Module Descriptor

Title	Edge Computing and TinyML		
Session	2025/26	**Status**	Published
Code	COMP10091	**SCQF Level**	10
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	Graham Parsonage		

Summary of Module

This module builds on the foundational knowledge gained in previous data science modules. It introduces the field of Tiny Machine Learning (TinyML), its real-world applications, and the future possibilities of this transformative technology. TinyML brings the power of machine learning (ML) to the performance- and power-constrained domain of tiny devices and embedded systems, commonly referred to as edge devices. Successful deployment in this field requires a knowledge of applications, algorithms, hardware, and software.

In this module, students are introduced to the language of TinyML, which extends beyond the traditional machine learning toolkit due to the energy and memory constraints of tiny devices. The module introduces students to various applications, where they will see how tools like voice recognition work in practice on small devices and implement standard algorithms, such as neural networks.

Students will utilise an open-source hardware and prototyping platform to design and build edge devices. The module emphasises hands-on experience building machine learning applications for edge devices and the responsible and sustainable design of artificial intelligence systems for constrained devices.

The module also focuses on operational concerns for machine Learning deployment, such as automating the deployment and maintenance of a TinyML application at scale. Real-world examples spanning the complete product life cycle demonstrate how tiny devices are deployed and updated once they are in the hands of the end consumer.

The syllabus will include the following:

- Designing ML applications at scale
  - Application domains of Edge Devices
  - Application methods
- Ethics in TinyML systems
  - Bias: definition, measuring and monitoring
  - Sustainability
- TinyML engineering
  - Definition
  - Roles within TinyML Teams
  - Challenges

- TinyML applications
  - Data Engineering for TinyML
  - Model training
  - Quantisation
  - Common TinyML applications
- TinyML deployment
  - Embedded hardware and software
  - Architectural considerations
  - Programming for microcontrollers
  - Packaging TinyML models

Some example tasks undertaken by students throughout this module are The deployment of a TinyML application using a full development lifecycle and the critical examination of various real-life TinyML projects considering factors such as bias and interpretability and sustainability.

This module will work to develop a number of the key 'I am UWS' Graduate Attributes to make those who complete this module:

- Universal: analytical; ethically-minded; and socially responsible
- Work Ready: enterprising; knowledgeable; and an effective communicator
- Successful: innovative; transformational; and resilient

Module Delivery Method	**On-Campus**[1] ☒	**Hybrid**[2] ☐	**Online**[3] ☐	**Work -Based Learning**[4] ☐
Campuses for Module Delivery	☐ Ayr ☐ Dumfries	☒ Lanarkshire ☐ London ☒ Paisley	☐ Online / Distance Learning ☐ Other (specify)	

Terms for Module Delivery	Term 1	☐	Term 2	☒	Term 3	☐
Long-thin Delivery over more than one Term	Term 1 – Term 2	☐	Term 2 – Term 3	☐	Term 3 – Term 1	☐

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

Learning Outcomes	
L1	Critically evaluate ethical considerations in edge computing and TinyML
L2	Select and justify appropriate methods associated with the application and deployment of TinyML solutions
L3	Demonstrate a detailed understanding of the machine learning engineering process when deployed on microcontrollers.
L4	Develop and deploy a TinyML system utilising suitable tools and best practices, ensuring reliability, scalability, and adherence to ethical considerations.
L5	

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	**During completion of this module, there will be an opportunity to achieve core skills in:**
Knowledge and Understanding (K and U)	**SCQF 10** Detailed knowledge and understanding of the concepts and principles of the machine learning engineering process when deployed on edge devices Understanding of the ethical issues that are apparent when developing machine learning applications for edge devices.
Practice: Applied Knowledge and Understanding	**SCQF 10** Execute a defined project of identifying the requirements and methods and completing an implementation and deployment of a TinyML solution using the specific technologies covered by the module.
Generic Cognitive skills	**SCQF 10** Demonstrate originality and creativity in addressing professional-level issues, such as those presented in the coursework. Make recommendations where data/information is limited or comes from a range of sources such as internal company documentation and/or data files.
Communication, ICT and Numeracy Skills	**SCQF 10** Present and convey information about Edge Computing and TinyML applications in the form of the coursework
Autonomy, Accountability and Working with Others	**SCQF 10** Exercise autonomy and initiative when working with a range of tools that enable the development and deployment of machine learning solutions

Prerequisites	**Module Code**	**Module Title**
	Other	
Co-requisites	**Module Code**	**Module Title**

Learning and Teaching
In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours.

Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	Student Learning Hours (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture / Core Content Delivery	18
Tutorial / Synchronous Support Activity	6
Laboratory / Practical Demonstration / Workshop	24
Independent Study	152
Please select	
Please select	
TOTAL	200

Indicative Resources

The following materials form essential underpinning for the module content and ultimately for the learning outcomes:

Banerjee, R. (2023) Hands-on TinyML: Harness the power of Machine Learning on the edge devices (English Edition) by (ISBN: 9789355518446)

Warden, P. & Duke, T. (2019) Building Responsible TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers. O'Reilly

(N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements

In line with the Student Attendance and Engagement Procedure, Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.

For the purposes of this module, academic engagement equates to the following:

The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. You will scan your attendance via the scanners each time you are on-campus and you will login to the VLE several times per week. Where you are unable to attend a timetabled learning session due to illness or other circumstance, you should notify the Programme Leader that you cannot attend. Across the School an 80% attendance threshold is set. If you fall below this, you will be referred to the Student Success Team to see how we can best support your studies.

Equality and Diversity

The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code.

Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will be presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. This module has lab-based teaching and as such you are advised to speak to the Module Co-ordinator to ensure that specialist assistive equipment, support provision and adjustment to assessment practice can be put in place, in accordance with the University's policies and regulations.
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	**Computing**
Overall Assessment Results	☐ **Pass / Fail** ☒ **Graded**
Module Eligible for Compensation	☐ **Yes** ☒ **No** **If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.**
School Assessment Board	Business & Applied Computing
Moderator	TBC
External Examiner	TBC
Accreditation Details	
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	1.1

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Portfolio of Practical Work
Assessment 2
A Report of practical work that shows the student's approach to deploying a TinyML model to a given case-study-like problem, including justifications and ethical considerations taken.
Assessment 3
(N.B. (i) Assessment Outcomes Grids for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed. (ii) An indicative schedule listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Component 1							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**

Report of practical/ field/ clinical work	☐	☒	☒	☒	☐	50	0

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Report of pratical/fileld/clinical work	☒	☒	☒	☒	☐	50	0

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
	☐	☐	☐	☐	☐		
Combined total for all components						100%	0 hours

Change Control

What	**When**	**Who**
Updated Attendance & Engagement Requirements and updated Equality and Diversity	20/08/2025	A Adamson