The career prospects for graduates of this major are also very flexible – we can explore industries like machine learning, AI, data engineering and analysis, supply chain, finance; the list goes on.*

**Feng Zhuoer, ESD Senior**

### Dialogue Sessions with Head of Pillar



ESD students are engaged in closed-door dialogue sessions with our Head of Pillar in every pillar term. At these sessions, students are welcome to share their thoughts, and provide feedback about ESD curriculum, course instructors, and administrative support. They can also suggest innovative ideas to enhance their learning journey at ESD. The conversion of System Design Studio to a student learning space was just one such example. So, do look out for email notifications and don't miss these opportunities!

### Student-led Team Bonding Activity

The student team bonding activity, held in May 2023, provided an opportunity for ESD juniors and sophomores to get to know each other better and form stronger bonds over dinner and a series of engaging activities such as board games, ESD-themed challenges, and trivia plan.



## Students' Achievements

### Youth Action Challenge Season 4 (Oct 2022 – Feb 2023)

A group of SUTD students, Tan Zen Sheen (ESD), Claudia Lai (DAI), Tan Shu Yi (ESD), Reina Peh (ESD) and Darren Chow (EPD) joined the Youth Action Challenge Season 4 (Oct 2022 – Feb 2023). Their project Silver Online Service (under the Support for the Vulnerable Groups theme) was awarded a total grant of S\$11,000. [Read more here.](#)



*Participating in the challenge was an incredible experience for our team. It gave us the opportunity to develop an innovative solution to address a pressing societal issue, and the mentorship and guidance we received from industry professionals greatly enhanced the quality of our proposal. Our solution won us the grant award, allowing us to further advance our project in prototype development, outreach, marketing, and volunteer recruitment. We are excited to make a real difference in the lives of elderly in Singapore, and we are proud to be part of the movement towards a more inclusive society.*

*Our key takeaways were the importance of empathy, collaboration, and perseverance. We encourage young people to identify social issues, think outside the box, seek guidance from mentors, and have confidence in their capacity to make a difference.*

**Tan Shu Yi, ESD Senior**

### Accenture University Innovation Challenge 2023 Finalists



A group of SUTD students, Justin Wong (ESD), Emily Chee (ESD), Tee Yue Wan (ESD), Ng Qiao Wen (ESD), and Ng Xue Min (EPD) joined the Accenture innovation challenge in January 2023. The problem statement was "How might we help the travel and hospitality industry reduce carbon emissions". The challenge spanned over two weeks, and the team was assigned a mentor, Ishan Girdhar who patiently gave them insightful feedback and prepared them for the final presentation/pitching to the judges. The team emerged as one of the finalists out of six groups. Through this event, the students gained more exposure to Accenture's culture and networked with many like-minded individuals. All of them had a return offer for Fall Internship 2023 with Accenture.

### Awarded 1st prize for Julius Baer x Tenity Intrapreneurship Program 2023

A group of SUTD students, Chan Wei Jie Ivan (CSD), Kwa Yu Liang (ESD), and Loy Xing Jun (ESD), participated in an intrapreneurship challenge for bank Julius Baer and was awarded 1st prize and a 12-month fully paid intrapreneurship program with the company. [Read more here.](#)



*This competition provided me with valuable learning experience and inspired me to think outside the box. I'm truly thankful for my exceptional teammates. Their efforts led us to victory.*

**Loy Xing Jun, ESD Junior**

### Chirag Sivakumar, ESD Senior, awarded Player of the Year award for 2022 by Singapore Cricket Club



### Foo Wenxin, ESD Junior, awarded Gold Medal for Women's Floorball during SEA Games 2023



## Check Out Facilities for ESD Students








Data Analytics Lab



Systems Design Studio

## Explore Other ESD Resources

 <p>Videos on ESD Core Courses</p>	 <p>ESD Specialisation Tracks</p>	 <p>ESD Project Showcases</p>	 <p>ESD Info Booklet</p>	 <p>FAQs</p>
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## Enrichment Programmes

### Global Exchange Programme / Singapore Universities Student Exchange Programme

*My time in Finland and Aalto University has been nothing short of magical! The teaching faculty and facilities are world-class, boasting a vibrant student life. From Orienteering to Sitsits, there has never been a week without some student-organised event. The inclusive environment makes it ideal for learning and simply being ourselves.*

*In Finland, you will never be two steps away from culture, design, nature, and saunas. My promise is that there is something (or everything) that will interest you. Understandably, travelling abroad can sound intimidating. But life is never smooth sailing. So why not take the leap of faith and live the academic experience of a lifetime? After all, Elämä on ihmisen parasta aikaa. ("Life is man's best time.")*


**Leon Puah** (Aalto University, GEXP Fall 2022)



*The GEXP experience at the University of Waterloo was a transformative journey for me, allowing me to embrace diversity, foster lifelong friendships, and pursue academic growth. The university provided a vibrant global community, enriching academic pursuits by bringing together students from diverse cultural backgrounds and various academic interests. Networking on a global scale, I had the chance to connect with incredible minds from different industries, opening opportunities for meaningful outreach and collaboration that would prove invaluable in my future career pursuits.*

*If you're considering embarking on GEXP, take time to plan your study path to align with your academic goals. Embrace all the challenges and opportunities that come your way, as they'll help you grow personally and academically while exploring new cultures and landscapes. Stay open-minded and positive throughout the journey, knowing it will make you a more resilient and culturally aware global citizen. You've got this!*


**Chen Yijia** (Waterloo University, GEXP Fall 2023)



*I had an incredibly positive SUSEP exchange experience that allowed me to broaden my horizons and gain new perspectives. I have taken a few courses under the Data Science and Analytics department at NUS, which allowed me to explore my academic interests in greater depth. I was able to learn from distinguished professors, engage with diverse perspectives, and develop new skills in a challenging environment. Additionally, I had the opportunity to network with other students and faculty members, which helped me to expand my professional network and gain valuable insights into the industry.*

*Being the first student from the ESD pillar to participate in SUSEP, my advice to ESD students who are interested in SUSEP is to be proactive in researching course offerings and to consult with academic advisors to ensure that the credits can be mapped back to their degree requirements. Most importantly, stay open-minded, embrace the differences and diversity, and make the most of this once-in-a-lifetime opportunity to broaden your perspective and build lasting relationships.*

**Tan Shu Yi** (National University of Singapore, SUSEP Spring 2024)



Check out more ESD students' exchange experiences on [#WeAreSUTD](#).

## Undergraduate Research Opportunities Programme

### Feng Zhuoer, ESD Senior, co-authored 2 research papers

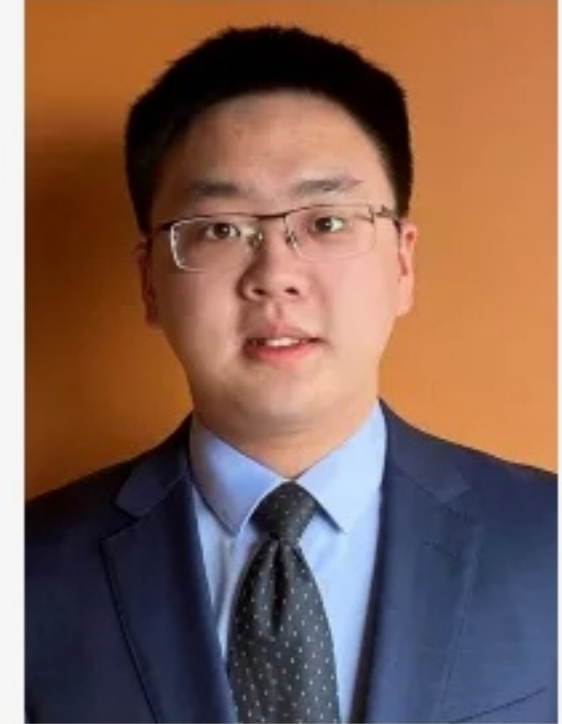
- First and Presenting Author at American Geophysical Union (AGU) Fall Meeting 2022: [Modelling Power Supply and Tracking in the Malay Peninsula to Characterize Malaysia's Transition into a Liberalized Electricity Market](#)
- Co-author for paper: [Cataloguing MoSi<sub>2</sub>N<sub>4</sub> and WSi<sub>2</sub>N<sub>4</sub> van der Waals Heterostructures: An Exceptional Material Platform for Excitonic Solar Cell Applications](#), published in *Advanced Materials Interfaces* 2/2023

*What I have learned in ESD classes was very helpful during my research projects. Besides optimization, skills like simulation modeling and statistics are also crucial. For example, to study the behavior of the power sector when price for natural resources (e.g., coal and gas) changes, we gathered the historical price data, modeled them with a multivariate Gaussian distribution, and created 500 scenarios to compare and analyze the resultant energy share and system cost. Also worth mentioning is that data engineering and analysis is also important for academic research, whether its processing survey data, using econometrics tools, or machine learning, being a good data engineer/analyst will make the research experience much smoother, for which ESD classes are great at.*

*Advice for juniors:*

1. Make the best use of what you have, such as our friendly SUTD professors :)
2. Find out what you are interested in, explore by participating in UROP projects
3. Polish your math and data skills

**Feng Zhouer, ESD Senior**



## Undergraduate Teaching Opportunities Programme

### Gabriel Yong, ESD Senior, served as Undergraduate Teaching Assistant for 40.014 Engineering Systems Architecture, 40.002 Optimisation, 10.018 Modelling Space and Systems

*Being an Undergraduate Teaching Assistant (UTA) has been a very fulfilling experience both in a personal and academic sense. Initially, I recalled Modelling Space and Systems being a tough and challenging module. Thus, I became a UTA in part to help juniors and in part to revise the subject matter. This mindset has led me to take on TA positions in Optimization and Engineering Systems Architecture.*

*I think that being a UTA forces you to open up your perspective. It makes you realise that there is a spectrum of approaches to learning and that no one way is necessarily better. As the term progresses, you realise you have to learn the tendencies of the class and how to communicate the subject better depending on who you are talking to. Some people work better with the abstractness and generality of things, while others might only understand through clear and worked examples. In doing so, with this gained perspective, your understanding of the subject matter improves, and the revisiting of the subject allows for what you learned to become internalized better in the long term.*

*Consider taking up a TA position in SUTD in a module that interests you, I'm sure it'll be a decision that you won't regret!*

**Gabriel Yong, ESD Senior**



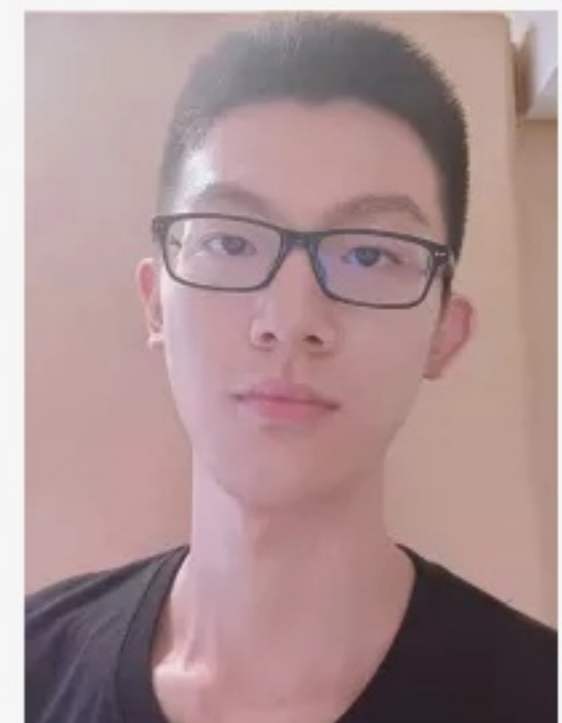
## Internship Programme

### Su Chang, ESD Senior, interned at GlobalFoundries Singapore Pte. Ltd.

*I worked as an intern for the project – "Intern Design Enablement" at GlobalFoundries Singapore. Basically, this is a machine learning project, and it is for predicting the wafer yield condition for the company laboratories. I could use data analysis and machine learning knowledge learnt in ESD for this work. I also learned new technical knowledge and improved my self-learning skill and communication skill.*

*My advice to students who are embarking on internship – always arrive at the workplace early and be hardworking. Do not shy away and ask questions when you are unsure. Most importantly, having a good attitude is key to a successful internship experience!*

**Su Chang, ESD Senior**



## Featured Faculty

Lingjie Duan, Associate Professor and Associate Head of Pillar (Research)

Congratulations to Professor Lingjie Duan for his new appointment as the Associate Head of Pillar (Research), ESD effective January 2023!



It is my esteemed privilege to extend this greeting as the newly appointed Associate Head of Pillar for ESD. In addition to formulating the research strategy and overseeing activities within ESD, I am delighted to contribute to the ongoing advancement of this esteemed department and support our esteemed faculty members, students, and researchers.

ESD boasts an exceptional faculty known for their groundbreaking work in emerging fields such as data science & analytics, machine learning & AI, and operations management & decision science. As one of these distinguished individuals, I specialize in the interdisciplinary realm of network economics, focusing on advancing crucial multi-agent AI theories for 6G and computer network applications. I am honored to have received multiple prestigious awards and recognition, including my inclusion in Stanford University's list of top 2% scientists in 2022. Continuously aiming to push the boundaries of my research domain, I aspire to achieve substantial and practical impact.

Together, through our collective efforts, I aim to foster an open, collaborative, and sustainable research ecosystem that benefits everyone within ESD. For instance, to our undergraduate students, I wholeheartedly support all your educational pursuits, encouraging you to unlock your boundless potential. Remember, education transcends mere grades and examinations. It is a lifelong commitment to nurturing a thirst for knowledge, fostering critical thinking abilities, and embracing curiosity towards captivating research problems. With a plethora of classes, project showcases, academic/industry seminars, and other related activities, let us share and collaborate with open minds, ready to explore novel concepts and expand our intellectual horizons.

## Alumni

### Hear What Our Alumni Say



*The preparation for uncertainties and complexities. Working in a consulting company, we are exposed to new technologies, stakeholders, and industries, therefore, the ability to adapt and excel cross functionally is an important skillset. The ESD coursework has developed this skill early on, through course project dealing with real world problems with industry partners, we are able to deliberate on the best solution based on our interpretation to the problem raised by the client. In addition, throughout the ESD*

*coursework, we are taught to hone our analytical thinking, develop a design process and mathematical knowledge to optimise technical problems. This knowledge has direct impacts as a data practitioner, the ability to back up findings with statistical significance and analytical storytelling is critical to the success of my job as a Data Engineer at Accenture.*

**James Gan, Class of 2021, Senior Analyst – Data Engineer at Accenture**



*Good design is all about systems thinking. To make sure we are not simply pushing pixels, designing for thoughtful interactions and meaningful experiences requires thinking at a broader level about the product construct, and what goals it helps end users achieve. Through the ESD curriculum, I've been trained to adopt a system thinking perspective: seeing product features as interconnected wholes, rather than separate parts. This helps me collaborate with designers to craft research questions, by identifying operational*

*assumptions and potential root causes of usability problems. I am thus able to design research studies to glean the most valuable insights.*

*Additionally, the broad-based learning in ESD helped me build rigour in multiple forms of systems design, making me familiar with technical implications of different design decisions. This helps me contribute to product discussions, such as by flagging out dependencies and edge cases to note. It also helps that ESD projects give us plenty of challenges to push ourselves! I've had to step up to lead projects, liaise with industry partners, and present my thoughts in an accessible way – and I believe it's shaped me to become a more effective advocate of good design in my workplace.*

**Grace Tan, Class of 2021, UX Researcher at Singtel**

### 2022 ESD Employment Statistics

# 89.5%

Overall Employment Rate

# S\$5,046

Mean Gross Monthly Salary