



جامعة الإمام محمد بن سعود الإسلامية  
كلية علوم الحاسب والمعلومات

# ماجستير العلوم

## في الذكاء الاصطناعي

### M.Sc. in Artificial Intelligence

توصيف البرنامج والمقررات

١٤٤٥ هـ - ٢٠٢٣ م



## نبذة عن البرنامج

صدر قرار مجلس الجامعة الموقر رقم ٢٥-١٤٤١هـ/١٤٤٢هـ بالموافقة على استحداث برنامج ماجستير العلوم في الذكاء الاصطناعي، وذلك بعد موافقة مجلس الجامعة في جلسته الثانية عشرة بتاريخ ١٥/١٠/١٤٤٢هـ على ما تم رفعه من توصيات من مجلس قسم علوم الحاسب ومجلس كلية علوم الحاسب والمعلومات في العام ذاته.

ويعد استحداث هذا البرنامج استجابةً مباشرةً لمتطلبات التنمية في المملكة العربية السعودية ولتوجيهات قادتها -حفظهم الله ورعاهم- وسعيًا للمشاركة في تحقيق رؤية المملكة ٢٠٣٠ والخطط التنموية الوطنية عن طريق تأهيل جيل مختص في الذكاء الاصطناعي قادر على مواكبة التقنيات الحديثة في هذا المجال وتوظيفها في العديد من القطاعات مثل القطاعات الصحية والاقتصادية والتعليمية.

## اهداف ورسالة البرنامج

رسالة البرنامج هي تخريج جيل من الخبراء والباحثين المؤهلين والذين يمتلكون المعارف والمهارات اللازمة للتعامل مع مختلف التحديات ذات العلاقة بمجال الذكاء الاصطناعي. ويسعى البرنامج لإنجاز أهدافه عن طريق المساهمة بشكل فعال في المجالات البحثية الحديثة وتطوير أنظمة ذكاء اصطناعي متقدمة وتقديم الخدمات للمؤسسات المهنية ذات العلاقة في هذا المجال وخدمة المجتمع المحلي والإنسانية بشكل عام في مجال الذكاء الاصطناعي.

تتلخص اهداف البرنامج في التالي:

- تخريج جيل من الخبراء المؤهلين بالمعارف والمهارات اللازمة في مجال الذكاء الاصطناعي.
- تزويد الملتحقين بالبرنامج بالمهارات المعرفية والعملية لإجراء أبحاث متقدمة في المجال.
- توفير والمحافظة على بيئة تعليمية وبحثية فعالة لديها القدرة على تزويد الخدمات المطلوبة في المجال للمؤسسات المهنية والمجتمع المحلي وللجامعة.

## شروط القبول

يشترط للقبول في البرنامج بصفة عامة ما يأتي:

- تقدير لا يقل عن جيد في الشهادة الجامعية بالانتظام.
- ان تكون شهادة البكالوريوس في مجال علوم الحاسب والمعلومات، ولمجلس القسم الموافقة على تخصصات اخرى عند إعلان القبول.
- الحصول على الدرجة المطلوبة في اختبار القدرات للجامعيين عند التقديم.
- الحصول على الدرجة المطلوبة في اختبار اللغة الانجليزية STEP او ما يعادلها في اختبار TOEFL و IELTS.
- اجتياز الاختبار التحريري او المقابلة إن وجدت-

ولمجلس القسم والكلية التعديل على شروط القبول والمفاضلة بين المتقدمين والإعلان عنها بالتعاون مع عمادة الدراسات العليا بالجامعة.

## الخطة الدراسية

قامت لجنة استحداث وتوصيف البرنامج على بناء الخطة الدراسية استناداً إلى المقارنات المرجعية مع الجامعات العالمية الرائدة في المجال (على سبيل المثال **Carnegie Mellon University** و **Imperial College London**)، مع الايفاء بمتطلبات الإطار الوطني للمؤهلات الصادر من هيئة تقويم التعليم والتدريب و متطلبات الاعتماد الاكاديمي البرامجي للمركز الوطني للاعتماد الاكاديمي.

الخطة الدراسية لماجستير العلوم في الذكاء الاصطناعي (ماجستير أكاديمي) تتكون من ٤٨ ساعة دراسية موزعة إلى ست مستويات، ويتطلب استكمال البرنامج مدة لا تقل عن سنتين (ستة فصول دراسية) مع اتمام الرسالة العلمية.

### M.Sc. in Artificial Intelligence

Credit Hours	Course Name	Course Code	
4	Advanced Computational Tools	AI6640	1 <sup>st</sup> Level
4	Machine Learning	AI6610	
4	Optimization & Metaheuristics	AI6615	2 <sup>nd</sup> Level
4	Deep Learning	AI6613	
4	Data Mining and Big Data Analytics	AI6670	3 <sup>rd</sup> Level
4	Semantic Web and Knowledge Representation	AI6675	
4	Digital Image Processing	AI6660	4 <sup>th</sup> Level
4	Natural Language Processing	AI6665	
2	Seminar in Research Methods	AI6795	5 <sup>th</sup> Level
2	Research Study	AI6797	
12	Thesis	AI6799	6 <sup>th</sup> Level

Credit Hours	Course Name	Course Code
<b>4</b>	<b>Optimization &amp; Metaheuristics</b>	<b>AI6615</b>

This course presents an overview of the main metaheuristics used to solve hard optimization problems. Many real-life applications in several disciplines such as engineering, operational research, bioinformatics, robotics, etc., involve hard optimization problems. This course aims to introduce the fundamentals of metaheuristic optimization, as well as some popular metaheuristic single solution-based algorithms such as Simulated Annealing and Tabu Search and population-based algorithms, e.g., evolutionary algorithms and swarms intelligence. Moreover, the course tackles advanced topics such as multi-objective optimization, Hybrid Metaheuristics, and Parallel Metaheuristics.

Credit Hours	Course Name	Course Code
<b>4</b>	<b>Machine Learning</b>	<b>AI6610</b>

This course provides a broad introduction to machine learning and statistical pattern recognition. It will familiarize students with a broad cross section of models and algorithms from interdisciplinary techniques such as statistics, linear algebra, optimization, and decision theory. The course tackles essential and fundamental models such as Regression Models (Bias-Variance Decomposition, Bayesian Linear Regression, SVM), Classification Models (Discriminative Functions, Generative, Discriminative, Kernel Methods), Graphical Models (Bayesian Networks and its inference), and Clustering Models (k-mean clustering, Mixtures of Gaussians, Latent variable models, and expectation-maximization (EM) algorithm). The course also covers basic real-world issues and possible solutions such as bias-variance tradeoff, curse of dimensionality, and ensemble methods. Additionally, advanced topics in ML models are covered in this course.

Credit Hours	Course Name	Course Code
<b>4</b>	<b>Digital Image Processing</b>	<b>AI6660</b>

This course introduces image processing and Computer vision related algorithms. This course covers various topics in digital image processing primarily image analysis techniques and concepts. The main areas to be presented and covered in the course include imaging sensors and their principles; Image representation and storage; techniques for noise reduction and image enhancement; filtering and transform techniques for image processing; Spatial transformations and image registration; Segmentation and thresholding techniques; Applications of morphology to image processing including erosion, dilation and hit-or-miss operations for binary and grey scale images; Image feature estimation such as edges, lines, corners, texture and simple shape measures. Object classification, template matching techniques and basic image-based tracking will be also examined.

Credit Hours	Course Name	Course Code
<b>4</b>	<b>Natural Language Processing</b>	<b>AI6665</b>

The aim of this course is to introduce concepts of NLP and their role in Artificial Intelligence. It covers the underlying concepts starting from lexical and heuristics solutions such as regular expressions to advanced techniques in NLP such as statistical and generative language modeling. The course introduces vector semantics and embedding, which form the basis for Neural Language models such as recurrent neural networks, encoder-decoder models, attention, and contextual embedding. The course also covers constituency grammar and parsing. Many NLP tasks will be studied including text classification, information extraction, coreference resolution, discourse analysis, summarization, dialog systems and machine translation. Advances and challenges for in Arabic NLP will be reviewed.

Credit Hours	Course Name	Course Code
<b>4</b>	<b>Advanced Computational Tools</b>	<b>AI6640</b>

This course targets students who require a basic level of proficiency in data analysis. The course emphasizes practical skills and techniques commonly used in data analysis such as clustering, classification, regression, and network analysis. This course aims to equip students with a practical understanding of classical data analysis and computer vision techniques to develop proficiency in applying these techniques using a modern programming language (Python). This course focuses on the fundamentals of each technique and their practical settings in which these methods are useful. The course will also cover relevant use cases and Python packages that enable students to perform experiments with their data.

Credit Hours	Course Name	Course Code
<b>4</b>	<b>Deep Learning</b>	<b>AI6613</b>

The aim of this course is to introduce Deep Learning concepts and their role in Artificial Intelligence. These concepts include machine learning, regression and probability distributions. Additionally, the course addresses the regularization and optimization of Deep Neural Networks (DNNs). The course also covers the anatomy of several DNN architectures and their applications, such as Convolutional Neural Networks, Sequence to Sequence Models, Attention Models, Autoencoders, Variational Autoencoders, and Deep Boltzmann Machines. The course also reviews Representation Learning and Reinforcement Learning concepts.

Credit Hours	Course Name	Course Code
<b>4</b>	<b>Semantic Web and Knowledge Representation</b>	<b>AI6675</b>

This course aims to cover concepts of knowledge representation and their role in Artificial Intelligence. It covers the underlying concepts in first-order logic and reasoning in FOL. The course addresses the complexity of reasoning, its limitations and developments for practical use in systems such as defaults and Answer Sets Programming. The course also covers the actions representation and plan generation. It then moves on to Description Logics and their influence on OWL, a main representation language for the Semantic Web. The course also provides an overview of RDF and SPARQL and covers recent and practical applications such as Linked Data and Knowledge Graphs.

Credit Hours	Course Name	Course Code
<b>4</b>	<b>Data Mining and Big Data Analytics</b>	<b>AI6670</b>

Data mining (DM) is an interdisciplinary field of databases, mathematics/statistics, machine learning and visualization, which aims to extract valuable information hidden in large volumes of raw data. This course will cover core topics in DM and their applications. Specifically, this course will cover how DM techniques are applied to solve numerous problems and the techniques' limitations; assist students in selecting appropriate DM techniques when faced with new problems, etc. Additionally, students will be introduced to hands-on experience in applying DM techniques by implementing a complete solution using one or more DM software packages.

Credit Hours	Course Name	Course Code
<b>2</b>	<b>Research Study</b>	<b>AI6797</b>

This course is a pre-requisite for registering the thesis. Initially, students are associated with potential supervisors based on research interests. Then, students are guided by those supervisors toward writing a complete thesis proposal. This course is conducted as weekly lectures and meetings in which students and supervisors discuss research topics related to the thesis proposal.

Credit Hours	Course Name	Course Code
<b>2</b>	<b>Seminar in Research Methods</b>	<b>AI6795</b>

This course introduces students to the fundamentals of scientific research conduct and covers topics related to professional and academic practices in computing research. Topics introduced in this course includes the philosophy of research, qualitative and quantitative research, accessing and evaluating research materials, assessing outcomes, and results dissemination. Broadly, topics in this course focus on two main areas: research skills and communication skills. Namely, students will learn about research processes and methods, scientific and technical writing, research tools, critical thinking, team communication and teamwork, oral communication, and presentation skills.

Credit Hours	Course Name	Course Code
<b>12</b>	<b>Thesis</b>	<b>AI6799</b>

The thesis aims to introduce students to scientific research in the artificial intelligence (AI) discipline. Students will explore in depth an area of research in AI by applying the knowledge acquired through the program's courses. These areas include problem solving, knowledge representation and reasoning, machine learning, natural language processing, computer vision, constraint-based reasoning, deep learning, data mining, etc.

Students are expected to understand their thesis topic, formulate the problematic of the thesis, arise specific research questions, study the literature review, analyze existent solutions, propose strategies, recommendations, and answers to the raised research questions, and finally present their findings and defend them in a college-wide seminar.



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2023 – 1445 H

@ccis\_imamu

ccis@imamu.edu.sa

[units.imamu.edu.sa/colleges/ComputerAndInformation](https://units.imamu.edu.sa/colleges/ComputerAndInformation)

