**Artificial Intelligence & Data Science (AI&DS)**

**Study abroad module AY2023-24 at Nanyang Technological University Singapore**

**WEEKLY REPORT FOR WEEK 1**

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**PART A: Academic course on Cyber Security**

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| 1. **Mention 5 key learnings/takeaways from this course – Cyber Security that you learned this week. Please elaborate on these with mention of case studies, examples, references, and concepts covered in class.** |
| I had the opportunity to delve into the fascinating world of Cybersecurity and Blockchain technologies. Here are my key takeaways from the Cybersecurity course:   * [**Cryptography**: Cryptography is the process of hiding or coding information so that only the intended recipient can read it](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography)[1](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography). [It uses algorithms and mathematical concepts to transform messages into difficult-to-decipher codes](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography). [For instance, we studied the Advanced Encryption Standard (AES), which is considered virtually unbreakable](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography)[1](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography). * [**Hardware in Cyber Security**: Hardware security focuses on protecting systems against vulnerabilities at the physical layer of devices](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography). [A compromised physical component can undermine all additional layers of a system’s cybersecurity](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography)[4](https://www.weforum.org/agenda/2019/12/our-hardware-is-under-cyberattack-heres-how-to-make-it-safe/). [We explored how hardware attacks take advantage of vulnerabilities in hardware-manufacturing supply chains](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography)[4](https://www.weforum.org/agenda/2019/12/our-hardware-is-under-cyberattack-heres-how-to-make-it-safe/). * [**Side Channel Analysis**: Side-channel analysis (SCA) is a method used to assess the physical security of cryptographic systems](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography). [It involves exploiting extra information that can be gathered because of the fundamental way a computer protocol or algorithm is implemented](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography)[6](https://en.wikipedia.org/wiki/Side-channel_attack). [We learned about various types of side-channel attacks, such as power-monitoring and electromagnetic attacks](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography). * **Hardware Analysis Techniques**: We were introduced to various hardware analysis techniques in the lab. This included the use of a rework station and wire bonding station, photonics measurement of internal signals in VLSI, and the use of a Focused Ion Beam (FIB) for hardware analysis. These techniques help in understanding the internal workings of hardware components and identifying potential vulnerabilities. * **Power/Electromagnetic Side Channel Analysis Platform**: This platform allows us to analyse power consumption and electromagnetic emissions from hardware devices. [By studying these ‘side channels’, we can detect potential vulnerabilities and protect against hardware-based attacks](https://www.fortinet.com/resources/cyberglossary/what-is-cryptography).   These learnings have significantly deepened my understanding of Cybersecurity and its critical role in today’s digital world. The practical exposure through lab sessions was particularly enlightening, providing hands-on experience with advanced hardware analysis techniques and platforms. |
| **2. Take any industry/organization of your choice and explain how you would apply these learnings practically.** |
| Let’s consider the banking industry, specifically a hypothetical bank called “SecureBank”. Here’s how the learnings from the Cybersecurity course could be applied:   * **Cryptography**: SecureBank could use cryptographic techniques to secure online transactions and protect customer data. For instance, SecureBank could implement the Advanced Encryption Standard (AES) for data encryption to ensure that customer information and transaction details remain confidential and secure. * **Hardware in Cyber Security**: SecureBank could invest in secure hardware to protect its physical systems from tampering or unauthorized access. This could include secure servers for storing customer data and secure point-of-sale (POS) systems for processing transactions. * **Side Channel Analysis**: SecureBank could conduct regular side-channel analysis to identify potential vulnerabilities in their systems. By monitoring power consumption and electromagnetic emissions, SecureBank could detect unusual patterns that might indicate a potential security breach. * **Hardware Analysis Techniques**: SecureBank could use hardware analysis techniques to assess the security of their physical systems. This could involve using a rework station and wire bonding station, photonics measurement of internal signals in VLSI, and the use of a Focused Ion Beam (FIB) for hardware analysis. * **Power/Electromagnetic Side Channel Analysis Platform**: SecureBank could implement a power/electromagnetic side channel analysis platform to monitor the power consumption and electromagnetic emissions of their hardware devices. This could help in detecting potential hardware-based attacks and implementing necessary countermeasures.   In conclusion, the learnings from the Cybersecurity course could be practically applied in the banking industry to enhance data security, protect physical systems, and proactively identify and address potential security threats. This would not only help in safeguarding customer data but also in building customer trust and ensuring regulatory compliance. |

**PART B: INDUSTRIAL VISIT (Teradata)**

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| **Write your observations and learnings from this industrial visit. What role does this company, and this sector plays in the economy of Singapore?** |
| My industrial visit to Teradata in Singapore was a highly informative experience. [Teradata is a global leader in data warehousing and analytic technologies](https://www.databricks.com/glossary/data-lakehouse). The company’s commitment to harnessing data to drive business outcomes and its innovative use of technology were evident during the visit.  One of the key learnings from the visit was the importance of data handling in today’s digital age. Teradata’s emphasis on data management resonated with my coursework at NTU, where I pursued cybersecurity. The company’s strategies for data encryption, user access controls, and regular security audits highlighted the practical applications of the theoretical concepts we learned.  [Teradata’s approach to data handling involves the use of various data storage and management systems such as data lakes, data houses, and data warehouses](https://www.databricks.com/glossary/data-lakehouse). [A data lake is a centralized repository that allows you to store all your structured and unstructured data at any scale](https://www.databricks.com/glossary/data-lakehouse). [A data house, on the other hand, is a system that aggregates data from different sources into a single, central, consistent data store to support data analysis, data mining, artificial intelligence (AI), and machine learning](https://www.databricks.com/glossary/data-lakehouse). [A data warehouse is a system used for reporting and data analysis, and is considered a core component of business intelligence](https://www.databricks.com/glossary/data-lakehouse)[6](https://en.wikipedia.org/wiki/Data_warehouse).  [Data availability and consistency are two crucial aspects of data handling](https://www.databricks.com/glossary/data-lakehouse). [Data availability is the process of ensuring that data is available to end users and applications, when and where they need it](https://www.databricks.com/glossary/data-lakehouse). [It defines the degree or extent to which data is readily usable along with the necessary IT and management procedures, tools, and technologies required to enable, manage and continue to make data available](https://www.databricks.com/glossary/data-lakehouse)[7](https://www.techopedia.com/definition/14678/data-availability). [Data consistency, on the other hand, refers to the accuracy and uniformity of data stored across multiple data sources](https://www.databricks.com/glossary/data-lakehouse)[8](https://www.metaplane.dev/blog/data-consistency-definition-examples). [In a consistent database, once a transaction has been committed, all subsequent accesses to that data will reflect the updated value](https://www.databricks.com/glossary/data-lakehouse)[9](https://www.montecarlodata.com/blog-data-consistency/).  [Teradata also boasts an impressive uptime of 99.996%](https://www.databricks.com/glossary/data-lakehouse)[10](https://uptime.is/99.996)[, which translates to a downtime of only about 21 minutes per year](https://www.databricks.com/glossary/data-lakehouse)[11](https://www.knownhost.com/blog/uptime-guarantee-explained/). This high level of uptime ensures that data is readily available for use almost all the time.  In terms of the broader IT sector in Singapore, it plays a significant role in the country’s economy. [Singapore is one of the most wired countries and technologically advanced Information and Communications Technology (ICT) markets in the world](https://www.databricks.com/glossary/data-lakehouse). [The government views ICT investments as a source of economic and social development and aims to be a Smart Nation](https://www.databricks.com/glossary/data-lakehouse). [The city-state is home to many global technology firms, including Google, IBM, Meta, Amazon Web Services, and others, offering digital platforms and services that are key to the digital transformation of companies locally](https://www.databricks.com/glossary/data-lakehouse).  Teradata, as part of this sector, contributes to the economy by providing innovative data solutions and consultancy services. [By helping organizations leverage data effectively, Teradata supports the digital transformation of businesses, thereby contributing to the growth and competitiveness of the Singaporean economy](https://www.databricks.com/glossary/data-lakehouse).  In conclusion, the industrial visit to Teradata offered valuable insights into the practical applications of AI, cybersecurity, and data handling technologies in the industry. It also underscored the significant role of the IT sector in Singapore’s economy. As a student studying AI and having pursued Cybersecurity at NTU, I found the visit particularly insightful and enriching. |

**PART C: Cultural Visit to Gardens by The Bay**

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| **Write your observations and learnings from this cultural visit. Share your views on the tourism sector of Singapore and the role it plays in its economy.** |
| My recent cultural visit to Gardens by the Bay in Singapore was an enlightening experience. [The Gardens, spanning 101 hectares in the Central Region of Singapore, adjacent to the Marina Reservoir](https://en.wikipedia.org/wiki/Gardens_by_the_Bay), is a testament to the harmonious blend of nature, art, and technology. [The iconic Supertrees, the Flower Dome, and the Cloud Forest were not just visually stunning, but also demonstrated how technology can be leveraged to create sustainable ecosystems](https://www.gardensbythebay.com.sg/).  [The Gardens by the Bay is a sanctuary for nature lovers and budding horticulturalists alike](https://en.wikipedia.org/wiki/Gardens_by_the_Bay). It offers a unique blend of nature, culture, and technology, showcasing how urban environments can coexist with nature. [The Supertrees, for instance, are vertical gardens that perform a multitude of functions, which include planting, shading, and working as environmental engines for the gardens](https://www.gardensbythebay.com.sg/).  The visit was also a great opportunity to understand the role of technology in managing and maintaining such a large-scale project. It was fascinating to learn about the advanced technologies used in the climate control of the biomes and the sustainable management of resources.  Now, turning to the tourism sector of Singapore, it plays a significant role in the country’s economy. [Singapore is one of the most popular tourist destinations in Asia, attracting millions of visitors each year](https://en.wikipedia.org/wiki/Gardens_by_the_Bay). [The tourism sector contributes about 4% of Singapore’s annual gross domestic product (GDP)](https://bing.com/search?q=tourism+sector+of+Singapore). [It encompasses a wide range of businesses, including hotels, restaurants, travel agencies, attractions, and transportation services](https://en.wikipedia.org/wiki/Gardens_by_the_Bay).  The Gardens by the Bay is a prime example of a tourist attraction that not only draws visitors but also enhances the city’s sustainability efforts. Such attractions contribute significantly to the tourism revenue and play a vital role in the economy.  In conclusion, the visit to Gardens by the Bay was a valuable learning experience, providing insights into the integration of technology with nature and the importance of sustainable practices. It also highlighted the significant role of the tourism sector in Singapore’s economy. As a student studying Artificial Intelligence and having pursued Cybersecurity and Blockchain technologies at NTU, I found the visit particularly insightful in understanding the practical applications of these technologies in real-world scenarios. |

**PART D: Campus Visit (NTU & SMU)**

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| **Write your significant observations & thoughts of these campus visits.** |
| My visits to Nanyang Technological University (NTU) and Singapore Management University (SMU):  **Nanyang Technological University (NTU)**: The NTU campus was a blend of modern architecture and lush green spaces, creating an environment conducive to both learning and relaxation. The cultural diversity was palpable, with students from various countries contributing to a vibrant and inclusive campus culture. This multicultural environment provided a unique opportunity to learn about different cultures and perspectives. The interactions with fellow students were enriching, leading to lively discussions and exchange of ideas beyond academics. The campus facilities, including libraries, sports complexes, and food courts, were top-notch, adding to the overall positive experience.  **Singapore Management University (SMU)**: Even though my visit to SMU was brief, it was quite impactful. The campus was bustling with energy and activity. The interaction with SMU students provided insights into their campus life and culture. Despite the rigorous academic schedule, the students seemed to maintain a balance with extracurricular activities. The campus was well-equipped with modern facilities, and the central location of SMU in the heart of Singapore added to its appeal.  In both universities, the emphasis on holistic development, encompassing academics, cultural exposure, and personality development, was evident. These visits have broadened my perspective, emphasizing the importance of cultural exchange and interpersonal interactions in shaping one’s learning journey. I look forward to incorporating these experiences into my personal and academic life at Jio Institute. |