



**Zarqa University**  
**Faculty: Information Technology**  
**Department: Computer Science**  
**Course title: Tools of Artificial**  
**Intelligence (1501420)**

**Instructor:**  
**Lecture's time:**  
**Semester:**  
**Office Hours:**

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### **Course description:**

This course explains how to build systems that learn and adapt using real-world applications from industry and science (e.g., learning to classify astronomical objects, to predict medical diagnoses, etc.). Students will learn tools and algorithms to create machine learning models that learn from data, and to scale those models up to big data problems. Python packages such as SKLearn, Tensorflow, Theano, Keras and NLTK will also be introduced.

### **Aims of the course:**

*Students are expected to:*

1. Become familiar with AI Tools including its inference, knowledge representation, and implementations.
2. Investigate applications of AI Tools in intelligent agents, Image recognition, Natural language processing, big data, and sequential data.
3. Experience AI methods such as neural networks, nearest-neighbor methods, Least square and other machine learning models
4. Experiment with a machine learning model for simulation and analysis.
5. Explore the current scope, potential, limitations, and implications of intelligent systems.

### **Intended Learning Outcomes (ILOs):**

*Upon successful completion of this course, students will be able to:*

#### **A. Knowledge and Understanding**

*A1. Concepts and Theories:*

- Identify the different tools of AI
- Understand the concepts and methodologies of machine learning
- Understand the basics of machine learning areas including Natural Language Processing, Neural Networks and recognition

*A2. Contemporary Trends, Problems and Research:*

- Understand the concept of problem solving as recognition, and learn how to use the various and tools.

*A3. Professional Responsibility:*

- Abide by laws and regulations of software development and design



## B. Subject-specific skills

### B1. Problem solving skills

- Analyze, compare and criticize the different tools
- Analyze and compare inference mechanisms of AI tools

### B2. Modeling and Design

- Synthesize modified ML algorithms from existing ones.

### B3. Application of Methods and Tools

- Contrast the main approaches to AI: vector vs. sequential.

## C. Critical-Thinking Skills

### C1. Analytic skills:

- Solve a problem requiring a suitable knowledge representation

### C2. Strategic Thinking:

- Use strategic thinking to propose efficient solutions for complex AI problems

### C3. Creative thinking and innovation:

- Use creative thinking and innovation to mix different AI algorithms to solve complex problems

## D. General and Transferable Skills (other skills relevant to employability and personal development)

D1. *Communication*: Express and communicate ideas in written and oral forms.

D2. *Teamwork and Leadership*: Be cooperative members of a team.

D3. *Organizational and Developmental Skills*: plan, prioritize, and achieve defined goals.

D4. *Ethical and Social Responsibility*: Understand that they are accountable for their actions and there must be a balance between economic growth and the welfare of the society and environment.

## Course Structure:

Week	Hours	ILOs	Topics	Teaching Procedure	Assessment methods
1 <sup>st</sup> and 2 <sup>nd</sup> week	6	A1, A2, A3, B1	<b>Introduction:</b> Types of learning, Design of a learning system, Datasets, Python: Variables, Operators, Basic operations on vectors, Matrix Functions, The If Statement, Loop, Functions.	T: Lecture & Discussion L: Reading lecture notes, Reading Chapter 1	Exams In class questions Quiz-1
3 <sup>rd</sup> to 4 <sup>th</sup> week	6	A1, B1, B2, C1, D1	<b>Classical methods and Feature extraction:</b> Nearest neighbor methods, Least square, model selection, S2N.	T: Lecture & Presentation L: Reading Chapter 2	Exams Assignment 1



5 <sup>th</sup> to 6 <sup>th</sup> week	6	A1, A4, B2, B3, C1, C2, D1	<b>Neural Networks:</b> Feedforward Network Functions, Network Training, Error Back-propagation, Regularization in Neural Networks, Sci-Learn Package and Keras	T: Lecture & Presentation L: Reading Chapter 34	Exams Class Participation
7 <sup>th</sup> to 9 <sup>th</sup> week	6	A1, B2, B3, C1, C2, C3	<b>Deep Learning:</b> Convolution neural networks (CNN), Recurrent neural networks (RNNs), Tensorflow, Theano and Keras.	T: Lecture & Presentation L: Reading lecture notes, Chapter 10	Exams Quiz-2
10 <sup>th</sup> and 12 <sup>th</sup> week	6	A1, B1, B2, B3, C1, C2, C3	<b>Natural Language Tools (NLTK):</b> searching, replacing, splitting, joining, indexing, using regular expressions, detecting word patterns, stemming, tokenization. Extracting Information from Text, Chunking, Chinking, Building Feature Based	T: Lecture & Presentation L: Reading lecture notes, Reading about NLTK	Exams Class Participation
13 <sup>th</sup> and 14 <sup>th</sup> week	6	B2, B4, C2, D1, D2, D3, D4	<b>Big Data Tools:</b> Big Data, Hadoop, MapReduce on data stored in HDFS, Pig, Hive.	T: Lecture & Presentation L: Reading lecture notes,	Exams

## References:

### A. Main Textbook:

1. Eibe Frank and Ian H. Witten Data Mining: Practical Machine Learning Tools and Techniques. 2005 by Elsevier Inc. **B. Supplementary Textbook(s):**

- 1- Chris. Bishop. Pattern Recognition and Machine Learning. Springer, 2006.
- 2- Artificial Intelligence A Modern Approach Stuart Russel and Peter Norvig, Prentice Hall, 2<sup>nd</sup> ed. 2003
- 3- Lecturer's Notes
- 4- <http://www-stat.stanford.edu/~tibs/ElemStatLearn/>
- 5- <http://www.cs.nyu.edu/~yann/2005f-G22-2565-001/schedule.html>
- 6- <http://research.microsoft.com/en-us/um/people/cmbishop/prml/7-http://bengio.abracadoudou.com/lectures/old/index.html>



## Assessment Methods:

Methods	Grade	Date
First Exam	20%	
Second Exam	20%	
Assignments (Reports /Quizzes/ Class Participation)	10%	
Final Examination	50%	

## Teaching and Learning Methods:

### Interactive lectures (ILOs: A1, A2, A3, A4)

Lecture on major concepts and issues: Interactive lectures with videos and PowerPoint slides are conducted with lecturer explaining and illustrating the concepts. Students will be invited to share their view and experience in applying the concepts.

### Group Projects and Presentations (ILOs: B1, B2, B3, C1, C2, C3, D1, D2, D3, D4)

Students will work on a course projects (2 to 3 students in a group). Each group will submit a short proposal of their project, including the names of team members starting from the second week of classes. Once the project is approved by the instructor, the group submits a more extended proposal which includes the role of each team member, Time-Plan, and the tools and applications that will be employed in the project. Each group will submit their project with a presentation at the end of the semester.

### Online search / research and short presentations (ILOs: C2, C3, D1, D3)

Each student will be required to search the net for a new topic that relates to this course. A one page summary of this topic is to be submitted along with a 10 minute presentation.

### Textbook Problems (ILOs: A1, A2, A3)

Problems have been selected for in-class illustration of certain concepts and applications. Additional textbook problems have been assigned for students to practice and gain better understanding of the concepts discussed. Homework assignments will be collected for grading.

### Outside-classroom activities (ILOs: B3, C1, D2, D4)

Students are required to schedule meetings with their groups, and to document the results of such meetings.



## **AI Lab (ILOs: C1, C2, C3)**

Students are required to visit the lab and to experiment with Java and PROLOG

### **COURSE POLICIES**

The University Regulations on academic dishonesty will be strictly enforced! Please check the University Statement on plagiarism.

**Make-up Exams:** Only students with valid excuses are allowed to have make up exams. All excuses must be signed by the Faculty Dean. Student has the responsibility to arrange with his/her instructor for an exam date before the occurrence of the next regular exam.

All assignment and class work must be submitted at the specified due date. No late work will be accepted. Attendance policy will be strictly enforced (refer to student's Handbook)

No make up for quizzes under any circumstance.

