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Changes to Master of Information Technology and Management Specializations

The following changes to the existing **Master of Information Technology and Management Data Analytics and Management Specialization** will be effective for students entering the degree in Fall 2024. The Data Analytics and Management Specialization will be divided into two new specializations, **Applied Data Science and AI** and **Data Modeling and Management**, and a correction will be made which replaces one elective course in the **Management Information Systems** specialization.

New Master of Information Technology and Management Specialization
Applied Data Science and AI: (Courses in red are new courses and are attached.)

- Required courses (12 hours)
  - ITMD 514 Programming for Data Analytics (Programming for Data Analytics)
  - ITMD 521 Big Data Infrastructure
  - ITMD 522 Data Mining and Machine Learning
  - ITMD 523 Advanced Topics in Data Management
  - ITMD 524 Applied AI & Deep Learning
  - ITMD 537 Data Science Practicum [prerequisites: ITMD 514 and ITMD 522]
- Specialization Elective courses (select 6 credits hours from the following)
  - INTM 522 Modeling for Decision-Making
  - ITMD 525 Topics in Data Science and Management
  - ITMD 526 Data Warehousing
  - ITMD 529 Advanced Data Analytics
  - ITMD 561 Web Intelligence (NLP, IR, RecSys) [prerequisite: ITMD 514]
  - ITMS 527 AI for Cybersecurity [prerequisite: ITMD 514 or ITMS 514]

New Master of Information Technology and Management Specialization
Data Modeling and Management:

- Required courses (12 hours)
  - ITMD 510 Object-Oriented Application Development
  - ITMD 514 Programming for Data Analytics
  - ITMD 521 Big Data Infrastructure
  - ITMD 523 Advanced Topics in Data Management
  - ITMD 526 Data Warehousing
  - ITMS 528 Database Security
- Specialization Elective courses (select 6 credits from the following)
  - ITMD 522 Data Mining and Machine Learning
  - ITMD 525 Topics in Data Science and Management
  - ITMD 529 Advanced Data Analytics
  - ITMD 541 Web Application Foundations
  - ITMD 555 Open-Source Intelligent Device Applications
  - ITMD 566 Service-Oriented Architectures
  - ITMT 531 Object-Oriented System Analysis, Modeling, and Design

In the **Management Information Systems** specialization, **ITMD 527 Data Analytics** has been replaced with **ITMD 514 Programming for Data Analytics**. This is a correction reflecting the fact that ITMD 527 is no longer offered and has been replaced with ITMD 514.

ITMD 537 SYLLABUS

ITMD 537 Data Science Practicum

Hours: 3 credit hours / 45 contact hours

Instructor: Yong Zheng, Ph.D.

Textbook, title, author, and year:
Online material as assigned by instructor

Specific course information

a. **Catalog description:** In this project-oriented course, students will work in small groups to solve real-world data analysis problems and communicate their results. Innovation, soundness of solutions and evaluations, and clarity of presentation will be key elements of evaluation. The topic of the projects may come from university research faculty or from industry partners.
b. **Prerequisites:** ITMD 514, ITMD 522

Specific goals for the course

a. **Course Outcome:** The goal of this project-based course is for students to learn how to apply data science skills and techniques to real-world problems and to interpret and communicate their results. Students will work in groups of three or four to solve real-world data analysis problems or other industry data analytics challenges. Projects topic may come from university research faculty or from industry partners. To keep the scope of the course manageable and to facilitate teamwork, the course will be limited to 24 students.
b. **Course Student Outcomes:**
Upon successful completion of the course the student should be able to do the following:
   - Prepare a proposal to solve a problem using techniques of data science.
     - Explain the problem and it's importance.
     - Explain the methods proposed to solve the problem.
   - Prepare a detailed project plan to solve a problem using techniques of data science, based on a previously developed proposal.
   - Complete a data survey including any issues of inconsistency or incompleteness.
   - Create a problem solution based on a comprehensive examination and analysis of data relevant to the problem at issue.
   - Draft a complete project report, detailing analytic methods that were applied and their results, together with an interpretation of the results and their implications for the project sponsor.
   - Present the results of a project in data science, explained in terms that that a layman can understand.
   - Work with, lead, and manage teams in an enterprise environment to collaboratively arrive at optimal technology solutions.

Topics to be covered

There are no formal lecture-style classes. The course consists of hands-on lab exercises, group discussions and presentations. Students will learn the potential topics for research projects in the 1st week. Student groups will be formed in the 2nd week, followed by group proposals, literature reviews, group practice and discussions, supervision by the instructor, and bi-weekly group presentations in the following weeks. Specific deliverables during the course include:

a. **Project Proposal:** This includes both a written proposal and a short oral presentation, explaining the problem and its importance, the methods the team proposes to apply to the problem, and what new understanding is to be expected.
b. **Project Plan:** This is a detailed plan and schedule of the tasks that the team will perform to successfully complete the project.
c. **Data Survey:** This is a short document discussing the state of the data supplied for the task, including any issues of inconsistency or incompleteness and how they will be addressed in the project, as well as a preliminary exploratory analysis of the structure of the data.
d. **Project Report:** This written report details the analytic methods that were applied and their results, together with an interpretation of the results and their implications for the project sponsor.
e. **Project Presentation:** Teams will also be required to orally present their analyses, and explain them in terms that a layman can understand.

ITMD 561 SYLLABUS

ITMD 561 Web Intelligence

Hours: 3 credit hours / 45 contact hours

Instructor: Yong Zheng, Ph.D.

Textbook, title, author, and year:

Recommender Systems Handbook 2nd edition, Francesco Ricci and Lior Rokach, 2015
Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, and Edward Loper, 2009

Specific course information

a. **Catalog description:** Embrace the dynamic landscape of the digital realm with our groundbreaking course in Web Intelligence. This course is designed to empower students with a profound understanding of Web Mining, Natural Language Processing (NLP), Information Retrieval (IR), and Recommender Systems (RecSys), pivotal components in shaping the intelligent future of the web. Web Mining can uncover the hidden gems within the vast expanse of the web through the exploration of web mining techniques. NLP is a popular topic in AI and job market. From sentiment analysis to language generation, students will gain hands-on experience in developing systems that can understand, interpret, and generate human language effectively. We will also navigate the intricacies of IR and learn the art of efficiently accessing and presenting relevant information from the vast web ecosystem. Topics in RecSys help students explore the art and science of personalized content delivery. This course will feature both knowledge (e.g., concepts, algorithms) and practical skills (e.g., tools and libraries by Python) in these related topics.
b. **Prerequisites:** ITMD 514

Specific goals for the course

a. **Course Outcome:** Upon completion of the Web Intelligence course, students will emerge with a comprehensive skill set and understanding of web mining, Natural Language Processing (NLP), information retrieval, and recommender systems, as well as skills of using Python to solve problems in these topics. They will demonstrate mastery in applying web mining techniques to extract valuable insights from diverse data sources, effectively implementing NLP algorithms for tasks like sentiment analysis and text summarization. Additionally, students will showcase the ability to design and optimize information retrieval systems, utilizing search algorithms and relevance ranking, while also constructing and evaluating personalized recommender systems. Through interdisciplinary integration, they will tackle complex problems, fostering a holistic approach to web intelligence. Ethical considerations will be ingrained, enabling responsible decision-making in the development and implementation of intelligent systems. Practical applications and hands-on projects will highlight students' capacity to address real-world challenges, fostering innovation and creativity in the evolving landscape of web technologies. Effective communication of complex technical concepts will be emphasized, preparing students for diverse roles in data science, machine learning, and web development.
b. **Course Student Outcomes:**
Upon successful completion of the course the student should be able to do the following:
   - Demonstrate proficiency in web mining techniques to extract patterns and insights from diverse web data sources.
   - Apply Natural Language Processing (NLP) algorithms for tasks such as sentiment analysis, named entity recognition, and text summarization.
   - Design and implement efficient information retrieval systems, employing search algorithms, indexing strategies, and relevance ranking.
   - Construct collaborative filtering, content-based filtering, and hybrid recommender systems for delivering personalized content recommendations.
   - Integrate knowledge from web mining, NLP, information retrieval, and recommender systems to solve interdisciplinary problems.
   - Execute hands-on projects and practical applications, applying acquired knowledge to address contemporary challenges in these topics.
   - Deliver optimal technical and policy technology solutions for the problems of business, industry, government, non-profit organizations, and individuals using web intelligence technologies and methods.

Topics to be covered

a. Overview of Data Mining & Machine Learning
b. Web Mining: Web Usage Mining
c. Web Mining: Web Structure Mining
d. NLP: Basic Techniques in Text Mining
e. NLP: Semantic Technologies
f. NLP: Distributed Representations and LLMs
g. NLP Applications: Sentimental Analysis, Web Content Mining
h. Introduction to Information Retrieval
i. IR: Data Preprocessing, Basic IR by using NLP
j. Exam and IR: Ranking Methodologies
k. Introduction to RecSys: Categories, Tasks, Evaluation Methods
l. Recommendation Algorithms: Collaborative Filtering
m. Recommendation Algorithms: Content-Based Approaches and Hybrid Models
n. Different Types of Recommender Systems
o. Final Project Presentations

ITMS 527 SYLLABUS

ITMS 527 AI for Cybersecurity

Hours: 3 credit hours / 45 contact hours

Instructor: Marwan Omar, Ph.D.

Textbook, title, author, and year:
Machine Learning for Cybersecurity Cookbook, Emmanuel Tsukerman, 2019

Specific course information

a. **Catalog description:** This course is designed to equip students with knowledge and skills necessary to understand, implement, and leverage artificial intelligence (AI) techniques in the realm of cybersecurity. In an era where cyber threats continue to evolve and grow in complexity, AI has emerged as a powerful tool to defend against and mitigate these threats. This course explores the intersection of AI and cybersecurity, providing a comprehensive understanding of how AI technologies can be used to protect computing systems. By the end of this course, students will be well-equipped to leverage the power of AI to enhance cybersecurity efforts, making them valuable assets in the ever-evolving landscape of digital security. Join us on this exciting journey into the world of "AI for Cybersecurity" and prepare to defend against the digital threats of tomorrow. The course is intended for students with a basic understanding of computing and cybersecurity concepts.

b. **Prerequisites:** ITMD 514 or ITMS 514

Specific goals for the course

a. **Course Outcome:** The goal of this course is for students to learn how to apply artificial intelligence (AI) techniques to the problems of controlling cybersecurity risk to enterprise information assets. Students will learn the applications, benefits, limitations, and concerns regarding the use of AI in cybersecurity contexts. The course consists of lectures, hands-on lab exercises, group discussions, and assignments, which will give students the opportunity to work with AI tools and datasets relevant to cybersecurity. Guest speakers from industry and academia may also provide insights into cutting-edge developments in the field.

b. **Course Student Outcomes:**
Upon successful completion of the course the student should be able to do the following:

- Recall and describe fundamental concepts of cybersecurity, to include
  - threat landscapes;
  - attack vectors;
  - security protocols.
- Describe the role of AI in cybersecurity, including its applications, benefits, and limitations.
- Use AI algorithms and tools to detect, analyze, and respond to cyber threats.
- Explain the ethical and legal considerations surrounding the use of AI in cybersecurity.
- Employ critical thinking and problem-solving skills to address emerging cyber threats.
- Manage and deploy information resources applicable to each student's particular area of focus in an enterprise setting.

Topics to be covered

a. Introduction to cybersecurity
b. Fundamentals of AI
c. AI Applications in Cybersecurity
d. AI-driven security analytics
e. Ethical & Legal aspects of AI in Cybersecurity
f. Real-world case studies
g. Future trends