1. **Title of the module**

DIGM8440 (EL844) - Image Analysis with Security Applications

1. **School or partner institution which will be responsible for management of the module**

Engineering and Digital Arts

1. **The level of the module (Level 4, Level 5, Level 6 or Level 7)**

Level 7

1. **The number of credits and the ECTS value which the module represents**

15 credits (7.5 ECTS)

1. **Which term(s) the module is to be taught in (or other teaching pattern)**

Autumn

1. **Prerequisite and co-requisite modules**

None

1. **The programmes of study to which the module contributes**

MSc/PDip in Information Security and Biometrics

MSc/PDip in Advanced Electronic Systems Engineering

MSc Cybersecurity

1. **The intended subject specific learning outcomes.
On successfully completing the module students will be able to:**
* Understand fundamental techniques for processing of digital images.
* Understand the fundamentals of pattern classification systems, with particular reference to analysis of images.
* Understand how image analysis relates to security applications.
1. **The intended generic learning outcomes.
On successfully completing the module students will be able to:**
* Demonstrate ability in generating, analysing, presenting and interpreting data.
* Learn to use ICT.
* Develop core key skills, such as effective learning, critical thinking and time management.
1. **A synopsis of the curriculum**

Fundamentals of Image Processing:

General introduction to digital image processing; image acquisition, quantisation and representation; Affine transforms; image enhancement techniques: contrast manipulation, binarisation, noise removal (spatial and frequency domain); edge detection techniques; image segmentation: edge-based, region- based, watershed; Hough transform; image feature extraction; advanced image processing: morphological operations, colour image processing, various image transforms (Fourier, wavelet, etc).

Fundamentals of Pattern Recognition:

Patterns and pattern classification, and the role of classification in a variety of application scenarios, including security and biometrics. Basic concepts: pattern descriptors, pattern classes; data pre-processing, training and evaluation. Introductions to algorithms, e.g. Naïve Bayes, logistic regressions etc. Cost and utilty and their relationship. Practical case studies.

Security Applications and Image Analysis
Signature authentication and analysis, Digital watermarking, Content hidden in Images and Video, Steganography. Image forensics. Implementation Essentials:

Programming and data analysis using MatLab and other software tools as appropriate. Introduction to practical work using MatLab. Students not familiar with Matlab programming will be provided with appropriate introductory material before this lecture.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**
* Gonzalez, Rafael C. and Woods, Richard E., Digital Image Processing. 3rd edition. London: Pearson Education. ISBN 978-0131687288
* Solomon Chris and Breckon T. Fundamentals of Digital Image Processing: A Practical approach with examples in Matlab. 2011. Wiley-Blackwell. ISBN 978-0470844731
* Webb, Andrew and Copsey, Keith D. Statistical Pattern Recognition. 3rd edition. Wiley. 2011. ISBN 978-0470682289
* Duda, Richard O. and Hart, Peter E. and Stork, David G. Pattern Classification. 2nd edition. Wiley-Interscience. 2000. ISBN 978-0471056690
* Sencar, Husrev T. and Mamon N. (Eds.). Digital Image Forensics: There is more to a picture than meets the eye. Springer. 2013. ISBN 978-1461407560
* Fridrich J. Steganography in digital media: Principles, Algorithms and Applications. Cambridge Univ Press. 2009. ISBN 978-0521190190
* Gonzalez, Rafael C. and Woods, Richard E., and Eddins, Steven L. Digital Image Processing using Matlab. 2nd edition. Gatesmark Publishing. 2009. ISBN 978-0982085400
1. **Learning and teaching methods**

Total contact hours: 48

Private study hours: 102

Total study hours: 150

1. **Assessment methods**
	1. Main assessment methods

Workshops (50%)

Test (50%)

13.2 Reassessment methods

Like-for-like

1. **Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section12) and methods of assessment (section 13)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | *8.1* | *8.2* | *8.3* | *8.4* | *9.1* | *9.2* | *9.3* |
| **Learning/ teaching method** |  |  |  |  |  |  |  |
| Private Study | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| *Workshop* | **X** | **X** | **X** | **X** | **X** | **X** |  |
| *Lecture* | **X** | **X** | **X** | **X** | **X** |  |  |
| **Assessment method** |  |  |  |  |  |  |  |
| *Workshop Assignment* | **X** |  | **X** | **X** | **X** | **X** | **X** |
| *Class tests*  | **X** | **X** | **X** | **X** | **X** |  |  |

1. **Inclusive module design**

The School recognises and has embedded the expectations of current equality legislation, by ensuring that the module is as accessible as possible by design. Additional alternative arrangements for students with Inclusive Learning Plans (ILPs)/declared disabilities will be made on an individual basis, in consultation with the relevant policies and support services.

The inclusive practices in the guidance (see Annex B Appendix A) have been considered in order to support all students in the following areas:

a) Accessible resources and curriculum

b) Learning, teaching and assessment methods

1. **Campus(es) or centre(s) where module will be delivered**

Canterbury

1. **Internationalisation**

Practical work is undertaken using internationally recognised system modelling tools such as MATLAB to illustrate the design and analysis processes for image processing and pattern recognition systems. The module also introduces international standards for image formats such as JPEG.

**If the module is part of a programme in a Partner College or Validated Institution, please complete sections 18 and 19. If the module is not part of a programme in a Partner College or Validated Institution these sections can be deleted.**

1. **Partner College/Validated Institution**
2. **University School responsible for the programme**

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**Revision record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
| 21/01/2020 | Major | September 2020 | 10, 13 | No |
|  |  |  |  |  |