Information Sciences and Technology Department  
Course Syllabus  

Knowledge Mining from Big Data

Catalog Description
Introduction to methods and tools related to knowledge mining/representation/visualization, and annotation and retrieval for Big-Data Applications from an applied perspective with the focus on emerging research problems. This course combines survey lectures with in-depth presentation of relevant issues through seminars, and hands-on experience using existing technologies and public data sources.

Educational Objectives
1. Introduction to knowledge mining.
2. Explain the role of technologies in architecture of semantic web.
3. Introducing tools and techniques for knowledge mining, representation, and visualization.
4. Construction of knowledge graphs for classification, annotation, search and retrieval in emerging Big-Data applications.
5. Develop skillset through implementation of hands-on projects.

Rationale
We are in the age of Big Data, an age that tracks our digital footprints. Most of this data is captured through sensor devices that provide low-level descriptors for the data. To answer user queries, we need to bridge the semantic gap between low-level raw data and high-level user queries. This course is intended to practice insights, and discuss tools and technologies to correlate data across multiple data sources, and develop techniques to bridge the semantic gap in the context of big data applications.
## Major Topics

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course plan, overview of past, present, and future of Internet, Intro to Semantic Web, Overview of Linked Open Data and Semantic Web Technology and Tools</td>
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<tr>
<td>2</td>
<td>Semantic Web Technology, Multimedia Computing in the age of Big-Data, Multimedia Metadata Standards</td>
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<td>3</td>
<td>Feature Extraction I: Multimedia Content</td>
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<td>4</td>
<td>Feature Extraction II: Multimedia Context, Big Sensory Data Streams</td>
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<tr>
<td>5</td>
<td>Overview of Big-Data Analytics and Knowledge Mining from Heterogeneous Datasets</td>
</tr>
<tr>
<td>6</td>
<td>Mid-Term Exam</td>
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<tr>
<td>7</td>
<td>Ontologies, Knowledge Graph Construction, Reasoning, and Querying</td>
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<tr>
<td>8</td>
<td>Seminar I: Knowledge Mining as a new paradigm for Big-Data Analytics Papers</td>
</tr>
<tr>
<td>9</td>
<td>Project Demo (Research Plan)</td>
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<tr>
<td>10</td>
<td>Seminar II: Knowledge Representation Papers</td>
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<tr>
<td>11</td>
<td>Seminar III: Knowledge Graph Refinement Papers</td>
</tr>
<tr>
<td>12</td>
<td>Seminar IV: Operations on Ontologies Papers</td>
</tr>
<tr>
<td>13</td>
<td>Applications of Present and Emerging Big Multimedia-Data (Search Engines, Multimedia Information Retrieval, Hazard Applications, etc.) and Challenges (Security, Performance, Privacy, etc.)</td>
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<tr>
<td>14</td>
<td>Final Project Demo</td>
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<td>15</td>
<td>Final Exam</td>
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## Recommended Prerequisites

AIT 582

## Objectives

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

- Understand fundamentals and principles of Semantic Web technology
- Understand the conceptual components of formal models including axioms, rules, relationships, and individuals
- Understand the basics of Multimedia semantics
- Create reusable formal models, and processes to create/update/query such models that help to describe formal semantics used in a multimedia application
- Understand the future trend
Reading List

Required Textbooks:

Recommended Textbooks:
- Multimedia Semantics Metadata, Analysis, and Interaction Raphael Troncy (Editor), Benoit Huet (Co-Editor), Simon Schenk (Co-Editor), ISBN: 978-0-470-74700-1
- [http://www.w3.org/standards/techs/rdf#w3c_all](http://www.w3.org/standards/techs/rdf#w3c_all)
- [http://www.w3.org/Submission/SWRL/](http://www.w3.org/Submission/SWRL/)

Instructor Contact Information

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Office: ENGR 5304
Office Hours: Please see Blackboard.

Grading

Grades will be awarded in accordance with the GMU Grading System for graduate students. See [http://www.gmu.edu/academics/catalog/0304/apolicies/graduate.html#TOC_H17](http://www.gmu.edu/academics/catalog/0304/apolicies/graduate.html#TOC_H17) for more information.

Letter grades will be assigned according to the following scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Grade Points</th>
<th>Graduate Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>4.00</td>
<td>Satisfactory / Passing</td>
</tr>
<tr>
<td>A</td>
<td>4.00</td>
<td>Satisfactory / Passing</td>
</tr>
</tbody>
</table>

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Final grades will be determined based on the following components:

<table>
<thead>
<tr>
<th>Total Points</th>
<th>100%</th>
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<tbody>
<tr>
<td>Midterm Exam</td>
<td>20%</td>
</tr>
<tr>
<td>Project and Demo</td>
<td>35%</td>
</tr>
<tr>
<td>Survey Presentation</td>
<td>15%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</td>
</tr>
<tr>
<td>Assignments, Quizzes</td>
<td>10%</td>
</tr>
<tr>
<td>Class Discussion (Bonus)</td>
<td>5%</td>
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</table>

Religious Holidays
A list of religious holidays is available on the University Life Calendar page. Any student whose religious observance conflicts with a scheduled course activity must contact the Instructor at least 2 weeks in advance of the conflict date in order to make alternative arrangements.

Attendance Policy
Students are required to attend each class, to complete any required preparatory work and to participate actively in lectures and discussions. As members of the academic community, all students are expected to contribute regardless of their proficiency with the subject matter.

Students are expected to make prior arrangements with Instructor if they know in advance that they will miss any class and to consult with the Instructor as soon as possible if they miss any class without prior notice. Students who anticipate absences are discouraged from taking the class.

Departmental policy requires students to take exams at the scheduled time and place, unless there are truly compelling circumstances supported by appropriate documentation. Except in such circumstances, failure to attend a scheduled exam will result in a score of zero (0) for that exam, in accordance with Mason policy on final exams. Students should not make travel plans or other discretionary arrangements that conflict with scheduled classes and/or exams. If the University is closed due to weather or other unforeseen conditions,
final exams may be rescheduled. Contact the instructor in advance if you have a serious problem that prevents you from meeting course requirements.

Communications
Registered students will be given access to a section of the Blackboard Learning System for this course. Blackboard will used as the primary mechanism (outside of lectures) to disseminate course information, including announcements, lecture slides, homework and other assignments, and scores for homework and exams.

Communication with the Instructor on issues relating to the individual student should be conducted using GMU email, via telephone, or in person - not in the public forums on Blackboard. Email is the preferred method. Federal privacy law and GMU policy require that any communication with a student related in any way to a student's status be conducted using secure GMU systems - if you use email to communicate with the Instructor you MUST send messages from your GMU email account.

Privacy
Instructors respect and protect the privacy of information related to individual students.

As described above, issues relating to an individual student will discussed via email, telephone or in person. Instructors will not discuss issues relating to an individual student with other students (or anyone without a need to know) without prior permission of the student.

Assessable work other than final exams will be returned to individual students directly by the Instructor (or by a faculty or staff member or a Teaching Assistant designated by the Instructor, or via another secure method). Under no circumstances will a student's graded work be returned to another student. Faculty and staff will take care to protect the privacy of each student's scores and grades.

Disability Accommodations

The Office of Disability Services (ODS) works with disabled students to arrange for appropriate accommodations to ensure equal access to university services. Any student with a disability of any kind is strongly encouraged to register with ODS as soon as possible and take advantage of the services offered.

Accommodations for disabled students must be made in advance – ODS cannot assist students retroactively, and at least one week's notice is required for special accommodations related to exams. Any student who needs accommodation should contact the Instructor during the first week of the semester so the sufficient time is allowed to make arrangements.
Honor Code
All members of the Mason community are expected to uphold the principles of scholarly ethics. Similarly, graduating students are bound by the ethical requirements of the professional communities they join. The ethics requirements for some of the communities relevant to Applied IT graduates are available via the following links:

- ACM Code of Ethics and Professional Conduct
- IEEE Code of Ethics
- EC-Council Code of Ethics

On admission to Mason, students agree to comply with the requirements of the Honor Code at George Mason University. Student members of the George Mason University community pledge not to cheat, plagiarize, steal, and/or lie in matters related to academic work. The Honor Code will be strictly enforced in this course.

Any use of the words or ideas of another person(s), without explicit attribution that clearly identifies the material used and its source in an appropriate manner, is plagiarism and will not be tolerated. The Instructor reserves the right to use manual and/or automated means (including such services as Turnitin.com) to detect plagiarism in any work submitted by students for this course, and to direct Teaching Assistants and/or other faculty and/or staff members to do likewise in support of this course.

For this course, the following requirements are specified:

All assessable work is to be prepared by the individual student, unless the Instructor explicitly directs otherwise.

All work must be newly created by the individual student for this course for this semester.

Any usage of work developed for another course, or for this course in a prior semester, is strictly prohibited without prior approval from the instructor.

The result of violating the honor code is 0 for the corresponding assignment (or any other content), and ‘F’ in the course if the incident is repeated.