The Athena SWAN (Scientific Women's Academic Network) Charter was established in 2005 with the aim of *"Encouraging and recognising commitment to advancing gender equality"* within STEM subjects, i.e., science, technology, engineering, and mathematics. The Athena SWAN agenda has grown overtime to promote equality in general. Scan the QR code opposite for more background about Athena SWAN at Heriot-Watt, including guidance and resources.

## 1. Athena SWAN Summer UG Bursary Project Reports

Below you will find reports from our seven Athena SWAN Summer UG Bursary students – 4 funded by Edinburgh and 3 funded by Dubai, with 1 jointly supervised by Dubai and Edinburgh colleagues. See **item 2** (page 13) for information about the **2025 Athena SWAN Summer UG Bursary Scheme**.

Building an Open-source Visualization System in support of Parkinson's Disease patients
Student: **Sweta Acharya** (Dubai-Edinburgh)
Supervisors: **Joe Wells and Drishty Sobnath**

Introduction Parkinson's disease is a neurological condition that affects the nervous system and the body's nerve-controlled regions. *(Parkinson's statistics 2024)* According to Parkinson's Europe, it has affected 10 million people globally. It has several symptoms such as tremors, and rigidity or slow movement in the limbs. This project's GUI was created with ease of use and intuitiveness in mind, making it simple to manipulate the 3D models. A comprehensive and interactive perspective of the muscular system is provided by the user's ability to rotate around and zoom into the loaded models.
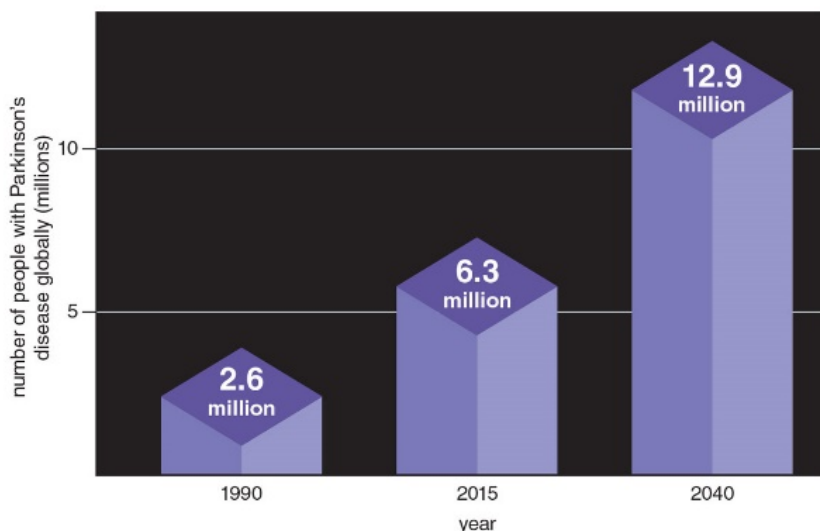
(The rise of parkinson's disease | American scientist)

Aim: This project aims to create a 3D graphical user interface (GUI) in Python that allows users to visualize the muscles impacted by Parkinson's disease.

Identified Gap: The thigh muscles play a major role in balance and gait and are often affected in Parkinson's disease, thus examining these muscles closely will be beneficial. (*Stevens-Lapsley et al., 2012*) According to

an article by the National Library of Medicine, a cross-sectional study revealed considerably weaker quadriceps in patients with PD motor symptoms higher than 31.7 on the Unified Parkinson's Disease Rating Scale (UPDRS motor). According to this, quadriceps function is a crucial indicator of motor impairment in Parkinson's disease (PD). *(Islam et al., 2020)* In a study conducted using electromyography (EMG) to assess the lower limb activity of individuals, it was found that PD patients had a significantly lower percentage of activity in the lower limb compared to HOAs (Healthy Older Adults). Thus, concentrating on the thigh muscles may provide significant insight into difficulties with movements, and muscle efficiency, and ultimately help PD patients.

Approach: This project integrates several Python libraries such as pygame, OpenGL, and pyQT. The program employs PyQt to build the graphical user interface. It utilizes Qlabels, QComboBoxes, and QListWidgets to construct a user-friendly interface. OpenGL is cross-platform and has a flexible API that has a large array of tools to render and manipulate 3D images. The code uses OpenGL to load .obj files that store the geometric information of the musculoskeletal models. A .png file contains the palette for adding colour to the loaded models. Parser methods have been used to load and display the .obj files with their colours. The project uses 3D files imported from sketchfab.com that were modified and shaded according to the project specifications using Blender. A bash script has been created that smoothly installs all the required packages, installs the application, and runs it on the user's machine. The interface is split between a display section for visualising muscles and a simple form with a scrolling menu for selecting bones, joints, and muscles to display. The 3D rendering section is adjustable to make it larger or smaller to view the musculoskeletal models effectively.

Challenges: There are various hurdles in creating a 3D muscle rendering application with python such as ensuring cross-platform compatibility and a bug-free user interface. Allowing users to manipulate the 3D images without derailing camera focus has been achieved by taking keyboard inputs of smaller values instead of mouse inputs to ensure precise and controlled movements.

Results:
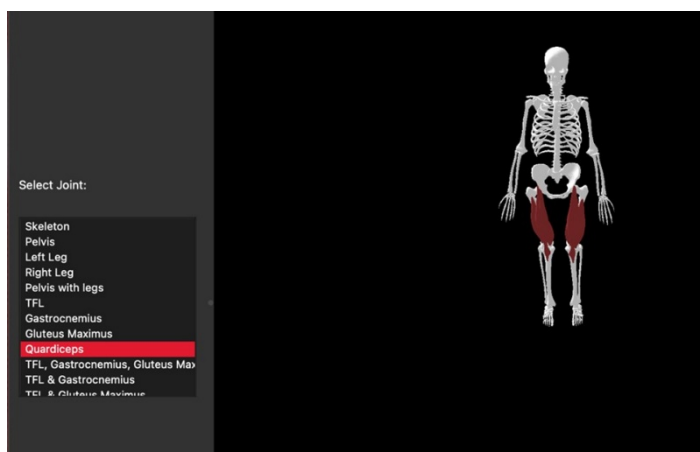
This is a screenshot of the GUI Window without any images loaded on the right.

The blank side on the right displays the images and the menu is on the left. The following methods have been implemented to set up the OpenGL Widget:

```
initializeGL(self):
paintGL(self):
resizeGL(self, w, h):
```
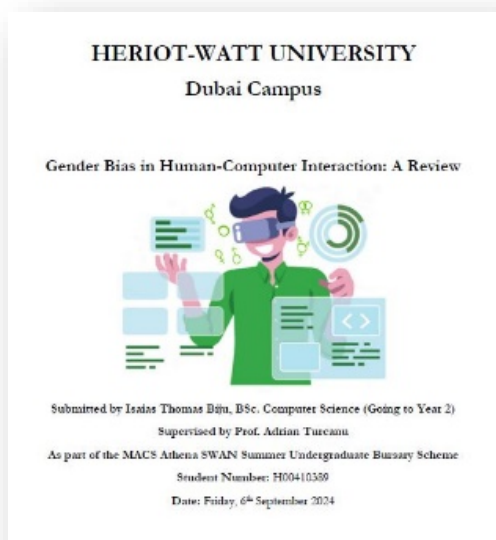
Gender bias in Human Computer Interaction
Student: **Isaias Thomas Biju** (Dubai)
Supervisor: **Adrian Turcanu**

I am extremely grateful and honoured to have been a recipient of the MACS Athena SWAN Undergraduate Bursary Scheme 2024, performing under the supervision of Prof. Adrian Turcanu. After about four months reading 60+ peer-reviewed articles and conference papers on Gender Bias and the latest trends in Human-Computer Interaction (HCI) from the Discovery tool, I am pleased to report the successful completion of my review article titled 'Gender Bias in Human-Computer Interaction'.

Though the paper has neither primary nor secondary research (since I have not collected or analysed data at any stage), its value lies in its consolidation of a wide range of existing literature on the subtle and overt manifestations of gender bias in HCI. Except for the image used in the cover page (which has been slightly tweaked by me multiple times), the graphics used in the paper are designed by me to bring visual flair to an otherwise information-heavy paper. There are almost no wasted sentences, as almost every line contains an example of bias or a potential solution to it. From underlying conceptual foundations to potential resolutions, the paper is replete with carefully referenced and cited knowledge (48 peer-reviewed articles and conference papers). I used our university's Skills Hub webpages for its Literature and Synthesis Matrix in the early stages of plotting, layout and thematic analysis. By following the layout of some other research papers in APA format and HWU Cite Them Right referencing, I included sections titled Abstract, Keywords, Introduction, Conclusion, References and so on.

I hope that my paper not only presents its findings, but also motivates further research and review towards greater Equality, Diversity and Inclusion (EDI) practices.

HERIOT-WATT UNIVERSITY
Dubai Campus

Gender Bias in Human-Computer Interaction: A Review

Submitted by Isaias Thomas Biju, BSc. Computer Science (Going to Year 2)
Supervised by Prof. Adrian Turcanu
As part of the MACS Athena SWAN Summer Undergraduate Bursary Scheme
Student Number: H00410389
Date: Friday, 6ᵗʰ September 2024

Contents

Copies available on request from Isaias [itb2000@hw.ac.uk]

Graph Convolutional Networks for Image and Mesh Denoising
Student: **Maria Esteban Casadevall** (Edinburgh)
Supervisor: **Audrey Repetti**

Image denoising is an inverse problem that aims to recover a clean image from a noisy one, usually after being degraded by Gaussian noise. While variational methods have traditionally been used for this task, deep learning approaches, particularly CNN, have demonstrated to outperform these classical techniques [1]. In this project, we investigate the use of Graph Convolutional Neural Networks (GCN) for images and 3D-Meshes denoising.

Graph Neural Networks take as input a graph, along with a set of feature vectors associated which each node. Since the order of nodes in a graph is arbitrary, GNNs are designed to incorporate this property into their architecture. In this project we use the GCN presented in the paper *Semi-Supervised Classification with Graph Convolutional Networks* [2] to construct our models.

| Image Denoising with GCN	3D-Mesh Denoising with GCN
Before implementing the GCN, we first need to transform the image to a graph. In this project we explored three different ways to do so. All the approaches convert each pixel into a node, with its features containing the RGB values. The difference lies in how these nodes are connected to one another. The method that performed the best consists in a grid-like graph structure. For our experiments, we used 64×64 grey images provided by the Fetch Olivetti Faces dataset.	3D-Meshes are naturally modeled as graphs. In this case, Gaussian noise is added to the position of the nodes, without changing the topology of the graph. For our experiments, we worked with an 8100-node mesh of a bunny.

Figure 1: Denoised images with GCN
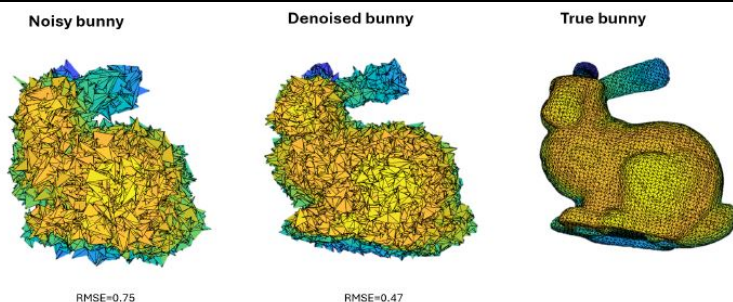
Figure 2: Denoised mesh with GCN

In a future work it will be interesting to investigate more optimal ways to constructs graphs from images, and to improve the performance of the models with more sophisticated State-of-the-Art techniques.

The MACS Athena SWAN Bursary gave me the opportunity to explore neural networks for the first time and improve my Python skills. I thoroughly enjoyed the experience and I am looking forward to expand this project on the future.

References

[1] Diego Valsesia, Giulia Fracastoro, and Enrico Magli. Image denoising with graph-convolutional neural networks. *2019 IEEE International Conference on Image Processing (ICIP)*, 2019.

[2] Thomas Kipf and Max Welling. Semi-supervised classification with graph convolutional networks. *International Conference on Learning Representations (ICLR)*, 2016.

TechSheCan: Empowering Women in Technology
Student: **Mufliha Shake Dawood** (Dubai)
Supervisor: **Drishty Sobnath**

Summary: The TechSheCan project aimed to bridge the gap between female non-cognate students and computer science students by promoting awareness, interest, and engagement in Data Science and Artificial Intelligence (AI) fields. Three events were organized, particularly focused on encouraging women to explore and consider careers in technology.

Event Details

Event Name	Event Date	Number of Registrations
Green Datathon 1: Mapping Forest Futures	3rd July 2024	38
Green Datathon 2: Mapping Forest Futures	17th July 2024	42
UX/UI Design Hackathon: Crafting a Greener Future	23rd August	46

Event Description:

The TechSheCan event series comprised three sustainability-themed sessions designed to inspire and equip women with skills in Data Science and AI. We hosted two Green Datathons focused on analyzing global forest trends using the FAO's dataset (1990-2020). These events featured Kehinde Makinde, a Data Analyst who transitioned from Information Security, and Souvenir Okey, a Business Analyst with expertise in both Machine Learning and business. During these datathons, I conducted beginner-friendly, code-along workshops using Google Colab, guiding participants through Python libraries for data analysis, cleaning, manipulation, and basic prediction tools. Our final event was a UX/UI Design Hackathon centered on crafting a greener future. Sarah Longbottom, who transitioned from a non-computing background shared her journey. The session included an overview of UI/UX concepts, Figma demonstration, and discussions on enhancing the design process. Participants worked in teams to design Personal Carbon Footprint Dashboards, which they presented at the end of the session.

Event Outcome:

Undergraduate and postgraduate students from various disciplines had substantial improvements in their knowledge across various technical areas, including data science skills (such as data cleaning, analysis, and visualization) and design competencies (like UI/UX design and prototyping with Figma) was observed through the survey. Notably, there was a marked increase in interest in pursuing technology-related careers, with many participants expressing a higher likelihood of entering fields such as AI, Data Science, and Design/Generative AI after attending the events. The quality of challenges provided across all events was consistently rated as good to excellent, contributing to the overall positive experience. Participants particularly valued the opportunities for learning new skills, collaborating with peers, and networking. These results underscore the success of the events in both enhancing technical knowledge and inspiring career interest in technology fields among the diverse group of attendees.

Conclusion:

The TechSheCan project promoted female role models in technology, increased AI/Data Science interest among non-cognate students, and built a supportive community for those exploring computer science. It encouraged interdisciplinary collaboration, providing learning and networking opportunities, successfully empowering women and bridging the gap between non-cognate students and tech careers.

Future Recommendations:

To sustain momentum and interest, it is essential to continue organizing similar events while expanding the range of topics to include emerging technologies. Increasing collaboration with industry partners will provide participants with real-world insights and developing a mentorship program can offer ongoing support to those interested.
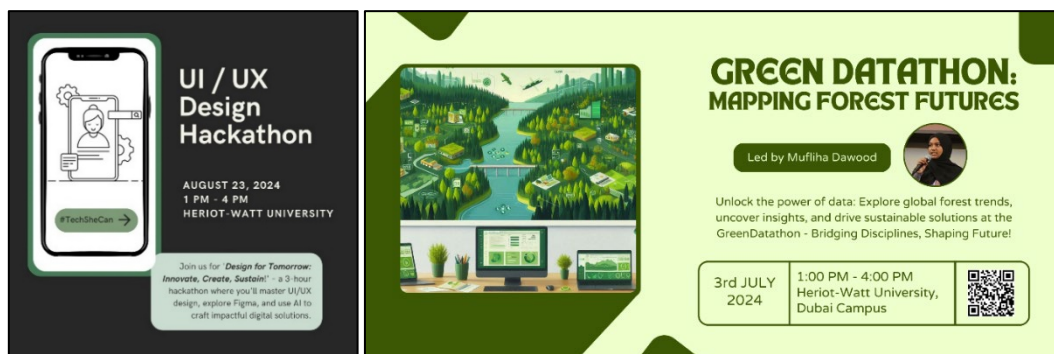
Appendices:

Fig 1 & Fig 2: Marketing Materials for Hackathon and Datathon respectively.

Fig 3: Speaker (Mufliha) taking to participants a Code-Along Workshop.
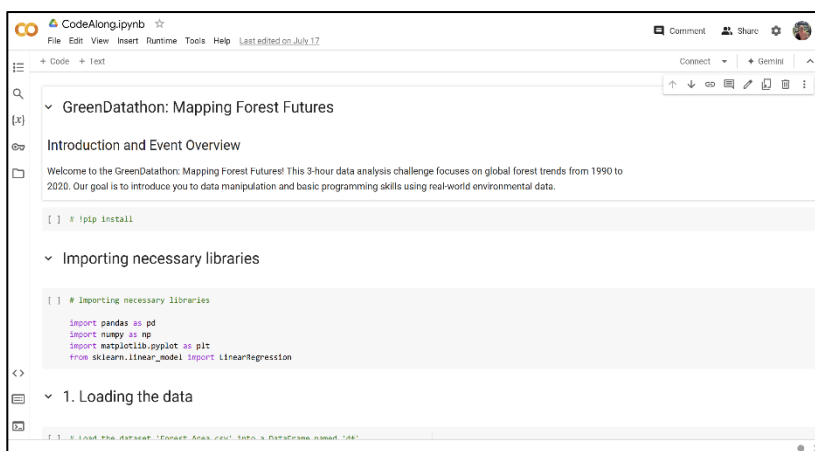

Fig 4: (left) Dr. Drishty Sobnath (Project Supervisor) addressing the participants at the beginning of the Datathon; (right) Code-Along code snippet.

Easing the Transition from College to University
Student: **Kumi Gilchrist** (Edinburgh)
Supervisor: **Kathrin Stark**

This summer, I worked on a project aimed at supporting Associate Students transitioning from College into Year 3 of the Computer Science (CS) programme at Heriot-Watt University. This transition is particularly challenging because Associate Students are required to quickly adjust to a new institution while tackling one of the toughest academic years of the CS degree programme. Limited awareness of the Associate programme among Lecturers can lead to courses structured with the assumption that students have specific prior knowledge from Years 1 and 2, causing a context gap for Associate Students. Additionally, many Associate Students must balance the demands of university on top of pre-existing work and caring responsibilities.

[Figure 1: Justyna and I working on additional study guides for Associate Students]

To address these challenges, I teamed up with another Associate Student, Justyna, to create an Associate Students Network. The goal was to facilitate peer support, build community, and offer informal mentoring opportunities for Associate Students. Key outputs of the project include establishing dedicated communication channels on Microsoft Teams and Discord, allowing students to connect and share experiences. We also provided additional study resources specifically tailored to challenging Year 3 CS courses. Importantly, we worked with university staff to secure access to Year 1 and 2 CS course materials, helping students bridge gaps in assumed knowledge. Finally, we organised in-person events to foster connections among Associate Students on campus.

I found this project both enjoyable and rewarding. I developed leadership and project management skills by taking this initiative from conception to completion. Collaborating with fellow

students and staff across the university has also strengthened my sense of community, and I believe Heriot-Watt is genuinely invested in supporting its Associate Students' success.

[Figure 2: Kicking off the school year with a pizza party for Associate Students]

More Associate Student events are planned to take place over the academic year ahead. I'm excited to see how this project develops in the months and years to come.

A Study of the Topological Definition and other Aspects of Continuity
Student: **Gabrielle Pirie** (Edinburgh)
Supervisor: **Beatrice Pelloni**

Towards the end of the second year of my Actuarial Science course, my professor for Multivariable Calculus and Real Analysis B, Beatrice Pelloni, approached me with a proposal for a project we could put forward for the MACS Athena SWAN Summer Bursary. A colleague of Beatrice's in America, Peter Olver had been looking at teaching the Multivariable Calculus course from a basis of topological continuity as opposed to the current method of limits. Throughout my summer, I was looking through the course notes produced by Olver, followed by other textbooks looking at continuity, in order to gain a better understanding of what needed to be covered in the course, as well as what direction of approach may be more understandable for the students. It has been very interesting to see the ways different textbooks approach the same material, and I feel that the MACS Athena SWAN Summer Bursary has allowed me a better understanding of the material, ways of writing mathematics on a computer, and the way mathematical ideas can be conveyed to others.

A STUDY OF THE TOPOLOGICAL DEFINITION AND OTHER ASPECTS OF CONTINUITY

GABRIELLE PIRIE (HERIOT-WATT UNIVERSITY)

The purpose of this summer research project was to study the concept of continuity, central to mathematical analysis, in more detail and greater generality than was done in the real analysis course. In particular, I read through a draft calculus textbook by Peter Olver who revisits the usual content of the real analysis course using only the topological definition of continuity and the consequences of this for defining continuity in topological metric spaces. We also reviewed and studied the definition and properties of some fundamental continuous functions: logarithm, exponential, and trigonometric functions.

Timeline. I had an in person meeting with my supervisor on the 07/05/24 in order to receive any physical media required. I had project meetings with my supervisor weekly or bi-weekly from 28/5/24 to 31/7/24, with three holiday breaks in between.

Week 1-3. For the first part of the project, I went through the material in Olver's book [3], studying the topological definition of continuity and giving alternative proofs of all the basic theorems in real analysis using it. I also solved a few exercises on this material, discussing them in the final week on this period.

Week 4-5. I then studied Chapter 8, *Continuity*, of O'Searcoid book on Metric Space [1], and did a number of the exercises in it. This forced me to dip back into some of the earlier definitions in the book, too.

Week 6. I studied Chapter 6, *The logarithmic and exponential functions*, of the classic book by Apostol on Calculus [2], and did many of the very long list of exercises.

Week 7-8. I used introductory notes to learn the basics of LaTeX to write up exercise solutions and report. I wrote up and discussed the solutions of the problems that I have considered and finalised the writing of this report.

Results and reflections on the project.

Continuous Calculus.

- Better for a deeper understanding (possibly because I had already done one calculus course)
- Definitions and theorems appeared harder to memorise (would be necessary for the completion of the course)
- Would likely be better taught instead of read, but that would be the case if it was the go-to way of teaching calculus
- Interesting to read, though slightly dry in a number of places

Continuous Topology.
- Useful, good practice for wordier questions that require wordier answers
- Good practice for quickly scouring through the notes for relevant definitions and theorems.

Metric Space.
- Used language I was unfamiliar with, so took a bit longer to understand
- Diagrams were helpful for better understanding what the examples/questions were saying

Exercises 8.+.
- Interesting, it requires the use of prior information to answer some of the questions
- Sometimes difficult to understand what the questions were asking of you, making it difficult to finish

One-Variable Calculus with an Introduction to Linear Algebra.
- It was fairly easy to tell that the book was written a long time ago from the language used
- Explains a lot of maths that we usually just get told works (like the differentiation formulas for arcsin/arccos) - it was really interesting to see how some of that is derived
- A lot easier to read than "Continuous Calculus", less dry and more streamlined

Exercises 6.+.
- Really fun, you had to apply lots of previous knowledge (or just knowledge restated in the textbook) in order to reach the correct conclusion
- The little hints and suggestions they provide are actually very useful - sometimes the hints textbooks provide are things you had already tried and don't help if you're stuck
- There are no worked solutions, so if you were stuck you would need to have someone you could ask for help - e.g. a teacher

LaTeX.
- Fairly easy to get the hang of quickly
- The information sent to me by Beatrice was very helpful (the LaTeX tutorial and the PowerPoint from a colleague)
- Easy to google if unsure of how to do something
- It seems like it would be very useful in the future, so learning it has long term benefits

REFERENCES

[1] Mícheál O'Searcoid, *Metric spaces*, Springer Science & Business Media (2006)
[2] Tom M. Apostol, *Calculus*, Volume 1, John Wiley & Sons (1991)
[3] Peter Olver, *Continuous Calculus*, Preprint (2023)

Peer-led support for Year 3 Direct Entry Students
Student: **Justyna Ulejczyk** (Edinburgh)
Supervisor: **Kathrin Stark**

During the summer of 2024, I collaborated with Kumi Gilchrist on a project under the Athena SWAN Summer Bursary scheme, initiated by one of our lecturers at Heriot-Watt University. The goal of the project was to improve the experience of direct-entry students who join the university in their 3rd year, often from college-level education.

We recognised where students were frequently facing challenges. Students starting in 3rd year, not 1st year, coming mostly from college education, very often struggle on many levels. This project aimed to fill that gap by creating a structured support system.

During our work in summer, we created online spaces for new students: MS Teams and Discord server.
The MS Teams group is designed for sharing resources, collaborating, planning and advertising events for this small cohort. The Discord group's goal is to connect informally and share thoughts and ideas not necessarily related to university.

After consulting with the associate programme director and drawing from our personal experiences, we identified the specific areas where students struggle, and highlighted what kind of support would be most beneficial.

Next steps in our project were events. In Week 1 of the academic year, we hosted an introductory event where we presented the project and invited students to network over pizza. We organised a small gathering over the mentioned pizza to get to know each other and answer questions. We are also planning a Q&A session to address concerns for Year 2 students who are considering direct entry in Year 3.

The peer-led support system was designed with sustainability in mind so that it can be developed further in the coming years. We hope future students will take the initiative to lead the project and continue supporting new direct-entry students.

For me, the most rewarding aspect of the project has been connecting with students and engaging them with university life. This experience allowed me to expand my leadership and organisational skills, build a wider network, and reflect on my own journey through university.

I really enjoyed taking part in the project. Meeting new people and sharing my personal experience let me reflect on my journey at university.

2. MACS Athena SWAN Summer Undergraduate Bursary Scheme 2025

The aim of the **MACS Athena-SWAN Summer Undergraduate Bursary Scheme** is to improve gender equality across our three disciplines, and more broadly address diversity, equality and inclusion (EDI) issues. Any project that funds a student from an under-represented group meets this criteria. Likewise, a project topic that directly addresses EDI issues also meets this criteria. Project ideas can come from students and/or academic staff from across the School. A project proposal, however, must be submitted by an academic member of staff that is willing to act as the project supervisor. **Details of the application process for 2025 will be advertised in the January issue of the Athena SWAN Newsletter**.

3. MACS Athena SWAN Silver Award Application Update

Our MACS Athena SWAN Silver Award Application was submitted on the 30th of September. This has been a huge team effort, involving **MACS staff and students (Edinburgh campus)**, as well as **Expert Advisors from Heriot-Watt's Human Resources Directorate**:

Ben Agnew, Lehel Banja,i Diana Bental, Tessa Berg, Lyonell Boulton, Damien Clancy, Fraser Daly, Pamela Docherty, Catherine Donnelly, Rhona Feist, James Gaunt, Theodoros Georgiou, Jurriaan Hage, Jennifer Hurley, Andrew Ireland, Stefan Klus, Sara Lombardo, Manuel Maarek, Alistair McConnell, Susan McKenzie, Mika Moriyama, Maja Pearson, Beatrice Pelloni, Marcelo Pereyra, Claire Porter, Penny Premsuriya, Mateja Presern, Audrey Repetti, Marta Romeo, Christian Saemann, Lucia Scardia, Lisa Scott, Ian Sharpe, Kathrin Stark, Rob Stewart, Andrew White and Sara Wood.

Watch this space for further updates!

***

If you have suggestions or questions related to Athena SWAN, or an event that you would like to advertise, then please send them to us via athena-macs@hw.ac.uk. In addition, if you would like to be part of the new **MACS Equality Diversity and Inclusion Team (EDIT)** then please do get in touch.

Audrey Repetti and Andrew Ireland
(MACS Athena Swan Coordinators)

Ada Lovelace Day 2024
in Dubai

MACS Dubai are planning an Ada Lovelace Day 2024 event which will take place on **Thursday 3rd October 5-6pm.** Ada Lovelace Day is celebrated every year on the second Tuesday of October month to celebrate the contribution of women in Science, Technology, Engineering and Maths (STEM) in the memory of the world's first computer programmer.

Calling on all **MACS Dubai Computer Science students who will be going into Year 4 in September** to step into the spotlight and share your passion, projects, and career goals in a dynamic format using the **PechaKucha presentation** style. Each presenter shows 20 slides, each for 20 seconds of their achievements as a computing student at Heriot-Watt.

Join us for the electrifying **PechaKucha presentations** where creativity knows no bounds! Participate in our event, develop your soft skills and you will receive a presenter certificate that can impress your next employer.

Presenter slots are limited, please get in touch via the email address below to secure a place and showcase your work:

d.sobnath@hw.ac.uk

Organizers: **Drishty Sobnath** and **Hind Zantout**
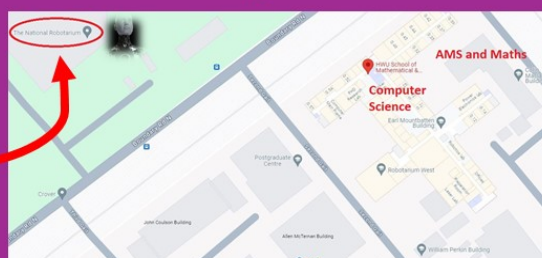
Ada Lovelace Day 2024
In Edinburgh

Register today to avoid disappointment!

The School of Mathematical & Computer Sciences (MACS)

A Robot Demo + Refreshments to celebrate

Ada Lovelace Day 2024

1pm Tuesday 8 October (1-hour)
@ the National Robotarium

Invitation open to: All Year 1 Undergraduate students from our Departments of **Actuarial Mathematics & Statistics, Mathematics** and **Computer Science**.

A MACS Athena SWAN sponsored event

Register Today and Avoid Disappointment!

The Amica

Dr Marta Romeo

Why Ada Lovelace Day?

Scan QR Code to find out more