H8MLE: Machine Learning

Module Code:	H8MLE
Long Title	Machine Learning APPROVED
Title	Machine Learning
Module Level:	LEVEL 8
EQF Level:	6
EHEA Level:	First Cycle
Credits:	10
Module Coordinator:	
Module Author:	Alex Courtney
Departments:	School of Computing
Specifications of the qualifications and experience required of staff	MSc and/or PhD degree in computer science or cognate discipline. May have industry experience also.

Learning Outcomes

On successful completion of this module the learner will be able to:

#	Learning Outcome Description
LO1	Apply and evaluate the efficacy of data preparation methods
LO2	Build and evaluate advanced machine learning models in various problem domains
LO3	Extract, interpret and evaluate information and knowledge from non-trivial real-world data sets
LO4	Comprehend, analyse and evaluate key concepts in machine learning

Dependencies

Module Recommendations

No recommendations listed

Co-requisite Modules

No Co-requisite modules listed

Entry requirements	Learners should have attained the knowledge, skills and competence gained from stage 3 of the BSc (Hons) in Computer Science. Learners should also have completed the Introduction to AI and ML module from stage 3 of the BSc (Hons) in Computer Science.

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Module Content & Assessment

Indicative Content
Data Mining Methodologies and Ethics in Machine Learning KDD & CRISP-DM. Ethics in data sourcing & handling. Regulatory & Privacy Components (including Data Protection Act). Ethical implications of machine learning
Data pre-processing and transformation (I) Identifying and Handling Missing Values. Handling Outliers. Dimensionality Reduction (PCA, MCA, etc.)
Factors Affecting a Machine Learning Model Bias-Variance Trade-off. Curse of Dimensionality. Understanding Factors that can affect model performance; e.g. Type III errors, selection bias, measurement errors, improper variable encoding
Regression Revision of Simple Linear Regression. Multiple Linear Regression. Linear Model Selection and Regularization
Data pre-processing and transformation (II) Measuring Predictor Importance. Transformations for single and multiple predictors. Feature Engineering. Understanding, Detecting and Handling (massive) class imbalance
Classification Review of Logistic Regression and K-Nearest Neighbours. Naïve Bayes
Decision Trees Decision Trees. Appropriate Use Cases. Regression and Classification Trees. Node Purity. Pruning
Ensembles Random Forest. Bagging and Boosting Methods (e.g. XGBoost, AdaBoost, CART aggregation etc.)
Clustering Notions of distance and similarity. k-means, k-medoids, hierarchical clustering. Applications of clustering. Plotting and understanding clusters. Cluster evaluation measures: DBIndex, WSSSE, scree plots
Introduction to Black Box Methods Introduction to Support Vector Machines (SVMs). Introduction to Artificial Neural Networks (ANNs). Hyper-parameter Optimization techniques

Assessment Breakdown	%
Coursework	40.00%
End of Module Assessment	60.00%

Assessments

Full Time

Coursework

Assessment Type:	Formative Assessment	**% of total:**	Non-Marked
Assessment Date:	n/a	**Outcome addressed:**	1,2,3,4
Non-Marked:	Yes		

Assessment Description:
Formative assessment will be provided on the in-class individual or group activities.

Assessment Type:	Project	**% of total:**	40
Assessment Date:	n/a	**Outcome addressed:**	1,2,3
Non-Marked:	No		

Assessment Description:
Group project focusing on the practical application of machine learning techniques to data sets. Individual components of the project may be assessed at earlier stages.

End of Module Assessment

Assessment Type:	Terminal Exam	**% of total:**	60
Assessment Date:	End-of-Semester	**Outcome addressed:**	4
Non-Marked:	No		

Assessment Description:
The end of semester examination will contain essay-style questions examining the theory behind machine learning techniques covered during the semester, and may require some calculation. Marks will be awarded based on clarity, structure, relevant examples, depth of topic knowledge and an understanding of the potential and limits of solutions.

No Workplace Assessment

Reassessment Requirement

Repeat examination
Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.

Reassessment Description
Repeat examination Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element. Learning EnvironmentLearning will take place in a classroom/lab environment with access IT resources. Learners will have access to library resources, both physical and electronic and to faculty outside of the classroom where required. Module materials will be placed on Moodle, the College's virtual learning environment

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Module Workload

Module Target Workload Hours 0 Hours

Workload: Full Time

Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Classroom & Demonstrations (hours)	24	Every Week	24.00
Tutorial	Other hours (Practical/Tutorial)	24	Every Week	24.00
Independent Learning	Independent learning (hours)	202	Every Week	202.00
			Total Weekly Contact Hours	48.00

Module Resources

Recommended Book Resources

Brett Lantz. (2019), Machine Learning with R - Third Edition, Packt Publishing, p.458, [ISBN: 9781788295864].

Gareth James,Daniela Witten,Trevor Hastie,Robert Tibshirani. (2014), An Introduction to Statistical Learning, Springer, p.426, [ISBN: 9781461471370].

Christian Heumann,Michael Schomaker,Shalabh. (2017), Introduction to Statistics and Data Analysis, Springer, p.456, [ISBN: 978-3-319-46162-5].

Supplementary Book Resources

Kartik Hosanagar. (2019), A Human's Guide to Machine Intelligence, Penguin, p.272, [ISBN: 9780525560890].

This module does not have any article/paper resources

This module does not have any other resources

Discussion Note:	