# Report of Validation Panel

**Date of Meeting:** 12th January 2018

**Named Award:** Master of Science

**Programme Title:** Master of Science in Artificial Intelligence

**Award Type:** Master of Science

**Award Class:** Major Award

**NFQ Level**: 9

**Intakes Commencing:** September 2018

**ECTS/ACCS Credits:** 60

**PANEL MEMBERS**

| Name |
|---|
| Ms Brigid Crowley, Head of Department, Department of Computing, Creative Media & Information Technology, Institute of Technology Tralee |
| Dr Seán Duignan, Head of Department, Department of Computer Science & Applied Physics, Galway-Mayo Institute of Technology |
| Mr James Hurley, Director of Software Engineering - Enterprise Technology & Services, McKesson Ireland |
| Mr Brendan Butler**,** Sr. Director, Hybrid Cloud Engineering (HCE), Dell EMC \| Converged Platforms and Solutions Division (CPSD) |
| Dr Pio Fenton, Head of Department, Department of Marketing & International Business, Cork Institute of Technology |
| Ms Caroline O'Reilly, Curriculum Design Facilitator, Academic Quality Enhancement Office, Cork Institute of Technology |

**PROPOSING TEAM MEMBERS**

| Name |
|---|
| Mr. Tim Horgan, Head of Department, Department of Computer Science |
| Prof Hugh McGlynn, Head of School of Science & Informatics |
| Dr. Ted Scully, Lecturer, Department of Computer Science |
| Dr. Seán McSweeney, Lecturer, Department of Computer Science |
| Dr. Ruairi O'Reilly, Lecturer, Department of Computer Science |
| Dr. Vincent Emeakaroha, Lecturer, Department of Computer Science |
| Dr. Laura Climent, Lecturer, Department of Computer Science |
| Dr. Ignacio Castiñeiras, Lecturer, Department of Computer Science |
| Dr. Alejandro Arbelaez, Lecturer, Department of Computer Science |
| Dr. Donna O'Shea, Lecturer Department of Computer Science |
| Dr. Diarmuid Grimes, Lecturer, Department of Computer Science |
| Dr. Samane Abdi, Lecturer, Department of Computer Science |
| Prof. Dirk Pesch, Head of Centre, Nimbus Research Centre (Absent on Institute Business) |

**BACKGROUND TO THE PROPOSED PROGRAMME**

In recent years Artificial Intelligence (AI) techniques have experienced a resurgence following concurrent advances in computer power, large amounts of data and theoretical understanding. AI techniques have become an essential part of the technology industry, helping to solve many challenging problems in computer science.

Advances in Artificial Intelligence and Machine Learning (ML) are having a profound impact on a wide range of industries including manufacturing, transport, logistics, marketing, commerce, customer service, agriculture, IT, security and health care, to name but a few. The drive for automation from these sectors has created a demand for staff with this expertise. The aim of this programme is to produce expert AI developers. Successful completion of the programme will equip these graduates with the desired skills and provide them with the following benefits:

- Ability to deal with technically complex problems
- Support in making strategically important decisions within their profession
- Gain a qualification that is in high demand in the marketplace
- Attain expertise to carry out AI research in academic and R&D environments
- Provide intelligent solutions to IT problems in companies and organizations
- Pursue doctoral studies within the domain of AI and ML

The following table provides an initial overview of the programme proposal and structure.

| | |
|---|---|
| Title | Artificial Intelligence (MSc) |
| ECTS Credits | 60 |
| Sponsor | Department of Computer Science |
| Head of Department of Computer Science | Mr Tim Horgan |
| Head of School of Science & Informatics | Prof Hugh McGlynn |
| Entry Requirements | Minimum 2nd class Honours degree in the field of Computer Science, Electrical/Electronic Engineering or in a cognate discipline. |
| Duration (Full-time) | One academic year |
| Duration (Part-time) | Two academic years |
| Modes | Full-time and part-time online |
| Delivery | Full-time (September 2018) |
| Number of places | 20 |

# FINDINGS OF THE PANEL

*NOTE: In this report, the term "**Requirement**" is used to indicate an action or amendment which in the view of the Panel **must** be undertaken prior to commencement of the Programme. The term "**Recommendation**" indicates an item to which the Institute/Academic Council/Course Board should give serious consideration for implementation at an early stage and which should be the subject of ongoing monitoring.*

The Panel **commends** the team on their energy, enthusiasm and dedication in putting together the MSc in Artificial Intelligence programme proposal. The team demonstrated an excellent level of technical knowledge in presenting what is a unique national Level 9 Masters programme being proposed as one of the first of its kind in Ireland.

The Panel wishes to acknowledge the excellent presentation by the team and management on profiling the programme development and implementation plans.

The Panel has considered the documentation provided and has discussed the programme with the proposers. Based on this, the Panel has arrived at a number of Findings, Requirements and Recommendations as follows.

## 1. Programme-Level Findings

### 1.1 NEED FOR THE PROGRAMME

| **Validation Criterion: Is there a convincing need for the programme(s) with a viable level of applications?** |
|---|
| Overall Finding: Yes |

### 1.2 AWARD

| **Validation Criterion: Are the level and type of the proposed awards appropriate?** |
|---|
| Overall Finding: Yes, subject to certain requirements |

1.2.1 The programme designation as a Master of Science in Artificial Intelligence is appropriate. It is a **requirement** that all modules undertaken by learners on the 60 credit programme should be at expert level. Currently module Practice Machine Learning needs to be amended to reflect this level of study

### 1.3 LEARNING EXPERIENCE

| **Validation Criterion: Is the learning experience of an appropriate level, standard and quality overall?** |
|---|
| Overall Finding: Yes |

### 1.4 PROGRAMME STRUCTURE

| **Validation Criterion: Is the programme structure logical and well designed (including procedures for access, transfer and progression)?** |
|---|
| Overall Finding: Yes, subject to certain Requirements and Recommendations |

The programme outcomes and semester schedules are outlined in Appendix 1.

Findings, requirements and recommendations concerning individual modules (if any) are recorded in section 2 below.

**1.4.1 Requirement**: To ensure that applicants are appropriately selected, a clear set of entry requirements which reflect programming, mathematical and statistical requirements should be clearly published.

**1.4.2 Requirement:** Revisit the mapping of module and programme outcomes to better reflect the achievement of Competence Context, role, learning to learn and insight (PO5 to PO8) which is currently reflected in all modules to better identify the focused delivery of these areas for the learner. Fix minor typos in PO4 and PO6.

**1.4.3 Recommendation**: Review how best to facilitate the introduction and application of ethical practices across the programme modules in addition to that being delivered in module COMP9011 Research Practice & Ethics.

**1.4.4 Recommendation:** The programme should clearly outline the thematic nature of modules and interconnectedness to aid the learner in understanding learning paths linked to elective options.

**1.4.5 Recommendation:** The programme needs to consider the introduction of one or two hour scheduled workshops to support the completion of the 15 credit research project which can be delivered over a number of weeks as appropriate, to support project completion in conjunction with the lecturing supervisory team.

### 1.5 PROGRAMME MANAGEMENT

| **Validation Criterion: Are the programme management structures adequate?** |
|---|
| Overall Finding: Yes, subject to certain Requirements. |

**1.5.1 Requirement:** An assessment matrix for the programme should be developed so as to guide the learners. The module assessment dates currently proposed should be revisited and amended to ensure a fair spread of workload completion across weeks 13 to semester end.

**1.5.2 Requirement:** Ensure that 'Free Choice' electives selected by learners meet the requirement to study at expert level.

**1.5.3 Recommendation**: An assessment strategy for the programme should be developed so as to guide the programme team and facilitate the exploration of opportunities for more integrative assessment such as cross modular projects and further opportunities for multidisciplinary and interdisciplinary assessment activities across the programme modules.

### 1.6 RESOURCE REQUIREMENTS

| **Validation Criterion: Are the resource requirements reasonable?** |
|---|
| Overall Finding: Yes. |

The Panel was assured by the Head of School that appropriate resources in terms of staffing and facilities are in place to support the programme validation.

### 1.7 IMPACT ON THE INSTITUTE

| **Validation Criterion: Will the impact of the programme on the Institute be positive?** |
|---|
| Overall Finding: Yes |

## 2. Module-Level Findings

The Panel notes that 11 modules on the proposed programme as presented to the panel are new modules. The panel was informed that the new draft modules will be subject to the internal scrutiny by the CIT module moderator.

In exercising its brief to consider the overall standard and appropriateness of modules, the Panel wishes to add the following findings, requirements and recommendations.

### 2.1 ALL MODULES

**2.1.1 Requirement:** Any revisions to Module Descriptors or Semester Schedules made to address the recommendations and requirements in this report require sign-off from the CIT Module Moderator and the Registrar's Office prior to approval by the CIT Academic Council.

**2.1.2 Requirement**: Ensure all module workload descriptors include a reference to 'independent study' in addition to other workload descriptors.

**2.1.3 Requirement**: The coursework breakdown across the module descriptors should be reviewed and revised where necessary to clarify the actual assessment deliverables, mapping to learning outcomes and associated timings.

**2.2. MODULES**

**2.2.1 Practice Machine Learning**

The proposers informed the panel that this was an expert level module rather than an advanced level module.

**2.2.2 COMP9016 Knowledge Representation**

**Requirement**: Remove the reference to e.g. in Learning Outcome 2 and reflect the listed examples in the indicative content.

**2.2.3 COMP9058 Metaheuristic Optimisation**

**Requirement**: Remove the reference to e.g. in Learning Outcome 5 and reflect the listed examples in the indicative content.

**2.2.4 Big Data Processing**

**Recommendation:** Include the term 'for example' in the references to MapReduce and Spark under Coursework project to allow flexibility to amend if technology requirements change.

**2.2.5 COMP9011 Research Practice & Ethics**

**Recommendation:** Under Learning outcome 3 consider how ethical considerations can be applied and not just discussed. The panel suggested the adoption of "Evaluate and apply ethical considerations that are relevant to field of computer science" to allow the learner to attain a deeper understanding of the importance of ethics to their working practices.

**2.2.6 Computer Simulation & Analysis**

**Requirement:** Edit with a view to shortening the 'module description' so that it remains within the defined publishable character allowance.

**Requirement:** Complete the "Workload" in full and part time mode to reflect Lecture, Lab and independent learning components with appropriate workload descriptors adhering to the total weekly contact hours of 7.

**2.2.7 Natural Language Processing**

**Recommendation:** Revisit the requirement for learners to complete three assessment components and consider reducing this to two.

**2.2.8 Deep Learning**

**Recommendation:** Revisit the requirement for learners to complete three assessment components and consider reducing this to two.

**2.2.9 AI Research Project**

**Requirement:** Provide a rationale for the differences between the full and part time supervision allowances for the project.

**Requirement:** Revisit the assignment of hours in Full time workload to reflect a total weekly learner workload of 21 hours for this 15 credit module.

**Recommendation**: Plan for the provision of supports to learners who may require additional English language or technical writing support to assist them with project completion.

**2.2.10 Planning & Scheduling**

**Recommendation:** Consider adding Planning & Scheduling content which is not just AI specific to aid the learners appreciation of the opportunities and challenges of this domain.

**2.2.11 Fraud and Anomaly Detection**

**Recommendation**: Reconsider the use of double active verbs in each of the four learning outcomes to ensure that each can be achieved by the two planned assessment projects.

## Other Findings

At the validation meeting the panel were very supportive of the programme due to the constructive engagement during the panel sessions. The panel supported and encouraged further development of the programme in line with discussions, requirements and recommendations made by the panel.

The panel wishes to commend the staff and management on their energy, teamwork and enthusiasm and dedication in putting together the programme proposal.

## 4. Conclusion

Based on the above findings, the Panel has arrived at the following conclusions:

- The Master of Science in Artificial Intelligence meets the required standard for an award in the Science field of study at Level 9 of the National Framework of Qualifications.
- The Programme meets the criteria for validation of new programmes adopted by the Academic Council of Cork Institute of Technology.

The Panel therefore recommends that the Programme be validated for five academic years, or until the next programmatic review, whichever is soonest, subject to implementation of the Requirements above, and with due regard to the Recommendations made.

| **Implementation of Requirements and Recommendations** |
|---|
| **Requiring Registrar's Office Sign-Off:** |
| 1.2.1 **Requirement** Status – Completed<br>Practical Machine Learning was listed as an advanced module in error, this has now been fixed. |
| 1.4.1 **Requirement** Status - Completed<br>The following text will be included in the **Admission Requirements** (example) for this programme:<br>*"Successful applicants will hold at least a second-class honours degree in Computer Science, Computing, Electrical/Electronic Engineering or a cognate discipline. Furthermore, all successful applicants are required to have a proficiency in mathematics, including statistics, and an advanced level of coding competency in a modern high-level computer programming language."* |
| 1.4.2 **Requirement** Status – Completed<br>Revisit the mapping of module and programme outcomes to better reflect the achievement of Competence Context, role, learning to learn and insight (PO5 to PO8) which is currently reflected in all modules to better identify the focused delivery of these areas for the learner. Fix minor typos in PO4 and PO6. |
| 1.4.3 **Recommendation** Status – Completed<br>The programme team have met and intend to hold further meetings to discuss how best to facilitate the introduction and application of ethical practices across the programme modules in addition to that being delivered in module COMP9011 Research Practice & Ethics. |
| 1.4.4 **Recommendation** Status – Completed<br>The thematic nature of modules and interconnectedness to elective options will feature in the new programme webpage on www.cit.ie and will form part of programme promotion and student induction. |

| |
|---|
| 1.4.5 **Recommendation** Status – Completed<br>The programme proposal team agrees with this finding and has included an additional contact time of a half hour per week in the AI Research Project module, which will be block scheduled to support the learners. |
| 1.5.1 **Requirement** Status – Completed<br>An assessment matrix for the programme has be developed for learners to ensure a fair spread of workload. A copy of the assessment matrix is attached in the appendix. |
| 1.5.2 **Requirement** Status – Completed<br>The programme development team fully agree with this recommendation and will implement same. |
| 1.5.3 **Recommendation** Status – Completed<br>We will refer this recommendation to the TLU for guidance and support. |
| 2.1.1 **Requirement** Status – Accepted<br>All revisions require sign-off from the CIT Module Moderator and the Registrar's Office prior to approval by the CIT Academic Council. |
| 2.1.2 **Requirement** Status – Completed<br>All module workload descriptors now include a reference to independent study in addition to other workload descriptors. |
| 2.1.3 **Requirement** Status – Completed<br>The coursework breakdown across all module descriptors have been revised where necessary to clarify the actual assessment deliverables, mapping to learning outcomes and associated timings. |
| 2.2.1 **Requirement** Status – Completed<br>Please see item 1.2.1 above. |
| 2.2.2 **Requirement** Status – Completed<br>**Knowledge Representation** - Reference in Learning Outcome 2 to indicative content has been removed as the programme team's view is that this approach is more appropriate. |
| 2.2.3 **Requirement** Status – Completed<br>**Metaheuristic Optimisation** - Reference in Learning Outcome 5 to indicative content has been removed as the programme team's view is that this approach is more appropriate. |
| 2.2.4 **Recommendation** Status – Completed<br>**Big Data Processing** - the term 'for example' is now included in the references to MapReduce/Spark. |
| 2.2.5 **Recommendation** Status – Completed<br>**Research Practice & Ethics** - Learning outcomes adjusted to reflect broader consideration of ethics in project preparation work. |
| 2.2.6 **Requirement** Status – Completed<br>**Computer Simulation & Analysis** – Module description shortened. The workload sections in full and part time mode have been updated to reflect Lecture, Lab and independent learning components with appropriate workload descriptors adhering to the total weekly contact hours of 7. |
| 2.2.7 **Recommendation** Status – Completed<br>**Natural Language Processing** – The module author defended the selection of three assessments on the day of the validation panel. It is the opinion of the module author that the three assessments should be retained for the Natural Language Processing module as removal of an assessment or an attempt to combine two of the existing assessments would not allow all four learning outcomes to be examined. |
| 2.2.8 **Recommendation** Status – Completed<br>**Deep Learning** – Assessment components have been reduced to two. |
| 2.2.9 **Requirement** Status – Completed<br>**AI Research Project** – An error in the part-time supervision allowance has been corrected and weekly learner workload updated. Support for learners has been addressed in consultation with the Academic learning Centre. |
| 2.2.10 **Recommendation** Status – Completed<br>**Planning & Scheduling** – The module author feels it is appropriate to retain the existing learning outcomes. However, he has added an additional element to the indicative content that describes the real-world applications of planning and schedule and provides motivation for the study of the topic. |
| 2.2.11 **Requirement** Status – Completed<br>**Fraud and Anomaly Detection** – Double active verbs have been removed from the learning outcomes**.** |

## APPENDIX 1 – Proposed Programme Outcomes – Master of Science in Artificial Intelligence

### Programme Outcomes

Upon successful completion of this programme the graduate will be able to demonstrate... :

| | | |
|---|---|---|
| **PO1** | **Knowledge - Breadth** | |
| | **(a)** | A mastery of the theoretical knowledge and applied skills necessary to analyse, critically evaluate and apply the principles and practices of machine learning, metaheuristic optimisation, big data processing, knowledge representation, deep learning, decision analytics and related technologies to artificial intelligence systems. |
| **PO2** | **Knowledge - Kind** | |
| | **(a)** | An awareness and critical understanding of developments in a number of specialist areas in artificial intelligence; discuss current challenges and research activities in these areas and apply accepted methodologies for tackling research problems. |
| **PO3** | **Skill - Range** | |
| | **(a)** | Select and apply research tools and techniques of inquiry; critically evaluate design and implementation issues in artificial intelligence systems; communicate to a range of audiences in both written and verbal media about new and emerging theories and technologies. |
| **PO4** | **Skill - Selectivity** | |
| | **(a)** | Independently acquire and assess knowledge in novel and emerging technologies, integrate this knowledge of various technologies to successfully plan and implement an artificial intelligence project. |
| **PO5** | **Competence - Context** | |
| | **(a)** | An ability to analyse and document measures to address risks and weaknesses in artificial intelligence systems; develop guidelines regarding professional and ethical practices in the exploitation of computer technology; design and implement a solution that requires significant preliminary research for novel and unfamiliar situations. |
| **PO6** | **Competence - Role** | |
| | **(a)** | Initiate, lead and manage projects of significant complexity involving multidisciplinary teams; formulate and document a system design and communicate this philosophy to developers, systems engineers, QA etc; work as a member of a strategic leadership team in an organisation; participate in peer collaborations, mentoring and evaluation exercises. |
| **PO7** | **Competence - Learning to Learn** | |
| | **(a)** | Devise programme to support his/her continuing professional development, independently learn, understand, evaluate and apply new knowledge. |
| **PO8** | **Competence - Insight** | |
| | **(a)** | Act in a manner consistent with the best interests of clients, colleagues and other stakeholders and the general public, maintain integrity and independence in professional judgement. |

**Appendix 2 – Semester Schedules – Master of Science in Artificial Intelligence**

Stage 1 / Semester 1

| Mandatory | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Mod Code** | **Module Title** | **Co-ordinator** | **Level** | **Credits** | **FT Contact Hours** | **PT Contact Hours** | **Course Work** | **Formal Exam** |
| No Code Yet | Practical Machine Learning (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| COMP9016 | Knowledge Representation (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| COMP9058 | Metaheuristic Optimisation (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| No Code Yet | Big Data Processing (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| COMP9011 | Research Practice & Ethics (Draft) | TIM HORGAN | Expert | 5.0 | 3.00 | 3.00 | 100.0 | 0.0 |

| Elective | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Mod Code** | **Module Title** | **Co-ordinator** | **Level** | **Credits** | **FT Contact Hours** | **PT Contact Hours** | **Course Work** | **Formal Exam** |
| No Code Yet | Computer Simulation & Analysis (Draft) | TIM HORGAN | Expert | 5.0 | 7.00 | 4.00 | 100.0 | 0.0 |
| No Code Yet | AI for Sustainability (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| No Code Yet | Recommender Systems (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| No Code Yet | Natural Language Processing (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| FREE6001 | Free Choice Module (Approved) | PAUL GALLAGHER | N/A | 5.0 | 4.00 | 0.00 | 50.0 | 50.0 |

Stage 1 / Semester 2

| Mandatory | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Mod Code** | **Module Title** | **Co-ordinator** | **Level** | **Credits** | **FT Contact Hours** | **PT Contact Hours** | **Course Work** | **Formal Exam** |
| No Code Yet | Deep Learning (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| COMP9057 | Decision Analytics (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| No Code Yet | AI Research Project (Draft) | TIM HORGAN | Expert | 15.0 | 1.00 | 1.00 | 100.0 | 0.0 |

| Elective | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Mod Code** | **Module Title** | **Co-ordinator** | **Level** | **Credits** | **FT Contact Hours** | **PT Contact Hours** | **Course Work** | **Formal Exam** |
| No Code Yet | Robotics & Autonomous Systems (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| No Code Yet | Planning & Scheduling (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| No Code Yet | Fraud and Anomaly Detection (Draft) | TIM HORGAN | Expert | 5.0 | 4.00 | 4.00 | 100.0 | 0.0 |
| FREE6001 | Free Choice Module (Approved) | PAUL GALLAGHER | N/A | 5.0 | 4.00 | 0.00 | 50.0 | 50.0 |

## Appendix 3 – Assessment Matrix

| Semester 1 | W2 | W3 | W4 | W5 | W6 | W7 | W 8 | W 9 | W10 | W11 | W12 | W13 | W14 | W15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Machine Learning | | | | | | | | PJ | | | | PJ | | |
| Knowledge Representation | | | | | | | PJ | | | OB | | | PJ | |
| Metaheuristic Optimization | | | | | PJ | | | | | | | | | PJ |
| Big Data Processing | | | | | | | PJ | | | | | PJ | | |
| Research Practice and Ethics | | | | | | | | ES | | | | | OT | |

| Semester 2 | W2 | W3 | W4 | W5 | W6 | W7 | W 8 | W 9 | W10 | W11 | W12 | W13 | W14 | W15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Deep Learning | | | | | | PJ | | | | | | PJ | | |
| Decision Analytics | | | | | | | PJ | | | | | PJ | | |
| AI Research Project | | | | | PJ | | | | | | | | PJ | |

Assessment Codes

| Assessment Type | Code | Assessment Type | Code |
|---|---|---|---|
| Essay | ES | Project | PJ |
| Open Book Exam | OB | Other | OT |