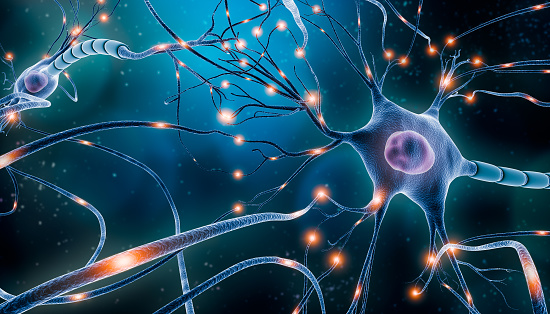
A picture containing logo

Description automatically generated

Level 7 Data Analytics and Visualisation

Module Handbook



Beautiful Pictures of Neural Network

Joke from <https://blog.galvanize.com/the-best-data-science-jokes-on-the-web/>



(<https://www.kdnuggets.com/2015/12/more-data-science-humor-cartoons.html> )

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# What this Module is About?

## Introduction from the Module Leader

A quote from SiSense: “Data intelligence refers to all the analytical tools and methods companies employ to form a better understanding of the information they collect to improve their services or investments.”[[1]](#footnote-1).

This module equips you with advanced data analytics, predictive analytics and data intelligence as well as analytics skills. It will support the development of an in-depth, systematic and critical understanding of the current research issues relating to Data Analytics and Intelligence.

## Module team and contact details

|  |  |  |  |
| --- | --- | --- | --- |
| Module Team | Room No | Tel. Extn. | Email Address |
| Prof. Ah-Lian Kor (Leader) | **Leighton 127** | **8123243** | [A.Kor@leedsbeckett.ac.uk](mailto:A.Kor@leedsbeckett.ac.uk%20) |
| Dr. Abiodun Yusuf | **Leighton G14** | **8122437** | [A.B.Yusuf@leedsbeckett.ac.uk](mailto:A.B.Yusuf@leedsbeckett.ac.uk) |
| Prof. Jiamei Deng | **Leighton 128** | **8127627** | [J.Deng@leedsbeckett.ac.uk](mailto:J.Deng@leedsbeckett.ac.uk) |

## Module Aims

On behalf of the module team, I would like to welcome you to this module, which we hope you will find both challenging and rewarding.

The module is based around the use of data analytics for informatics, decision making support, and intelligent systems. We will investigate the models, approaches, issues, techniques and technologies to support data analytics and intelligence. At MSc level, the style of learning is very self-directed, you are expected to investigate and explore topics independently and report back to the group. It is important to be able to understand and explain your findings.

Topics such as data analysis, visualisation, analytical method and big data will be discussed. The module provides you with an in-depth, systematic and critical understanding of the current research issues concerning Data Analytics, Data Intelligence and Knowledge Discovery.

The foundations of this module are based on the theories and practical issues associated with Analytics and Intelligence. We will use the python toolset for the application of theories – note that there are many other software products that can be used for analytics, visualisation, statistics, data mining, machine learning and decision support making.

We hope this will be a valuable learning experience for you. This module builds on students’ database design experience to achieve learning outcomes as follows.

## Module Learning Outcomes

On completion of this module, you should be able to have:

**LO1** A critical awareness of current problems and research issues in tools used for Data Analytics and Representation.

**LO2** A comprehensive understanding of current advanced scholarship and research in data mining, data analysis, data intelligence, and how this may contribute to the effective design and implementation of data representation applications.

**LO3** The ability to consistently apply knowledge concerning current research and advanced scholarship in area of data mining, data analysis, and data intelligence in an original manner and produce work which is at the forefront of current developments.

**LO4** Critically evaluate basic principles and motivations behind the idea of data Intelligence, understanding different perspectives relating to data Intelligence and develop ideas regarding the ways in which data intelligence (e.g. Business Intelligence, Edge Intelligence, Cloud Intelligence or Network Intelligence) principles can be translated into feasible and effective practices for and decision support systems.

## Module Learning Activities

**Online recorded lectures:** you will need to view online recorded powerpoint slides. If you have any query, raise them during face-to-face tutorial sessions.

**Face-to-face scheduled sessions**: face-to-face scheduled sessions are for discussion of any queries you have about the lectures, lab exercises, and assignment/phase test. Note: the availability of face-to-face scheduled sessions is subject to latest UK government policies and regulations.

**Self-paced unscheduled tutorial sessions:** go through fully guided step-by-step lab exercises. Tutorial sessions will be individual-based practical sessions that allow students to analyse, evaluate, and implement solutions. Such practical sessions will help strengthen your hand-on experience in developing solutions to support decision making or intelligent systems. We aim to train you as a consultant, an analyst and a solution provider for you and your future employers. Extensive independent research and application will be expected as students will need to read around the subject in order to gain a wider understanding of the theory application of the technologies covered. There will be a report to describe the mini research that you have undertaken. Students are expected to be disciplined and self-regulated, completing activities and tasks set for each week in order to keep to the schedule in Section 2.

## Graduate Attributes Developed and Assessed

The **ENTERPRISE** graduate attribute is developed and assessed via problem-solving activities.

The **DIGITAL LITERACY** graduate attribute is both assessed and developed via interpreting and evaluating data.

## The ANALYTICAL graduate attribute is developed and assessed via data analytics involving statistics, prediction, optimisation, machine learning – a means to develop knowledge discovery and yielding business intelligence and analytics.

## Communication

All module materials will be time-released on MyBeckett, and announcements will be made via MYBECKETT Announcement Facility or student emails.

# Weekly Schedule

|  |  |  |
| --- | --- | --- |
| **Date (Week commencing)** | **Tutor**  **Face-to-Face**  **Online Live** | **Session** |
| Week 1 – 26/09/2022 | AK | **Introduction to module, and assessment**  **Lecture 1 Introduction to the Module**  Tutorial DAV Assessment  Tutorial/Self-Paced Lab Session 1- Anaconda Python and Jupyter Notebook  Tutorial/Self-Paced Lab Session 2- Introduction to Python Programming  Tutorial/Self-Paced Lab Session 3- Google Colab  **Lecture 2: Descriptive Statistics**  Tutorial/Self-Paced Lab Session 4 - Exercises for descriptive statistics  Tutorial/Self-Paced Lab Session 5 - Python programming for descriptive statistics part 1 |
| Week 2 – 03/10/2022 | AY | **Lecture 3 Part 1: Inferential Statistics 1 (T-test)**  **Lecture 3 Part 2: Inferential Statistics 2 (ANOVA)**  Tutorial/Self-Paced Lab Session 6 - Python programming for inferential statistics part 1 (T-test)  Tutorial/Self-Paced Lab Session 7 - Python programming for inferential statistics part 1 (ANOVA) |
| Week 3 – 10/10/2022 | AK | **Lecture 4 Part 1: Inferential Statistics 2 Part 1 (Correlation)**  **Lecture 4 Part 2: Inferential Statistics 2 Part 2 (Chi Square)**  Tutorial/Self-Paced Lab Session 8 - Python programming for inferential statistics part 1 (Correlation)  Tutorial/Self-Paced Lab Session 9 - Python programming for inferential statistics part 1 (Chi-Square) |
| Week 4 – 17/10/2022 | AY | **Lecture 5: Advanced Data Analytics 1 (Time Series)**  Tutorial/Self-Paced Lab Session 10 - Python programming for Advanced Data Analytics 2 (Time Series) |
| Week 5 – 24/10/2022 | JD | **Lecture 6: Advanced Data Analytics 3 (Neural Network)**  Tutorial/Self-Paced Lab Session 11 - Python programming for Advanced Data Analytics 3 (Neural Network) |
| Week 6 – 31/10/2022 | AK | **Lecture 7: Advanced Data Analytics 4 (Decision Tree)**  Tutorial/Self-Paced Lab Session 12 - Python programming for Advanced Data Analytics 4 (Decision Tree) |
| Week 7 – 07/11/2022 | AK | **Lecture 8: Advanced Data Analytics 2 (Regression)**  Tutorial/Self-Paced Lab Session 13 - Python programming for Advanced Data Analytics 3 (Regression) |
| Week 8 – 14/11/2022 | AY | **Lecture 9: Advanced Data Analytics 5 (Clustering and Association Analysis)**  **Assignment Support**  Tutorial/Self-Paced Lab Session 14 - Python programming for advanced data analytics part 5 (Clustering and Association Analysis) |
| Week 9 – 21/11/2022 | JD | **Lecture 10: Advanced Data Analytics 6 (Supervised and Unsupervised Learning)**  Tutorial/Self-Paced Lab Session 15 - Python programming for advanced data analytics part 6 (Supervised and Unsupervised Learning) |
| Week 10 – 28/11/2022 | AY | **Lecture 11: Advanced Data Analytics 7: Deep Learning**  Tutorial/Self-Paced Lab Session 16 - Python programming for advanced data analytics part 7 (Deep Learning Part 1)  Tutorial/Self-Paced Lab Session 17 - Python programming for advanced data analytics part 8 (Deep Learning part 2) |
| Week 11 – 05/12/2022 | AK/AY | **Assignment/Exam Support** |
| Week 12 – 12/12/2022 | AY/AK | **Independent Study** |
| Week 13 – 19/12/2022 |  | **Christmas Break** |
| Week 14 – 26/12/2022 |  | **Christmas Break** |
| Week 15 – 03/01/2023 | AK/AY | **Coursework Submission**   1. **Report (submit via turnitin link)** 2. **Youtube video file showing student’s face and slides (10 minutes) (submit a text file with url of the youtube video and submit via video presentation link)** 3. **Python Codes and Dataset (or url) (submit via codes/dataset link)**   Submission Deadline: Tuesday, 03/01/2023, Time 12:00 noon |
| Week 16 – 09/01/2023 | AK/AY | **DAV Phase-Test**  Tentative date: Tuesday, 10/01/2023, Time and tbc (check your online timetable) |

**Contact Hours**

Your learning experience will involve weekly online recorded lectures (self-study); weekly 1 an hour and a half hours face-to-face live tutorials and self-paced lab sessions as well as directed reading and student-centred activities.

A student guide on contact hours is available here:

<https://www.qaa.ac.uk/docs/qaa/quality-code/contact-hours-student.pdf?sfvrsn=5046f981_8>

# Assessment

## Assessment Summary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Assessment Method:** | **Module Weighting:** | **Assessment Date:** | **Feedback Method:** | **Feedback Date:** |
| **1.** Phase Test  (2.5 hours) | **20%** | **w/c 09/01/2023 (tentative date is 10/01/2023)** | **tbc** | **Within 3 weeks** |
| **2. Coursework:** Report, Youtube video for presentation, Python Codes, Dataset (or url), | **80%** | **03/01/2023** | **Via MyBeckett** | **Within 3 weeks** |

# Key Resources to Support Learning

Your general understanding and application of a subject area will improve the more you ‘read around’. In your postgraduate studies, we expect to be confident in researching literature on topics and appreciating the varied views and insights this may offer – so the suggestions below are just that, suggestions and recommendations.

Sustainable Development Goals, Data analytics and Intelligence – of interest

* **UN Sustainable Development Goals** <https://sdgs.un.org/goals>
* **AI for Sustainability and Innovation** <https://www.mdpi.com/journal/applsci/special_issues/AI_Innovations>
* **AI and Sustainable Development**

<https://earth.org/data_visualization/ai-can-it-help-achieve-environmental-sustainable/>

* **Youtube** shouldn’t be overlooked for videos of lectures or ‘how tos’ (e.g. AI for good-Sustainability (<https://www.youtube.com/watch?v=mJ6rjJiIHyo>), business intelligence, data analysis, data visualisation and statistics)
* **Youtube** ‘Telling Stories Using Planetary and Sustainable Development Data’ <https://www.youtube.com/watch?v=Y4NIQW-UKco>
* The **Guardians ‘data’ blog** has some interesting data analysis stories. <http://www.guardian.co.uk/data>, their technology sections also include some good podcasts.
* **Computer Weekly** is available in the library and on: <http://www.computerweekly.com/Home/>. It is The Computing paper, lots of current information, white papers and jobs. A good place to research a company (with respect to their IT systems) before you go for an interview.
* **Coursera** has examples and tutorials to help you understand and get on with the final report. <https://www.coursera.org/learn/machine-learning-with-python>

**More specific material for the module, I have detailed material under the areas covered on the module.**

1. **Data Analytics for Smart Systems**
   1. **Smart Buildings** <https://www.sciencedirect.com/science/article/pii/S1877050920304506>
   2. **Smart Homes** <https://www.sciencedirect.com/science/article/pii/S1877050920304269>
   3. **Smart Environmental Monitoring Systems**

<https://www.paessler.com/it-explained/smart-environmental-monitoring>

<https://www.sciencedirect.com/science/article/pii/S1877050920304282>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7309034/>

<https://www.mdpi.com/1424-8220/20/11/3113>

* 1. **Smart Cities**

<https://www.smart-energy.com/magazine-article/data-analytics-the-key-to-delivering-smart-cities/>

<https://www.mdpi.com/2624-6511/4/1/18/htm>

<https://ieeexplore.ieee.org/abstract/document/7447851>

<https://translateyar.ir/wp-content/uploads/2020/09/A-novel-big-data-analytics-framework-for-smart-cities.pdf>

<https://www.researchgate.net/publication/329438377_A_Systematic_Review_for_Smart_City_Data_Analytics>

* 1. **Smart Healthcare Applications**

<https://www.frontiersin.org/research-topics/22604/big-data-analytics-for-smart-healthcare-applications>

<https://www.researchgate.net/publication/334462854_Data_Analytics_in_Smart_Healthcare_The_Recent_Developments_and_Beyond>

<https://www.mdpi.com/2076-3417/9/14/2812/pdf>

* 1. **Smart Transportation**

<http://dianewoodbridge.com/publications/files/2018_SmartCity_NYC_Taxi.pdf>

<https://www.sciencedirect.com/science/article/pii/S1877050920321049>

<https://ieeexplore.ieee.org/document/8344848>

<https://www.hindawi.com/journals/jat/si/823595/>

<https://www.tandfonline.com/doi/full/10.1080/21680566.2017.1393968>

* 1. **Environmental Intelligence (e.g. Air Quality/Air Pollution)**

<https://dl.acm.org/doi/10.1145/3369555.3369557>

<https://www.intel.co.uk/content/www/uk/en/it-management/cloud-analytic-hub/fighting-air-pollution.html>

<https://www.intel.co.uk/content/www/uk/en/it-management/cloud-analytic-hub/fighting-air-pollution.html>

<https://www.mdpi.com/2079-9292/10/2/184/pdf>

<https://link.springer.com/chapter/10.1007%2F978-981-15-0978-0_17>

* 1. **Smart Energy/Smart Meter Data Analytics**

<https://link.springer.com/chapter/10.1007%2F978-981-15-0978-0_17>

<https://www.researchgate.net/publication/338127651_Smart_Meter_Data_Analytics_Electricity_Consumer_Behavior_Modeling_Aggregation_and_Forecasting>

<https://www.mdpi.com/2227-9717/8/4/484/pdf>

<https://cyberleninka.org/article/n/1491940.pdf>

<https://ieeexplore.ieee.org/document/6281612>

<https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8322199>

* 1. **Smart Agriculture**

<https://www.sciencedirect.com/science/article/pii/S1319157821001282>

<https://proagrica.com/news/how-data-analytics-is-transforming-agriculture/>

<https://www.sciencedirect.com/science/article/pii/S0308521X16303754>

<https://seleritysas.com/blog/2020/09/11/data-analytics-solutions-transformed-the-farming-industry/>

<https://www.talend.com/resources/big-data-agriculture/>

* 1. **Smart Manufacturing**

<https://smart-manufacturing.co.uk/>

<https://www.sciencedirect.com/science/article/pii/S2666188820300162>

<https://downloadnema.com/wp-content/uploads/2018/03/Article-1193-www.downloadnema.com_.pdf>

* 1. **Smart Government**

<https://www.sciencedirect.com/science/article/pii/S0740624X19300905>

<https://datasmart.ash.harvard.edu/news/article/analytics-city-government>

* 1. **Smart Data Center**

<https://azuremarketplace.microsoft.com/en-us/marketplace/apps/micro-focus.smart-data-center-analytics?tab=overview>

<https://www.microfocus.com/media/flyer/smart_data_center_analytics_service_flyer.pdf>

<https://www.datacenterknowledge.com/archives/2016/10/26/era-smart-data-center>

<https://www.cisco.com/c/dam/global/en_uk/solutions/data-center-virtualization/pdf/cisco_smart_data_center_strategies_in_a_multicloud_world_techtarget_report.pdf>

* 1. **Smart Resource Allocation**

<https://ieeexplore.ieee.org/abstract/document/8657791>

<http://ijcse.com/docs/INDJCSE14-05-02-036.pdf>

<https://www.sciencedirect.com/science/article/pii/S1084804517304277>

<https://repository.asu.edu/items/54825>

<https://alibabatech.medium.com/aiops-for-big-data-from-alibaba-e147455f71dd>

* 1. **Smart Business**

<https://medium.com/@ankita.shrimali/ai-data-analytics-the-intelligence-for-smart-business-decisions-7fcf77fe0734>

<https://smartdata-analytics.de/>

1. **Python**

<https://www.w3schools.com/python/python_ml_getting_started.asp>

<https://www.coursera.org/learn/machine-learning-with-python>

<https://scikit-learn.org/stable/>

1. **Statistical/data analysis**

These resources will be useful to provide you the required knowledge about statistical analysis.

**Introduction to Statistics by Coursera**

<https://www.coursera.org/learn/stanford-statistics>

**Introduction to Statistics by Libretext**

<https://stats.libretexts.org/Bookshelves/Introductory_Statistics/Book%3A_Introductory_Statistics_(Shafer_and_Zhang)/01%3A_Introduction_to_Statistics>

**Introduction to Statistics by Datacamp**

<https://www.datacamp.com/>

**Introduction to Statistics by MIT**

[Introduction to Statistics](https://www.youtube.com/watch?v=VPZD_aij8H0)



**Full course on basic data science**

[Statistics - A Full University Course on Data Science Basics](https://www.youtube.com/watch?v=xxpc-HPKN28)



1. **Google Colab**

<https://colab.research.google.com/notebooks/intro.ipynb>

1. **Google BigQuery Tutorial**

<https://cloud.google.com/bigquery/docs/tutorials>

All disabled students requiring additional support or alternative arrangements must declare and provide evidence of their disability to the Disability and Advice Team as early as possible:

<https://www.leedsbeckett.ac.uk/parents/student-support/disability-advice/>

1. **Open Source Datasets**

**Data center datasets**

<https://github.com/bean-zhang/awesome-datasets-about-datacenter>

**Google Cluster Data**

<https://github.com/google/cluster-data/blob/master/ClusterData2019.md>

**Alibaba Cluster Data**

<https://github.com/alibaba/clusterdata>

**Azure Datasets**

<https://azure.microsoft.com/en-us/services/open-datasets/#overview>

**Climate Data Online**

<https://www.ncdc.noaa.gov/cdo-web/datasets>

<https://www.climate.gov/maps-data/datasets>

<https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data>

<https://datasets.wri.org/dataset?q=climate>

**Air Quality**

<https://uk-air.defra.gov.uk/data/>

<https://www.gov.uk/government/collections/air-quality-and-emissions-statistics>

Atmosphere <https://data.world/datasets/atmosphere>

<https://www.epa.gov/outdoor-air-quality-data/download-daily-data>

Pollution Data <https://www.kaggle.com/sogun3/uspollution>

**Water Quality**

<https://data.europa.eu/data/datasets/dat-163-en?locale=en>

<https://environment.data.gov.uk/water-quality/view/landing>

<https://www.kaggle.com/adityakadiwal/water-potability>

<https://data.world/datasets/water>

**Smart Cities Datasets**

<http://iot.ee.surrey.ac.uk:8080/datasets.html>

India <https://smartcities.data.gov.in/>#

**EU Datasets**

<https://data.europa.eu/en>

**Environment Datasets**

<https://data.world/datasets/environment>

**IoT datasets**

<https://hub.packtpub.com/25-datasets-deep-learning-iot/>

**Energy Efficiency Datasets**

<https://www.kaggle.com/elikplim/eergy-efficiency-dataset>

<https://www.kaggle.com/c/ashrae-energy-prediction/data>

<https://archive.ics.uci.edu/ml/datasets/energy+efficiency>

**Greener Manufacturing**

<https://www.kaggle.com/c/mercedes-benz-greener-manufacturing/data>

<https://www.kaggle.com/paresh2047/uci-semcom>

You are free to choose any other datasets of your choice.

# Assessment

## Assessment Details

# Overview

You will produce a research paper of between 4000 plus or minus 10% words on a topic that addresses the outcomes of this module.

You are required to choose a sustainability-related topic area for your research. It is expected that your work will draw on existing literature and primary data from both simplified and detailed datasets. You should make an appointment with the Module team if you require further explanations.

In the first instance it is expected that you will explore a broad range of topic areas; stemming from this research, you will be required to submit a proposed title for your report along with notes on aims, objectives, methodology.

# Submission Date

* Submission date and time: 12:00 noon Tuesday 03/01/2023
  + Report submission 4000 plus or minus 10% words)
  + Youtube url for video presentation showing the face of the presenter and slides (10 minutes)
  + python codes, and dataset (note if dataset is too big, provide a google drive shared link to the dataset)
* Phase Test (2.5 hours)
  + Tentative 10th January 2023

Re-assessment: Re-assessment will be based on the assignment and will be due 7th April 2023. Details on the re-assessment will be given on MyBeckett.

**LEEDS BECKETT UNIVERSITY**

**SCHOOL OF BUILT ENVIRONMENT, ENGINEERING & COMPUTING**

**COVER SHEET FOR ALL ASSIGNMENT BRIEFS**

|  |  |
| --- | --- |
| Name of Module | Data Analytics and Visualisation |
| Name of Module Leader | Ah-Lian Kor |
| Main Assessment or Resit? | Main Assessment |
| Semester 1 or 2 or Term 1, 2 or 3 | Semester 1 |
| CRN | 15714 |
| Type of Assessment (Coursework; Presentation; Phase Test etc) | Coursework (Report)  Youtube video presentation showing the slides and face of presenter (10 minutes), Python Scripts, and Dataset  Phase Test |
| Date & deadline time of Submission | Coursework: 12:00 noon Tuesday 03/01/2023  Report, Youtube presentation, Python Scripts, and Dataset  Closed Book Face-to-face Phase Test (2.5 hours): 10/01/2023 |
| Date for Return of feedback | 3 weeks after submission |
| Type of Submission  (online via My Beckett; Handed in during Seminar; Presentation).  It is expected that all assignments will be submitted electronically. | VLE |
| Feedback (please specify how will feedback be given to students ) | VLE or email |
| Franchise delivery  Is the assessment for campus delivery the same for the franchise partner, if not please provide assessment for franchise partner. | Yes |

# Assignment Brief

Refer to the DAV Assignment Brief document.

# Understanding Your Assessment Responsibilities

**Mitigation and Extenuating Circumstances**

If you are experiencing problems which are adversely affecting your ability to study (called 'extenuating circumstances'), then you can apply for mitigation. You can find full details of how to apply for mitigation at:

<https://www.leedsbeckett.ac.uk/studenthub/mitigation/#:~:text=Examples%20of%20extenuating%20circumstances%20include,impacted%20by%20the%20coronavirus%20pandemic>

The University operates a fit to sit/fit to submit approach to extenuating circumstances which means students who take their assessment are declaring themselves fit to do so.

**Late Submission**

Without any form of extenuating circumstances, standard penalties apply for late submission of assessed work. Full details of the penalties for late submission of course work are available at <https://www.leedsbeckett.ac.uk/-/media/files/our-university/academic-regulations/3-education-assessment/ar3_education_and_assessment.pdf> .

**Academic Integrity**

Academic misconduct occurs when you yourself have not done the work that you submit. It may include cheating, plagiarism, self-plagiarism, collusion and other forms of unfair practice. What is and what is not permitted is clearly explained in *The Little Book of Academic Integrity* which is available to view at: <https://www.leedsbeckett.ac.uk/our-university/public-information/academic-regulations/> .

The serious consequences of plagiarism and other types of unfair practice are detailed in section 2.9 of the Regulations at <https://www.leedsbeckett.ac.uk/studenthub/academic-integrity/> .

1. <https://www.sisense.com/en-gb/glossary/data-intelligence/> [↑](#footnote-ref-1)