Title:	Data Visualisation & Analytics APPROVED
Long Title:	Data Visualisation & Analytics

Module Code:	DATA8008	**Duration:**	1 Semester

Credits:	5
NFQ Level:	Advanced
Field of Study:	Data Format
Valid From:	Semester 1 - 2018/19 (September 2018)
Module Delivered in	1 programme(s)
Next Review Date:	April 2023
Module Coordinator:	David Goulding
Module Author:	Aengus Daly
Module Description:	Data visualisation is of growing interest in the field of data science and analytics. In this module, the learner will investigate a variety of advanced visualisation concepts and tools for analysing multi-dimensional data, large data sets and geospatial data. The use and creation of dashboards with be examined. Data visualisation theory will be appraised. The learner will also examine major statistical modelling trends and challenges within the field of data science and analytics.

Learning Outcomes	
On successful completion of this module the learner will be able to:	
LO1	Describe the concepts, principles and methods of data visualisation.
LO2	Apply data explorative and pre-processing techniques to specified datasets.
LO3	Design, implement and communicate appropriate data visualisation techniques to solve data analytical problems.
LO4	Interpret and communicate patterns and knowledge discovered as a result of applying data visualisation and analytical techniques to data sets and analytical problems.
LO5	Assess a variety of data analytics solutions to current challenges in the area.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named MTU module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).*
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module. You may not earn additional credit for the same learning and therefore you may not enrol in this module if you have successfully completed any modules in the incompatible list.*
No incompatible modules listed
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.*
No requirements listed

Module Content & Assessment

Indicative Content
Data Visualisation Fundamentals History of data visualisation. Understand the various categories used in the field e.g. Information/data/scientific visualisation, infographics, visual analytics. Overview of theory and best practice in these fields, e.g. cognitive amplification, perceptual enhancement and ways to encourage inferential processes.
Data visualisation pre-processing techniques Learn data cleaning techniques relevant to data visualisation - data aggregation, data sampling, impute missing data, find inconsistencies. Learn transformation techniques - data normalisation, construct new variables, Investigate how to use regular expressions and data manipulation techniques to pre-process data sets. Implement these processes using R, Excel or similiar computer package.
Advanced visualisation techniques Investigate and implement computer based tools for visualisation, e.g. dashboard creation with RShiny, Tableau/Qlikview; how these packages can be connected to data sources, e.g. databases.
Geographic Information Systems (GIS) Investigate and implement GIS software, e.g. QGIS, R, ArcGIS; examine and discuss their features - interactivity, panning, zooming; browser based implementations.
Visualisation and Analytics Examine a variety of visualisation, analytical and statistical modelling methods that are used to solve data mining and data analytics problems, e.g. anomaly detection, pattern discovery, network analysis. Investigate clustering techniques e.g. partitioning methods, hierarchical clustering and advanced methods - fuzzy clustering, density based and model based clustering.
Data Analytics Techniques Investigate the main pitfalls in data visualisation and data analytics in a real-world setting. Compare and contrast various data analytics techniques.

Assessment Breakdown	%
Course Work	100.00%

Course Work

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Project	Design and implement a visualisation and/or analytical technique to solve a problem.	1,2,3,4	50.0	Week 8
Project	Evaluate and implement a visualisation technique to solve a problem; research and communicate a data analytics topic.	1,2,3,4,5	50.0	Week 12

No End of Module Formal Examination

Reassessment Requirement
Coursework Only *This module is reassessed solely on the basis of re-submitted coursework. There is no repeat written examination.*

The institute reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time				
Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Theory, algorithms and models of data visualisation and analtyics' techniques.	2.0	Every Week	2.00
Lab	Data visualisation and analytics laboratory - application and implementation of theory covered in lectures.	2.0	Every Week	2.00
Independent & Directed Learning (Non-contact)	Application of theory to project	3.0	Every Week	3.00
			Total Hours	7.00
			Total Weekly Learner Workload	7.00
			Total Weekly Contact Hours	4.00

Workload: Part Time				
Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Theory, algorithms and models of data visualisation and analtyics' techniques.	1.5	Every Week	1.50
Lab	Data visualisation and analytics laboratory - application and implementation of theory covered in lectures.	1.5	Every Week	1.50
Independent & Directed Learning (Non-contact)	Application of theory to project	4.0	Every Week	4.00
			Total Hours	7.00
			Total Weekly Learner Workload	7.00
			Total Weekly Contact Hours	3.00

Module Resources

Recommended Book Resources

- **Ben Fry 2007, *Visualizing Data*, O'Reilly Media Sebastopol, CA [ISBN: 0596514557]**
- **Nathan Yau 2011, *Vizualise This*, Wiley [ISBN: 0470944889]**
- **Matloff, Norman 2011, *The Art of R Programming*, No Starch Press San Francisco [ISBN: 9781593273842]**
- **Kabacoff, Robert I. 2015, *R in Action*, 2nd Ed., Manning New York [ISBN: 9781617291388]**
- **Kassambara, Alboukadel 2017, *Practical Guide to Cluster Analysis in R*, CreateSpace Independent Publishing Platform [ISBN: 1542462703]**

Supplementary Book Resources

- **Jiawei Han, Micheline Kamber, Jian Pei 2011, *Data Mining: Concepts and Techniques*, Morgan Kaufmann [ISBN: 9780123814807]**
- **Kotu, Vijay and Deshpande, Bala 2015, *Predictive Analytics and Data Mining*, Morgan Kaufmann, Elsevier MA, USA [ISBN: 9780128014608]**

This module does not have any article/paper resources

Other Resources

- **Website: *Nathan Yau - Flowing Data***
  http://flowingdata.com/
- **Website: *The Guardian - Data Visualisations***
  https://www.theguardian.com/technology/d ata-visualisation
- **Journal: *'Journal of Big Data'*, Springer**
  https://journalofbigdata.springeropen.co m
- **Website: *QGIS - GIS mapping software***
  https://qgis.org/en/site/forusers/downlo ad.html
- **Website: *Robin Lovelace - Creating maps in R***
  https://github.com/Robinlovelace/Creatin g-maps-in-R
- **Online Book: *Hadley Wickham, Garrett Grolemund - Tidyverse***
  http://r4ds.had.co.nz/
- **Website: *R Graph Gallery***
  https://www.r-graph-gallery.com/portfoli o/ggplot2-package/

Module Delivered in

Programme Code	Programme	Semester	Delivery
CR_SDAAN_8	Higher Diploma in Science in Data Science & Analytics	2	Mandatory