جامعة الإمام محمد بن سعود الإسلامية
كلية علوم الحاسب والمعلومات

ماجستير العلوم في الذكاء الاصطناعي

M.Sc. in Artificial Intelligence

توصيف البرنامج والمقررات

الإصدار ١,٠

١٤٤٤ هـ – ٢٠٢٢م

نبذة عن البرنامج

صدر قرار مجلس الجامعة الموقر رقم ٢٥-١٢-١٤٤١/١٤٤٢ هـ بالموافقة على استحداث برنامج ماجستير العلوم في الذكاء الاصطناعي، وذلك بعد موافقة مجلس الجامعة في جلسته الثانية عشرة بتاريخ ١٤٤٢/١٠/١٥ هـ على ما تم رفعه من توصيات من مجلس قسم علوم الحاسب ومجلس كلية علوم الحاسب والمعلومات في العام ذاته.

ويعد استحداث هذا البرنامج استجابةً مباشرة لمتطلبات التنمية في المملكة العربية السعودية ولتوجيهات قادتها -حفظهم الله ورعاهم- وسعياً 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 انظمة 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 ابحاث 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 IELTS و TOFEL .
- 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 اكاديمي) تتكون من ٣٤ ساعة دراسية موزعة إلى اربعة مستويات، ويتطلب استكمال البرنامج مدة لا تقل عن سنتين (أربعة فصول دراسية) مع اتمام الرسالة العلمية.

M.Sc. in Artificial Intelligence

Credit Hours	Course Name	Course Code	
3	Optimization & Metaheuristics	AI615	First Level
3	Machine Learning	AI610	
3	Digital Image Processing	AI660	
3	Natural Language Processing	AI665	Second Level
3	Advanced Computational Tools	AI640	
3	Deep Learning	AI613	
1	Seminar in Research Methods	AI795	Third Level
3	Data Mining and Big Data Analytics	AI670	
3	Semantic Web and Knowledge Representation	AI675	
9	Thesis	AI799	Fourth Level

Credit Hours	Course Name	Course Code
3	**Optimization & Metaheuristics**	**AI615**

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 algorithms, e.g., Genetic Algorithms, Simulated Annealing, Tabu Search and others.

Credit Hours	Course Name	Course Code
3	**Machine Learning**	**AI610**

The course introduces the fundamental concepts of machine learning (ML) and its recent applications. It examines a wide variety of models and algorithms designed from interdisciplinary techniques such as statistics, linear algebra, optimization, and decision theory. These models include Regression Models (Bias-Variance Decomposition, Bayesian Linear Regression, SVM), Classification Models (Discriminative Functions, Generative, Discriminative, Kernel Methods), Graphical Models (Bayesian Networks, Markov Random Fields), and Mixture of Models (Mixtures of Gaussians, Latent Variable Models, and Expectation-Maximization (EM) Algorithm). The course also covers basic real-world issues and possible solution 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
3	**Digital Image Processing**	**AI660**

This course provides an in-depth understanding of modern algorithms in the domain of image processing and computer vision. Student will be introduced to various image analysis techniques and concepts such as image enhancement, filtering, segmentation, features engineering, convolutional neural network and image classification. These techniques commonly play a core role in real world, computer vision-based applications. To implement these image processing algorithms, a popular programming language (e.g., Python) will be used throughout this course.

Credit Hours	Course Name	Course Code
3	**Natural Language Processing**	**AI665**

The aim of this course is to introduce concepts of NLP and their role in Artificial Intelligence. It covers the underlying concepts in regular expressions and language modeling. The course introduces vector semantics and embedding, which form the basis for NLP models such as recurrent neural networks, encoder-decoder models, attention and contextual embedding. The course also covers constituency grammars and parsing. Various NLP tasks will be studied including text classification, information extraction, coreference resolution, discourse analysis, summarization, dialog systems and machine translation. Advances in Arabic language processing will be reviewed as well.

Credit Hours	Course Name	Course Code
3	**Advanced Computational Tools**	**AI640**

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
3	**Deep Learning**	**AI613**

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
1	**Seminar in Research Methods**	**AI795**

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 focuses on two main areas: research skills and communicating 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
3	**Data Mining and Big Data Analytics**	**AI670**

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
3	**Semantic Web and Knowledge Representation**	**AI675**

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
9	**Thesis**	**AI799**

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.

ماجستير العلوم
في الذكاء الاصطناعي
M.Sc. in Artificial Intelligence

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