Ministry of Education
SINGAPORE

Science Centre Singapore

Agency for Science, Technology and Research
SINGAPORE

SINGAPORE SCIENCE & ENGINEERING FAIR AND NATIONAL STEM TALENT SEARCH

JOINT AWARDS CEREMONY

2025

PROGRAMME

Date: 29 April 2025, Tuesday
Venue: National Gallery Singapore

TIME	PROGRAMME
2:00PM	**Registration and Arrival of guests**
2:30PM	**Welcome by Master of Ceremony**
2:40PM	**Welcome Address by** **Associate Professor Lim Tit Meng** Fair Director & Co-chairperson, *Singapore Science & Engineering Fair Working Committee (SSEFWC) 2025* Chief Executive, *Science Centre Singapore*
2:50PM	**Address by Guest-of-Honour for NSTS 2025** **Professor Ng Huck Hui** Chief Judge, *National Science Talent Search 2025* Assistant Chief Executive, *Research and Talent Development, A*STAR* Chief Scientific Advisor, *Institute of Molecular and Cell Biology, A*STAR*
3.00PM	**SSEF 2025 Video Highlights** Singapore Science & Engineering Fair 2025 Awards Presentation
3:30PM	**NSTS 2025 Video Highlights**
3:35PM	**National STEM Talent Search 2025 Awards Presentation**
4:00PM	**Tour of Finalists' Exhibition and Tea Reception**
4:30PM	**End of Programme**

CONTENTS

Singapore Science & Engineering Fair (SSEF)

BACKGROUND

The Singapore Science & Engineering Fair (SSEF) is a national competition organised by the Ministry of Education (MOE), Science Centre Singapore, and A*STAR. The fair is open to all secondary and pre-university students between 15 and 19 years of age. Participants submit research projects on science, technology, mathematics and engineering. At the project exhibition in the fair, participants are interviewed by judges from organisations and institutions including local universities, polytechnics and research institutes.

The SSEF is affiliated to the highly prestigious Regeneron International Science and Engineering Fair (Regeneron ISEF), which is regarded as the Olympics of science competitions.

SSEF 2025

2025 marks the 25th anniversary of the Singapore Science and Engineering Fair (SSEF), a Silver Jubilee celebration of scientific excellence and innovation. This milestone year also coincides with SG60, commemorating 60 years of Singapore's independence. SSEF 2025 continues to attract strong participation from young scientists across Singapore, reaffirming the nation's commitment to nurturing STEM talent.

This year, 620 projects (for both Main and Junior Scientists) were registered for SSEF, spanning a wide range of STEM disciplines from over 53 participating schools. In the Main Category, 549 projects were submitted across fields such as Animal Sciences, Environmental Engineering, Robotics and Intelligent Machines, Mathematics, and others. Following rigorous evaluation, 321 projects were shortlisted for Final Judging on March 2025. 110 Main Category awards were presented, comprising:

- 22 Gold Awards
- 36 Silver Awards
- 29 Bronze Awards
- 23 Merit Awards

In the Junior Scientist Category, 71 projects were registered, with 28 projects shortlisted for Final Judging. Among them, 2 projects received Distinction for Project Awards, while 3 projects were awarded Merit for Project Awards. All participants in this category were also eligible for the Junior Scientist Video Contest, where 2 projects received Distinction and 3 received Merit for their engaging and effective communication of scientific concepts.

As part of the Silver Jubilee celebrations and in conjunction with SG60, SSEF 2025 introduced the **STEM for Good!** Contest, a special initiative aimed at inspiring students to explore how STEM can create a positive impact on society and shape the future. Participants were tasked with responding to the following prompt through a one-page infographic submission:

> ***"Identify a future problem or challenge that could arise in 10 – 20 years' time in Singapore and explain how STEM can be applied to solve the problem, along with how the proposed solution can benefit Singapore and/or humanity."***

The contest encouraged students to Be Curious, Be Creative, and Be the Change, fostering critical, adaptive, and inventive thinking while developing their communication skills.

A total of 516 submissions were received, with 113 from primary students (from 31 primary schools) and 403 from secondary and pre-university students (from 56 secondary schools and 15 JC/Pre-U schools). The top three winning entries in each category were recognised for their originality, clarity, and potential real-world impact.

Recognising Excellence in STEM Research

This year, 11 organizations contributed to the recognition of outstanding projects. Sponsors of Special Awards include Amgen, Institute of Chemical Engineers Singapore (IChemE), James Dyson Foundation (JDF), L'Oréal Groupé, NUS Chemistry, Singapore Association for the Advancement of Science (SAAS), Singapore Mathematical Society (SMS), Singapore Society for Microbiology and Biotechnology (SSMB), Singapore University of Technology and Design (SUTD), The Electrochemical Society (Singapore Chapter) (ECS), and Maritime and Port Authority of Singapore (MPA). A total of 65 Special Awards were presented to projects that demonstrated exceptional innovation and research impact.

With the continued support of educators, research mentors, industry partners, and the scientific community, SSEF 2025 serves as a launchpad for future innovators. As we celebrate 25 years of scientific excellence, we look forward to seeing how the next generation of scientists and engineers will harness STEM to solve global challenges and shape a better future for Singapore and beyond.

FOREWORD

2025 is a landmark year for the Singapore Science and Engineering Fair (SSEF) as we celebrate 25 years of scientific excellence of our students, alongside Singapore's 60th year of independence (SG60). This year's SSEF25-SG60 twin commemoration is a testament to Singapore's commitment to STEM education, honouring the past, celebrating the present, and envisioning the future.

SSEF has always been more than just a competition — it is a platform for students to contribute to society through research and innovation, allowing them to connect with peers, educators, industry partners, and the public through science communication. The Silver Jubilee celebration in 2025 aligns with SG60's key themes, reflecting Singapore's STEM education journey while inspiring a shared vision for the future—one where science, technology, and engineering empower individuals and communities.

Mr. Teo Kok Hong
Chairperson, *Singapore Science & Engineering Fair Working Committee (SSEFWC) 2025*
Director, *Sciences Branch, Curriculum Planning and Development Division, Ministry of Education*

Honouring the Past

As we celebrate 25 years of SSEF, we pay tribute to our past achievements and milestones through an Exhibition Wall, showcasing key breakthroughs and impactful projects from past participants. We also take this opportunity to honour our long-serving teacher coordinators, judges, and partners, whose dedication has been instrumental in nurturing generations of young scientists. Their contributions have laid the foundation for the continued success of SSEF, and we are deeply grateful for their commitment to STEM education.

Celebrating the Present

SSEF 2025 saw a strong participation of 1464 students from 53 schools, submitting 620 projects for the Main Category and Junior Scientist categories. After rigorous evaluation, 349 projects were shortlisted for Final Judging, leading to the presentation of 22 Gold, 36 Silver, 29 Bronze, and 23 Merit Awards for the Main Category and 2 Distinction and 3 Merit prizes for the Junior Scientist Project Award. These efforts were celebrated during the Awards Parade and Ceremony, where we announced Singapore's delegates for the International Science and Engineering Fair (ISEF), providing them with an opportunity to showcase their research on a global stage. We are not after numbers. We celebrate the growing enthusiasm for STEM among students and reaffirm SSEF's role in nurturing future scientists, engineers, and innovators.

Looking to the Future

Beyond celebrating achievements, SSEF 2025 also aims to inspire the next generation of scientists and innovators. Several key initiatives introduced this year encourage students to envision how STEM can be applied to solve future challenges:

- The STEM for Good! Contest — a signature event of SSEF25 and SG60 — challenged upper primary to pre-university students to identify a future problem that Singapore might face in the next 10–20 years and propose a STEM-based solution to address it in a 1-page infographic. A total of 516 submissions were received, with 113 from primary students and 403 from secondary and pre-university students. Winning entries from each educational category (upper primary, lower secondary, upper secondary, and pre-university) reflect the innovative thinking and problem-solving skills of our young scientists.
- An Interactive Aspiration Wall, powered by Trinax's social wall technology, allows students and the public to digitally share their reflections on Singapore's STEM journey and aspirations for the future. This dynamic platform fosters a sense of collective purpose, innovation and forward-thinking.

SSEF Public Day & STEM Talks

This year's SSEF Public Day, held on 12 March 2025 at the Singapore Expo Convention Centre, brought STEM to life for students and the public. The event provided a platform for students to showcase their innovative STEM research projects to local scientists, industry experts, and the wider community. Leading organisations in Singapore's STEM ecosystem also highlighted the importance of STEM careers in shaping Singapore's future.

Participants engaged in sharing sessions by SSEF finalists, hands-on activities, and interactive exhibits by Altimate Nutrition, Agency for Science, Technology and Research (A*STAR), Crunch Cutlery, CTRL+SHIFT, DSO National Laboratories, Defence Science and Technology Agency (DSTA), Home Team Science and Technology Agency (HTX) , Maritime and Port Authority of Singapore (MPA), National Quantum Office (NQO), Land Transport Authority (LTA), Space Faculty, Singapore Land Authority (SLA), Temasek Life Laboratories and Trinax. Through these activities, attendees gained first-hand insights into how STEM drives innovation, solves real-world challenges, and creates new career opportunities.

To further inspire young minds, STEM Talks were held online on 26 and 28 February 2025, featuring expert speakers from A*STAR, DSO, DSTA, and HTX. These sessions provided firsthand insights into STEM professions, covering topics such as precision human gene editing, development of autonomous systems and Unmanned Aerial Vehicle (UAV) technology. Such engagements are invaluable in encouraging students to pursue careers in STEM and contribute to Singapore's scientific and technological development. These talks were also recorded and uploaded onto the SSEF website, ensuring broader accessibility for students and educators.

Acknowledgments and Looking Ahead

The success of SSEF 2025 would not have been possible without the dedication of our STEM community. I extend my deepest appreciation to our teachers, research mentors, and judges, whose guidance had been instrumental in shaping our students' research journeys. My heartfelt thanks also go to our sponsor organisations for Special Awards and partner institutions, whose support made the milestone SSEF25 possible. The Special Awards and partner organisations are IChemE, JDF, L'Oréal Groupé, NUS Chemistry, SAAS, SMS, SSMB, SUTD, ECS, MPA, A*STAR, Altimate Nutrition, Crunch Cutlery, CTRL+SHIFT, DSO, DSTA, HTX, NQO, LTA, Space Faculty, SLA, TLL and Trinax. My deepest gratitude also goes to our longstanding co-organisers, Science Centre Singapore and A*STAR, for their dedication to ensure an enriched STEM learning experience for our students.

Shaping the Future Through STEM

Looking at the innovative projects and bold ideas presented this year, I am reminded of the immense potential that lies within our youth. Science and innovation have always been the driving forces behind progress, and it is their curiosity, creativity, and determination to challenge the status quo that will propel Singapore into the future.

> ***"Innovation starts with a single question. What if? How can we do this better? I encourage every participant to continue asking these questions, to never stop learning, and to push the boundaries of what is possible. The future belongs to those who dare to create it."***

As we conclude this special Silver Jubilee edition of SSEF, let us continue to Be Curious, Be Creative, and Be a positive agent of Change. Looking ahead to SSEF 2026, we are excited to further expand opportunities for young scientists, deepen industry collaborations, and strengthen STEM education. With rapid advancements in fields such as artificial intelligence, biomedical sciences, sustainability, and space technology, we hope to inspire even more students to push the boundaries of knowledge and innovation. I look forward to witnessing how our young scientists will rise to new challenges and shape the next chapter of Singapore's STEM journey.

Mr. Teo Kok Hong
Chairperson, *Singapore Science & Engineering Fair Working Committee (SSEFWC) 2025*
Director, *Sciences Branch, Curriculum Planning and Development Division, Ministry of Education*

FOREWORD

This year marks the 25th anniversary of the Singapore Science & Engineering Fair (SSEF), a distinguished platform created by the Ministry of Education (MOE), Science Centre Singapore (SCS) and Agency for Science, Technology and Research (A*STAR). Reaching this Silver Jubilee is a testament to SSEF's enduring impact in nurturing young scientific talent and fostering innovation. SSEF celebrates the passion of our budding scientists and engineers by giving them the opportunity to present their inspiring ideas to industry experts. The winners will have the privilege to represent Singapore at the prestigious International Science and Engineering Fair (ISEF), considered the Olympics of science competitions.

Top candidates from SSEF 2025 with outstanding research projects will have the opportunity to advance to the National STEM Talent Search (NSTS), an annual competition that celebrates excellence in STEM and inspires students to push the boundaries of innovation. Their work will be assessed by a distinguished panel of judges, led by Professor Phoon Kok Kwang, President of the Singapore University of Technology and Design (SUTD), alongside Chief Judge Professor Ng Huck Hui, Assistant Chief Executive, Research and Talent Development, A*STAR.

Associate Professor Lim Tit Meng
Fair Director & Co-chairperson, *Singapore Science Engineering Fair Working Committee 2025*
Chief Exeecutive, *Science Centre Board Singapore*

SSEF and NSTS give young minds the chance to bring their ideas to life, working alongside professional mentors to refine their research. Through these experiences, they gain invaluable insights and discover the excitement of a future in STEM.

Over 1000 students from Singapore submitted 610 research projects this year. Of these, x projects were submitted for NSTS 2025 to compete for the finalist positions. I am deeply encouraged by the students' passion and dedication and can't wait to see their projects that will be showcased at the awards ceremony on 29 April.

My sincere gratitude to all judges, mentors, trainers, teachers, parents and officials involved in this meaningful journey. On behalf of the Centre, I extend my heartfelt appreciation to MOE, A*STAR, our sponsors and partners for their invaluable support. Through this collaboration, we remain committed to shaping the next generation of scientists and innovators.

Associate Professor Lim Tit Meng
Fair Director & Co-chairperson, *Singapore Science Engineering Fair Working Committee 2025*
Chief Executive, *Science Centre Board Singapore*

SSEF 2025 WINNERS

GOLD

Teo Shen Han
RIVER VALLEY HIGH SCHOOL
Birds of a Feather: Plumage Colour Analysis for Subspecies Assessment of Locally-Threatened Songbirds

Glenda Lim Yu Xuan, Ashmi Chatterjee, Kim Jisoo
RAFFLES INSTITUTION
Development of 3D-Printed Millifluidic Bioreactor for the Fabrication of Personalised Gum (Gingival) Tissue Grafts

Mai Shia Glenys Khor
RAFFLES INSTITUTION
High-throughput Transcriptome Profiling of Angiosarcoma for Discovery of Novel Gene Expression Signature associated with Chemoresistance

Lee Chong Jin, Ian
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Spike protein of SARS-CoV-2 kills cells by targeting fumarase

Kiera Shandhiri Lim Tao Jing
RAFFLES INSTITUTION
Alien: Covenant - Cytoneme Biology of Polyaneuploid Cancer Cells To Confer Chemotherapy Resistance

Aaron Jacob
VICTORIA JUNIOR COLLEGE
Development of a novel diagnostic tool for antibody responses to vaccines

Septimus Chui Jun Hong, Ngiam Lihong, Mukherjee Maharshi
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
DeepHepatoScope: An AI-Powered Interactive Toolkit for Cell Type Annotation and Spatial Analysis of Hepatocellular Carcinoma RNA-Seq Data

Shen Yufan, Sabriel Chin Jing Ting, Krystal Lee Si Xuan
NATIONAL JUNIOR COLLEGE
Flexible Capacitive Touch Sensor using Kirigami-inspired Transparent Film Design

Rameshkumar Dhanvine
TEMASEK JUNIOR COLLEGE
Generative AI for Optical Metasurface Lenses: Optimizing Light Manipulation through a Fully AI-Driven Design Framework

SSEF 2025 WINNERS

GOLD

Koh Shan Jun, Lim Eng Joo, Sarah Oh
RAFFLES INSTITUTION
ECOBounce (Energy-Efficient, Clean, Optimised) Trampoline Energy Generator

Chen Tingyu, Alvin Liu En Yu, Lemuel Tan
HWA CHONG INSTITUTION
Advanced Photoluminescence Imaging for Tandem Solar Cells (APITSC)

Timothy Goh Zhi Bin, Poh Hong Wee, Louis (Fu Hongwei), Zachary Chia Min
HWA CHONG INSTITUTION
Hexagonal Flow Free

Toh Shiong Enn, Sean, Raphael Teng Zhi Xiang, Yang Zi Yan
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Analyzing Convex Plane Curves with Support Function

Ying Liqian
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Make24: Elegant Elementary Bounds for a Numbers Game

Zeaus Koh Jin Rui
HWA CHONG INSTITUTION
Novel thermostable phage-nanoparticles delivered by hydrogel: Small but mighty weapons against multi-drug resistant Staphylococcus aureus

Hilda Seah Kai Hui, Lau Linn-I, Lee Jin Yuan
HWA CHONG INSTITUTION
3D Printing Sustainable and Self-Healing Wearable Electronics from Green Materials

Ang Shi Qi Georia
HWA CHONG INSTITUTION
LuminaSand: Harnessing the Optical Potential of Silicon Dioxide with Focused Laser Beam

Li Xinyang
HWA CHONG INSTITUTION
Molecular Multilayers Studied by Two-beam precision Ellipsometry

Felicia Tan Ee Shan, Amy Low Li Ying
RAFFLES INSTITUTION
Hear Me Out (& Think): MAESTRO, a Multimodal Agentic model with Efficient, Synergistic Text-Reasoning Optimisation framework

SSEF 2025 WINNERS

GOLD

Tan Min Sen, Zachary Choy Kit Chun
RAFFLES INSTITUTION
Think Outside the Bot: Automating Evaluation of Creativity in LLMs for Physical Reasoning with Semantic Entropy and Efficient Multi-Agent Judge

Wang Zerui, Kwok Xin Ze Vincent
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
LiDRNet: A Lightweight Inertial Dead Reckoning Network

Yeo Hui Yu, Wang Yunxi, He Zihan
RAFFLES INSTITUTION
Beyond the Usual Suspects: Identifying Causal Variants Underlying Neuropathic Pain Outside of the SCN genes

SILVER

Quek Tian Yin Esther
RAFFLES INSTITUTION
Co-culture of C2C12 muscle and 3T3-L1 fat cells for realistic cultured meat

Jessyn Oh Jia Xin, Amelia Tay Juey Oon, Luo Xindi
RAFFLES GIRLS' SCHOOL (SECONDARY)
Posture Detection for Geriatric Physiotherapy Application

Hsiao Li Chia, Anthea Neo Rui En
HWA CHONG INSTITUTION
Organ-on-chip technologies to study vascular dysfunction in cardiometabolic diseases

Michelle Khoo Hui Sin, Chieu Le Xuan, Soh Ping Lynn
RAFFLES GIRLS' SCHOOL (SECONDARY)
Posture Detection for Physiotherapy Application

Tiu Kai Qi, Xu Ruiqi, Han Rui En, Raeann
HWA CHONG INSTITUTION
Enhancing ACL Rehabilitation: Integrated Motivational Dynamics with Multimodal Gamified Feedback and Cognitive Behavioral Mechanisms

Wu Cheng Sheng, Ethan Wong
HWA CHONG INSTITUTION
Hollow Shells to Solid Bones: Sustainable 3D-Printed Bioactive HA & β-TCP Scaffolds for Enhanced Bone Regeneration

SSEF 2025 WINNERS

SILVER

Low Jayleigh, Phua Li Wen Collette
DUNMAN HIGH SCHOOL
Acetylcholinesterase-based detection of Malathion: A review of optimum analytical conditions

Huang Ziyan, Ma Yicheng Ethan, Zhuo Yue
HWA CHONG INSTITUTION
Investigating the Role of Neutrophils and Macrophages in Bronchopulmonary Dysplasia Using Mouse Models

Chng Yun Jing Crystal
HWA CHONG INSTITUTION
Ambulatory blood pressure control and Cognition in patients with Obstructive Sleep Apnea

Lee Sio Huang, Clara Tong Rui Sze, Kate Isabelle Ong
RAFFLES GIRLS' SCHOOL (SECONDARY)
Stereocontrolled Synthesis of Functional Cavitands

Fu Cai Gui, Li Jiayou
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE
Development of a Novel Portable Reactor for Hydrogen Production Using Gallium and Upcycled Aluminium with Spent Coffee Grounds and Tea Leaves in Seawater

Wang Chen, Possaweekrish Wipasstharitsakul, Liang Yihang
HWA CHONG INSTITUTION
Innovative Strategies for Emotion Regulation: Integrating BCI and System Dynamics

Guo Yatian, Rayner Ng Zheng Hao, Tan Yan Zuo
TEMASEK JUNIOR COLLEGE
Walkable Southeast Asia: A Comparative Study Between Phnom Penh and Ho Chi Minh City

Chua Wenzheng Frederic (Cai Wenzheng), Ng Yu Heng
HWA CHONG INSTITUTION
Synthesising and Comparing the Microplastic Degradation Efficiencies of Magnetically Removable Bismuth Based Microswimmers

Teo Xin Hui Joyce, Tan Ig Jer Kenji, Chan Zhang Hong Kasper
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE
Glued to Sustainability with ur-DAd (used and recycled Diaper based Adhesive)

SSEF 2025 WINNERS

SILVER

Nicholas Koh
RAFFLES INSTITUTION
Design and Fabrication of Low-Profile Low Cost 3D Printed Risley Prism in The X-Band

Ma Weiyi, Onn Qi Huan
DUNMAN HIGH SCHOOL
Adjoint Optimisation of Multi-Angle Achromatic Metalenses

Mahith Manesh, Nevin Shi En Yu
NATIONAL JUNIOR COLLEGE
Novel Synthesis and Doping of MoS_2/MIL-53 (Fe) Composite for Hydrogen Generation and Storage

Kabir Srivastav
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Paper Folding: Extensions of Gallivan's Formula

Caelen Chang Kai Mun, Ethan Kong Lye Kit
HWA CHONG INSTITUTION
Development Of A Novel Method For Synthesizing Pectin Hydrogels

Nainika Gupta
RAFFLES INSTITUTION
Riceballs: Multi-purposed Sustainable Carbon-Silica Composites Synthesised from Laser-Annealed Rice Husk Ash

Ang Chee Wei
NANYANG JUNIOR COLLEGE
A Stretchable and Conductive PAN-Ag Material for Soft Electronic Applications

Tan Yu Ning
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE
3-in-1 Functionalities of Recycled Polystyrene for Safer Pedestrian Walkways

Joseph Edwin Selvakumar Joy Merwin, Chew An-yuan Christopher, Loh Yong Wei Bryan
ANGLO-CHINESE SCHOOL (INDEPENDENT)
LumiTENG: A Novel Self-Powered Mechanoluminescent TriboElectric NanoGenerator for Dynamic Multidirectional Pressure and Strain Sensing

SSEF 2025 WINNERS

SILVER

Joshua Lee Kai Shen, Joshua Lew Yi Le, Siew Bok Chong
RAFFLES INSTITUTION
Investigating the Hyperuniform State by the Scaling of Structure Factor in Spinodal Decomposition

Tan Teng Fong Christopher
RAFFLES INSTITUTION
Anisotropic Elastohydrodynamics of Paper due to Moisture Absorption

Huang Haoyang, Lin Jiarui, Lee Jing Kitt Jae
RAFFLES INSTITUTION
Magneto-Impedance Spectrometer for Rotating Magnetic Nanoparticles

Zafyra Keinastya Syahdeni, Jayian Tan Rui Sheng
NATIONAL JUNIOR COLLEGE
Investigating Optimum Condition for Spirodela Polyrhiza to Yield Highest Nutrient Content

Chng Qian Hui
RIVER VALLEY HIGH SCHOOL
Characterising root architecture responses to phosphate deficiency in Arabidopsis

Tricia Tan Hui Xin
RAFFLES INSTITUTION
Urban Glow: Investigating Leaf Fluorescence under the Stress of City Life

Teo Yi Kai, Kelly Kwek Yi Yi
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Harnessing non-destructive eDNA detection methods for understanding plant-pollinator relationships

Kezmond Lee Jun Yaw
ANGLO-CHINESE SCHOOL (INDEPENDENT)
Assessing the Allelopathic Effects of Lemongrass (Cymbopogon Citratus) Extract on the Germination and Post-Germination Growth of Mung Bean (Vigna Radiata) Seeds

Zhao Jianzhi
HWA CHONG INSTITUTION
AI+Robot: Intelligent Robot for Smart Cities and Smart Homes with Deep Learning and Sensor Fusion

SSEF 2025 WINNERS

SILVER

Wang Jiayu, Ding Chenghao
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
An Observation is Worth 4 Words: Image Patching for Efficient Subgoal Navigation in Partially Observable Environments

Wu Tongyu Belinda
DUNMAN HIGH SCHOOL
From Pixels to Profile: Automated Multi-View 3D Head and Neck Reconstruction for Remote Medical Diagnostics from Selfie Images

Pranjal Dasghosh
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Sharing is all you need: Novel Orientation-Sharing Algorithm for Enhanced Image Reconstruction in Single-Particle Imaging

BRONZE

Jiang Yuzhen, Kaitlyn Teong Hui Sian
RAFFLES INSTITUTION
Antibacterial Cu-Coated Bone Scaffolds to Reduce Risks of Implant Failure

Tan Tai Chuen Gareth
HWA CHONG INSTITUTION
Biological and Physical Characterisation of a Chitosan hydrogel for healing pressure sores

Tan Hao En Jayden, Wang Yaoda
HWA CHONG INSTITUTION
Investigating the properties of magnetised biochar derived from Pandanus Amaryllifolius

Sureshkumar Harini Sree, Joycelyn Eudora Jerome Jude Arokiaraj
METHODIST GIRLS' SCHOOL (SECONDARY)
Enhancing Transdermal Delivery of Hydrophobic Actives with Lipid-Based Nanocarriers

Chen You'An
RAFFLES INSTITUTION
High Throughput Experimentation for Multi-Factor Optimisation of Pharmaceutically Relevant Site-selective Suzuki-Miyaura Couplings

SSEF 2025 WINNERS

BRONZE

Tan En Ting Lauren
RAFFLES INSTITUTION
From Protein to Promise: Design of Stapled Peptides to Disrupt the KEAP1-NRF2 Protein-Protein Interaction

Elijah Chew Ze Feng
RAFFLES INSTITUTION
Forever chemicals then and now: Comparative toxicity assessment of emerging versus legacy PFAS on Synechocystis growth

Koh Rui Xin Kiera, Amanda Teng, Joella Renae Long
NANYANG JUNIOR COLLEGE, EUNOIA JUNIOR COLLEGE
Pond Water Analysis using Precision Ellipsometry

Dylan Gan Kai Jie, Sng Josh, Tan Yong Tat
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Biofluorescence of Mussel Shells and its Applications in Water Purification

Soh Jung Xuan, Brendon Han Wei Ding
DUNMAN HIGH SCHOOL
Meta-gramAI: Paving the Future for Holographic Metalens Design with AI Optimisation

Rebecca Sim Zhi Ning
RAFFLES INSTITUTION
Optimisation of continuous development from FlatSat to 3D CubeSat – a novel Over-The-Air (OTA) Solution

Wong Luo Wen, Yang Moshi, Kiefer Owen Tanya Young
RAFFLES INSTITUTION
Seawalls with Retrofitted Rock Pools to Mitigate Wave Overtopping and Seabed Scouring

Wu Yutong
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Student Developed Nanosatellite and its Integration

Derrick Lukimin, Tey Yi Xiang, Fan Wendi
HWA CHONG INSTITUTION
Square Concatenation

SSEF 2025 WINNERS

BRONZE

Ng Wen Xi, Esther Keziah Lim Rui Qi, Reanne Teo Woo Hng
NANYANG GIRLS' HIGH SCHOOL, METHODIST GIRLS' SCHOOL (SECONDARY), EUNOIA JUNIOR COLLEGE
Modelling the RC4 Cipher as an Integer Quadratic Programming Problem

Jia Hanyu, Chng Ming Cong Jerrell
HWA CHONG INSTITUTION
In-house Production and Modification of Biocellulose

Syed Ahnaf Mahmud, Aravind Balamurugan, Oommen Kandathil Dhruv
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Green Synthesis of Ferromagnetic Metal-doped TiO_2 Nanoparticles Using Spent-Coffee-Grounds for Efficient Degradation of Methylene Blue Dye

Yee Aik Seng, Gareth Goh Yu Heng, Toh Jia Ying, Zelda
NANYANG JUNIOR COLLEGE
Shell Shock: Harnessing Crab Shells and Graphene Oxide for Sustainable Energy and Breath Sensing Applications

Pavana Jaishankar, Kim Yoonsu
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Organic Integrated Passive Cooling Paint for Energy-Free Temperature Regulation

Chua Ke Rui
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Characterization of Fluidic Jet Refraction Through an Inclined Mesh

Solomon Lim Jun Hui
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Novel Neutron-Driven Cyclic Reaction in the Formation of Polonium-210

Muzzammil Dadeh
VICTORIA JUNIOR COLLEGE
Investigation of multistate polarisation in Aluminium Scandium Nitride ($Al_{0.7}Sc_{0.3}N$) for high-density ferroelectric memory devices

Wang Duanyu
RAFFLES INSTITUTION
Magneto-optical absorption of hot sodium vapor

SSEF 2025 WINNERS

BRONZE

Chaw Clara, Huang Yuyang, Fong Poh Lin Pauline
NATIONAL JUNIOR COLLEGE, COMMONWEALTH SECONDARY SCHOOL
Effects of RB Intensity Ratio on Growth Parameters

Wang Yunze
RAFFLES INSTITUTION
Theoretical modelling and experimental construction of a 3D passive dynamic quadruped walker

Samuel Soo En Yu, Wesley Teng Z Sean, Chandrasekaran Balaganesh
RAFFLES INSTITUTION
Feature Guided Activation Additions For Improved Model Steering Vectors

Nguyen Hoang Long
VICTORIA JUNIOR COLLEGE
From Data to Rules: Applying Machine Learning to Cellular Automata

Tan Xinyi, Leung Hoi Yan
RAFFLES INSTITUTION, HWA CHONG INSTITUTION
Investigating the Application of Metabolic Labelling in Immunoassay Detection of Staphylococcus aureus

Neo Wee Zen, Peh Yew Kee, Koh Kai Jun Elgin
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Explainable Diagnosis of Migraine via Deep Learning through the Use of EEG Data

MERIT

Ryan Quek Kai En, Ang Rui Han Jennifer, Jacinda Kung Jiexin
HWA CHONG INSTITUTION
Generating a neutrophil activation map for population health tracking and disease susceptibility prediction

Lath Bharat, Saatvik Sharma, Mak Mun Yew
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Revolutionizing Food Safety: Immediate, Direct Identification of Probiotic Microbes using MALDI-TOF MS

Tessa Yap
RAFFLES INSTITUTION
Exploiting Microbial Genes to Increase Tumour Immunogenicity

SSEF 2025 WINNERS

MERIT

Yeang Anson, Mikaela Valya Skote
CLEMENTI TOWN SECONDARY SCHOOL
Metabolic Reprogramming by Spike Causes Methyl-glycation of Actin

Sammi Tee Yang Xin, Wang Yuxiao, Akshainie Dhanabalan
METHODIST GIRLS' SCHOOL (SECONDARY)
Investigating candidate germline factors expressed in cancer for therapeutic target discovery

Fidele Poh Xing Yun
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE
Entropy-Driven Molecular Feature Selection: A Novel Information-Theoretic Framework for Predictive Solubility Modeling

Pang Zhi Enn, Selvam Preethi, See Jian Liang
MILLENNIA INSTITUTE
Enhancing Banknote Security Using Thermochromic Pigmentation And Digital Authentication

Ma Xinyue
RIVER VALLEY HIGH SCHOOL
Examining Mathematical Literacy Determinants: A Machine Learning Approach using XGBoost and SHAP Analysis

Feng Sirui, Koay Jun Rong, Chua Yun Cheng
NANYANG JUNIOR COLLEGE
Boosting the Accuracy of Cell Type Annotation Predictions Through Deep Learning Multi-model Ensemble using Weighted and Soft Voting Approaches

Lin Huai En Reann, Toh Keting Kellyn, Brendon Lim Yu Hung
NATIONAL JUNIOR COLLEGE
Discovering sustainable methods to effectively filter out copper from water bodies

Shankar Kerthana, Vidhya Marianne Joseph
RAFFLES INSTITUTION
Investigating Potential of AC Electrocoagulation for Removal of Microplastics

Suchita Manikandan, Cherelle Wong, Joyce Wang Yiqing
RAFFLES INSTITUTION
Green Enzyme Engineering: Bioremediation of Methylene Blue-Contaminated Wastewater Using Hydrogel-Immobilised Enzyme Extract Synthesised from Spent Mushroom Compost

SSEF 2025 WINNERS

MERIT

Chang Brayden Jon Yon, Zhong Jinxuan
ST. JOSEPH'S INSTITUTION, RAFFLES INSTITUTION
Deep Reinforcement Learning AI for Multi-User Allocation in Massive Multiple-Input Multiple-Output (MIMO) Communication Systems

Ee Kui Wei
ANGLO-CHINESE SCHOOL (INDEPENDENT)
A Comparative Study of Cruciform and Annular Parachutes: Evaluating Drag and Stability Performances

Chuah Jia Wern Audrey, Mounita Reza
ST. JOSEPH'S INSTITUTION, CEDAR GIRLS' SECONDARY SCHOOL
Geometric optimisation of LCAT resonators to aid the development of 6G high-speed network

Chia Xuan Ye
CLEMENTI TOWN SECONDARY SCHOOL
Sustainable and Economical Tactile Sensor for Parkinson's Disease Diagnosis

Ravikumar Shivreshi, Duanmu Chuanjie
VICTORIA JUNIOR COLLEGE, RIVER VALLEY HIGH SCHOOL
Tailoring 3D curvature at micron scale using optical lithography

Yeap Zheng Ting, Tan Yee Neng Chloe, Wang Jixuan
NATIONAL JUNIOR COLLEGE
Investigating the effects of different surface structures on growth of algae biofilm

Wong JingCi Nivelle, Tan Suan Yee, Loo Xin En Nicole
HWA CHONG INSTITUTION
Increasing concentration of Butyrates in microgreens

Nathaniel Cheng Rong En, Sean Gan
ANGLO-CHINESE SCHOOL (INDEPENDENT)
Solving the Green-Heterogeneous Vehicle Routing Problem

Oliver Yeow Zi Lok, Kieran Chai Kai Ren
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
What's under the hood? A novel vulnerability scanner for kernel drivers

SSEF 2025 WINNERS

MERIT

Zhang Yihao, Ni Haoran, Sun Beichen
HWA CHONG INSTITUTION
Depth, Thermal & RGB-Segmented Silhouette Imaging in Human Pose Estimation for Activity Monitoring

Soh Jun Heng, Ang Wei Sheng Wilson, Elton Ng Yew Tien
CATHOLIC HIGH SCHOOL (SECONDARY)
New Frameworks for Analysing Security-Efficiency Tradeoffs in Range Searchable Encryption

JUNIOR SCIENTIST CATEGORY VIDEO AWARDS

DISTINCTION

Teo Hui Qing, Emily, Evelyn Chan Yu Xuan, Winstella Muliawan
RIVER VALLEY HIGH SCHOOL
Haste Makes Waste: Investigating the antimicrobial and antioxidant properties of fruit peels for preservation of food

Xu Haocheng, Dexter Tan Yu Cheng, Yeo Si Han Valerie
RIVER VALLEY HIGH SCHOOL
Saying Bye to Pesticides: Investigating impacts of different Washing Agents have on residual Pesticides for food safety

MERIT

Charlene Poh Qing Wei, Li Pengfei, Tan Yurou, Jaselle
RAFFLES GIRLS' SCHOOL (SECONDARY)
Increased Duration of Heat Treatment of Vegetable Oils Worsens Alzheimer's Disease in Drosophila

Tanush Garg, Itzel Poh Yu Xuan, Zhou Shanwei
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Evaluating Effectiveness of Aqueous Hand Sanitizers

Teo Min Xuan, Rachelle Amelia Tan
CHIJ ST. NICHOLAS GIRLS' SCHOOL (SECONDARY)
Using Food Waste to Create An Alternative to Regular Plastic

SSEF 2025 WINNERS

JUNIOR SCIENTIST CATEGORY PROJECT AWARDS

DISTINCTION

Jiang Yuxuan, Zhao Zilin Wesley
HWA CHONG INSTITUTION
Investigating the Potential of Superworms and Bacteria on the Biodegradation of Plastic

Teo Min Xuan, Rachelle Amelia Tan
CHIJ ST. NICHOLAS GIRLS' SCHOOL (SECONDARY)
Using Food Waste to Create An Alternative to Regular Plastic

MERIT

Alvarez Marco Lorenzo Tanzon, Chua Yu Zhi Randel, Lee Sen Rong Alex
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE
Investigation of the effectiveness of different liquid soaps on the growth of E.coli

Ng Tze Rey, Zhu Minghao Ryan, Wang Yen-Hsung
NATIONAL JUNIOR COLLEGE
Efficiency and Efficacy of Different Nutshell-derived Activated Carbon in Cleaning up Oil Spills

Jervin Lee Jia Jun, Kong Tze Lre, Goh Chen Xuan
KRANJI SECONDARY SCHOOL
Investigating How Different Types of Starch Content in Bioplastic Made from Food Waste Affects Properties of Bioplastic

SSEF SPECIAL AWARDS

Amgen Ampower Special Award for Science and Technology

Lu Zhiyi, Lu Zhiyue, Jocelyn Chai Hui Min
RAFFLES INSTITUTION
Developing an Injury Model for Age-related Macular Degenerative Disease using Photodynamic Therapy On Compound 1

SSEF SPECIAL AWARDS

Amgen Ampower Special Award for Science and Technology

Claire Lee Yi Shuen, Yang Xin Yu Caelyn
NATIONAL JUNIOR COLLEGE
Synthesis of Zn-doped TiO2 Photocatalyst with Citrus Peel Extract for Degradation of Malachite Green Dye

Yan Hai De, Xu Wanjia, Xu Zixin
RAFFLES INSTITUTION
Effect of Cu^{2+} on the Removal of Tetracycline and Ofloxacin via Electrocoagulation

Dylan Gan Kai Jie, Sng Josh, Tan Yong Tat
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Biofluorescence of Mussel Shells and its Applications in Water Purification

Qiang Kaixin, Jeong Siyeon
NATIONAL JUNIOR COLLEGE
Plastic Bags as Excellent Oil Adsorbers

ECS Special Awards

Ng Wai Yan Nadja (Wu Hui'en), Jolene Lee Jia Xin, Ang Liang Tze
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE
Investigation of the Effect of Different Types of Food Waste on the Energy Produced by a Microbial Fuel Cell

Calyn Sim (Shen Lexin), Caitlyne Ong Moon (Wang Man), Chan Shi En Abby
UNITY SECONDARY SCHOOL
Development of Vermicompost-based Batteries for Sustainable Energy Solutions

B Aaradhana, Ava Kristen Tan, Nandini Gupta
RAFFLES GIRLS' SCHOOL (SECONDARY)
Techno-Economic Analysis of Electrolyser Systems for Low-Carbon Energy Solutions: Modelling, Life Cycle Cost Analysis and Graphical User Interface for Sustainable Hydrogen Production

IChemE Singapore Awards

Lim Rui Siang, Li Tianyin, Pang Yang Zhi
HWA CHONG INSTITUTION
AI-Driven MOSFET Bypass Systems and Computer Vision for Mitigating Partial Shading Losses in Photovoltaic Systems

SSEF SPECIAL AWARDS

IChemE Singapore Awards

B Aaradhana, Ava Kristen Tan, Nandini Gupta
RAFFLES GIRLS' SCHOOL (SECONDARY)
Techno-Economic Analysis of Electrolyser Systems for Low-Carbon Energy Solutions: Modelling, Life Cycle Cost Analysis and Graphical User Interface for Sustainable Hydrogen Production

James Dyson Foundation Design Engineering Award

Zynn Wong
HWA CHONG INSTITUTION
Autogenous Healing of Concrete Using Recycled Cementitious Materials

Chuah Jia Wern Audrey, Mounita Reza
ST. JOSEPH'S INSTITUTION, CEDAR GIRLS' SECONDARY SCHOOL
Geometric optimisation of LCAT resonators to aid the development of 6G high-speed network

Zhang Ning An Serene, Isabelle Zai Min Si
RAFFLES INSTITUTION, EUNOIA JUNIOR COLLEGE
Developing & Evaluating Optimal Configurations of VR Equipment for Tracking and Defence Applications

William Edward Sugiharto, Lau Wan Leng Bridgette
ANGLO-CHINESE JUNIOR COLLEGE, EUNOIA JUNIOR COLLEGE
Artificial Intelligence-based Power Demand Forecasting

L'Oréal Special Award for Innovation in Sustainability

Hu Enxi, Goh Yu Xuan Amber, Thomas Lee Xin Liang
HWA CHONG INSTITUTION
Electrochemical Strategies for Effective Algae Growth Control

SSEF SPECIAL AWARDS

L'Oréal Special Award for Innovation in Dermatology and Cosmetology

Sureshkumar Harini Sree, Joycelyn Eudora Jerome Jude Arokiaraj
METHODIST GIRLS' SCHOOL (SECONDARY)
Enhancing Transdermal Delivery of Hydrophobic Actives with Lipid-Based Nanocarriers

Maritime Singapore Award for SSEF

Mahith Manesh, Nevin Shi En Yu
NATIONAL JUNIOR COLLEGE
Novel Synthesis and Doping of MoS2/MIL-53 (Fe) Composite for Hydrogen Generation and Storage

NUS Chemistry Special Awards

Clarice Woo Hoi Yang
NATIONAL JUNIOR COLLEGE
Soy Simple Yet Soy Complex: A Multimodal Study of Interfacial Dynamics and Droplet Morphology in Protein-based Emulsions

Lee Sio Huang, Clara Tong Rui Sze, Kate Isabelle Ong
RAFFLES GIRLS' SCHOOL (SECONDARY)
Stereocontrolled Synthesis of Functional Cavitands

Nerella Naveena, Ashley Yeo Sze Lin
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Synthesis and Characterisation of Novel Tetraphenylene-Containing Carbon Nanobelts

Chen Hao Yang, Wong Shi Qi
DUNMAN HIGH SCHOOL
Co-doping of Nickel and Oxygen onto Polymeric Carbon Nitride for Catalytic Applications

Li Changcheng, Lai Li Hang Damien
RAFFLES INSTITUTION
Recycling titanium metal for sustainable additive manufacturing

SSEF SPECIAL AWARDS

NUS Chemistry Special Awards

Kuan Jing Xuan, Koh Jia Xuan, Rajasekaran Dhinesh
HWA CHONG INSTITUTION, YISHUN INNOVA JUNIOR COLLEGE, NANYANG JUNIOR COLLEGE
Nanolithography based on scanning probes

Hu Yu Xin Juliana, Ma Jiayi, Niu Hongrui
HWA CHONG INSTITUTION
Chemically controlled opto-electronic artificial neural networks

Fu Cai Gui, Li Jiayou
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE
Development of a Novel Portable Reactor for Hydrogen Production Using Gallium and Upcycled Aluminium with Spent Coffee Grounds and Tea Leaves in Seawater

SUTD Research and Innovation Awards: Artificial Intelligence

Zhao Jianzhi
HWA CHONG INSTITUTION
AI+Robot: Intelligent Robot for Smart Cities and Smart Homes with Deep Learning and Sensor Fusion

Tan Jia Hui, Joy, Liang Ruiqi
HWA CHONG INSTITUTION
Development of a Low-Cost Unmanned Ground Vehicle for Campus Security

SUTD Research and Innovation Awards: Aviation

Tan Yan Qi, Darius Seah Boon Siong, Boyce Ang Kok Hong
RAFFLES GIRLS' SCHOOL (SECONDARY), RIVER VALLEY HIGH SCHOOL, HWA CHONG INSTITUTION
Design & Development of Delta Wing with Loitering Capabilities

Rachel Pao Jiayi
HWA CHONG INSTITUTION
Parametric Studies on the Aerodynamics of a Cruciform Parachute

SSEF SPECIAL AWARDS

SUTD Research and Innovation Awards: Cities

Koh Shan Jun, Lim Eng Joo, Sarah Oh
RAFFLES INSTITUTION
ECOBounce (Energy-Efficient, Clean, Optimised) Trampoline Energy Generator

Tan Yu Ning
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE
3-in-1 Functionalities of Recycled Polystyrene for Safer Pedestrian Walkways

SUTD Research and Innovation Awards: Healthcare

Wu Cheng Sheng, Ethan Wong
HWA CHONG INSTITUTION
Hollow Shells to Solid Bones: Sustainable 3D-Printed Bioactive HA & β-TCP Scaffolds for Enhanced Bone Regeneration

Mai Shia Glenys Khor
RAFFLES INSTITUTION
High-throughput Transcriptome Profiling of Angiosarcoma for Discovery of Novel Gene Expression Signature associated with Chemoresistance

SUTD Research and Innovation Awards: Multi-disciplinary

Glenda Lim Yu Xuan, Ashmi Chatterjee, Kim Jisoo
RAFFLES INSTITUTION
Development of 3D-Printed Millifluidic Bioreactor for the Fabrication of Personalised Gum (Gingival) Tissue Grafts

Wu Tongyu Belinda
DUNMAN HIGH SCHOOL
From Pixels to Profile: Automated Multi-View 3D Head and Neck Reconstruction for Remote Medical Diagnostics from Selfie Images

SSEF SPECIAL AWARDS

SUTD Research and Innovation Awards: Sustainability

Teo Xin Hui Joyce, Tan Ig Jer Kenji, Chan Zhang Hong Kasper
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE
Glued to Sustainability with ur-DAd (used and recycled Diaper based Adhesive)

Fu Cai Gui, Li Jiayou
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE
Development of a Novel Portable Reactor for Hydrogen Production Using Gallium and Upcycled Aluminium with Spent Coffee Grounds and Tea Leaves in Seawater

SAAS Special Awards - Poster Awards for Science Communication

Calyn Sim (Shen Lexin), Caitlyne Ong Moon (Wang Man), Chan Shi En Abby
UNITY SECONDARY SCHOOL
Development of Vermicompost-based Batteries for Sustainable Energy Solutions

Sim Wei En Isaac, Nicholas Ng Eng Siong, Zhao Junsen
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Importance of dead barnacle shells as a habitat in the upper intertidal zone of the Johor Strait

Michelle Khoo Hui Sin, Chieu Le Xuan, Soh Ping Lynn
RAFFLES GIRLS' SCHOOL (SECONDARY)
Posture Detection for Physiotherapy Application

Tan Tai Chuen Gareth
HWA CHONG INSTITUTION
Biological and Physical Characterisation of a Chitosan hydrogel for healing pressure sores

Chng Yun Jing Crystal
HWA CHONG INSTITUTION
Ambulatory blood pressure control and Cognition in patients with Obstructive Sleep Apnea

SSEF SPECIAL AWARDS

SAAS Special Awards - Poster Awards for Science Communication

Kiera Shandhiri Lim Tao Jing
RAFFLES INSTITUTION
Alien: Covenant - Cytoneme Biology of Polyaneuploid Cancer Cells To Confer Chemotherapy Resistance

Fidele Poh Xing Yun
SCHOOL OF SCIENCE AND TECHNOLOGY, SINGAPORE
Entropy-Driven Molecular Feature Selection: A Novel Information-Theoretic Framework for Predictive Solubility Modeling

Paige Gan Zi Ning
HWA CHONG INSTITUTION
Network Clustering of Drug-Drug Interactions

Guo Yatian, Rayner Ng Zheng Hao, Tan Yan Zuo
TEMASEK JUNIOR COLLEGE
Walkable Southeast Asia: A Comparative Study Between Phnom Penh and Ho Chi Minh City

Asnith Muniraju, Jane Therese Ng, Daisy Liow Han Yi
RAFFLES INSTITUTION
Immobilising Laccase onto Moringa oleifera Seeds and Husks as Novel Bioadsorbents for Acetaminophen Removal

Rameshkumar Dhanvine
TEMASEK JUNIOR COLLEGE
Generative AI for Optical Metasurface Lenses: Optimizing Light Manipulation through a Fully AI-Driven Design Framework

Lim Ye Jun (Lin Yejun), Juven Raphael Kenneth, Carbajal Dominic John Mendoza
DEYI SECONDARY SCHOOL
The Antimicrobial Power of Herbal Plants: An Investigation on a Possible Solution to Antibiotic Resistant Escherichia coli (E.coli)

Ang Shi Qi Georia
HWA CHONG INSTITUTION
LuminaSand: Harnessing the Optical Potential of Silicon Dioxide with Focused Laser Beam

SSEF SPECIAL AWARDS

SAAS Special Awards - Poster Awards for Science Communication

Yee Yi Xin Kristen, Justin Chong Jia Xuan
EUNOIA JUNIOR COLLEGE, RIVER VALLEY HIGH SCHOOL
Magnonic nano ring resonator for neuromorphic computing

Zafyra Keinastya Syahdeni, Jayian Tan Rui Sheng
NATIONAL JUNIOR COLLEGE
Investigating Optimum Condition for Spirodela Polyrhiza to Yield Highest Nutrient Content

Wang Jiayu, Ding Chenghao
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
An Observation is Worth 4 Words: Image Patching for Efficient Subgoal Navigation in Partially Observable Environments

Soh Jun Heng, Ang Wei Sheng Wilson, Elton Ng Yew Tien
CATHOLIC HIGH SCHOOL (SECONDARY)
New Frameworks for Analysing Security-Efficiency Tradeoffs in Range Searchable Encryption

Tan Yu Ying, Tan Yan Ning, Trinice, Damien Lee Ming Hui
NATIONAL JUNIOR COLLEGE
Synthesis of Moringa Oleifera Silver Nanoparticles for Anticancer Properties

William Edward Sugiharto, Lau Wan Leng Bridgette
ANGLO-CHINESE JUNIOR COLLEGE, EUNOIA JUNIOR COLLEGE
Artificial Intelligence-based Power Demand Forecasting

Timothy Goh Zhi Bin, Poh Hong Wee, Louis (Fu Hongwei), Zachary Chia Min
HWA CHONG INSTITUTION
Hexagonal Flow Free

SSEF SPECIAL AWARDS

Singapore Mathematical Society Awards for Ingenuity

Derrick Lukimin, Tey Yi Xiang, Fan Wendi
HWA CHONG INSTITUTION
Square Concatenation

Nguyen Tien Minh, Chong Yu Teng Aden
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Investigation on the Convergence Properties of a Markov Chain

Toh Shiong Enn, Sean, Raphael Teng Zhi Xiang, Yang Zi Yan
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Analyzing Convex Plane Curves with Support Function

Akash Thiagarajan, Ruhan Tasneem Shafa
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Probabilistic Analysis of the Chromatic Polynomial

Ying Liqian
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Make24: Elegant Elementary Bounds for a Numbers Game

Tan Song Ze Hayden, Wu Ning Song Samuel
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Solving n-tuple Inverse Pythagorean Equations

Timothy Goh Zhi Bin, Poh Hong Wee, Louis (Fu Hongwei), Zachary Chia Min
HWA CHONG INSTITUTION
Hexagonal Flow Free

SSMB Special Award in Microbiology

Zeaus Koh Jin Rui
HWA CHONG INSTITUTION
Novel thermostable phage-nanoparticles delivered by hydrogel: Small but mighty weapons against multi-drug resistant Staphylococcus aureus

STEM for Good! Contest

Pre-University

Kaela Gan Shao Yi
HWA CHONG INSTITUTION
Turning Waste into Wealth

Li Kit On Hubert, Joshua Ling, Marcus Lu, Loh Ming Yao Alexander
RAFFLES INSTITUTION
Extending Semakau Landfill Vertical Expansion for Sustainable Waste Management

Tan Xin Yi Hannah, Rashee Jha, Yin Mingjun, Prawin Kuhanesan, Kirubasankaran Nidharshan Raam
RAFFLES INSTITUTION
Thread of Defence

Upper Secondary

Ho Bao Khanh, Hoang Bao Chi, Bach Le Khanh Van
CEDAR GIRLS' SECONDARY SCHOOL
Algae Guard

Tan Le En, Tang Linda, Dhingra Saadya, Alicia Lim Ke Xuan, Chong Jia Yu
NUS HIGH SCHOOL OF MATHEMATICS AND SCIENCE
Biochar – the Good Kind of Char

Hannah Eliz Go Lomotos, Macayle Paquing Ledesma, Angela Chloe Royeca Ong, Sophia Amelia Zhu Lee
PAYA LEBAR METHODIST GIRLS' SCHOOL (SECONDARY)
BioMASH: Pyrolyzed Waste-derived Biochar for Wastewater Treatment

STEM for Good! Contest

Lower Secondary

Bheema Lokesh Yuktha
CHIJ ST. THERESA'S CONVENT
Ensuring Food Security in Singapore

Alina Lew Lin Rong, Samantha Ang Jia En, Clarysse Wong Jing Kei, Gao Yexuan, Quek Xinyan Kyra
NANYANG GIRLS' HIGH SCHOOL
GEMM (Genetically Engineered, Modified& Manipulated) Rice as a Protein Alternative

Theresa Alphonse Kuzhimattathil, Wu Meiyi, Tang Lijuan, Yuan Qiaoen, Lee Heejae
RAFFLES GIRLS' SCHOOL (SECONDARY)
Care in Crises: Addressing Singapore's Healthcare Crisis in 2040

Primary

Ebel Ng Rui Xuan, Schvelle Gan Yu Xuan, Hu Xiang Ying, Sim Kah Yee, Wu Chien He
CHONGZHENG PRIMARY SCHOOL
Reducing Plastic Waste in Singapore

Abbilyn Peh Xin Ping
METHODIST GIRLS' SCHOOL (PRIMARY)
Rising Sea Level in Singapore

Kelly Koh En Ning, Tang Suet Yee
SENGKANG GREEN PRIMARY SCHOOL
Climate Change

ISEF 2025:

STUDENT DELEGATES

Ang Shi Qi Georia

School Hwa Chong Institution

Title LuminaSand: Harnessing the Optoelectronic Potential of Silicon Dioxide with Focused Laser Beam

Abstract The increasing reliance on optoelectronic devices in communication, sensing, and display technologies has driven the search for alternative materials that are cost-effective, scalable, and highly efficient. Conventional optoelectronic materials, such as gallium arsenide and indium tin oxide, face challenges related to scarcity, high production costs, and environmental concerns. This study explores a simple alternative approach to fabricating silicon-carbon nanotube (SiCNT) based composite material for optoelectronic application through laser-initiated rapid annealing and quenching. The site-specific laser treatment process induces localised suspended SiCNT structure and cyan fluorescence under ultra-violet excitation. Comparisons between laser treatment in ambient versus vacuum environment identified oxygen defects as the likely contributor to the observed cyan fluorescence. This laser-transformed composite material achieves an ~82,000-fold increase in electrical conductivity compared to its pristine state. Device testing further elucidates its capability to effectively generate photocurrent, particularly with a 532 nm monochromatic laser. This work highlights the potential of rapid laser-initiated transformation of SiCNT composite as an economical and scalable optoelectronic material, offering a promising alternative for future technological applications.

Teo Shen Han

School River Valley High School

Title Birds of a Feather: Plumage Colour Analysis for Subspecies Assessment of Locally-Threatened Songbirds

Abstract Quantitative analysis of colouration in specimens has always posed a challenge in taxonomy, and is yet often crucial as morphological traits may sometimes reveal variations not observed in genetic studies. This paper made use of the Chestnut-winged Babbler (*Cyanoderma erythropterum*) species complex as a model and explored two methodologies - the 75% subspecies rule, and the CIEDE2000 colour distance method, of which the latter is a novel method in taxonomy. Given its large number of described subspecies, the species complex serves as an appropriate model to test subspecies validity using this novel approach. Results have shown that a synonymized subspecies *(C. e. apega)* requires re-instalment and recognition, while one widely-recognized subspecies *(C. e. fulviventre)* should be synonymized. Being a critically endangered bird in Singapore, this suggests *C. erythropterum's* susceptibility to human disturbance, and hence highlights the importance of having accurate taxonomy of the species complex for proper subspecies-specific conservation measures to be introduced. This work indicates that current subspecies taxonomies of many species may remain error-ridden, especially in the tropics, and highlights the importance and viability of large-scale taxonomic revisions globally, while incorporating quantitative colorimetric approaches as described in this study.

Ying Liqian

School NUS High School of Mathematics and Science

Title Make24: Elegant Elementary Bounds for a Numbers Game

Abstract The elegance of Mathematics is manifested in the complexities which arise from a set of simple rules. Growing up, when long bus rides got boring, I would play a mathematical brain teaser with my parents. Now, this game holds much sentimental value to me and brings back fond memories. Thus, I decided to research the mathematical properties of this game - Make24. The game begins with 4 randomly chosen number cards, each with a (not necessarily distinct) integer value between 1 and 10 inclusive. Players then compete to be the fastest to form a mathematical expression using each of the cards exactly once with the operations +, -, ×, ÷ and evaluates to 24, in order to win. Additionally, each operation must yield an integer. For instance, for the cards 3, 4, 7, 9, a winning expression would be (9 - 7) × 3 × 4. It is well-known that 4 cards is insufficient to guarantee the existence of a winning expression. For instance, one cannot form 24 from the numbers 1, 1, 1, 1. Thus, I ask: How many cards will guarantee the existence of a winning expression? I show in my research that this number is 9 for Make24. Further, I then defined η(n) to be the minimum number of cards to guarantee the existence of a winning expression to form any integer, n. In my research, I study the properties of the function through Reduction and Induction steps, eventually showing that $[3\log_3 n] \leq \eta(n) \leq [3\log_2 n] + 1$ holds for all $n > 2$. The methodology of the research where complex problems are broken down into simpler subproblems leads to fascinating mathematical insights, and the research contributes to Algorithmic Analysis by measuring algorithms' efficiencies in pruning.

Rameshkumar Dhanvine

School Temasek Junior College

Title Think, Generate, Optimize: Presenting a Novel Fully AI-Driven Design Framework for Metasurface Lenses

Abstract The design of flat metasurfaces is essential for advancements in LiDAR systems, 6G telecommunications, and optical imaging. However, conventional design methods rely on computationally expensive Electromagnetic (EM) simulations and predefined unit cell geometries, limiting achievable phase profiles and hindering innovation. This project introduces METAGEN (Metasurface Generation Engine for Next-gen Optics), a fully AI-driven framework that addresses these constraints by integrating 2 components: a novel Inverse Design Framework and a Forward Modelling Framework. The Inverse Design Framework employs a Wasserstein Conditional GAN enhanced with Feature-wise Linear Modulation (FiLM) to generate freeform unit cell designs effectively, optimizing light manipulation beyond conventional structures. The Forward Modelling Framework leverages deep learning to predict spectral responses of generated designs, reducing the need for costly EM simulations. This AI-driven approach enables rapid design iterations, generating hundreds of optimized designs in minutes, compared to traditional EM simulations that take hours for a similar task. Additionally, AI-generated freeform metasurfaces enable near-continuous phase control, expanding the design space beyond predefined geometries. This advancement allows for the realization of achromatic and wide field-of-view metalenses across various wavelength spectra. The framework's generative capabilities also provide various unit cell designs that achieve similar spectral responses, offering greater flexibility in metasurface optimization. The project also features a RAG chatbot that provides insights on metasurfaces and METAGEN, making the design process accessible to those with minimal EM simulation experience. By leveraging AI, this project expands the metasurface design space, enhances optical performance and accelerates innovation for applications in AR, LiDAR, cameras, and next-gen imaging. Future work involves integrating Physics Informed Neural Networks (PINNs) into the forward model to improve accuracy and performance, enhancing the explainability of the design-spectral relationship.

Wang Zerui, Kwok Xin Ze Vincent

School NUS High School of Mathematics and Science

Title LiDRNet: Lightweight Inertial Dead Reckoning Network

Abstract

Accurate indoor positioning remains a significant challenge due to poor permeability of Global Navigation Satellite System (GNSS) signals within buildings, rendering traditional GNSS-based methods ineffective. Alternatives often suffer from limitations, hindering their practicality in constrained platforms. We propose a lightweight and robust deep learning method for pedestrian dead reckoning (PDR), termed LiDRNet. Our method leverages the Neutral Ordinary Differential Equation (Neural ODE) technique and applies them to existing architectures ResNet and LSTM. We then operate on a Heading Agnostic Coordinate Frame and apply back-propagation on velocity loss to improve the effectiveness of our model. Finally, we use the Neural-ODE backbone to predict motion trajectories from raw Inertial Measurement Unit (IMU) data, significantly reducing the number of parameters. Benchmarking LiDRNet against SOTA deep learning approaches shows a significant improvement in performance aspects, reducing parameter count by up to 7 times while achieving comparable accuracy. Our results also indicate that LiDRNet achieves an average trajectory error (ATE) that is within an acceptable range for practical application with an average error of less than 4 meters for every 250 meters travelled. LiDRNet is well-suited for deployment on resource-constrained edge devices such as smartphones or IoT platforms for accurate, robust and real-time dead reckoning. Enabling accurate indoor positioning without the need for external infrastructure or high computational resources allows our approach to significantly enhance navigation, which has the potential to improve navigation assistance, asset tracking, and emergency response in indoor settings (such as cave systems or dense forests).

Amy Low Li Ying, Felicia Tan Ee Shan

School Raffles Institution

Title Hear Me Out (& Think): MAESTRO, a Multimodal Agentic model with Efficient, Synergistic Text-Reasoning Optimisation framework

Abstract

The increasing complexity of multimodal content presents significant challenges for Vision-Language Models (VLMs), particularly in hateful video detection, where existing models suffer from weak auditory integration, static reasoning, and high computational costs. Current approaches fail to incorporate non-verbal audio cues, rely on frame-by-frame sampling, and struggle to reason across time, limiting efficiency and accuracy. To overcome these limitations, this study presents MAESTRO, a novel plug-and-play framework that enhances existing Video-Language Models through three key innovations. First, MAESTRO's Transcript Chunking mechanism effectively integrates the underutilised audio modality, capturing both speech and non-speech cues for richer semantic representation. Second, MAESTRO–Unified Modality Alignment maps video, text, and audio into a shared semantic space, enabling deeper cross-modal interactions than traditional VLMs. Third, MAESTRO–Adaptive Global-Local Reasoning Loop dynamically refines its analysis by integrating fine-grained local details with broader global contextual information, eliminating the need for exhaustive frame-by-frame processing and significantly improving computational efficiency. MAESTRO achieves state-of-the-art (SOTA) performance, attaining 93% F1-score on MultiHateClip for hateful video detection. Beyond this use case, it establishes new benchmarks in Video Question-Answering (VQA), achieving F1 scores of 82.0% on MSRVTT-QA, 86.9% on MSVD-QA, and 87.2% on ActivityNet-QA, demonstrating its effectiveness in general video-language reasoning. These results highlight the model's ability to enhance VLMs for a wide range of multimodal tasks while maintaining computational efficiency. With its scalable and efficient design, MAESTRO has broad applications beyond content moderation, including improving general VQA, enabling greater automation in multimodal content analysis, and enhancing AI-driven reasoning for complex video-language tasks.

National STEM Talent Search

By Science Centre Singapore

National STEM Talent Search 2025

BACKGROUND

The National STEM Talent Search (NSTS) is an annual competition by Science Centre Singapore with support from the Ministry of Education. Previously known as the A*STAR Talent Search, the competition was inaugurated in 1995 and is based on a concept similar to the Regeneron Science Talent Search in the USA. NSTS is a prestigious annual competition that aims to motivate and accord national recognition on students who excel in science and technology. Through NSTS, Singaporean students aged 15 to 21 years old are given a platform to showcase their projects and are encouraged to further their interest in science, technology, engineering, and mathematics (STEM).

NSTS participants are evolved from the winners of the Singapore Science & Engineering Fair (SSEF) 2025 after the first round of judging on their presentation of their submitted research projects for SSEF. NSTS participants then undergo two more rounds of selection by a panel of judges consisting of scientists from A*STAR, NTU, NUS, SIT and SUTD and chaired by a renowned local scientist.

NSTS winners need to display resourcefulness, mastery of scientific concepts, as well as passion for scientific research.

There are four scientific categories for NSTS 2025:

- Biomedical Science
- Computer Science & Mathematics
- Engineering
- Material Science

FOREWORD

It is our privilege to welcome Professor Ng Huck Hui as the chief judge for this year's NSTS. Professor Ng is the Assistant Chief Executive for Research and Talent Development under the Agency for Science, Technology and Research. He is renowned in the field of stem cells, having spent more than a decade in research to understand and uncover the intricacies of gene regulation and how they relate to cell biology.

The scientific journey, while often demanding, can bring remarkable satisfaction and insight. Through NSTS, we aim to inspire upcoming scientists to pursue excellence in their research and innovation endeavours.

The strong turnout of 58 participants this year reflects the strong interest in NSTS. Our committee is delighted to witness the passionate pursuits by students across diverse scientific disciplines. The submissions range from original contributions in basic science to innovative solutions that can improve lives. The quality of the submissions this year bodes well for the development of our next generation of scientific talents in Singapore.

Professor Phoon Kok Kwang
Chairperson, *National STEM Talent Search 2025 Awards Committee*
President, *Singapore University of Technology and Design*

We commend all participants for devoting many hours in their research and in preparing for NSTS 2025. Your remarkable achievements speak of your efforts which you should be very proud of. Regardless of the outcomes, we believe every participant has experienced personal growth and gained valuable expertise through this process, making it a meaningful journey. Besides the learning journey, you have made friends along the way. Our judges and I were happy to see the joy in your eyes as you shared your research stories. We are certainly very proud of you. Learning is always most effective when you are having fun.

Our deepest appreciation goes to all who contributed to NSTS's success, particularly the Awards Committee and Science Centre Singapore. We also extend our heartfelt thanks to the dedicated judges, mentors, school leaders and teaching staff whose commitment has been instrumental in bringing this event to fruition.

Thank you.

Professor Phoon Kok Kwang
Chairperson, *National STEM Talent Search 2025 Awards Committee*
President, *Singapore University of Technology and Design*

NSTS 2025

FINALISTS

Chua Ke Rui

School NUS High School of Mathematics and Science

Mentor Dr. Bernard Ricardo

Project Title Characterization of Fluidic Jet Refraction Through an Inclined Mesh

Category Name Engineering

Abstract

Limited research has explored jet refraction through an inclined wire mesh, due to complex surface interactions. This study introduces a novel analytical law of fluid refraction that integrates numerical modelling to determine the refraction angle. Film formation on the mesh causes the jet to cohere to the film, refracting away from the normal. Our law of fluid refraction is derived by modelling the vertical and surface-bound components of the refracted jet separately, allowing us to develop an analytical solution, with coefficients determined numerically via the Navier-Stokes equation with the k-ϵ turbulence model. The refraction angle was experimentally determined via image segmentation and parabola fitting. Experimental results align with our refraction law ($p=0.65>0.05$, Chi-squared test). Refraction angle increases with impingement angle and mesh porosity, is invariant to jet diameter, and decreases with jet velocity. This study has potential applications in minimising turbulence while redirecting flow in piping, irrigation and biomedical systems.

Lee Chong Jin, Ian

School NUS High School of Mathematics and Science

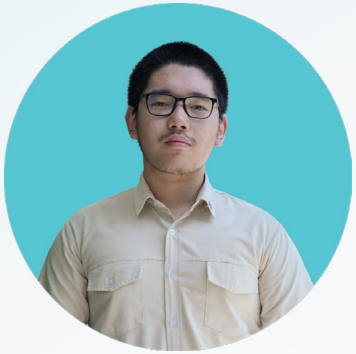
Mentor Assoc Prof Norbert Lehming, Dr. Low Kai Leng

Project Title Spike protein of SARS-CoV-2 kills cells by targeting fumarase

Category Name Biomedical Science

Abstract

Diabetes is associated with more severe COVID-19 disease, and COVID-19 infection increases the risk of non-diabetic patients developing new-onset hyperglycaemia or diabetes. This suggests that COVID-related pathology is linked to abnormal sugar metabolism. However, it is unclear how SARS-CoV-2 undermines sugar processing, and why this increases viral pathogenicity. My project showed that the viral surface Spike protein binds to and inhibits the function of the Krebs cycle enzyme fumarase. Inhibiting Spike-fumarase interactions reduced both the fumarase inhibition and cytotoxicity caused by Spike. Krebs cycle inhibition by Spike is likely to reduce mitochondrial ATP generation, increasing oxidative stress and insulin resistance. This novel mechanism explains how SARS-CoV-2 might cause dysfunctional mitochondrial energy production, cell death and diabetes. My findings also show proof-of-concept for a novel therapeutic approach – since blocking Spike from interacting with fumarase reduces Spike-induced pathology, future drugs targeting Spike-fumarase interactions could potentially reduce COVID pathology and prevent post-COVID diabetes.



Li Xinyang

School Hwa Chong Institution

Mentor Prof Nikolai Yakovlev

Project Title Molecular Multilayers Studied by Two-beam Precision Ellipsometry

Category Name Material Science

Abstract Molecular multilayers are used for controlled coatings, substrate functionalization, and microcapsule fabrication. To study novel multilayers, precision ellipsometry is a highly effective technique which offers molecular-level sensitivity by measuring the polarization of light—specifically, the phase shift (Δ) and amplitude ratio (Ψ) between s- and p-polarized reflections. We developed a unique two-beam precision ellipsometer capable of independently and simultaneously measuring Δ and Ψ with sub-milliradian accuracy. This enhanced sensitivity allowed us to resolve a counterintuitive result observed with the single-beam system. By accounting for the silicon oxide thickness, silicon's extinction coefficient, and the refractive index of the surrounding solution, we developed an effective formalism to provide an accurate description of the transient state of attachment of ultra-thin bilayers. Our two-beam system demonstrated exceptional analytical power in detecting and characterizing subtle changes in multilayer thickness and refractive index, offering detailed insights into kinetics of multilayer formation.

Lim Jun Hui Solomon

School NUS High School of Mathematics and Science

Mentor Dr. Pong Boon Kin

Project Title Novel Neutron-Driven Cyclic Reaction in the Formation of Polonium-210

Category Name Engineering

Abstract In this study, a previously undescribed cyclic nuclear reaction based on neutron-driven interactions was investigated. The cyclic reaction could potentially enhance the production efficiency of polonium-210. The cyclic reaction occurs in four steps: absorption of neutrons by bismuth-209 produces bismuth-210, which beta-decays to form polonium-210. The alpha particles emitted by polonium-210 would then react with beryllium-9 to release more neutrons, driving a cyclic chain reaction. A novel compound, bismuth beryllium acetate (BBA), was synthesised to produce the cyclic reaction, and the prepared compound was characterized with ICP-MS spectrometry and SEM microscopy. To initiate the cyclic reaction, the BBA compound was irradiated with neutron fluxes from a californium-252 neutron source. Gamma spectroscopy was used to demonstrate neutron emission from the irradiated material, confirming that the cyclic reaction has occurred. Evidence of the cyclic reaction was also obtained through the observed autocatalytic reaction kinetics.

Nainika Gupta

School Raffles Institution

Mentor Prof Sow Chorng Haur, Dr. Poh Eng Tuan

Project Title TRASH to TRASH-URE with Rice Husk Ash: A Novel, Sustainable Alternative to Synthesise Carbon-Silica Composites using Rice Husk Ash (RHA)

Category Name Material Science

Abstract Rice husk ash (RHA) is a major agricultural waste formed in rice-producing countries, with around 25 million tonnes wasted annually. Yet, its chemical composition (~80% silica, ~20% carbon) gives RHA much potential that has yet to be harnessed. This study aims to repurpose RHA into functional carbon-silica composites, which industrially require prolonged heating and complex starting materials. RHA-derived Silica NPs were mixed with RHA (1:1), followed by ablation with a CNC laser, which saw the formation of microspheres (approx. 20-50μm) that consisted mainly of silicon and oxygen, with some carbon present. Lasering in an inert environment or using a pulsed laser yields smaller composites (approx. 10-40μm and 700-900nm respectively). The microspheres formed were tested as antimicrobial agents, with similar efficiencies against E. coli to ampicillin, and chemical sensors for the detection of Rhodamine B till concentrations of 10^-8M.

Samuel Soo En Yu

School Raffles Institution

Mentor Dr. Tan Guoxian, Dr. Yan Ming

Project Title Feature Guided Activation Additions for Improved Model Steering Vectors

Category Name Computer Science and Mathematics

Abstract Effective and reliable control over large language model (LLM) behavior is a significant challenge. While activation steering methods, which add steering vectors to a model's hidden states, are a promising approach, existing techniques often lack precision and interpretability in how they influence model outputs. We introduce Feature Guided Activation Additions (FGAA), a novel activation steering method that leverages insights from Contrastive Activation Addition (CAA) and Sparse Autoencoder-Targeted Steering (SAE-TS). By operating in the latent space of a Sparse Autoencoder (SAE) and employing optimization techniques to select desired SAE features, FGAA constructs precise steering vectors that provide better steering effects while maintaining coherence of steered model outputs. In this regard, evaluations on Gemma-2-2B and Gemma-2-9B models across various steering tasks demonstrate that FGAA outperforms existing steering methods of CAA, SAE decoder steering, and SAE-TS. Our results also highlight important trade-offs between steering scale and general model capabilities that are consistent across all tested steering methods.

Tan Teng Fong, Christopher

School Raffles Institution

Mentor Mr Sze Guan Kheng

Project Title Anisotropic Elastohydrodynamics of Paper due to Moisture Absorption

Category Name Material Science

Abstract

Paper-based microcantilever and microfluidic devices have shown to be more precise and sensitive compared to current mechanisms. However, there is poor control over water imbibition and hygro-expansion to obtain exact, desired bending responses. Hence, the bending response of tracing paper placed on a water source was investigated experimentally and theoretically. This occurs due to differential hygro-expansion along the paper thickness as water diffuses up the paper. An improved mathematical model was presented for curling short strips, accounting for nonlinearities. A novel model was presented for rolling long strips, accounting for surface tension, weight and capillary pressure. Results reveal non-constant diffusivity that decreases with increasing pore connectivity, while increased thickness reduces curvature and prolongs the curling timescale. Varying temperature confirms diffusion-dominated water transport. Non-uniform curvature caused by external forces is observed as rolling, and anisotropic expansion causes a width-dependent rolling velocity. This work lays the foundation for future prototype development.

Tricia Tan Hui Xin

School Raffles Institution

Mentor Dr. Lim Xiaodai Sharon

Project Title Urban Glow: Investigating Leaf Fluorescence under the Stress of City Life

Category Name Biomedical Science

Abstract

Global climate change is driving an increase in the frequency, severity, and duration of heat stress, which adversely impacts plant growth and development. This presents a significant threat to global food security, particularly for Singapore, which depends heavily on food imports. The Urban Heat Island (UHI) effect worsens this challenge, even as the country pushes to boost local food production. This study examines how urban heat stress affects Amaranthus tricolor, focusing on its nutritional value and stress response. It explores the link between the plant's chlorophyll content and the bright red fluorescence it emits under UV light. Findings show that this fluorescence can be a useful indicator of how urbanization and climate stress impact plant growth and nutrition, offering farmers timely feedback to improve crop yield and quality. The study also found that while heat stress disrupts photosynthesis, plants can partially recover through adaptive mechanisms, boosting resilience to environmental stressors.

Wang Zerui

School NUS High School of Mathematics and Science

Mentor Dr. Lim Yang Teck Kenneth, Dr. Chiam Sher-Yi, Mrs Phylliscia Chew

Project Title LiDRNet: Lightweight Inertial Dead Reckoning Network

Category Name Computer Science & Mathematics

Abstract

Accurate indoor positioning remains a significant challenge due to poor permeability of Global Navigation Satellite System (GNSS) signals within buildings, rendering traditional methods ineffective. Alternatives often suffer from limitations, hindering their practicality in constrained platforms. We propose a lightweight and robust deep learning method for pedestrian dead reckoning, termed LiDRNet.

We used the Neutral Ordinary Differential Equation (NeuralODE) technique, operated on a Heading Agnostic Coordinate Frame and apply back-propagation on velocity loss to improve the effectiveness of our model. We then predict motion trajectories from raw IMU data. Benchmarking LiDRNet against other State-Of-The-Art shows a reduction of parameter count by 7 times while achieving an average trajectory error of 4 meters.

LiDRNet is well-suited for deployment on resource-constrained edge devices for accurate real-time dead reckoning. Enabling on-edge accurate indoor positioning allows our approach to significantly enhance navigation, which can improve navigation assistance, asset tracking, and emergency response in indoor settings.

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Institute of Physics Singapore (IPS)
Institution of Engineers, Singapore (IES)
James Cook University
JTC Corporation
Keep Looking Ahead (KLA)
Kulicke & Soffa
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Nanyang Polytechnic (NYP)
Nanyang Technological University (NTU)
National Environmental Agency (NEA)
National Parks Board (NParks)
National University Health System (NUHS)
National University of Singapore (NUS)
Ngee Ann Polytechnic (NP)
Pacific Biosciences Singapore
PSB Academy
PUNGGOL 21 CCMC
Republic Polytechnic (RP)
SBS Transit Rail Pte Ltd
Singapore Academy of Young Engineers and Scientists (SAYES)
Singapore Health Services (SingHealth)
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Singapore Institute of Technology (SIT)
Singapore Management University (SMU)
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Singapore University of Social Sciences (SUSS)
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