Submodule Digital Twins

Module No.		Lecture Title	Content / Educational Objective	Expert Lecturer
1		**Regulatory aspects for Digital Twins**		
	1.1	Access and use of healthcare data for research	Summary of legislation regarding use of health care data and data privacy management	Bairbre McNicholas
	1.2	Assent and consent of patients for use of their data in Europe	Introduction to the regulation of secondary data use from patients in healthcare setting, focus on vulnerable populations	Bairbre McNicholas
2.		**Software for Digital Twins**		
	2.1	Introduction to the MATLAB environment for Digital Twins	Introduction to using the MATLAB language and IDE for running a basic digital twin, including input of data and visualisation of results.	Fei Chen and Niall Madden
	2.2	From mathematical models to digital twins	Fundamentals of incorporating a mathematical model into a digital twin system (in MATLAB)	Fei Chen and Niall Madden
3.		**Machine Learning to Support Digital Twins**		
	3.1	Fundamentals of Machine Learning	Key terminology in Artificial Intelligence (AI) and Machine Learning (ML); ML tasks, including classification, regression, clustering, and reinforcement learning; Data Preprocessing; Organising data into training, testing and validation subsets.	Michael Madden
	3.2	Overview of Deep Learning	Neural network basics; neural network notation and calculations; training with backpropagation; deep neural networks; foundation models.	Michael Madden