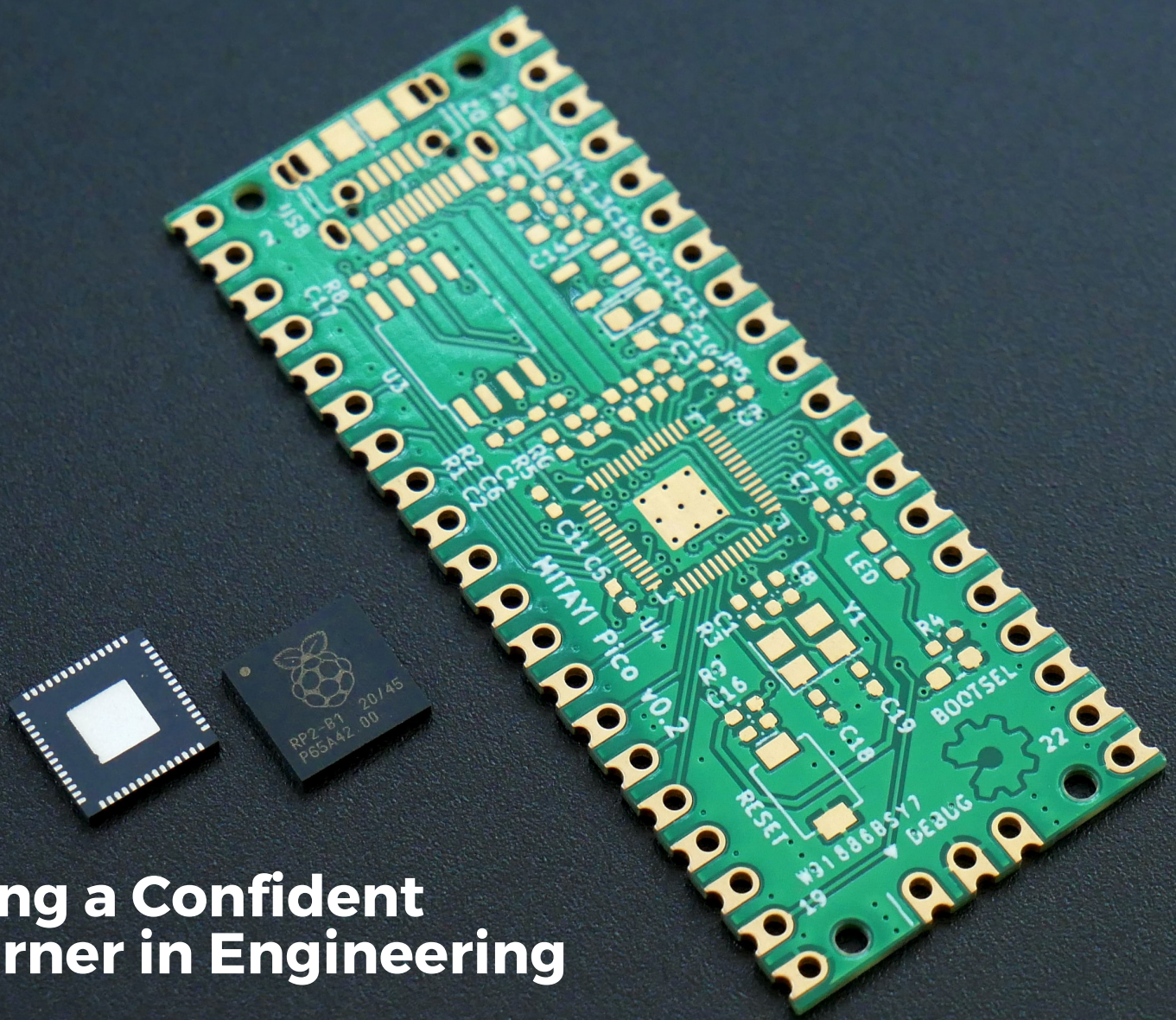# E CARRIER

THE OFFICIAL MAGAZINE OF ENTC

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ENTC Electronic and Telecommunication Engineering

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# Being a Confident Learner in Engineering

by Ranga Rodrigo

Twenty years of experience with engineering students has shown me that the defining trait of a successful and enjoyable undergraduate career at a competitive engineering school is all about sustaining a level of high confidence. Authentic confidence---in exceptionally talented students---thrives on and leads to academic success. Therefore, actively nurturing confidence and maintaining good grades simultaneously are important. There are certain time-tested methods of achieving these---budgeting time, concentrating on overcoming one challenge at a time, and working in peer groups---, often overlooked due to being obvious. In this short article, I will equip the students with these few techniques for graduating as successful and confident engineers.

If we do not honor the time allocation that we ourselves made for a course module and, due to that, are not able to understand the lessons or solve problems, our mind will play the trick of telling us that we cannot do the work because we are not good at it. Thereby, we ourselves have created our own daemon which torments our academic work and life! Our lack of confidence in this one module will spill over to the others. The solution is there in the problem definition itself: we must allocate frequent time slots for each module in our personal timetable and honor those allocations. To put it in another way, if we treat the time that we have as money and carefully budget it, i.e., allocate timeslots for each module, assignments, general reading, leisure, hobbies, and sleep, and adhere to our own regulations, we will shun away the daemon that kills our confidence.

Sticking to the time allocation trick works well in fair weather; what should we do if we have already lost confidence in almost all course modules? This situation is more challenging. When one does not comprehend a lesson, the temptation is to skip the following lessons leading to a disconnect with the module. Consequently, assignments become impossible, workload overwhelming, and examinations insurmountable. This, however, is a commonplace situation that can be easily overcome. To overcome this difficulty, rather than attempting to study all modules at once, we can do a one-time allocation of a full day or two for one module we like and unceasingly study until understanding dawns. The rationale is that if we overcome one challenge out of many, we will be able to magically be confident in all modules at hand. If we lose confidence in many modules altogether, we must work on regaining confidence by just mastering one single module.

Working in peer groups makes learning much easier and more enjoyable in challenging situations, and in achieving exceptional targets. Peer groups naturally form in a university setting. Working in groups on solving hard problems is a well-tested method. For instance, I have witnessed student groups brainstorm on engineering designs, formulating research problems, and solving such problems leading to unimaginable results. Some students collaborate on assignments and study together for examinations. A caveat in this respect may be---unauthorized collaboration and plagiarism---traps we must be very careful about when working in groups. In contrast, a valuable byproduct is the joy of working in groups. Therefore, whenever you feel challenged about a lesson, are in search of research problems, or exhaustively thinking of solutions, consider resorting to the sure solution of working together in a peer group.

The tricks of time allocation and following through, overcoming one academic challenge at a time, and working in peer groups have survived the test of time in achieving academic success. All these traits lead to reinforcing our confidence and academic achievements in undergraduate life in an enjoyable manner.
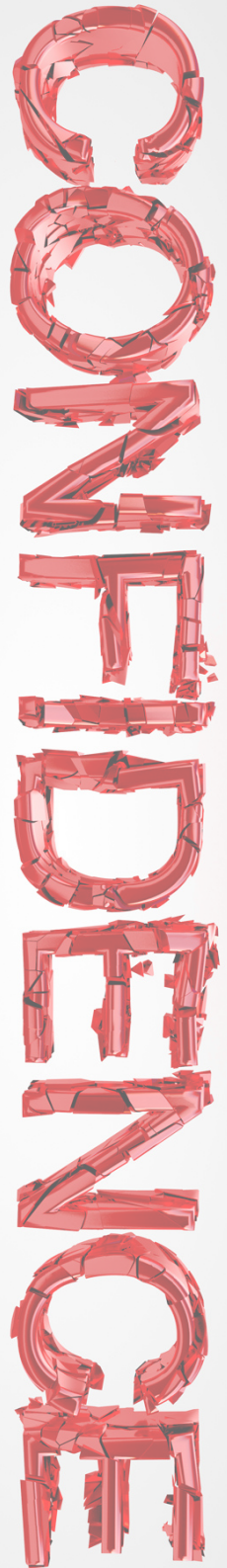
Website Traffic Fingerprinting

by Yasod Ginige

Tor is a free and open-source software for enabling anonymous communication. It directs internet traffic through a free, worldwide, volunteer overlay network, consisting of more than six thousand relays, to conceal a user's location and usage from anyone performing network surveillance or traffic analysis. Using Tor makes it more difficult to trace a user's internet activity which is a plus point for the Dark Web. The Dark Web is the hidden collective of internet sites only accessible by a specialized web browser. It is used for keeping internet activity anonymous and private, which can be helpful in both legal and illegal applications. These illegal activities are going through Tor continuously increasing cybersecurity threats and legal authorities cannot use IP addresses to monitor suspicious activities and collect evidence against criminals. However, if an attacker can trace the encrypted traffic of a user at the access point, he/she can extract some valuable metadata which reveals the visiting websites of a user, and it opens a path to act against these illegal activities.

Traffic fingerprinting attacks allow an adversary to infer the webpage or the website loaded by a user based only on patterns in the user's encrypted traffic. HTTPS encrypted traffic can leak information about underlying contents through various statistical properties of traffic flows like packet lengths and timing without decrypting them. An attacker can develop a model to identify a selected subset of websites using a sufficient amount of data collected using these traffic traces. Then if an attacker can eavesdrop on a user's traffic, given a traffic trace is from that subset and continuous for a sufficient time, this model can be used to identify which website that particular traffic trace belongs to[2]. This concept is called Traffic Fingerprinting. There are some limitations which are discussed later in this article.

The next problem would be finding out a method to trace someone's traffic. There are some open-source software tools we can use to trace traffic over Wi-Fi. 'Airodump-ng' and 'Wireshark' are some tools that allow passive listening for WiFi communication and it only reveals metadata without decrypting data packets. Also, if the attacker is from a legal background, he/she can tap routers and use filters to trace user traffic. Either way, collected data can be used to train a deep learning model and it will learn traffic patterns that are unique for each website. After analyzing the literature published in the recent past, it is clear that Convolutional Neural Networks are the best matching deep learning structures for this classification problem [6][2]. Even though it looks very straightforward there are some challenges to overcome in order to take this concept to the application level.

First and foremost, it should be emphasized that there are millions of websites actively running on the internet and an attacker cannot train his model using all these websites. He/She will be interested in a subset of that, which probably has around 100 websites and most of the websites will be unknown, and the trained model will be blind to those. Also, there is a possibility that a traffic trace from an unmonitored website and a monitored website has similar characteristics. So, there is a high probability of misclassifying a traffic trace from that unmonitored website as a monitored traffic trace. This is called the open set classification problem in traffic fingerprinting. As a solution for that, recent research has found a technique that uses the penultimate layer outputs for classification[1][3]. Since Softmax function eliminates information of the penultimate layer by forcing them towards 0 and 1 edges, eliminating that step would preserve valuable information which can be used to identify open set traffic traces. For example, let's say the penultimate layer is bounded to (-128,127). Then the penultimate vector for a close set input and an open set input would look like as follows. It is challenging to define a classification rule using this penultimate layer information and there are several techniques used by state-of-the-art models. Class anchor clustering[3], euclidean distance based classification in the penultimate vector space and fitting those distances to distributions[1][5] to predict probabilities are some of the key ideas used in these methods. More details can be found in the cited resources.

UNMONITORED WEBSITES - OPEN SET

MONITORED WEBSITES - CLOSE SET
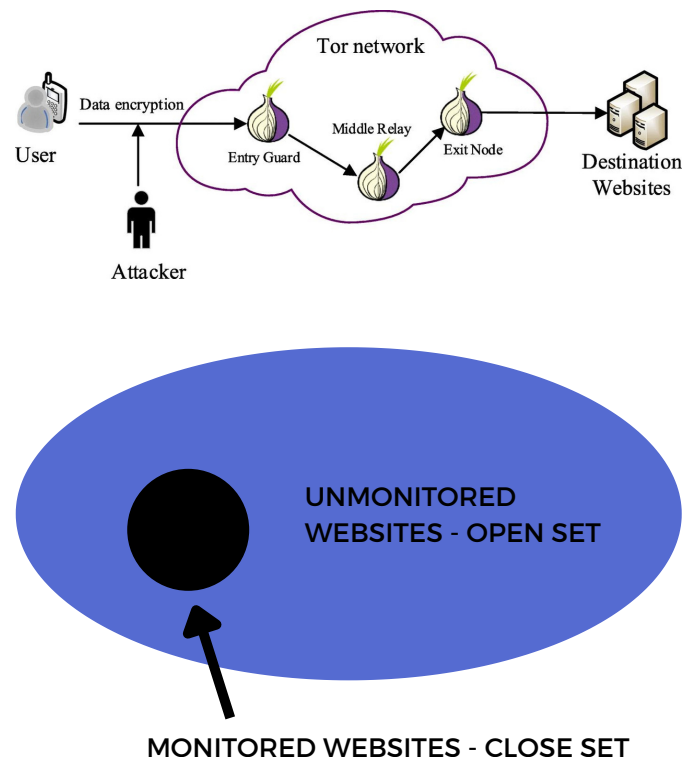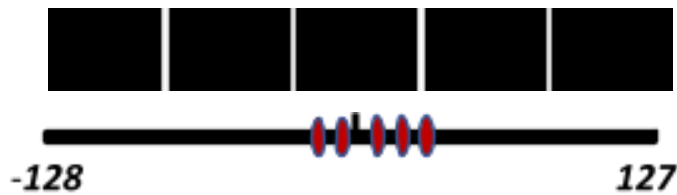
Penultimate layer output for an **open**-**set** input. It can be clearly seen that values are concentrated at the middle and there isn't any distinctly high value. So, it is likely that the model doesn't have trained for an input trace like this. So, it should be an open-set website.

Penultimate layer output for a **close**-**set** input. It can be clearly seen that values are concentrated at the edges and only one value is distinctly high. So, we can classify it as Class 3.

Another problem to be overcome is content changes in the monitored websites over time. This causes changes in traffic traces of a particular website so the accuracy of a trained model will drop. Ensemble learning of snapshots of deep neural networks has provided some robustness over this issue but retraining the model after some time would be the best solution for that. Required time and resources can be reduced by using transfer learning.

We can deploy these models on routers, P4 switches to detect illegal activities happening over the internet. One of the main issues is that most of these already deployed devices have only an integer arithmetic unit. So, we can't deploy normal deep learning models on these devices since they need floating point arithmetic support. To solve this issue, we can represent all the floating points using integers. This conversion is called quantization of deep learning models and it doesn't reduce the accuracy significantly[4]. Also, Traffic fingerprinting can have negative effects on network security because an adversary can infer details about web pages that the user is accessing.This technique is used to build various attacks and continuous research must be done to develop defending methods. On the other hand, this can be used to identify illegal activities in cyberspace. So, Traffic fingerprinting brings us both pros and cons and it depends on the purpose of the user.

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Memory Management in C++

by Supun Kuruppu

Managing memory is an important part of developing software. It is especially important in firmware development due to the resource constraint nature of those applications. In some programming languages like Python or Java, the entirety of the memory management process is done automatically, thus relieving the programmer of memory management. However, the complete automation causes inefficiencies in the final program. In C/C++, which are the standard languages for firmware development, only a portion of the memory management process is automated. The programmer has to manage a portion of the memory management process to develop efficient, robust firmware solutions. To understand how to manage memory in C++, it is essential to recognize the memory layout of C++ programs.

Memory Layout of C++ Programs

The memory layout of a C++ program is the arrangement of the memory that it gets assigned by the Operating System.
As depicted in figure 1, it consists of five main sections. They are arranged from higher memory addresses to lower memory addresses as shown.

1) **Text/Code Segment** : This portion of the assigned memory contains all the executable instructions of the program. It is read-only and it is located below both the Stack and the Heap to prevent Heap and Stack overflows from causing an overwrite.

2) **Initialized Data Segment** : This section of the allocated memory contains all the global and static variables of the program that have been initialized to some value.

3) **Uninitialized Data Segment** : This part of the designated memory contains all the global and static variables of the program that have not been initialized to any value.

Figure 1: Memory layout of a C++ program

4) **Stack** : The Stack is a section of the allocated memory that contain data that are associated with the current scope of the program. As the name suggests, it follows a LIFO structure.

5) **Heap** : The Heap is also a section of the assigned memory that holds data. However, it has no association with the Heap data structure. It is a pile of memory locations that are available for the programmer to utilize.

Although there are five main sections in the layout of the allocated memory of a C++ program, there are only two portions that relate to the memory management that need to be done by the programmer, the Stack and the Heap.

Stack Memory

As mentioned previously, the Stack is a section of the assigned program memory that contains data associated with the current scope of the program until the scope's completion. Furthermore, the collection of data relating to a specific scope in the Stack is called a "Stack frame". In the case of nested scopes, the Stack frame of the nested scope is loaded on top of its parent's Stack frame. Since the nested scope is executed to completion before its parent scope due to the sequential nature of programs, the Stack memory behaves according to the LIFO structure. Moreover, the Stack saves data in contiguous memory locations. Therefore, allocating data onto the Stack is extremely efficient, since only the Stack Pointer needs to be moved by the size of the data.

The Stack memory is relatively small. In the Windows operating system, the default size of the Stack memory is 1 MB. Each Stack frame is stored in this Stack's allocated space and the amount of memory that needs to be assigned for each Stack frame is calculated during the program's compilation. Once the program goes out of a specific scope, the Stack frame of that scope is deleted automatically and those memory locations become free for a new Stack frame. If the entire Stack gets occupied and the program instructions request Stack memory for a new Stack frame, the program throws a "Stack Overflow" error.
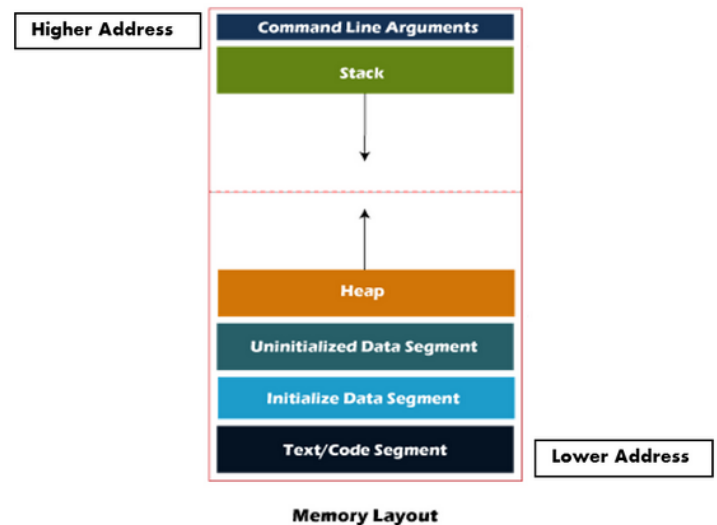
Demonstration

- Allocating an integer on the Stack with the value 5

```
int main(){
    int val = 5;
}
```

```
0x0000007f7ddffa00    00 10 83 7a   f7 7f 00 00   00 00 00 00   05 00 00 00
0x0000007f7ddffa10    00 fb df 7d   7f 00 00 00   3f 14 83 7a   f7 7f 00 00
0x0000007f7ddffa20    01 00 00 00   f7 7f 00 00   18 70 83 7a   f7 7f 00 00
```

The "val" variable has been allocated to the Stack memory in the depicted memory location. Since the integer is 4-bytes, it is represented by four hexadecimal numbers.

- Automatic deletion of out-of-scope variables

```
void func(){
    Example example_obj;

    return;
}
```

```
Output:

Example object is created
```

```
int main(){
    func();

    return 0;
}
```

```
Output:

Example object is created
Example object is deleted
```

As soon as the program goes out of the "func" function where the "example_obj" is created, that object gets automatically deleted.

- Contiguous nature of the Stack

```
int val = 5;

// Allocating  an  integer
array
int num_array[3];

// Assigning values
num_array[0] = 1;
num_array[1] = 2;
num_array[2] = 3;
```

```
0x000000d15abff840    70 f8 bf 5a   d1 00 00 00   a8 18 4d 2e   f7 7f 00 00
0x000000d15abff850    60 25 9b 17   4a 02 00 00   00 00 00 00   01 00 00 00
0x000000d15abff860    01 00 00 00   02 00 00 00   03 00 00 00   05 00 00 00
0x000000d15abff870    60 f9 bf 5a   d1 00 00 00   3f 14 4d 2e   f7 7f 00 00
0x000000d15abff880    01 00 00 00   f7 7f 00 00   18 70 4d 2e   f7 7f 00 00
```

The value of the variable "val" and the values of the array "num_array" are saved in contiguous memory locations.

```
; 5    :  int val = 5;

    mov DWORD PTR _val$[ebp], 5


; 6    :  int num_array[3] = { 1, 2, 3};


    mov DWORD PTR _num_array$[ebp], 1
    mov DWORD PTR _num_array$[ebp+4], 2
    mov DWORD PTR _num_array$[ebp+8], 3
```

The value of the variable "val" and the values of the array "num_array" are saved in contiguous memory locations.

It takes only one assembly instruction to allocate the integer variable on the Stack and three assembly instructions to allocate the integer array of length three on the Stack. Therefore, Stack allocation is extremely fast and efficient.

To be continued...

Professional Development Short Course

by Ishan Fernando

To be proficient in a secured professional career, developing the required set of skills and keeping up to date on current trends is utterly essential. "Professional development short course" helps to identify and develop key strengths of the ENTC undergraduates who will be stepping out of the university. This program will add values to excel at professional behavior in and around the industry, which is equally important as academic qualifications. This short course helps to provide that extra boost needed to uplift future careers. This was initiated under the guidance of Dr. Subodha Charles, Senior Lecturer at ENTC, to raise our students' confidence as they enter the professional space. The end goal is for our graduates to go into the industry confidently.

"ACING AN INTERVIEW", the initial session under this short course, was held on the 20th of January 2022. The significant figures who grace the event with their participation are Mr.Hiran Jayarathne, Head of Product Management & Business Analysis, Mr. Najith Liyanage, Senior Product Manager, Miss Shashini Konkaduwage, Assistant Manager and Miss Nikeshala Samanthilaka, Senior Executive at LSEG technology as the speakers. The main objective of this session was to enhance the awareness of CV screening and the interview stage in the recruitment process. Speakers shared their knowledge on the dos and don'ts of making a good CV in a way that reflects your personality. The ideal format to follow and some special tips to be successful in the CV screening stage were also discussed. The frequently asked questions in the interview stage and how to deliver a good response were also discussed during the session. Speakers introduced the STAR interview model and gave key recommendations to follow when preparing for an interview. Miss Shashini & Miss Nikeshala did a live demonstration of an interview for a better understanding. At last, the speakers made the audience aware of FinTech careers at LSEG and career opportunities at LSEG Technology.

The second session was conducted on the 13th of March 2022 on the topic of "PERSONAL BRANDING" by Mr. Niroshan Madampitige, Co-Founder of International OKRs Alliance & Head of Projects at Vetsoria, and Miss Dahamsa Madampitige, a young keynoter, and a singer. Speakers shared about the success formula to build up a quality personal brand while explaining PDCA management methodology. They spoke about purpose-shaped talents and guided to identify what is your shape as a professional. Personal branding basics were explained and they mentioned personal branding onion as a guide to follow for a good personal brand. Using two in-class activities, they made the audience aware of evaluating canvas and value proposition canvas.

Both sessions were conducted successfully with enthusiastic participation. Professional development short course will have several sessions in the future in order to uplift the knowledge on professional ethics in the workplace and the critical aspects that a successful engineer must enhance through his/her carrier.

First Session of the Professional Development Short Course

ACING AN INTERVIEW

By Hiran Jayaratna,
Head of Product Management & Business Analysis at LSEG Technology

On the 20th of January
7 pm onwards

ENTC
Electronic and Telecommunication Engineering

Mr. Niroshan Madampitige
Co-Founder-International OKRs Alliance
Head of Projects - Vetsoria
Visiting Lecturer - Brimingham City University

Dahamsa Madampitige
Youngest Keynoter in Sri Lanka
Singer

Second Session of the Professional Development Short Course

PERSONAL BRANDING

On the 13th of March
4.30 pm onwards

ENTC
Electronic and Telecommunication Engineering

Paper Acceptance at International Conference of Computer Vision and Pattern Recognition (CVPR) 2022

by Rahul Jeyanthan

Undergraduates at the Department of Electronic and Telecommunication Engineering have never been shy of showing off their abilities at both the local and international levels. In this latest example, a final year project group from the department has taken the department to the very peak of the field of computer vision.

This team comprising Mohamed Afham, Isuru Dissanayake, Dinithi Dissanayake, and Amaya Dharmasiri presented a research paper titled, "CrossPoint: Self-Supervised Cross-Modal Contrastive Learning for 3D Point Cloud Understanding" which was accepted at CVPR 2022, the world's top computer vision conference. This year, the conference was held at Ernest N. Moral Convention Center in New Orleans from June 21 to 23, 2022. It is extremely rare for the research of an undergraduate group to be accepted at a conference of this caliber and the team is grateful for the assistance of Dr. Ranga Rodrigo, Head of the Department of Electronic and Telecommunication Engineering at the University of Moratuwa, and Dr. Kanchana Thilakaratna, a Senior Lecturer from the University of Sydney for their invaluable guidance.

Crosspoint proposes a novel approach toward 3D point cloud understanding through self-supervised learning. According to the team, the problem they were aiming to address was the laborious nature of manual annotation of large-scale point cloud datasets. The method proposed by the team involves a 3D-2D correspondence of objects by maximizing agreement between point clouds and the corresponding rendered 2D image in the invariant space while encouraging invariance to transformations in the point cloud modality. Experimental results have shown that Crosspoint outperforms the previous unsupervised learning methods in a diverse range of downstream tasks including 3D object classification and segmentation and can be considered a state-of-the-art technique currently.

This is a proud moment for the Department of Electronic and Telecommunication Engineering as acceptance at such a prominent conference is one that is not easily achieved. Our heartfelt wishes go to the entire undergraduate team as well as Dr.Rodrigo and Dr.Thilakaratna and wish them the best of luck in their future research.

Research Publications

by Vidushika Rasanji

Undergraduates at the Department of Electronic and Telecommunication Engineering own the pride of being insightful researchers with research articles accepted for top-tier journals. The research column of this article focuses on a research paper accepted for the 44th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC'22) by 17 batch undergraduates.

Research paper acceptance @ International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC'22)

"Semantic Segmentation of Micro-CT Images to Analyze Bone Ingrowth into Biodegradable Scaffolds" is a research paper conducted by Gnanavel Ganeshaaraj and Kaushalya Sivayogaraj under the supervision of Dr. N.W Nuwan Dayananda and Mr. A.I. Kondarage. It has been accepted to present at the International Conference of the IEEE Engineering in Medicine and Biology Society 2022, the world's largest international biomedical engineering conference, which will be held at the Scottish Event Campus (SEC) in Glasgow, United Kingdom from 11th to 15th of July 2022.
This paper is a part of a final year project study that analyzes bone ingrowth into 3D printed biodegrade scaffolds. A novel 3-stage image processing pipeline has been developed to perform an accurate segmentation of the scaffold, bone, and pores from µ-CT images, to investigate bone ingrowth accurately. The conference paper describes the methodologies related to the development of the pipeline and the results associated with it.

Honorable Mentions

Sandushan Ranaweera managed to secure the 2nd Place in Asia Pacific Region at the Internet for All Competition (2021) organized by IEEE Communication Society, under the supervision of Dr. Tharaka Samarasinghe.

Devinda Srinath, Kalana Sanhinda, Manjitha Kularatne, and Nisal Jayamuni secured overall 2nd place and the People's Award at IEEE Electronic Design Competition (2021) organized by IEEE.

Nuwan Bandara, Dilshan Bandara, and Derek Nanayakkara of Team Stimulus won 1st place at MindXtra Innovation Competition: Human-Elephant Conflict Track (2022) which was organized by Leo Club of the University of Moratuwa.

Team Phoenix's Isuru Munasinghe and Yomali Lokugama managed to secure a place in the Top 5 Innovative Ideas at the INNOVMIND Ideathon International Competition (2021) organized by IEEE Industry Applications Society of Sri Lanka Technological Campus.

Chalani Ekanayake, Sachini Chandanayake and Sandani Jayawardena of Team Ares secured 3rd place at SLIIT Codefest Datathon (2022) organized by SLIIT and Nagarro.

Hasantha Nadeeshan, Hiruna Vidumina, Gangitha Maheekumara, and Prishan Samarasinghe were able to place 3rd, 4th, 6th, and 10th respectively at Huawei ICT Competition Sri Lanka 2021-2022 organized by Huawei.

ENTC Careers Fair

by Maleesha Ruvindi

ENTC Careers Fair is a prominent event in the department calendar. Since 2018, E-club has organized the ENTC Careers fair annually as a platform to bridge the gap between fresh graduates and the industry. It is the official careers fair of the Department of Electronics and Telecommunication Engineering of the University of Moratuwa, an occasion for the industry to meet a pool of competent ENTC undergraduates to discuss career opportunities, conduct interviews, and recruit candidates fulfilling the company criteria.

This year, the event was successfully held on the 12th of January 2022 for the fourth consecutive time. It was carried out virtually through zoom and a website. Over 40 leading companies from the industry joined hands with the Department of Electronics and Telecommunication Engineering to choose the best matches for their company roles. Above 110 final-year undergraduates participated and faced the interviews to find their dream jobs. The event was sponsored by Synopsys Lanka, Huawei Technologies, Paraqum Technologies, Axiata Digital Labs, and Yaala labs.

Every year, as a part of the Careers Fair, interview preparation sessions are carried out to aid fresh graduates in preparing for their interviews. This year, two such sessions were carried out virtually, prior to the interviews. Mr. Savindu Herath, a department graduate, conducted an invaluable session on interview preparation on the 30th of December 2021.

A CV preparation session was carried out by Mr. Tharindu Malawaraarachchi, Co-founder, Director of Fcode Labs, on 1st January 2022. Key elements of a CV and proper structuring were discussed with detailed examples. The usefulness of these sessions was proved by the active participation of students.

Additionally, a series of information sessions were conducted from the 3rd to the 7th of January by eighteen leading companies. During each session, the respective company informed the students about their company vision, short-term and long-term goals, available positions, and the projects undertaken by the company.

Pi Mora 1.3, a Step towards a Proficient Raspberry Pi Community

by Samudika Pathiratna

Aiming to establish an extensive Raspberry Pi community in Sri Lanka, Pi Mora 1.3 marked a significant milestone as the final stage of the first premier Raspberry Pi Jam Series in the country. Pi Mora 1.3 was launched on 23rd April 2022 on a virtual platform and successfully concluded on 30th April 2022.

In comparison to the previous stages of the Pi Mora Jam Series, Pi Mora 1.3 intended to encourage a broad demographic, which was not limited to the undergraduates of the Department of Electronic and Telecommunication Engineering at the University of Moratuwa. Pi Mora 1.3 can be recognized as a fruitful effort to expand the horizons of technology enthusiasts regarding more advanced applications of Raspberry Pis, including the disciplines of drone technology, robotics, and machine vision.

Similar to the preceding stages, Pi Mora 1.3 featured two guest talks from reputed industry professionals representing the local industry as well as overseas industries and a workshop conducted by undergraduates of the University of Moratuwa. The Jam commenced with an informative Talk session on "Applications of Raspberry Pi in Drone Technology" with Mr. Janith Gunarathna, an alumnus of ENTC as the resource person. As the UAV System Engineer and Chief Technical Officer at Pristine Innovations, he shared his invaluable experience with the participants.

The second session, a workshop conducted by Avishka Perera and Yasiru Karunanayaka, undergraduates of ENTC, was primarily focused on the use cases of Raspberry Pi in machine vision. The workshop facilitators demonstrated a face mask detection project, explaining the content of the code from scratch, starting with computer vision fundamentals.

Bringing the first of the Pi Mora Jam Series to successful completion, the final session of Pi Mora 1.3 was a Talk session, with Mr. Achala Athukorala, an ENTC alumnus, as the speaker. As a research engineer at Singapore University of Technology and Design(SUTD), Singapore, and with experience acquired as a former electronics engineer at Zone24x7, he enlightened the audience on 'Applications of Raspberry Pi in Robotics'. The session was informative and mainly focused on autonomous navigation for mobile robots with ROS using Raspberry Pi. The content elaborated on the operation of the navigation system and the procedure of setting it up. Inspired by the positive outcomes of its preceding stages, Pi Mora aspires to launch more Jam Series in the future with the hope of expanding the audience and nourishing technology enthusiasts with knowledge.

LSEG Tech Equipment Handover

by Sandani Jayawardena

London Stock Exchange Group

LSEG Technology, a division of the London Stock Exchange Group (LSEG) develops and operates high-performance technology solutions for over 40 organizations and exchanges. For over 300 years, LSEG has earned its clients' trust as a diverse international markets infrastructure organization. Throughout the past years, LSEG has continually supported the Department of Electronic and Telecommunication (ENTC) Engineering through sponsoring the major iconic events within the department which include the Annual Careers Fair, Sri Lanka Robotics Challenge (SLRC), and holding insightful short courses on professional development for ENTC undergraduates.

LSEG Technology has very recently donated two servers and four FPGA boards to the Electronic and Telecommunication Engineering Department of the University of Moratuwa. The event was coordinated by Mr. Thayaparan Sripavan, Head of Hardware Accelerated Systems at LSEG Technology. The handover event was held at the university premises with the participation of Mr. Hiran Jayaratna, Head of Product Management & Business Analysis at LSEG Technology, Mr. Prabath Fernando, Head Of Architecture at LSEG Technology, and Mr. Prasanna Karunarathna, Head of Business Operations at LSEG Technology representing LSEG Technology. Dr. Ranga Rodrigo, Head of the Department of Electronic and Telecommunication Engineering, Dr. Chamira Edussooriya, and Dr. Subodha Charles, Senior Lecturers at ENTC, attended the event representing the department. A special thanks go to Prof. Gihan Dias for hosting the event.

As ENTC undergraduates, we are extremely grateful for the generosity of LSEG for this valuable gift to the department. We will be reaping maximum benefits from these equipments in the near future.

A Win-Win Relationship
Industry Collaboration

by Sachini Chandanayake

Creative Software

In recent years, there has been a significant increase in research interest supporting the development of the autonomous vehicle, which has the ability to sense and react to its immediate environment while navigating roadways without any human intervention. In autonomous driving systems, the object detection subtask is one of the most critical prerequisites for autonomous navigation as it allows the vehicle to account for obstacles when inspecting future trajectories. Therefore, it is crucial to utilize algorithms as accurately as possible with minimum latency. In this context, objects are classified into two categories; static and dynamic objects. Traffic lights, traffic signs, road signs, markings, etc. are considered static objects, whereas moving vehicles, pedestrians, animals, etc., are deemed dynamic objects.

Road Sign, Traffic Light, and Static Object Detection for Self-Driving - Stage II

Even though significant improvements have been achieved in object detection for autonomous navigation in the past few years, no study has been devoted to tailoring any of the algorithms or datasets for the local (Sri Lankan) context. Further, one of the open challenges in traffic detection is the inability to detect traffic signs with sufficient accuracy. In collaboration with Creative Software, a group of final year students of the Department of Electronic and Telecommunication Engineering supervised by Dr.Peshala Jayasekara and Dr. Ranga Rodrigo have taken on this challenge to address these issues. Creative software is a leading company in providing high-quality, cost-effective solutions in the Sri Lankan tech industry while collaborating with university students to promote their engagement in research. The team focuses on some unique problems regarding static object detection for autonomous driving. The primary purpose of the project is to prepare an SL traffic light dataset and an SL lane dataset. They propose a novel algorithm that simultaneously uses two cameras of different fields of view for fine-grained real-time traffic light detection. Creative software plays a significant role by providing essential resources, including computational facilities, cameras, etc. It was massive support for the team to complete the project with expected results.

Multi-Sensor based Dynamic Object Detection, Tracking, and Trajectory Prediction - Stage II

Another critical aspect of autonomous driving is identifying and tracking dynamic 3D objects, including pedestrians and other vehicles, to ensure safe interactions between them. Further, autonomous vehicles must predict future trajectories of dynamic objects with high precision. Another group of final year students aims to address the challenge with the supervision of Dr. Peshala Jayasekara and Dr. Ranga Rodrigo in collaboration with Creative Software. They aim to develop a novel algorithm to detect and track dynamic objects in real-time in different weather conditions while exceeding existing results. The team proposes a class-aware attention method for trajectory prediction by considering the other types of vehicles to predict the future trajectory of the given vehicle. Further, they incorporate sensor fusion to detect dynamic objects on the road while utilizing the inputs from cameras and a Lidar. The collaboration has facilitated the team with required expensive equipment, including a Lidar, cameras, and computational resources. The support from Creative Software has been critical in making the project a success.
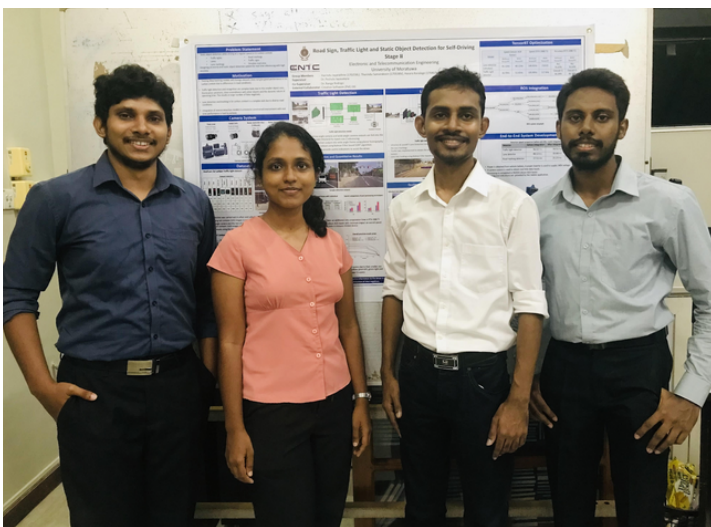
Exclusively for Tech Enthusiasts

by Ishrath Ahamed

## Important areas of Computer Architecture Innovation

Computer architecture continuously evolves to improve performance and efficiency while historical and technological scaling trends encounter constraints. A guest lecture series was organized for the final year students taking the module EN4650 - Computer Systems Architecture at the department to enrich the undergraduates by sharing knowledge with domain experts.

One of the lectures was conducted by Dr. Nuwan Jayasena on "Important areas of Computer Architecture Innovation." The objective of this talk was to discuss recent advances in critical areas of Computer Architecture and point out the rapidly increasing opportunities for computer architects.

Dr. Nuwan Jayasena is a Fellow at AMD Research. His interests include memory system architecture, accelerator-based computing, and emerging application domains. He obtained his Bachelor of Science in Computer Engineering from the University of Southern California in 1998 and M.S and Ph.D. in Electrical Engineering from Stanford University in 2000 and 2005, respectively. He holds 65 US patents. Before AMD, Dr. Jayasena was an architect at Nvidia Corp. and Stream Processors, Inc.

The key areas discussed were enhancements in microarchitecture, accelerator-based computing, and modular (or "chiplet-based") designs. The core message of the discussion was that undergraduates do not need to be intimidated by looking at the cutting-edge development going on right now. The basics of computer architecture and the modules you learn lay the groundwork. If you can master it during your undergrad studies, you'll be able to quickly take up these skills and have many opportunities ahead of you. Even the field's experts haven't figured it all out yet, but they're investigating these new horizons. You might be the next trailblazer!

Overall, the session was successfully conducted with enthusiastic participation. Expert knowledge and insights play a critical part in forming a flourishing group of students with a shared interest. We express our sincere gratitude to Dr. Nuwan Jayasena for the insightful session.
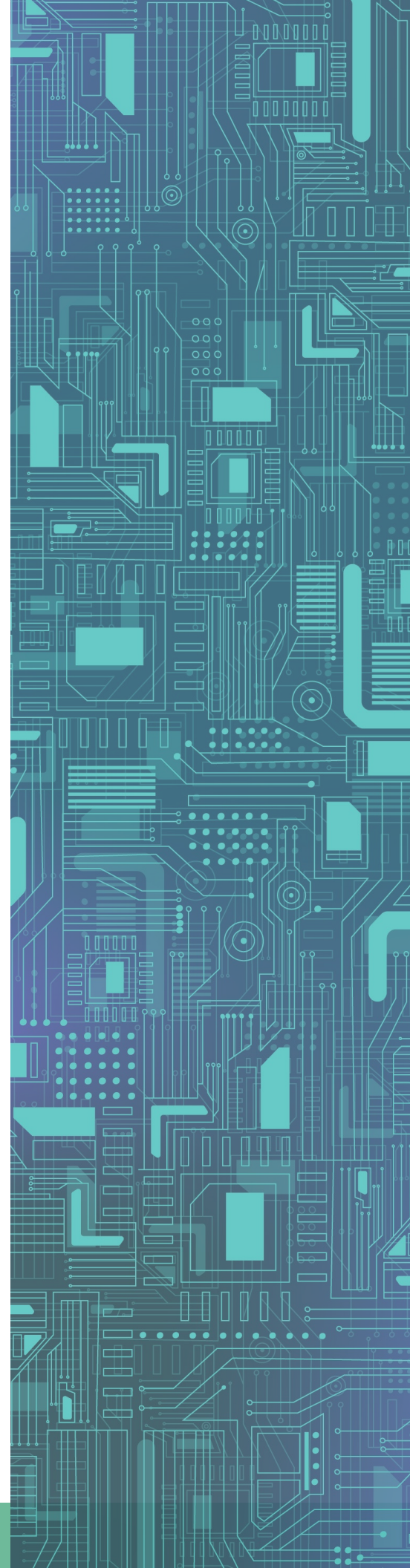
SPARK : Flashback of the Year

by Dinithi Dissanayake

@UoM SPARK
Making the Impossible Possible

2021 has been a challenging year for the world. However, with the support of the academic staff, the Spark Branch committee, and the beloved volunteers, we were able to successfully conclude one year since the start of Project Spark. Let's revisit the year 21/22 to outline the contributions of Project Spark to ENTC and the Sri Lankan Community.

08th of May : Distribution of RPis

232 Raspberry Pi gift parcels were successfully distributed to the two Junior batches of ENTC through the SPARK project. The gift parcel contained a Raspberry Pi 3B+, power supply, RPi case, a customized SD card, and a laptop sticker as a token. A care guide and a user guide for RPi 3B+ were compiled and distributed as assistance material to beginners. Visit the **Spark@UoM** web page for the care guide and the user guide along with two video instructions of how to set up the RPi in Windows and MacOS.

19th of July : Spark Launch

Spark Challenge, the main feature of Project SPARK, was launched on the 19 of July 2021, virtually. Dr. Ranga Rodrigo and Dr. Ajith Pasqual gave the introduction to the Spark Challenge, where the students are supposed to engage in a year-long funded project which gives a solution to the prevailing real-world problems. The students will be working as groups of four or five where three groups will be chosen as the first, second and third winners of the Spark Challenge after one year.

07th of Aug : Commencement of the Spark Training

Spark Training focuses on assisting students on the full product development lifecycle, from idea generation to product pitching. Justine Carrion-Weiss, Mark Smith, and Josh Robson are the external resource personnel who conduct this training. The training consists of 8 stages including 2 workshops, whereas this term's program is fully virtual. The students are exposed to the techniques which should be followed for proper idea generation targeting sustainable development goals. So far seven stages have been completed which include two half-day workshops.

Our team.

@UoM SPARK
Making the Impossible Possible

Josh **ROBSON**

Justine **CARRION-WEISS**

Mark **SMITH**
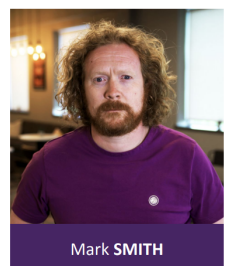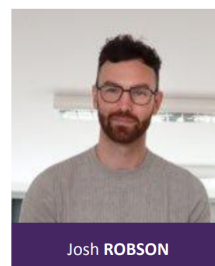
29, 30, 31st of Aug : Pi Mora 1.1

Pi Mora 1.1, the very first Raspberry Pi Jam in Sri Lanka was held in the month of August spanning from 29th to 31st. A Raspberry Pi beginners' workshop conducted by Mr. Bumuthu Dilshan (ENTC Alumni), Mr. Sahan Avandra (ENTC Alumni) , and Mr. Dilanka Wickramasinghe (Undergraduate (UG) ENTC) was held. Mr. Kasun Jayalath (RnD Eng: SLT) conducted a talk on Raspberry Pi and its advanced usage with his own experience. Finally, a show and tell session was held where Mr. Kithmin Wickramasinghe (ENTC Alumni), Mr. Thilina Jayalath (ENTC Alumni), Mr. Oshada Jayasinghe (ENTC Alumni), and Mr. Vihan Melaka (UG CSE) showed four interesting projects done with Raspberry Pis. The students got first-hand experience in implementing an object detecting algorithm on Raspberry Pi with this workshop.

06, 07, 13, 14th of Nov : Pi Mora 1.2

Pi Mora 1.2 was held in the month of November, with two talks and two workshops. The first session was conducted by Mr. Geeth Udugamkorala(UG ENTC) with an inspiring pep talk with a project demonstration on an application of Raspberry Pi in Computer Vision. The second talk was conducted by Mr. Janith Kodithuwakku who is a visiting lecturer at Deakin University. The two workshops were successfully concluded with interesting feedback from the participants

06th of March : Spark Challenge Induction

37 groups who are actively participating in the Spark Challenge were inducted at the Spark Challenge Induction Ceremony. They have finalized a bright set of ideas that will be contributing to the areas of Education, Transportation and Transport Efficiency, Healthcare Improvement, Environmental Conservation and Preservation, Power Generation and Efficiency, Food Production (Agriculture) and its Preservation, Statistical Modeling, Data Mining, and Simulation. They will be working on their projects with the help of 25 mentors and external collaborators till the end of June.

23, 24, 30th of April : Pi Mora 1.3

Pi Mora 1.3, the third Raspberry Pi Jam was held on the 23rd, 24th, and 30th of April 2022, with two talks and one workshop. Mr. Janith Kalpa Gunarathna(CTO: Pristine Innovations) and Mr. Achala Athukorala(Research Eng: SUTD Singapore) were invited as guest speakers for the sessions. They shared their experience in the application of Raspberry Pis in Drone Technology and Robotics. The workshop was conducted by Mr. Avishka Perera(UG ENTC) and Mr. Yasiru Karunanayake(UG ENTC) featuring the application of Raspberry Pi in Computer Vision.

Visit our **Raspberry Pi Community Group** to catch the Pi Mora sessions you missed. Be a member to get and share knowledge among your peers.
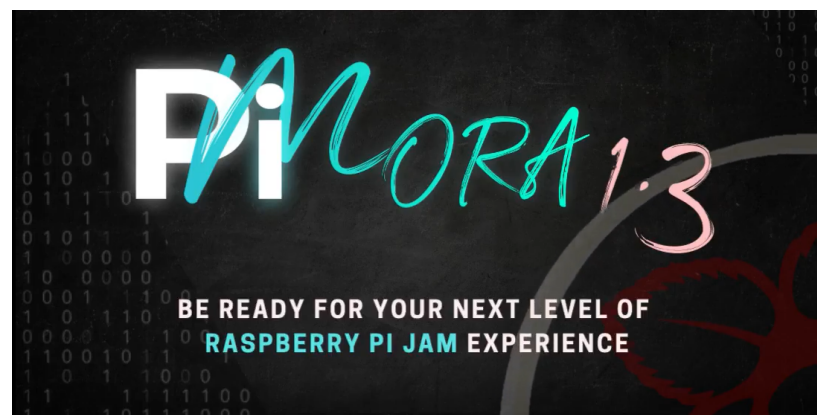
Dr. Chamira U. S. Edussooriya

by Thanushan Kamalakkannan

Dr. Chamira U. S. Edussooriya is a senior lecturer at the Department of Electronic and Telecommunication Engineering, providing his services since 2016. He received his B.Sc.Engineering (Hons) degree at the department. He obtained his M.A.Sc. in Electrical Engineering from the University of Victoria, BC, Canada. His thesis for the master's degree was selected as the best in the department of Electrical and Computer Engineering and nominated for the Lieutenant Governor's Silver Medal. He also holds a Ph.D. in Electrical Engineering from the University of Victoria, BC, Canada. Dr. Edussooriya has received the outstanding research performance award, awarded by the University of Moratuwa for four consecutive years from 2017 to 2020. He was also a recipient of the Charles S. Humphrey Graduate Student Award in 2014 and held the fellowship for doctoral studies at the University of Victoria. Dr. Edussooriya is the founding chair of the IEEE Sri Lanka Section Signal Processing Society Chapter. Furthermore, he is the founding staff advisor of the IEEE Signal Processing Society Student Branch Chapter at the University of Moratuwa. He has served as a member of the executive committee of the IEEE Sri Lanka Section and the chair of the Educational Activities Committee of the IEEE Sri Lankan Section in 2021.

Dr. Edussooriya is an active researcher in the department. His research interests mainly are in the broad area of multi-dimensional digital signal processing. In particular, light field and light field video processing, array signal processing (prioritizing on broadband beamforming and physical layer security), and low-complexity multi-dimensional digital filter designs. He also works on graph signal processing, computational imaging, and applications of machine learning. He has numerous publications in various top-tier conferences and journals. He is also a reviewer for several well-known journals and conferences. Dr. Edussooriya has collaborated with several professionals worldwide in many of his research projects. He has collaborated with Professor Leonard Bruton (University of Calgary, Canada), Professor Panajotis Agathoklis (University of Victoria, Canada), Professor Arjuna Madanayake (Florida International University, USA), and Dr. Chamith Wijenayake (University of Queensland, Australia) in the field of multi-dimensional signal processing. He has also collaborated with Professor Haejoon Jung (Kyung Hee University, South Korea) in the field of array signal processing with an emphasis on physical layer security, Dr. Dushan Wadduwage (Harvard University, USA) on computational imaging, and Dr. Janaka Senaratne (John Hopkins University, USA) on applications of machine learning for biomedical signal processing. His expertise in signal processing has been an invaluable resource to the undergraduates of our department.

Dr. Rukshani Liyanaarachchi

Dr. Rukshani Liyanaarachchi is a senior lecturer at the Department of Electronic and Telecommunication Engineering, rendering her services since 2021. She is a graduate of the Department of Electronic and Telecommunication Engineering. She obtained her M.Eng and Ph.D. degrees from the Department of Bioengineering at the University of Tokyo, Japan. Her Ph.D. thesis was on an intraoperative laparoscopic positron emission tomography system for diagnosing lymph node metastases in gastric cancer surgeries.
Dr. Liyanaarachchi was also a researcher at the Bio-Medical Precision Engineering Laboratory at the University of Tokyo before joining the Department of Electronic and Telecommunication Engineering. She has worked on hybrid PET- Compton imaging systems and high spatial resolution animal PET scanners during her days at the Bio-Medical Precision Engineering Laboratory at the University of Tokyo. Dr. Liyanaarachchi has research interests in biomedical imaging and computer-aided surgery. "Development and evaluation of a prototype detector for an intraoperative laparoscopic coincidence imaging system with PET tracers" and "Prototype detector for intraoperative PET-laparoscope system with a multi-layer movable detector Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment" are some of her major publications. She is currently working on ultrasound and other imaging modalities and heart sound analysis, and she will be an invaluable resource to the students at the ENTC department.
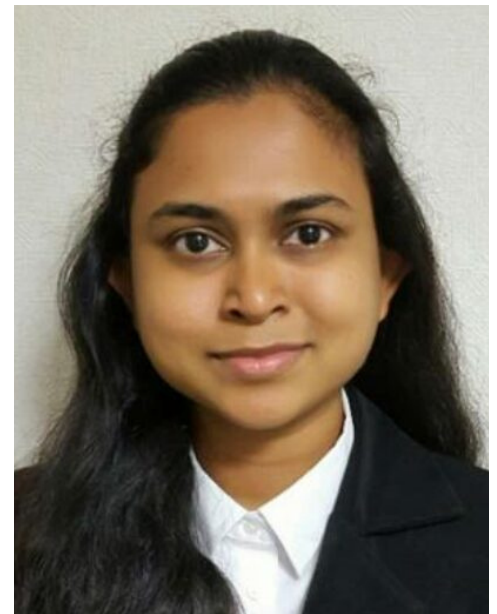
Miss.Amaya Dharmasiri

"ENTC opened up many opportunities for me that I didn't even know existed, and these make me prepared and equipped with a good skill set that will give me a head-start for my next chapter."

The Department of Electronic and Telecommunication Engineering at the University of Moratuwa is never short of success stories. In this spotlight, we will bring information about one of the most outstanding students in our department, Amaya Dharmasiri of the 2017th batch. She shows the perfect blend of academic and extracurricular activities, which led her to success in many different areas.

Her path to success begins at the Maliyadeva Girls' College in Kurunegala. The most significant achievement of Miss Amaya Dharmasiri during her school period was being the island first in G.C.E Advanced Level Examination in Physical Science stream, even while securing the Most outstanding student title in her year. She won a Bronze Medal at the 48th International Physics Olympiad held in Yogyakarta, Indonesia, in 2017. Also, she was the National Champion in Asian Physics Olympiad held in Yakutsk- Russia, in 2017.
She has actively participated in extracurricular activities in school and won the President Guide award, awarded by Sri Lanka Girl Guides Association in 2014. Moreover, marking a remarkable achievement in her career, she was able to win the Baden Powell Award, awarded by the World Organization of Scout Movement in 2019.

ENTC is not just about the academic and theoretical aspects. It always has a broad range of paths to success for all the students who have unique passions. Amaya Dharmasiri is one of the undergraduate students who took the maximum usage of these opportunities. She achieved a 4.1 (out of 4.2) overall GPA in her four years of academic life and won the Dean's List Certificate for all seven semesters in the department so far. She has done many undergraduate projects in the department. Some of them are related to the fields processor design and machine learning. These projects inspired her to discover more interesting things related to the field.

She has actively participated in university clubs and societies while hosting central posts there. She was the Chairperson of the IEEE Professional Communication Student Branch Chapter from 2021 to 2022. In the Gavel Club of the University of Moratuwa, she was the president for the year 2020-2021. Also, she was able to host the Assistant Program Manager post at Sustainable Education Foundation for the years 2020-2021.

As an undergraduate, she was able to list two publications under her name. One of them is 'CrossPoint: Self-Supervised Cross-Modal Contrastive Learning for 3D Point Cloud Understanding', which was accepted to Computer Vision and Pattern Recognition Conference(CVPR) 2022. The other one is 'Viewport-aware dynamic 360-degree video segment categorization', published in proceedings of the 31st ACM workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDAV '21). Also, she could obtain a higher-level research experience from the School of computing at the University of Sydney during her industrial internship period. Reaching beyond the great achievements in her student life so far, we wish her best of luck to lead her life to an even more successive level.

"Alone we can do so little; together we can do so much."

- HELEN KELLER -

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