

Level 4 Diploma in Artificial Intelligence

Level 5 Diploma in Artificial Intelligence

Qualification Specification

March 2024

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About QUALIFI

QUALIFI is recognised and regulated by Ofqual (Office of Qualifications and Examinations Regulator). Our Ofqual reference number is RN5160. Ofqual regulates qualifications, examinations, and assessments in England.

As an Ofqual recognised Awarding Organisation, QUALIFI is required to carry out external quality assurance to ensure that centres approved for the delivery and assessment of QUALIFI's qualifications meet the required standards.

Why Choose QUALIFI Qualifications?

QUALIFI qualifications aim to support learners to develop the necessary knowledge, skills and understanding to support their professional development within their chosen career and or to provide opportunities for progression to further study.

Our qualifications provide opportunities for learners to:

- apply analytical and evaluative thinking skills
- develop and encourage problem solving and creativity to tackle problems and challenges
- exercise judgement and take responsibility for decisions and actions
- develop the ability to recognise and reflect on personal learning and improve their personal, social, and other transferable skills.

Employer Support for the Qualification Development

During the development of this qualification QUALIFI consults with a range of employers, providers, and existing centres (where applicable) to ensure rigor, validity and demand for the qualification and to ensure that the development considers the potential learner audience for the qualification and assessment methods.

Equality and Diversity

QUALIFI's qualifications are developed to be accessible to all learners who are capable of attaining the required standard. QUALIFI promotes equality and diversity across aspects of the qualification process and centres are required to implement the same standards of equal opportunities and ensure teaching and learning are free from any barriers that may restrict access and progression.

Learners with any specific learning need should discuss this in the first instance with their approved centre who will refer to QUALIFI's Reasonable Adjustment and Special Consideration Policy.

Qualification Titles and Accreditation Number

These qualifications have been accredited to the Regulated Qualification Framework (RQF) and have their own unique Qualification Accreditation Numbers (QAN). This number will appear on the learner's final certification document. Each unit with the qualifications has its own RQF code. The QANs for these qualifications are as follows:

Level 4 Diploma in Artificial Intelligence 610/3934/2

Level 5 Diploma in Artificial Intelligence 610/3935/4

Qualification Aims and Learning Outcomes

Aims of the Diplomas

QUALIFI Level 4 Diploma in Artificial Intelligence

The aim of the QUALIFI Level 4 Diploma in Artificial Intelligence is to equip students with understanding of AI concepts and applications at an entry level. The diploma covers a range of topics, including the history and principles of AI, machine learning, data science, deep learning, AI ethics, and practical AI applications. Students will gain hands-on experience with popular AI tools and develop programming skills in languages like Python.

The Diploma emphasises ethical considerations and responsible AI development. It typically includes project work to apply AI knowledge to real-world challenges and prepares students for careers in AI development, data science, machine learning engineering, or further academic pursuits in the field. Assessment methods include exams, assignments, and project evaluations to ensure an understanding of AI principles and their practical application.

Successful completion of the QUALIFI Level 4 Diploma in Artificial Intelligence provides learners with the opportunity to progress to further study or employment.

Learning Outcomes of the QUALIFI Level 4 Diploma in Artificial Intelligence

The overall learning outcomes of the qualification are for learners to:

1. Demonstrate a fundamental understanding of artificial intelligence concepts, theories, and principles.
2. Apply machine learning algorithms and techniques to solve real-world problems.
3. Analyze and process data for AI applications, including data cleaning, transformation, and feature engineering.
4. Develop basic AI solutions using programming languages such as Python.
5. Evaluate the ethical and legal considerations associated with AI technologies.
6. Distinguish various impacts of AI on society, economy, and industry.

The learning outcomes and assessment criteria for each unit are outlined in the unit specifications.

QUALIFI Level 5 Diploma in Artificial Intelligence

The Level 5 Diploma in Artificial Intelligence (AI) builds upon the foundational knowledge and skills acquired in the Level 4 AI diploma, providing students with a deeper and more advanced understanding of AI technologies and applications. This program is designed to empower students with the expertise required to excel in the rapidly evolving field of AI.

The Level 5 diploma extends the scope of AI education by delving into complex topics such as advanced machine learning techniques, natural language processing, computer vision, reinforcement learning, and AI for robotics. Students will explore cutting-edge AI emerging technologies, staying at the forefront of innovation in the field. In addition to technical knowledge, this diploma emphasizes critical thinking, problem-solving, and the ethical dimensions of AI. Students will engage in hands-on projects, applying their AI expertise to address real-world challenges and contribute to the advancement of AI solutions.

The Level 5 AI diploma prepares graduates for a pathway for those seeking to pursue advanced studies in AI or related fields. Assessment methods include advanced projects, use-cases, and presentations, ensuring that students not only grasp advanced AI concepts but can also communicate and apply them effectively.

By completing the Level 5 Diploma in AI, students will be equipped with the knowledge, skills, and ethical awareness necessary to be competent professionals in AI technology. This program provides a robust foundation for successful careers and continued academic pursuits in the exciting and dynamic field of Artificial Intelligence.

Learning Outcomes of the QUALIFI Level 5 Diploma in Artificial Intelligence

The overall learning outcomes of the qualification are for learners to:

1. **Deep Understanding of Advanced AI Concepts:** Graduates will demonstrate an in-depth comprehension of advanced artificial intelligence concepts, extending their knowledge beyond the fundamentals to encompass cutting-edge theories, techniques, and principles in AI development.
2. **Advanced Machine Learning Proficiency:** Students will apply advanced machine learning algorithms and methodologies to tackle complex, multifaceted real-world problems, showcasing their ability to design and implement highly effective AI solutions.
3. **Advanced Data Handling Skills:** Graduates will possess advanced data analysis and preprocessing skills, including advanced data cleaning, transformation, and feature engineering techniques, enabling them to work with diverse and complex datasets in AI applications.
4. **Proficiency in Advanced AI Programming:** Students will master advanced AI programming languages and libraries, expanding their coding expertise to develop intricate AI solutions and incorporate advanced algorithms effectively.
5. **Advanced Ethical and Legal Assessment:** Graduates will conduct in-depth assessments of the ethical and legal implications of AI technologies, with the ability to navigate complex ethical dilemmas and compliance issues in AI development and deployment.
6. **Proficient in strategic impact of AI:** Students will critically evaluate the broader societal, economic, and industry impacts of AI, and they will develop the strategic acumen to

propose innovative AI strategies and applications that positively influence these domains.

These Level 5 program learning outcomes reflect the advanced nature of the diploma, focusing on deeper knowledge, advanced skills, and a heightened awareness of the ethical and societal implications of AI. Graduates will be well-prepared for professional roles in the field of Artificial Intelligence.

The learning outcomes and assessment criteria for each unit are outlined in the unit specifications.

Delivering the Qualification

External Quality Assurance Arrangements

All centres are required to complete an approval process to be recognised as an approved centre. Centres must have the ability to support learners. Centres must commit to working with QUALIFI and its team of External Quality Assurers (EQAs). Approved Centres are required to have in place qualified and experienced tutors, all tutors are required to undertake regular continued professional development (CPD).

Approved centres will be monitored by QUALIFI External Quality Assurers (EQAs) to ensure compliance with QUALIFI requirements and to ensure that learners are provided with appropriate learning opportunities, guidance, and formative assessment.

QUALIFI's guidance relating to invigilation, preventing plagiarism and collusion will apply to centres.

QUALIFI, unless otherwise agreed:

- sets all assessments;
- moderates' assessments prior to certification;
- awards the final mark and issues certificates.

Learner Induction and Registration

Approved Centres should ensure all learners receive a full induction to their study programme and the requirements of the qualification and its assessment.

All learners should expect to be issued with the course handbook and a timetable and meet with their personal tutor and fellow learners. Centres should assess learners carefully to ensure that they are able to meet the requirements qualification and that, if applicable, appropriate pathways or optional units are selected to meet the learner's progression requirements.

Centres should check the qualification structures and unit combinations carefully when advising learners. Centres will need to ensure that learners have access to a full range of information, advice and guidance to support them in making the necessary qualification and unit choices. During recruitment, approved centres need to provide learners with accurate information on the title and focus of the qualification for which they are studying.

All learners must be registered with QUALIFI within the deadlines outlined in the QUALIFI Registration, Results and Certification Policy and Procedure.

Entry Criteria

The qualifications have been designed to be accessible without artificial barriers that restrict access and progression. Entry to the qualifications will be through centre interview and applicants will be expected to hold the following:

Qualifi Level 4 Diploma in Artificial Intelligence

- learners who possess qualifications at Level 3 and/or;
- learners who have work experience in the governmental and non-governmental sector and demonstrate ambition with clear career goals.

Qualifi Level 5 Diploma in Artificial Intelligence

- learners who possess qualifications at Level 4 and/or;
- learners who have work experience in the governmental and non-governmental sector and demonstrate ambition with clear career goals.

In certain circumstances, learners with considerable experience but no formal qualifications may be considered, subject to interview and demonstrate their ability to cope with the qualification's demands.

Recognition of Prior Learning

Recognition of Prior Learning (RPL) is a method of assessment (leading to the award of credit) that considers whether learners can demonstrate that they can meet the assessment requirements for a unit through knowledge, understanding or skills they already possess and so do not need to develop through a course of learning.

QUALIFI encourages centres to recognise learners' previous achievements and experiences whether at work, home or at leisure, as well as in the classroom. RPL provides a route for the recognition of the achievements resulting from continuous learning. RPL enables recognition of achievement from a range of activities using any valid assessment methodology. Provided that the assessment requirements of a given unit or qualification have been met, the use of RPL is acceptable for accrediting a unit, units, or a whole qualification.

Evidence of learning must be valid and reliable. For full guidance on RPL please refer to QUALIFI's *Recognition of Prior Learning Policy*.

Data Protection

All personal information obtained from learners and other sources in connection with studies will be held securely and will be used during the course and after they leave the course for a variety of purposes and may be made available to our regulators. These should be all explained during the enrolment process at the commencement of learner studies. If learners or centres would like a more detailed explanation of the partner and QUALIFI policies on the use and disclosure of personal information, please contact QUALIFI via email support@QUALIFI-international.com

Learner Voice

Learners can play an important part in improving the quality through the feedback they give. In addition to the on-going discussion with the course team throughout the year, centres will have a range of mechanisms for learners to feed back about their experience of teaching and learning.

Professional Development and Training for Centres

QUALIFI supports its approved centres with training related to our qualifications. This support is available through a choice of training options offered through publications or through customised training at your centre.

The support we offer focuses on a range of issues including:

- planning for the delivery of a new programme
- planning for assessment and grading
- developing effective assignments
- building your team and teamwork skills
- developing learner-centred learning and teaching approaches
- building in effective and efficient quality assurance systems.

Please contact us for further information.

Progression and Links to other QUALIFI Programmes

Completing the **QUALIFI Level 4 Diploma in Artificial Intelligence** will enable learners to progress to:

- QUALIFI Level 5 Diploma in Artificial Intelligence
- Employment in an associated profession.

Completing the **QUALIFI Level 5 Diploma in Artificial Intelligence** will enable learners to progress to:

- A Level 6 qualification in relevant area
- Employment in an associated profession

Qualification Structure and Requirements

Credits and Total Qualification Time (TQT)

The QUALIFI Level 4 Diploma in Artificial Intelligence is made up of 6 units equating to 120 credits. All units are 20 credits in value. Each 20-credit unit approximates to a TQT of 200 hours incorporating 120 hours of GLH. 120 credits equate to 1200 hours of TQT.

The QUALIFI Level 5 Diploma in Artificial Intelligence is made up of 6 units equating to 120 credits. All units are 20 credits in value. Each 20-credit unit approximates to a TQT of 200 hours incorporating 120 hours of GLH. 120 credits equate to 1200 hours of TQT.

Total Qualification Time (TQT) is an estimate of the total amount of time that could reasonably be expected to be required for a learner to achieve and demonstrate the achievement of the level of attainment necessary for the award of a qualification. Examples of activities that can contribute to Total Qualification Time includes guided learning, independent and unsupervised research/learning, unsupervised compilation of a portfolio of work experience, unsupervised e-learning, unsupervised e-assessment, unsupervised coursework, watching a prerecorded podcast or webinar, unsupervised work-based learning.

Guided Learning Hours (GLH) are defined as the time when a tutor is present to give specific guidance towards the learning aim being studied on a programme. This definition includes lectures, tutorials and supervised study in, for example, open learning centres and learning workshops, live webinars, telephone tutorials or other forms of e-learning supervised by a tutor in real time. Guided learning includes any supervised assessment activity; this includes invigilated examination and observed assessment and observed work-based practice.

Rules of Combination

QUALIFI Level 4 Diploma in Artificial Intelligence

All Units are mandatory.

Unit Reference	Mandatory Units	Level	TQT	Credit	GLH
R/651/0599	Introduction to Artificial Intelligence and Applications	4	200	20	120
F/651/0600	Mathematical Foundations for Machine Learning	4	200	20	120
H/651/0601	Data Science Using Python	4	200	20	120
J/651/0602	Big Data Management	4	200	20	120
K/651/0603	Introduction to Deep Learning	4	200	20	120
L/651/0604	Artificial Intelligence Ethics	4	200	20	120
Total			1200	120	720

QUALIFI Level 5 Diploma in Artificial Intelligence

All Units are mandatory.

Unit Reference	Mandatory Units	Level	TQT	Credit	GLH
M/651/0605	Visualisation	5	200	20	120
R/651/0606	Reinforce Machine Learning	5	200	20	120
T/651/0607	Natural Language Processing	5	200	20	120
Y/651/0608	Human-AI Interaction	5	200	20	120
A/651/0609	Advanced Deep Machine Learning	5	200	20	120
H/651/0610	Introduction to Computer Vision	5	200	20	120
Total			1200	120	720

Achievement Requirements

Learners must demonstrate they have met all learning outcomes and assessment criteria for all the required units to achieve this qualification. QUALIFI will issue certificates to all successful learners via their registered centres.

Awarding Classification/Grading

Level 4 and Level 5 qualifications are graded.

Fail - 0-39%

Pass - 40%-59%

Merit - 60% - 69%

Distinction 70%+

All units will be internally assessed through written assignment, internally marked by the QUALIFI approved centre and subject to external quality assurance by QUALIFI.

Assessment Strategy and Methods

QUALIFI will provide [enter assessment method e.g. written assessment tasks] for each unit of this qualification. These tasks will address all learning outcomes and related assessment criteria, all of which must be demonstrated/passed in order to achieve the qualification.

The tasks will enable learners to draw on work-related information and/or examples wherever possible. Some assessment tasks will contain a practical assignment which will require observation by an assessor, see Assessment Guidance for further information.

The assessment tasks will require learners to draw on real organisational information or case studies to illustrate their answers. To support this activity during the programme of learning, centres are required to make sure that they include case studies of relevant

organisations and, wherever possible, encourage learners to draw on work-place opportunities to undertake research and investigation to support their learning.

QUALIFI provide a Candidate Workbook for each unit that learners should use to record their answers and/or cross-reference any supporting evidence relating to a practical task. Approved centres should request a copy of the assessment workbook.

Learner assessments will be internally marked by the approved centre and will be subject to external moderation by QUALIFI prior to certification.

Qualifi may provide summative assessments that cover the learning outcomes and assessment criteria. In addition, formative assessments may also be offered. In summary, the below table highlights the mechanics on both of these two assessments.

Formative Assessment	Summative Assessment
Will be used during the learning process	Will be used at end of the learning process
Provides feedback on learning-in-process	Evaluates achievement against learning outcomes and assessment criteria
Dialogue based and not graded	Will be graded with feedback

Evidence of both formative and summative assessments **MUST** be made available at the time of external quality assurance – EQA.

Please contact Qualifi for more information.

Unit Specifications

Qualifi Level 4 Diploma in Artificial Intelligence

Unit DAI401: Introduction to Artificial Intelligence and Applications

Unit code: R/651/0599

RQF Level: 4

Unit Aim:

This unit will provide students with a fundamental understanding of Artificial Intelligence (AI) and is an introductory unit for the Diploma in Artificial Intelligence Application. Students will gain knowledge of the evolving field of AI and explore the basic theoretical foundation of AI as it is applied in industry.

Learning Outcomes and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Understand the fundamental principles and concepts of AI.	1.1 Explain the principles of AI and the associated technologies
	1.2 Assess the impact of AI technologies on society
	1.2 Explain the function and purpose of the key AI models and Neural networks.
2. Understand trending AI applications and technologies used within industry.	2.1 Explain trending AI application used in different industries
	2.2 Discuss how these AI applications are implemented and the benefits to industry
3. Apply key trending AI tools to simple business scenarios	3.1 Assess AI trending tools used within industry and the challenges faced in implementing these technologies
	3.2 Discuss possible impact from such application of the trending AI tools.
4. Understand how AI can be used to address future sustainable society needs.	4.1: Describe society's future needs in respect of sustainability
	3.2: Review how AI applications can be optimized to address society's needs responsibly and sustainably.

Indicative Content

- AI principles and foundation, its technologies and impacts on society
- Trending AI application and their benefits in industries such as Education, Marketing and Small Businesses
- AI models and its purposes (Neural network, supervised, unsupervised, reinforced learning)
- AI technologies including data science, machine learning, natural language processing, computer vision, speech/image recognition and robotics
- Implementation of AI and its challenges

Suggested Resources

- Taulli, T., (2019), Artificial Intelligence Basics: A Non-Technical Introduction, Apress
- Lowe, A. & Lawless, S., (2021) Artificial Intelligence Foundations (BCS, The Chartered Institute for IT)
- Rialzul, S.M., (2023), AI in Everyday Life: Tools and Applications Paperback (Independently published)

Unit DAI402: Mathematical Foundations for Machine Learning

Unit code: F/651/0600

RQF level: 4

Unit Aim

In this unit students will explore the essential mathematical principles that form the bedrock of modern machine learning. The unit covers core concepts such as linear algebra, calculus, probability, and statistics, providing a mathematical foundation for understanding machine learning algorithms and techniques. Students will develop the skills needed to translate problems into mathematical models and communicate solutions effectively. Students will quantify business solutions to a given complex dataset.

Learning Outcomes, and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Understand the role of maths and statistics in Machine Learning.	1.1 Explain probability and its importance in business analytics.
	1.2 Calculate the probability of specific outcomes in given business scenarios.
	1.3 Classify with reasons, a given data as qualitative or quantitative
2. Understand statistical methods and tools for data analysis.	2.1 Explain the concept of inferential statistics and its role in business decision-making.
	2.2 For a given business case, explain a hypothesis that can be used to outline a statistical test to validate it.
	2.3 Interpret the results of hypothesis tests in the context of business analytics.
3. Be able to integrate statistical methods in solving business challenges.	3.1 Describe linear regression in analytics .
	3.2 Compute a simple linear regression model using a provided dataset
	3.3 Interpret the coefficients based on multiple regression analysis on a given dataset.
	3.4 Solve problems using derivatives (Product Rule, Quotient Rule) in business-related scenarios.
4. Be able to propose business solutions based on inferential statistics results.	4.1 Solve integral problems using trigonometric functions, exponentials, and logarithms, and explain their relevance in business contexts.
	4.2 Discuss the concept of computational complexity and its implications in data processing.
	4.3 Analyze a given complex dataset and interpret the results using appropriate statistical methods

Indicative Content

- Probability, Statistics, and Data Analysis
- Inferential Statistics and Hypothesis Testing
- Regression Analysis and Calculus
- Some Advanced Calculus and Computational Complexity

Suggested Resources

- Deisenroth, M. P., (2020), Mathematics for Machine Learning (Cambridge University Press)
- Wilmott, P., (2019), Machine Learning: An Applied Mathematics Introduction (Panda Ohana)

Unit DAI403: Data Science Using Python

Unit code: H/651/0601

RQF level: 4

Unit Aim

This unit introduces students to data science through the Python programming language. It covers fundamental Python programming concepts, data analysis techniques, and the use of Python libraries such as Pandas, NumPy, and Matplotlib for data manipulation and visualization. Students will learn how to apply Python to real-world data science problems, exploring topics such as machine learning algorithms, data wrangling, and exploratory data analysis. Students will have the opportunity to carry out projects to apply learned concepts in practical scenarios. Throughout the unit, the focus is on understanding and applying statistical methods for data analysis, ensuring a strong foundational skill set for aspiring data scientists.

Learning Outcomes, and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Understand Python for data analysis,	1.1 Describe Python fundamentals and data science concepts
	1.2 Write a small Python script on basic operations like variable assignments, loops, and conditionals
2. Be able to convert a given dataset to derive insights using data visualization	2.1 Organize a given dataset using Pandas before performing basic manipulations.
	2.2 Convert cleaned dataset into a series of visualizations to showcase different types of plots.
	2.3 Interpret the results from the visualizations.
3. Be able to apply basic machine learning concepts using Python	3.1 Apply statistical methods to a dataset with emphasis on concepts like mean, median, mode, variance
	3.2 Explain the results of the statistical summary and visual exploration on a chosen dataset.
4. Be able to analyze data to solve a given real-world data science problem.	4.1 Compare provided statistical methods and choose one to interpret its dataset
	4.2 Present insights on the given real-world data science problem

Indicative Content

- Python Basics and Introduction to Data Science
- Coding and use of key libraries like Pandas and NumPy.
- Data Manipulation and Visualization
- Matplotlib and Seaborn
- Exploratory Data Analysis and Basic Statistics
- Machine Learning in Python
- Mean, median, mode, variance

Suggested Resources

- Grus, J., (2019) Data Science from Scratch: First Principles with Python (O'Reilly Media)
- Shah, C., (2020) A Hands-On Introduction to Data Science (Cambridge University Press)
- Dasgupta, M., (2022) Practical Data Science Using Python (Packt Publishing)

Unit DAI404: Big Data Management

Unit code: J/651/0602

RQF level: 4

Unit Aim

This unit introduces students to the key concepts and characteristics of big data technologies, data mining, visualization, real-world applications, and ethical implications in the field of big data analytics. Students will explore big data and its crucial role in today's data-driven landscape and the structured to provide understanding and practical expertise in managing and analyzing extensive datasets. Students will develop an understanding of big data fundamentals and gain hands-on experience of using cutting-edge technologies. The unit aims to equip students with the necessary skills and knowledge to excel in the rapidly evolving field of big data analytics. Students will apply their knowledge and skills to a comprehensive dataset and present their data analysis.

Learning Outcomes, and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Understand what constitutes big data and its importance.	1.1 Explain the Big Data concepts and characteristics, and basic understanding of.
	1.2 Describe the basic aspects of Hadoop and NoSQL databases
	1.3 Assess the evolution of Big Data technologies and their impact on modern businesses.
2. Be able to use technologies and tools in big data analytics	2.1 Select and use appropriate technologies and tools to carry out practical coding or a process a dataset.
	2.2 Interpret a given dataset using basic data mining techniques and present findings.
3. Be able to apply techniques for mining, processing, and analyzing large datasets.	3.1 Describe the algorithms for classification, clustering, and association rule mining in processing datasets.
	3.2 Use tools to summarize data visualization-based on a given dataset.
	3.3 Interpret results from data visualization for specific industry to highlight business insights.
4. Be able to review applications of big data in different key industries.	4.1 Compare the ethical implications and privacy concerns in Big Data in different industries
	4.2 Carry out data analysis on a comprehensive dataset including ethical considerations
	4.3 Present the results of the data to highlight business insights, predictions, or strategies.

Indicative Content

- Fundamentals of Big Data and Technologies
- Hadoop and NoSQL, MapReduce, Spark databases
- Data Mining and Processing
- Classification or clustering
- Data Visualization and its applications in industries such as retail eCommerce, Public Relation, and Human Resources
- Tableau or PowerBI
- Ethical Implications in optimizing big data

Suggested Resources

- Gressel, S. & Pauleen, D., (2020) Management Decision-Making, Big Data and Analytics (Sage)
- Ghavam, P., (2020) Big Data Management: Data Governance Principles for Big Data Analytics (De Gruyter)

Unit DAI405: Introduction to Deep Learning

Unit code: K/651/0603

RQF level: 4

Unit Aim

In this unit learners will develop an understanding of the principles and applications of deep learning. They will revisit concepts associated with data science and machine learning before exploring key concepts relating to neural networks. Students will have the opportunity to practice solving real-life business problems using various neural network models and, subsequently, to analyse the results from such models. Students will use their knowledge and skills to evaluate the results of an image classification model and suggest how deep learning models can be improved.

Learning Outcomes, and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Understand basic machine learning concepts that apply when developing deep learning models.	1.1 Explain key concepts in machine learning
	1.2 Explain the process of data preparation / cleansing.
	1.3 Discuss the functions of classifier and ensemble in Machine Learning.
2. Understand how to develop basic deep learning models.	2.1 Explain key concepts of deep learning models
	2.2 Assess the use of these key concepts in deep learning modelling.
3. Be able to apply Neural network models to carry out simple tasks using popular frameworks.	3.1 Describe the purpose and deliverable outcome of Neural network models used in deep learning
	3.2 Select an appropriate Neural network model for an image classification.
	3.3 Model a selected Neural network model onto a given dataset.
4. Be able to interpret results using prepared sample data to preprocess deep learning models.	4.1 Select appropriate metric to evaluate the results of an image classification model
	4.2 Analyse the results produced and summarize how the deep learning model can be further improved

Indicative Content

- Fundamental concepts in deep learning and Neural network architecture
- Classification, Training / Testing Data, Overfitting and Underfitting.
- Neural network models and their derivable outcome
- Neural networks, backpropagation, activation functions and optimizers
- Data preparation and preprocessing
- Model evaluation and tuning.

Suggested Resources

- Trask, A., (2019) Grokking Deep Learning (Manning)
- Charniak, E., (2019) Introduction to Deep Learning (Mit Press)
- Glassne, A., (2021) Deep Learning: A Visual Approach (No Starch Press)
- Zhang, A., Lipton, Z., Li, M., (2023) Dive into Deep Learning (Cambridge University Press)

Unit DAI406: Artificial Intelligence Ethics

Unit code: L/651/0604

RQF level: 4

Unit Aim

In this unit learners will develop an understanding of ethical considerations and principles in relation to the development, deployment, and impact of AI. Students will discuss various industrial case studies to appreciate the ethical challenges associated with AI systems. They will identify dilemmas and express their views on possible conflicting outcomes. They will gain knowledge and skills to address ethical issues and explore factors to consider in making informed and responsible decisions. Students will have the opportunity to compare and analyse the various AI regulatory landscapes as advocated by global governmental agencies.

Learning Outcomes, and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Associate impact of AI on society with established ethical principles.	1.1 Discuss the key concept of AI and its impact on society. 1.1 Assess how to address human ethics and morality in AI deployment
2. Understand Ethical frameworks and principles in relation to AI deployment.	2.1 Explain the various elements of AI ethical frameworks 2.2 Review implementation of AI ethical framework and principles in current AI applications.
3. Understand mitigation in addressing bias, privacy, and security in AI application.	3.1 Explain the impact of bias, privacy, and security in AI application 3.2 Review the existing methods to identify, examine and mitigate bias, privacy, and security issues in AI systems.
4. Understand the governance and regulation of AI ethics.	4.1 Explain the responsibilities of government and industries to improve and regulate AI governance. 4.2 Compare the difference in global AI governance, including reasons for the differences

Indicative Content

- Ethical implications of AI technologies and AI ethical framework
- Privacy, fairness, transparency, and accountability.
- Challenges of bias AI algorithms and its implication on fairness
- Methods to examine and mitigate ethical issues in AI systems
- Existing regulatory landscape in governing AI systems

Suggested Resources

- Floridi, L., (2023) The Ethics of Artificial Intelligence: Principles, Challenges, and Opportunities (Oxford University Press)
- Coeckelbergh, M., (2020) AI Ethics (MIT Press)
- Adjei, A. T., (2023) AI Ethics: Navigating the Moral Dilemmas of AI: A Comprehensive Guide to Ethical AI Principles, Accountability, and Fairness Responsible Technology Ethics (Independent)

Qualifi Level 5 Diploma in Artificial Intelligence

Unit DAI501: Visualisation

Unit code: M/651/0605

RQF Level: 5

Unit Aim

This unit aims to provide students with fundamental knowledge of and hands-on practical skills in performing data visualization using graphic user-interface design and effective visual communication. Learners will cover the principles and theories of visualization and appreciate the purpose and benefits of the different types of data visualization and their respective tools and technologies. Students will practise applying user-experience design principles and communication skills using popular visualization tools and software to create interactive visualization on given datasets.

Learning Outcomes and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Understand the importance of data visualisation in business intelligence.	1.1 Discuss data visualisation and its benefits in business intelligence.
	1.2 Explain the different types of data visualization and when best to optimize them.
	1.3 Compare the various tools and technologies used in data visualization.
2. Be able to carry out data preparation for visualization.	2.1 Organise data collection, cleansing and preprocessing for effective data visualization
	2.2 Perform data quality validation and data preparation.
3. Be able to use different visual representations for decision-making.	3.1 Identify and select appropriate visualization tools to perform data visualization
	3.2 Carry out visualization on a given dataset using appropriate visualization tools
4. Be able to present visualizations using appropriate visualization tools.	4.1 Perform data preparation for visualizations.
	4.2 Present visualization on a given real-life business scenario.
	4.3 Analyse visualization results to interpret business insights.

Indicative Content

- Different types of visualization used in the industries
- Communication and design principles for data visualization leading to interactive user-experience design
- Use of popular visualization technology not limited to Tableau, Power BI and other open-source software tools
- Information architecture and data analysis deriving business insights from visualization

Suggested Resources

- Wilke, C.O., (2019) Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures, (O'Reilly)
- Pica, L. (2023) Present Beyond Measure: Design, Visualize, and Deliver Data Stories That Inspire Action (Wiley)
- Ryan, L., (2023) Visual Analytics Fundamentals: Creating Compelling Data Narratives with Tableau (Addison-Wesley)

Unit DAI502: Reinforced Machine learning

Unit code: R/651/0606

RQF level: 5

Unit Aim

This unit provides students with fundamental understanding of the principles, basic algorithms and practical usage of reinforced machine learning. Students will be introduced to various reinforcement machine learning algorithms, libraries and frameworks typically used to solve business problems. Students will work with a variety of datasets to produce simple designs and implement and evaluate reinforcement learning algorithms.

Learning Outcomes, and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Understand key concepts in Reinforced machine Learning.	1.1 Define key concepts in reinforcement machine learning.
	1.2 Compare supervised, unsupervised and reinforcement machine learning and their uses.
	1.3 Compare the functional capabilities of different reinforcement machine learning algorithms
2. Be able to apply reinforcement machine learning algorithms, libraries, and frameworks.	2.1 Carry out reinforcement machine learning tasks on a given real-life business problem.
	2.2 Review models and architectures used to solve real-life reinforcement machine learning problems
	2.3 Apply reinforcement machine learning algorithms, libraries and frameworks to solve practical business problems
3. Be able to analyse results of reinforcement machine learning.	3.1 Present insights of given model on real life business reinforcement learning problems
	3.2 Use appropriate evaluation metrics in reinforcement machine learning to analyse performance effectiveness for the given real-life problems
	3.3 Use hyperparameter tuning and optimization to improve performance of reinforcement machine learning models.

Indicative Content

- Basic concepts and principles of reinforcement machine learning
- Commonly used reinforcement learning algorithms, libraries and framework (not limited to Q-Learning, Deep Q Network, Policy Gradient and Actor-Critic models).
- Policy evaluation techniques and model-based reinforcement learning algorithms

Suggested Resources

- Winder, P., (2020) Reinforcement Learning: Industrial Applications of Intelligent Agents (O'Reilly)
- Sutton, R.S., Barto, A.G., (2018) Reinforcement Learning: An Introduction (MIT Press)
- Silver, D., (2023) Introduction to Reinforcement Learning – Video Lectures
<https://www.youtube.com/playlist?list=PLbWDNovNB5mqFBgg7i3MY6Ui4zudcvNFJ>,
27 Dec 2023

Unit DAI503: Natural Language Processing

Unit code: T/651/0607

RQF level: 5

Unit Aim

In this unit students will develop fundamental knowledge of skills in Natural Language Processing (NLP). Students will cover the fundamental concepts and algorithms commonly used for NLP. They will use Python libraries for NLP to build a search algorithm for extracting information from raw text. Students will have the opportunity to perform Sentiment Analysis to predict stakeholder sentiment.

Learning Outcomes, and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Understand fundamental concepts in Natural Language Processing (NLP).	1.1 Define key concepts and the various challenges associated with NLP.
	1.2 Explain preprocessing of textual data and the tokenization techniques for NLP analysis.
	1.3 Discuss various key NLP libraries, frameworks and other related tools.
2. Be able to use NLP libraries, frameworks, and other tools in text representations.	2.1 Implement NLP libraries, frameworks, and related tools on a sample text representation scenario
	2.2 Review the application of Sentiment Analysis using machine learning and other appropriate NLP methods
	2.3 Use appropriate NLP methods to analyse public sentiment within a given business scenario
3. Be able to use NLP methods and techniques to carry out sentiment analysis.	3.1 Compare the strength and weakness of different NLP methods and applications
	3.2 Use appropriate NLP techniques to analyse stakeholder sentiment within a chosen real-life business scenario.
	3.3 Examine output produced by NLP against results from a conducted survey using sentiment analysis.

Indicative Content

- Basic concepts and principles in linguistics, text preprocessing and cleaning
- Commonly used NLP libraries, frameworks and tools not limited to Python.
- NLP text classification, clustering and word representation techniques
- Techniques for sentiment detection for analyzing and classifying sentiment in text

Suggested Resources

- Kochma, E., (2022) Getting Started with Natural Language Processing (Manning)
- Vajjala, S., Majumder, B. (et. al) (2020) Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems (O'Reilly)
- Lane, H., Hapke, H., Howard, C., (2024) Natural Language Processing in Action: Understanding, analyzing, and generating text with Python (2nd Eds - Manning)

Unit DAI504: Human-AI Interaction

Unit code: Y/651/0608

RQF level: 5

Unit Aim

This unit aims to provide students with an understanding of the multidisciplinary areas involved in the field of Human-AI interactions. While the focus is on human interaction with AI, this unit covers the fundamental knowledge of and skills in designing an intuitive user-friendly human-machine interface. Students will consider human factors and basic elements in the psychology of human and AI interaction when using NLP interaction to influence conversational interface. Students will explore the fundamental concepts of explainable AI techniques to present transparent AI models.

Learning Outcomes, and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Understand key theories and concepts in human-AI interactions.	1.1 Explain the evolution and related concepts of Human-AI interaction
	1.2 Analyse user-centred design principles used in developing AI systems.
	1.3 Discuss how the design of an AI application uses principles of information architecture and intuitive user-friendly interaction.
2. Be able to carry out explainable AI techniques which take consideration of human factors and cognition.	2.1 Apply the various multimodal interaction techniques to analyse the effectiveness of various modalities for a given business scenario.
	2.2 Apply explainable AI techniques to improve transparency and trust in developed AI applications.
	2.3 Use human factors and cognitive load in designing the various interfaces within AI applications.
3. Understand design principles for collaborative human and AI systems.	3.1 Analyse user cognitive load to determine the processes and decision generated by AI application.
	3.2 Examine principles in designing AI systems that ensure collaboration between humans and AI systems.
	3.3 Investigate complexities in designing transparency for effective human and AI collaboration.

Indicative Content

- Basic concepts and principles in human-AI interactions with emphasis on user-experience linguistics, cognitive science and human cognition
- Designing the use of multimodal interaction techniques in designing intuitive AI application
- Basic design of human-AI systems using user-centered interface for AI, explainable AI techniques, and NLP interaction.
- Elementary concepts in conducting research

Suggested Resources

- Shneiderman, B., (2022) Human-Centered AI (Oxford Press)
- Eckroth, J., (2018) AI Blueprints: How to build and deploy AI business projects (Packt)
- Munn, M., Pitman, D., (2022) Explainable AI for Practitioners: Designing and Implementing Explainable ML Solutions (O'Reilly)
- Bartneck, C., Belpaeme, T., et al. (2020) Human-Robot Interaction: An Introduction (Cambridge University Press)
- Nielson, J. (2023) 10 Usability Heuristics for User Interface Design at <https://developer.apple.com/design/human-interface-guidelines/machine-learning>, 27 Dec 2023
- Google PAIR (2023) People + AI Guidebook at <https://pair.withgoogle.com/guidebook/> , 27 Dec 2023

Unit DAI505: Advanced Deep Learning

Unit code: A/651/0609

RQF level: 5

Unit Aim

This unit builds on the fundamentals of deep learning, data sciences, machine learning and Neural networks covered in the Level 4-unit Introduction to Deep Learning (AID405). Students will explore advanced Neural network architecture and techniques and their use in improving the performance of deep learning models. Students will have the opportunity to use deep learning models within NLP and Reinforcement Learning on given real-life business scenarios.

Learning Outcomes, and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Be able to review contemporary theories and concepts of deep machine learning.	1.1 Summarize contemporary theories, concepts and models of deep machine learning.
	1.2 Analyse the effectiveness of various deep machine learning models in addressing different business scenarios.
2. Understand advance Neural network architecture.	2.1 Investigate the use of advance Neural network architectures
	2.2 Explain the principles governing transfer learning.
	2.3 Explain the principles of improving trained-models
3. Be able to use different techniques to improve performance of deep machine learning models.	3.1 Investigate the hyperparameter tuning and generative models to improve performance.
	3.2 Use hyperparameter tuning to review impacts from different parameters on model.
	3.3 Use generative models to review effects on image generations and data synthesis.
4. Use deep machine learning models on Natural Language Processing (NLP) and Reinforced Machine Learning (RML).	4.1 Apply deep learning techniques in NLP tasks and examine the results.
	4.2 Integrate deep learning techniques within RML algorithms to solve complex problems.

Indicative Content

- Basic theories and concepts covered in deep learning.
- Advance Neural network concepts including Attention Mechanism, Recurrent Neural Networks and Hyperparameter tuning.
- Transferring learning and fine-tuning models for better performance
- Using deep machine learning models on NLP and RML.

Suggested Resources

- Sewak, M., Karim, M.R, (2018) Practical Convolutional Neural Networks: Implement advanced deep learning models using Python (Packt)
- Michelucci, U., (2019) Advanced Applied Deep Learning: Convolutional Neural Networks and Object Detection (APress)
- Vasilev, I., (2019) Advanced Deep Learning with Python (Packt)

Unit DAI506: Introduction to Computer Vision

Unit code: H/651/0610

RQF level: 5

Unit Aim

This unit focuses on the fundamentals of computer vision principles and techniques and their applications. In addition to understanding the theoretical concepts, students will have the opportunity to use common computer vision algorithms and systems. Students will explore techniques for image processing, feature extraction and representation as well as use algorithms to detect and classify objects within a given image.

Learning Outcomes, and Assessment Criteria

Learning Outcomes When awarded credit for this unit, a learner will:	Assessment Criteria Assessment of this learning outcome will require a learner to demonstrate that they can:
1. Understand key concepts and principles of computer vision.	1.1 Define the key concepts and principles of computer vision.
	1.2 Explain the evolution of computer vision and its application in AI.
	1.3 Apply basic image processing techniques to analyse results from enhanced visual data.
2. Be able to perform object recognition and image segmentation.	2.1 Use basic feature extraction and representation techniques to discover representation from raw data.
	2.2 Apply object detection algorithms as part of developing recognition system to classify objects in a given image.
3. Be able to apply deep learning models in computer vision.	3.1 Use image segmentation techniques to isolate images into specific segments.
	3.2 Use convolution Neural networks to classify images for the purpose of features learning.
	3.3 Assess the application of deep learning models and framework within computer vision.

Indicative Content

- Fundamental in image processing, segmentation and object recognition.
- Techniques for feature extraction, image recognition, classification and matching
- Using deep learning models in computer vision

Suggested Resources

- Bhuyan, M.K. (2019) Computer Vision and Image Processing: Fundamentals and Applications (CRC)
- Davies, E. R. (2017) Computer Vision: Principles, Algorithms, Applications, Learning (APress)
- Lakshmanan, Görner, V.M., Gillard, R. (2021) Practical Machine Learning for Computer Vision (O'Reilly)

Assessment Guidance

For the assessment of knowledge and understanding criteria, learners are required to provide written responses to the questions in this workbook, providing examples drawn from the workplace, case studies or investigative research where possible. It is a requirement that learners are able to analyse and demonstrate their understanding by use of theories, principles and models that are relevant to the subject matter.

The assessment of the following competence criteria by completion of a practical task:

Qualifi Level 4 Diploma in Artificial Intelligence

- **Unit AID401: Introduction to Artificial Intelligence and Applications**
 - Formative Assessment:
 - Discuss implementation and challenges of AI applications
 - Summative Assessment:
 - Investigate and review potential AI usage to address sustainable society needs in the future
- **Unit AID402: Mathematical Foundations for Machine Learning**
 - Formative Assessment:
 - Explain inferential statistics develop a hypothesis and outline a statistical test to validate it
 - Summative Assessment:
 - Apply the concepts learned to analyse a complex dataset, explaining the choice of statistical methods and interpreting the results.
- **Unit AID403: Data Science Using Python**
 - Formative Assessment:
 - Write a script in Python that demonstrates basic operations
 - Write a script in Python on a series of visualizations (using Matplotlib and Seaborn) using a given dataset
 - Summative Assessment:
 - Employ a simple machine learning model on a real-world dataset, accompanied by a report detailing the process, findings, and conclusions
- **Unit AID404: Big Data Management**
 - Formative Assessment:
 - Use appropriate techniques to perform basic data mining (like classification or clustering) and present findings.
 - Summative Assessment:
 - Apply learned concepts to process a given business scenarios and suggest business insights, predictions, or strategies on analysed data
- **Unit AID405: Introduction to Deep Learning**
 - Formative Assessment:
 - Use neural network models to execute several simple tasks on image classification.
 - Summative Assessment:
 - Use appropriate Neural network model and apply necessary metric to evaluate the result of an image classification model based on a given business scenario

- **Unit AID406: Artificial Intelligence Ethics**
 - Formative Assessment:
 - Write a review on existing methods to identify, examine and mitigate bias, privacy and security issues in AI systems.
 - Summative Assessment:
 - Write a review current issue concerning AI ethics and suggest what can be done to protect the society against bias implementation of AI

Qualifi Level 5 Diploma in Artificial Intelligence

- **Unit AID501: Visualization**
 - Formative Assessment:
 - Employ visualization tools to present data visualization for a given dataset using tools like Tableau or PowerBI, focusing on clarity and effectiveness of communication
 - Summative Assessment:
 - Present visualizations using appropriate tools on given real-life business scenario to interpret business insight
- **Unit AID502: Reinforced Machine Learning**
 - Formative Assessment:
 - Practice using reinforcement machine learning algorithms, libraries and frameworks to solve practical business problems
 - Summative Assessment:
 - Employ appropriate evaluation metrics in reinforcement machine learning to analyse performance effectiveness on given real-life problems
- **Unit AID503: Natural Language Processing**
 - Formative Assessment:
 - Practice using various NLP libraries, frameworks and tools on a sample text representation scenario
 - Summative Assessment:
 - Use learnt NLP techniques to examine stakeholders' views within a chosen real-life business scenario.
- **Unit AID504: Human-AI Interaction**
 - Formative Assessment:
 - Practice the various multimodal interaction techniques to analyse the effectiveness of different modalities for given business scenarios.
 - Summative Assessment:
 - Investigate effective design principles for collaborative human and AI systems.
- **Unit AID505: Advanced Deep Learning**
 - Formative Assessment:
 - Practice different advance deep learning techniques to review effects on image generations and data synthesis for given business scenarios.
 - Summative Assessment:
 - Employ deep learning models on NLP and RML for a given real-life business scenario.
- **Unit AID506: Introduction to Computer Vision**

- Formative Assessment:
 - Practice using different techniques for image processing and feature representations for given business scenarios.
- Summative Assessment:
 - Employ deep learning models in computer vision to classify images within given real-life business scenarios.

Contact Details

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