Course Outline (Higher Education)

School: School of Engineering, Information Technology and Physical Sciences

Course Title: DIGITAL IMAGING AND ARTIFICIAL INTELLIGENCE

Course ID: ENGIN3405

Credit Points: 15.00

Prerequisite(s): (MATHS3001 or MATHS3040)

Co-requisite(s): Nil

Exclusion(s): (ENMTX3030)

ASCED: 039999

Description of the Course:

The course introduces students to the advanced level knowledge and understanding of digital imaging and artificial intelligence. The students will learn about the historical development of artificial intelligence and image processing technologies and appreciate their use in current industrial environments. Students will further learn about the diversity of artificial intelligence, image processing and their applications. Through such learning, students will gain practical skills in developing various algorithms and building software based models to be implemented in physical mechatronic systems.

Grade Scheme: Graded (HD, D, C, P, MF, F, XF)

Work Experience:

No work experience: Student is not undertaking work experience in industry.

Placement Component: No

Supplementary Assessment: Yes

Where supplementary assessment is available a student must have failed overall in the course but gained a final mark of 45 per cent or above and submitted all major assessment tasks.

Program Level:

Level of course in Program	AQF Level of Program					
	5	6	7	8	9	10
Introductory						

Level of course in Program	AQF Level of Program					
	5	6	7	8	9	10
Intermediate						
Advanced			✔			

Learning Outcomes:

On successful completion of the course the students are expected to be able to:

Knowledge:

K1. Demonstrate understanding of image processing, image representation, image segmentation, feature extraction and low-level image analysis techniques.

K2. Demonstrate understanding of spatial and frequency filtering.

K3. Interpret and analyse image analysis algorithms in edge and shape detection, colour based segmentation and image thresholding.

K4. Demonstrate understanding of pattern recognition and classification process.

K5. Explain and outline the advanced concepts and historical development of artificial intelligence.

K6. Interpret and discriminate the development of various optimization and machine learning algorithms / techniques.

K7. Demonstrate advanced understanding of expert systems and neural networks.

Skills:

S1. Test and critically analyse results from the performed image analysis.

S2. Perform spatial and frequency filtering and feature extraction.

S3. Develop and analyse image analysis algorithms.

S4. Perform classification and pattern recognition using artificial intelligence and suitable methodologies.

S5. Evaluate optimization / network learning algorithms.

S6. Formulate and appraise fuzzy rules.

Application of knowledge and skills:

A1. Apply digital imaging and artificial intelligence techniques in areas of robot vision, condition monitoring, quality control, environmental sensing and interaction, object recognition and classification

A2. Design, develop and optimize intelligent models based on artificial intelligence methodologies.

A3. Develop advanced learning algorithms for a neural network model to achieve the required design objectives.

A4. Implement the knowledge and skills gained through this subject in designing and developing intelligent mechatronics product / system.

Course Content:

Topics may include:

- Introduction to digital imaging and image representation, addition and subtraction of images, spatial and frequency filtering.

- Image analysis algorithm with methods involving feature extraction, image segmentation, edge detection,

object counting and measurement and other low-level image analysis techniques.

- Pattern recognition and classification techniques.
- Artificial intelligence, reasoning, search and different machine learning and optimization algorithm / techniques.
- Introduction to artificial neural network, classifier, classification errors, perceptron update rule, perceptron convergence, generalisation, regularisation, regression, boosting, Markov models and hidden Markov models.
- Bayesian networks, radial bias networks, probabilistic neural networks, generalised neural networks, self-organising and learning vector quantisation networks.
- Introduction to fuzzy logic, fuzzy set and fuzzy logic expert systems.
- Use of artificial intelligence techniques in classification and pattern recognition.

Values:

V1. Appreciate the contribution of artificial intelligence and digital imaging in control and automation of an industrial mechatronic system.

Graduate Attributes

The Federation University FedUni graduate attributes (GA) are entrenched in the Higher Education Graduate Attributes Policy (LT1228). FedUni graduates develop these graduate attributes through their engagement in explicit learning and teaching and assessment tasks that are embedded in all FedUni programs. Graduate attribute attainment typically follows an incremental development process mapped through program progression. **One or more graduate attributes must be evident in the specified learning outcomes and assessment for each FedUni course, and all attributes must be directly assessed in each program**

Graduate attribute and descriptor		**Development and acquisition of GAs in the course**	
		Learning Outcomes (KSA)	**Assessment task (AT#)**
GA 1 Thinkers	Our graduates are curious, reflective and critical. Able to analyse the world in a way that generates valued insights, they are change makers seeking and creating new solutions.	K1-K7 S1-S6 A1-A4	1-3
GA 2 Innovators	Our graduates have ideas and are able to realise their dreams. They think and act creatively to achieve and inspire positive change.	K1-K7 S1-S6 A1-A4	1-3
GA 3 Citizens	Our graduates engage in socially and culturally appropriate ways to advance individual, community and global well-being. They are socially and environmentally aware, acting ethically, equitably and compassionately.	K1-K7 S1-S6 A1-A4	1-3

Graduate attribute and descriptor		Development and acquisition of GAs in the course	
		Learning Outcomes (KSA)	Assessment task (AT#)
GA 4 Communicators	Our graduates create, exchange, impart and convey information, ideas, and concepts effectively. They are respectful, inclusive and empathetic towards their audience, and express thoughts, feelings and information in ways that help others to understand.	K1-K7 S1-S6 A1-A4	1-3
GA 5 Leaders	Our graduates display and promote positive behaviours, and aspire to make a difference. They act with integrity, are receptive to alternatives and foster sustainable and resilient practices.	S1 A1-A4	1-3

Learning Task and Assessment:

Learning Outcomes Assessed	Learning Tasks	Assessment Type	Weighting
S1-S6, A1-A4	Experimental work and / or projects to verify students ability to apply knowledge and skills acquired in the course	Reports, demonstrations	10 - 30%
K1-K7, S1-S6	Relevant tasks and problems to enforce understanding of the students and help in gradual development of knowledge and skills throughout the course	Assignments, quizzes	10 - 30%
K1-K7	Questions and problems related to the course contents	Exams / Tests	40 - 60%

Adopted Reference Style:

Other (IEEE: Refer to the library website for more information)

Refer to the library website for more information

Fed Cite - referencing tool