**Course Specification**

**(**IT 342 Pattern Recognition**)**

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| **University:** | Helwan University |
| **Faculty:** | Faculty of Computers & Information |
| **Department:** | Information Technology |

**1. Course Data**

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| --- | --- |
| **Code:** |  **IT 342**  |
| **Course title:** | Pattern Recognition |
| **Level:** |  |
| **Specialization:** | CS&IT |
| **Credit hours:** | 3 hours |
| **Number of learning units (hours):**  | ( 3) theoretical (2 ) practical |

**2. Course Objective**

The course aims at providing a balanced approach between mathematics and practical implementation of “pattern recognition”. Such an approach provides students with the capability to analyze any dataset for modeling and prediction without sacrificing moderate theoretical background.

**3. Intended Learning Outcomes:**

1. **Knowledge and Understanding**

A23. Identify the fundamentals of Pattern Recognition.

1. **Intellectual Skills**

B5. Differentiate patterns, components and relation in modeling data and information

B7. Reconstruct results analysis.

1. **Professional and Practical Skills**

C21. Choose appropriate Data Modeling.

1. **General and Transferable Skills**

D14. Support Engineering skills.

**4. Course contents**

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| **Topic** |
| Introduction and review on probability and statistics |
| Introduction and review on linear algebra, matrices, and spaces. |
| Statistical decision theory, and Bayes regression and classification |
| Principal Component Analysis (PCA) and dimensionality reduction. |
| Linear models for regression  |
| Linear models for classification (LDA, QDA, logistic regress,…) |
| Neural networks for regression and classification and connection to linear models. |
| K-nearest neighbor rules for regression and classification  |
| Classification and Regression Trees (CART) |
| Receiver Operating Characteristic curve (ROC) and Area under the curve (AUC) |
| Assessment and design of classification rules |
| Cross validation and bootstraps |
| Data visualization in higher dimensions (if time permits) |

 **Mapping contents to ILOs**

|  |  |
| --- | --- |
| Topic | Intended Learning Outcomes (ILOs) |
| Knowledge and understanding | Intellectual Skills | Professional and practical skills | General and Transferable skills |
| Introduction and review on probability and statistics | A23 |  |  |  |
| Introduction and review on linear algebra, matrices, and spaces. | A23 |  |  |  |
| Statistical decision theory, and Bayes regression and classification | A23 |  |  |  |
| Principal Component Analysis (PCA) and dimensionality reduction. | A23 |  |  |  |
| Linear models for regression  | A23 |  |  |  |
| Linear models for classification (LDA, QDA, logistic regress,…) | A23 |  |  |  |
| Neural networks for regression and classification and connection to linear models. | A23 |  | C21 |  |
| K-nearest neighbor rules for regression and classification  | A23 |  |  |  |
| Classification and Regression Trees (CART) | A23 |  |  |  |
| Receiver Operating Characteristic curve (ROC) and Area under the curve (AUC) | A23 | B5 |  |  |
| Assessment and design of classification rules | A23 |  |  | D14 |
| Cross validation and bootstraps | A23 | B7 |  |  |
| Data visualization in higher dimensions (if time permits) | A23 |  |  |  |

**5. Teaching and Learning Methods**

* Lectures, and class work

**6. Teaching and Learning Methods for students with limited capability**

* Using data show
* e-learning management tools

**7. Students Evaluation**

1. **Used Methods**
* Written HW, Computer exercises, and exams.
1. **Time**

Weekly

1. **Grades Distribution**

Mid-Term Examination 20%

Final-term Examination 50%

Oral Examination. %

Practical Examination 10%

Semester Work and Project 20%

Other types of assessment %

Total 100%

**List of Books and References**

**a) Notes**

* Course Notes
* References

**b) Mandatory Books**

 Bishop, Pattern Recognition and Machine Learning; Springer.

**c) Suggested Books**

**d) Other publications**

 - Periodicals, Web Sites … etc

**Course Coordinator: Dr. Waleed Yousif**

**Chairman of the Department: Prof. Dr.**