# KING'S OWN INSTITUTE*

**Success in Higher Education**

## ICT734 MACHINE LEARNING T325 BRIEF

All information in the Subject Outline is correct at the time of approval. KOI reserves the right to make changes to the Subject Outline if they become necessary. Any changes require the approval of the KOI Academic Board and will be formally advised to those students who may be affected by email and via Moodle.
Information contained within this Subject Outline applies to students enrolled in the trimester as indicated

# 1. General Information

### 1.1 Administrative Details

| Associated HE Award(s) | Duration | Level | Subject Coordinator |
|---|---|---|---|
| Master of Information Technology | 1 trimester | Advanced | Dr Zhiheng Li<br>zhiheng.li@koi.edu.au<br>P: +61 (2) 9283 3583<br>L: 59 Darby St, Cooks Hill, NSW 2300.<br>Consultation: via Moodle or by appointment. |

### 1.2 Core/Elective

This subject is a core subject.

### 1.3 Subject Weighting

Indicated below is the weighting of this subject and the total course points

| Subject Credit Points | Total Course Credit Points |
|---|---|
| 4 | Master of Information Technology (64) |

### 1.4 Student Workload

Indicated below is the expected student workload per week for this subject

| No. Timetabled Hours/Week* | No. Personal Study Hours/Week** | Total Workload Hours/Week*** |
|---|---|---|
| 3 hours/week plus supplementary online material | 7 hours/week | 10 hours/week |

* Total time spent per week at lectures and tutorials
** Total time students are expected to spend per week in studying, completing assignments, etc.
*** Combination of timetable hours and personal study

**1.5 Mode of Delivery** Classes will be face-to-face or hybrid. Certain classes will be online (e.g., special arrangements).

**1.6 Pre-requisites**
ICT762 Data Analytics and Data Visualisation (co-requisite)
ICT724 Intelligent Systems (prerequisite)

### 1.7 General Study and Resource Requirements

- Students are expected to attend classes with the weekly worksheets and subject support material provided in Moodle. Students should read this material before coming to class to improve their ability to participate in the weekly activities.
- Students will require access to the internet and their KOI email and should have basic skills in word processing software such as MS Word, spreadsheet software such as MS Excel and visual presentation software such as MS PowerPoint.
- Computers and WIFI facilities are extensively available for student use throughout KOI. Students are encouraged to make use of the campus Library for reference materials.

*Software resource requirements specific to this subject:* Software resource requirements specific to this subject: Office 365, MS Imagine, MS Excel, Python, Spyder and Jupyter Notebook, Google Colab.

### 1.8 Academic Advising

Academic advising is available to students throughout teaching periods including the exam weeks. As well as requesting help during scheduled class times, students have the following options:

- Consultation times: A list of consultation hours is provided on the homepage of Moodle where appointments can be booked.
- Subject coordinator: Subject coordinators are available for contact via email. The email address of the subject coordinator is provided at the top of this subject outline.
- Academic staff: Lecturers and Tutors provide their contact details in Moodle for the specific subject. In most cases, this will be via email. Some subjects may also provide a discussion forum where questions can be raised.
- Head of Program: The Head of Program is available to all students in the program if they need advice about their studies and KOI procedures.
- Vice President (Academic): The Vice President (Academic) will assist students to resolve complex issues (but may refer students to the relevant lecturers for detailed academic advice).

# 2. Academic Details

### 2.1 Overview of the Subject

Many business processes are data-driven and unlocking the power of data with cutting-edge technology facilitates competitive insights. Machine learning enables computers to perform actions without explicit programming. Deep learning is rapidly emerging as a successful branch of machine learning to uncover complex patterns and features. This subject provides the student with a broad introduction to machine learning and deep learning. It will enable students to utilise a range of machine learning and deep learning techniques for extracting meaningful insights and making informed decisions about various data analytics problems.

### 2.2 Graduate Attributes for Postgraduate Courses

Graduates of postgraduate courses from King's Own Institute will gain the graduate attributes expected from successful completion of a postgraduate degree under the Australian Qualifications Framework (2nd edition, January 2013). Graduates at this level will be able to apply advanced body of knowledge from their major area of study in a range of contexts for professional practice or scholarship and as a pathway for further learning.

King's Own Institute's generic graduate attributes for a master's level degree are summarised below:

| | KOI Postgraduate Degree Graduate Attributes | Detailed Description |
|---|---|---|
|  | Knowledge | Current, comprehensive and coherent knowledge, including recent developments and applied research methods |
|  | Critical Thinking | Critical thinking skills to identify and analyse current theories and developments and emerging trends in professional practice |
|  | Communication | Communication and technical skills to analyse and theorise, contribute to professional practice or scholarship, and present ideas to a variety of audiences |
|  | Research and Information Literacy | Cognitive and technical skills to access and evaluate information resources, justify research approaches and interpret theoretical propositions |
|  | Creative Problem Solving Skills | Cognitive, technical and creative skills to investigate, analyse and synthesise complex information, concepts and theories, solve complex problems and apply established theories to situations in professional practice |
|  | Ethical and Cultural Sensitivity | Appreciation and accountability for ethical principles, cultural sensitivity and social responsibility, both personally and professionally |
|  | Leadership and Strategy | Initiative, leadership skills and ability to work professionally and collaboratively to achieve team objectives across a range of team roles<br>Expertise in strategic thinking, developing and implementing business plans and decision making under uncertainty |
|  | Professional Skills | High level personal autonomy, judgement, decision-making and accountability required to begin professional practice |

Across the courses, these skills are developed progressively at three levels:

- **Level 1 Foundation –** Students learn the skills, theories and techniques of the subject and apply them in stand-alone contexts
- **Level 2 Intermediate –** Students further develop skills, theories and techniques of the subject and apply them in more complex contexts, beginning to integrate the application with other subjects
- **Level 3 Advanced** – Students have a demonstrated ability to plan, research and apply the skills, theories and techniques of the subject in complex situations, integrating the subject content with a range of other subject disciplines within the context of the course

Generally, skills gained from subjects in the Graduate Certificate and Graduate Diploma are at levels 1 and 2 while other subjects in the Master's degree are at level 3.

### 2.3 Subject Learning Outcomes

Listed below, are key knowledge and skills students are expected to attain by successfully completing this subject:

| Subject Learning Outcomes | Contribution to Course Graduate Attributes |
|---|---|
| a) Explain machine learning methods and pipelines used for industry applications. |  |
| b) Apply machine learning algorithms to develop solutions for given problems and data sets. |  |
| c) Analyse the results and solutions of machine learning models in accordance with industry standard. |  |
| d) Investigate artificial neural networks and deep learning solutions for industry applications. |  |
| e) Reflect on the ethical considerations that arise when using machine learning. |  |

**2.4 Subject Content and Structure**

Below are details of the subject content and how it is structured, including specific topics covered in lectures and tutorials. Reading refers to the text unless otherwise indicated.

*Weekly Planner:*

| Week (beginning) | Topic covered in each week's lecture | Reading(s) | Expected work as listed in Moodle |
|---|---|---|---|
| Week 1<br>27 Oct | Introduction to machine learning | Ch 1: The Machine Learning Landscape (Géron) | Tutorial on Python programming machine learning basics<br>Formative not graded |
| Week 2<br>03 Nov | Machine learning pipelines: end-to-end machine learning, regression and classification tasks | Ch 2: End-to-End Machine Learning Project (Géron)<br>Ch 3: Classification (Géron)<br>What Is a Machine Learning Pipeline? | Tutorial on machine learning pipelines<br>Discussion questions/case study and Python programming exercise<br>Summative graded |
| Week 3<br>10 Nov | Machine learning ethical considerations | Resources will be provided on Moodle. | Tutorial on ethical considerations for machine learning<br>Discussion questions/case study<br>Summative graded |

| Week (beginning) | Topic covered in each week's lecture | Reading(s) | Expected work as listed in Moodle |
|---|---|---|---|
| Week 4<br>17 Nov | Training Models | Ch 4: Training Models<br>(Géron) | Tutorial on training algorithms<br>Discussion questions and Python programming exercise on regression models and cost functions<br>Summative graded |
| Week 5<br>24 Nov | Supervised Learning: Support Vector Machines (SVM) | Ch 5: Support Vector Machines<br>(Géron) | Tutorial on SVM<br>Discussion questions and Python programming exercise<br>Summative graded<br>Quiz |
| Week 6<br>01 Dec | Supervised Learning: Decision Trees (DTs), Random Forests (RFs) | Ch 6: Decision Trees<br>(Géron) | Tutorial on DTs<br>Python programming exercise on decision trees<br>Summative graded |
| Week 7<br>08 Dec | Supervised Learning: Random Forests | Ch 7: Ensemble Learning and Random Forests<br>(Géron) | Tutorial on RF<br>Discussion questions and case study on random forests<br>Summative graded<br>Assessment 3<br>Report due |
| Week 8<br>15 Dec | Unsupervised Learning: Clustering | Ch 9: Unsupervised Learning Techniques<br>(Géron) | Tutorial on Clustering<br>Discussion questions and Python programming exercise<br>Summative graded<br>Assessment 3<br>Presentations |
| Week 9<br>05 Jan | Artificial Neural Networks (ANNs) | Ch 10: Intro to ANNs with Keras<br>(Géron) | Tutorial on ANNs<br>Discussion questions and Python programming exercise on ANNs for regression/ classification |

| Week (beginning) | Topic covered in each week's lecture | Reading(s) | Expected work as listed in Moodle |
|---|---|---|---|
| | | | Summative graded |
| Week 10<br>12 Jan | Deep Learning (DL) Models | Ch 1, Ch 5, Ch 6 (Chollet) | Tutorial DL Models Discussion questions and Python programming exercise on DL models for classification<br>Summative graded |
| Week 11<br>19 Jan | Applications of ANNs and DL models | Ch 5, Ch 6 (Chollet)<br>Ch 14 (Géron) | Tutorial on ANN and DL applications Discussion questions and case study<br>Assessment 4 Report due |
| Week 12<br>27Jan (Tue) | Review | All chapters | Revision<br>Assessment 4 Presentations |
| Week 13<br>02 Feb | Study review week and Final Exam Week | | |
| Week 14<br>09 Feb | Examinations<br>Continuing students - enrolments for T126 open | | Please see exam timetable for exam date, time and location |
| Week 15<br>16 Feb | Student Vacation begins<br>New students - enrolments for T126 open | | |
| Week 16<br>23 Feb | • Results Released<br>• Review of Grade Day for T325 – see Sections 2.6 and 3.2 below for relevant information.<br>• Certification of Grades<br><br>NOTE: More information about the dates will be provided at a later date through Moodle/KOI email. | | |
| **T126 2 Mar 2026** | | | |
| Week 1<br>02 Mar | Week 1 of classes for T126 | | |

### 2.5 Teaching Methods/Strategies

Briefly described below are the teaching methods/strategies used in this subject:

- *Lectures* (1 hour/week) are conducted in seminar style and address the subject content, provide motivation and context and draw on the students' experience and preparatory reading.
- *Tutorials* (2 hours/week) include class discussion of case studies and research papers, practice sets and problem-solving and syndicate work on group projects. Tutorials often include group exercises and so contribute to the development of teamwork skills and cultural understanding. Tutorial participation is an essential component of the subject and contributes to the development of many of the graduate attributes (see section 2.2 above). Tutorial participation contributes towards the assessment in many subjects (see details in Section 3.1 for this subject). Supplementary tutorial material such as case studies, recommended readings, review questions etc. will be made available each week in Moodle.
- *Online* teaching resources include class materials, readings, model answers to assignments and exercises and discussion boards. All online materials for this subject as provided by KOI will be found in the Moodle page for this subject. Students should access Moodle regularly as material may be updated at any time during the trimester
- *Other contact* - academic staff may also contact students either via Moodle messaging, or via email to the email address provided to KOI on enrolment.

### 2.6 Student Assessment

Assessment is designed to encourage effective student learning and enable students to develop and demonstrate the skills and knowledge identified in the subject learning outcomes. Assessment tasks during the first half of the study period are usually intended to maximise the developmental function of assessment (formative assessment). These assessment tasks include weekly tutorial exercises (as indicated in the weekly planner) and low stakes graded assessments (as shown in the graded assessment table). The major assessment tasks where students demonstrate their knowledge and skills (summative assessment) generally occur later in the study period. These are the major graded assessment items shown in the graded assessment table.

Final grades are awarded by the Board of Examiners in accordance with KOI's Assessment and Assessment Appeals Policy. The definitions and guidelines for the awarding of final grades are:

- *HD High distinction* (85-100%): an outstanding level of achievement in relation to the assessment process.
- *D Distinction* (75-84%): a high level of achievement in relation to the assessment process.
- *C Credit* (65-74%): a better than satisfactory level of achievement in relation to the assessment process.
- *P Pass* (50-64%): a satisfactory level of achievement in relation to the assessment process.
- *F Fail* (0-49%): an unsatisfactory level of achievement in relation to the assessment process.
- *FW:* This grade will be assigned when a student did not submit any of the compulsory assessment items.

Provided below is a schedule of formal assessment tasks and major examinations for the subject.

| Assessment Type | When assessed | Weighting | Learning Outcomes Assessed |
|---|---|---|---|
| Assessment 1: Tutorial Activities: During tutorial sessions, learners will engage in guided discussions and activities focused on machine learning methods, applications, and analysis. Activities may include group discussions, practical exercises. | Weeks 2-11 | 20% | a, b, c, d, e |

| | | | |
|---|---|---|---|
| Assessment 2: Quiz:<br>This assessment will allow learners to demonstrate that they have understood the concepts covered in weeks 1 to 5. | Week 5 | 10% | a, c, e |
| Assessment 3 Individual Research Assignment:<br>This assessment will allow learners to investigate and analyse current trends and applications of machine learning in industry.<br>Recent and relevant peer- reviewed academic papers will need to be reviewed and cited. | Week 7 – Report (2000 words)<br>Week 8 – Presentation | 35%<br>[Report 25%<br>Presentation 10%] | a, c, e |
| Assessment 4: Group Research and Practical Assignment: This assessment will allow learners to apply machine learning/artificial neural network/deep learning models to solve problems. A report and presentation (demonstration) are required to document the solution and analysis. | Week 11 – Report (2500 words)<br>Week 12 - Presentation | 35%<br>[Report - 20%<br>(Group –10%,<br>Individual – 10%)<br>Presentation - 15%<br>(Group – 5%,<br>Individual – 10%)] | a, b, c, d, e |

*Requirements to Pass the Subject:*

To gain a pass or better in this subject, students must gain a *minimum of 50%* of the total available subject marks.

### 2.7 Prescribed and Recommended Readings

Provided below, in formal reference format, is a list of the prescribed and recommended readings.

**Prescribed Books**

Geron, A., 2022. Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow. 3rd ed. Sebastopol, California: O'Reilly.

Chollet, F., Moolayil, J. and Yolyan, L., 2021. Deep learning with Python. 2nd ed. Shelter Island, New York: Manning Publications.

(3rd edition is coming -https://www.simonandschuster.com/books/Deep-Learning-with-Python-Third Edition/Francois-Chollet/9781633436589)

**Other Resources:**

- Bernd Carsten Stahl, Doris Schroeder, and Rowena Rodrigues. Ethics of Artificial Intelligence - Case Studies and Options for Addressing Ethical Challenges, Springer, 2023. (open access)
- Chip Huyen. Designing Machine Learning Systems, O'Reilly Media, 2022.
- Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning, MIT Press, 2016. (open access)
- Mark Coeckelbergh. AI Ethics, MIT Press, 2020.
- Australia's AI Ethics Principles - Australia's AI Ethics Principles | Australia's Artificial Intelligence Ethics Framework | Department of Industry Science and Resources
- The Bletchley Declaration by Countries Attending the AI Safety Summit, 1–2 November 2023 - The Bletchley Declaration by Countries Attending the AI Safety Summit, 1–2 November 2023 | Department of Industry Science and Resources
- Coeckelbergh, M., 2020. AI Ethics. Cambridge, MA: MIT Press.

- Huyen, C., 2022. Designing machine learning systems. 1st ed. Sebastopol, California: O'Reilly.
- Stahl, B.C., Schroeder, D. and Rodrigues, R., 2023. Ethics of Artificial Intelligence : Case Studies and
- Options for Addressing Ethical Challenges. 1st ed. Cham, Switzerland: Springer.
- Heaton, J., 2017. Ian Goodfellow, Yoshua Bengio, and Aaron Courville: Deep learning : Genet
- Program Evolvable Mach.[e- ]. Springer Science and Business Media LLC.19 (1-2) pp.305.
- 10.1007/s10710-017-9314-z.

Website

• Australia's AI Ethics Principles - Australia's AI Ethics Principles | Australia's Artificial Intelligence Ethics Framework | Department of Industry Science and Resources

• The Bletchley Declaration by Countries Attending the AI Safety Summit, 1–2 November 2023 - The Bletchley Declaration by Countries Attending the AI Safety Summit, 1–2 November 2023 | Department of Industry Science and Resources