Scalable Safe Artificial Intelligence for Online Learning

FACULTY OF ENGINEERING

Department of Electrical and Computer Engineering (DECE)

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About the St. Augustine Campus of The University of the West Indies

Oriens Ex Occidente Lux - A Light Rising From The West

The University of the West Indies (The UWI) has been and continues to be a pivotal force in every aspect of Caribbean development; residing at the centre of all efforts to improve the well-being of people across the region. It is one of only two regional universities in the world.

St. Augustine Campus in Trinidad and Tobago was established in 1960 and is one of 5 campuses comprising The UWI and the second to be established after Mona in 1948. The St. Augustine Campus itself was born out of the Imperial College of Tropical Agriculture.

The most reputable ranking agency, *Times Higher Education,* has ranked The UWI among the top universities in the world. It is the only Caribbean-based University to make these prestigious lists. In 2020, it earned '*Triple 1st'* rankings—topping the Caribbean; and in the top in the tables for *Latin America and the Caribbean*, and global *Golden Age* universities (between 50 and 80 years old). The UWI is also featured among the top universities on THE's *Impact Rankings* for its response to the world's biggest concerns, outlined in the 17 United Nations Sustainable Development Goals (SDGs), including Good Health and Wellbeing; Gender Equality and Climate Action.

The UWI offers over 800 certificate, diploma, undergraduate and postgraduate degree options in Culture, Creative and Performing Arts, Food and Agriculture, Engineering, Humanities and Education, Law, Medical Sciences, Science and Technology, Social Sciences, and Sport. As the Caribbean's leading university, it possesses the largest pool of Caribbean intellect and expertise committed to confronting the critical issues of our region and wider world.

St. Augustine is still the only campus that boasts a Faculty of Food and Agriculture, an area of expertise that has long been interwoven into the history of the Caribbean islands. Long the main campus in Trinidad and Tobago, there are now two satellite campuses: one in nearby Mount Hope that houses the Faculty of Medical Sciences, and the recently built South Campus Debe-Penal.

Executive Summary

The Department of Electrical and Computer Engineering (DECE) at the St. Augustine Campus of the University of the West Indies is seeking US$97,696.00 in funding for the development of safe and reliable AI systems for education systems. This funding will cover the subscription fees to online tensor computing systems and hosting platforms, ensuring access to the latest and most powerful hardware throughout the development lifecycle of the project.

The world economic forum has projected that AI is anticipated to contribute $15.7T to the global economy by 2030, with education being counted among the most heavily impacted industries. Many higher education institutions have embraced large language models (LLMs) for diverse applications. However, concerns about data privacy, academic integrity, biases, and accessibility persist. The University of the West Indies (UWI), through the DECE, stands at the forefront of AI research and education in the Caribbean. The institution recognizes the need for AI in modern education, with its potential to enhance personalized learning and augment traditional teaching methods.

The development of scalable safe AI, additionally, holds the promise for building revenue streams for the UWI through selling subscription-based services to any educational system at any level, throughout the world.

The DECE at St Augustine has long been the hub of Electrical Engineering Education in the region and we look forward to your support as we continue to evolve to meet the region's development needs through the creation of ICT policies and frameworks and systems to guide the digital AI transformation of the region.

Background

In 2022, advanced AI systems such as GPT-4, the engine behind ChatGPT, have catalyzed significant operational shifts across numerous industries and sectors. The world is now transitioning to a future increasingly driven by these AI systems, whilst simultaneously racing to formulate policies and strategies to accommodate these intelligent systems as they become more prevalent. Among the sectors severely impacted by large language models (LLMs) is education, leading to divided opinions among many higher education institutions. Some universities utilize these tools for various purposes such as teaching, learning, research, administration, and community engagement. However, LLMs also raise issues related to data privacy, academic integrity, cognitive bias, accessibility, as well as gender and diversity. Despite these concerns, the key question isn't whether to employ LLMs in universities, but how to do so safely, effectively, and appropriately. Higher education institutions must take the initiative to find this balance or risk disadvantaging themselves and their students.

The University of the West Indies (UWI) plays an integral part in the Caribbean region's technological evolution, particularly in the realm of research and education. As the region's leading academic institution, UWI, through its Department of Electrical and Computer Engineering (DECE), is ideally positioned to spearhead research, development and operationalization of this field significantly impacting academia, research, education, and policymaking. Researchers in the department are diligently exploring the capabilities of LLMs, the operating hardware, software and algorithms, their applicability across various sectors, and their potential societal implications. The knowledge generated is uniquely applicable to the region's specific challenges and resources. Additionally, UWI plays a significant role in preparing future leaders in AI, offering courses/CPEs and programs centered around machine learning, AI ethics, and data policy.

In the digital age, the implementation of AI-enabled technology in university teaching methods has become essential. As the complexities of various academic disciplines continue to grow, conventional teaching strategies may struggle to adequately prepare students for their future careers. AI technologies, including large language models, can facilitate personalized and adaptive learning, catering to the unique needs of each student. They can provide immediate feedback, suggest resources for further study, and assist in managing assignments or projects. AI can augment faculty efforts, allowing educators to focus more on conceptual explanation, critical thinking, and creative problem-solving, rather than administrative tasks. In an increasingly interconnected and technologically advanced world, the integration of AI in teaching methods is not merely an option—it's a necessity for fostering an engaging, effective, and future-oriented learning environment. Since, there is a constant risk of lagging behind in this technology-driven era without adequate technical preparation and real-time response capability.

Four major points of concern arise in using the commercial vanilla LLM systems, the first deals with the quality of the curated data during training which can significantly impact the prevalence of cognitive bias and spread of disinformation, secondly the AI should incorporate teaching and learning models to facilitate knowledge building rather than simply disseminating information to the student, thirdly since the models exist off-platform data-privacy issues arise during inference, and finally there are issues in the tool’s accessibility, where in some cases can be offline and out of our control.

Investing in online tensor compute capacity and fine-tuning existing AI models provides an unprecedented opportunity to tackle these challenges directly. This innovative resource enables realistic, secure, and repeatable simulation of a broad spectrum of AI applications, from routine operations to specialized tasks. It allows policy makers, students, researchers, and industry professionals to interact with sophisticated AI systems, offering invaluable hands-on learning and research opportunities.

Securing rented computing systems can significantly diversify faculty revenue streams. Leveraging this resource in professional development courses will attract a broad array of professionals both internationally and locally who require state-of-the-art training in courses supported by multi-modal AI. This investment could help generate a sturdy and sustainable income for UWI, contributing to its financial stability and its ability to continue providing top-tier education and research. Additionally, funds can be allocated to hire specialized personnel for data generation, further enriching the learning environment and research capabilities of the institution.

Finally, as the leading voice in technological discourse within the region, the University of the West Indies (UWI) bears a significant responsibility to develop and promote information and communication technology (ICT) policies to navigate the ongoing digital transformation driven by artificial intelligence (AI). These policies should not only be grounded in rigorous research and practical implementation experience, but also crafted to address regional-specific challenges and opportunities. By harnessing its unique position, UWI can drive the conversation on how AI can be used ethically and effectively across various sectors, such as academia, research, policymaking, and industry. Furthermore, it should facilitate collaboration between researchers, educators, policymakers, and industry professionals to ensure the policies put forward are comprehensive and future oriented. This role for UWI is not only crucial for its own digital transformation, but also to guide the region as it navigates the myriad opportunities and challenges presented by the era of AI and large language models.

Future State

Subscription to the latest tensor compute capacity, coupled with our own models for embeddings and fine-tuning will place the DECE in a strategic position to develop, understand and offer courses with AI support. These methods can be implemented to advance current DECE courses and support the upcoming Continuously Professional Education (CPE) courses targeted at the international market. AI will be critical to the UWI's future success as an online distance learning provider. As enrolment increase so does the requirement for additional staff for tutoring and marking. AI will enable high quality course support and intelligent marking at much lower incremental costs than full time staff, allowing for higher quality delivery with less staffing.

Furthermore, investing in this technology would serve as a platform to enable the University to be at the forefront of research in AI applications, hardware, algorithms, models, and techniques. The specialized human resources built from this initiative will power the next generation of AI-based services for industry and business regionally. Finally, the University would possess the technology and platforms to investigate and create AI standards and policies as they deal with regional digital transformation. The University would and must serve as the expert hub for the regional community in AI matters.

The Ask

The DECE understands the rapid pace of AI research, developments in production environments and is asking for funding for renting online systems. The department will augment this with its expertise, engineers for instruction preparation and embedding vector data stores, creating software research platforms and software integrations into course management platforms. We are open to funding from any number of donors and are open to displaying the names of donors in the lab space, as long as UWI regulations permit.

Budget

Item	**Descriptions**	**Qty.**	**Unit Cost USD**	**Ext. Cost** USD
Fine Tuning/Training of LLMs	Parameter Efficient Training online LLM systems and • Inference prompts and completion • Generation of evolutionary prompts • Transfer learning and Neural Pruning of LLMs • Research on Multimodal DL algorithms and multi-agent systems • Pre-training/Fine-tuning on specific knowledge domains	24 mnths	$59,406	$59,406
Hosting/ Development of ancillary software	Ancillary Software development and instancing: • AWS EC2 + Domain (2 years) • Vector and NoSQL Database creation and hosting • Front-end and back-end software development and hosting	24 mnths	$10,000	$10,000
Safety, Alignment and testing	AI safety testing and alignment: • Safety and Toxicity benchmarking and construction of safety layers • Reinforcement Learning via Human Feedback to improve alignment • Complete system validation and testing	12 mnths	$28,290	$28,290
Total				$97,696

Conclusion

The DECE possesses a distinctive advantage in implementing, researching, and operating AI-based systems, thanks to its expertise encompassing technology in education, software, hardware, operations, and policy development. Alongside teaching AI and machine learning courses, the DECE intends to continue offering AI-enabled CPEs. By securing funding for server systems and online services, the department will be able to provide lucrative services in the form of CPE courses, workshops, consultations, and AI-powered applications to industry, government, and educational organizations. Consequently, the department would be at the forefront of AI, alongside other renowned universities in the field. Furthermore, the DECE would establish a platform for the University to launch research, make informed decisions, shape policies, and enhance the quality of teaching through AI. Your generous contributions enable us to perpetuate our esteemed legacy of intellectual guidance and local influence by delivering exceptional services to our students and the wider region.

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