

# SYST 584

## HETEROGENEOUS DATA FUSION

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### Course Description

Spring 2016

Introduces the theory, design and implementation of multi-source information fusion systems in various domains. The course covers distinct technologies for combining data from multiple, heterogeneous sources and performing inferences in support to applications such as cyber security, Semantic Web, decision support systems, situational awareness, intrusion detection, crisis management, and others. The technical content is largely multi-disciplinary, encompassing disciplines such as knowledge engineering, ontologies, statistical learning, artificial intelligence, and data mining.

#### Class Details

*Prerequisites: STAT 515 or STAT 544*

##### *Classes*

- \* Room 133 of the Innovation Hall.
- \* Tuesdays, from 4:30 p.m. to 7:10 p.m.

##### *Office hours*

- \* Room 2227 of the Engineering Building.
- \* Mondays, from 2:00 p.m. to 4:00 p.m., or by appointment.
- \* Dr. Costa's contact data: (703) 993-9989 / [pcosta@gmu.edu](mailto:pcosta@gmu.edu)

##### *Administrative*

- \* Registration and drop without tuition penalty deadline: Jan 26<sup>th</sup>.
- \* Drop with 33% tuition penalty: Feb 2<sup>nd</sup>.
- \* Final Drop deadline (66% tuition penalty): Feb 19<sup>th</sup>.

#### Course Logistics

1. All course communication will be done via the Blackboard system. Students are expected to have access and be able to use the system before classes start. Blackboard is accessible via the

- MyMason portal at <https://mymasonportal.gmu.edu/>. Instructions for using the Blackboard system are provided in the “resources” link at the bottom of the portal page.
2. Volgenau School Computing Resources has answers to many questions about school systems on their web site: <http://labs.vse.gmu.edu> and will try to help you if have problems connecting to school computing systems. However, they will not provide assistance with general computing questions or course assignments. Please contact me if you have any questions about how to use software to complete your assignments.
  3. Accommodations for disability: If you have a documented learning disability or other condition that may affect your academic performance you should: a) make sure this documentation is on file with Office for Disability Services (SUB I, Rm. 4205; 993-2474; <http://ods.gmu.edu>) to determine the accommodations you need; and b) let me know about your accommodation needs as soon as possible. If you have contacted the Center for Disability Services and are waiting to hear from a counselor, please keep me updated during the whole process.
  4. Inclement weather: Class sessions may be held remotely (via Blackboard Collaborate) due to inclement weather or other University emergencies. Check the Announcements area of the course website for updates.
  5. Students are expected to be able to attend classes held online via Blackboard Collaborate, as well as quizzes or other activities associated with such classes (e.g. snow days).

### **Expected Behavior**

1. Attendance in class is essential. If you need to miss a class, you must contact me in advance.
2. You are allowed to enter or leave at any time, provided you do your best to avoid disrupting the activity going on.
3. Please make sure you have your cell phone, tablet, pager, etc., in silent mode. Should you find yourself in *extreme* need to answer an incoming call, just leave the room to do so.
4. With a few exceptions, almost all of the course deliverables are submitted electronically (e.g. class-work and homework), scheduled in advance, and with some flexibility for students to change. Should any scheduled event impact a student’s participation in class activities and assignments, it is the student’s responsibility to coordinate with me in advance.
5. Students are permitted to interact on homework assignments, but your write-up must be your own. Assignments are intended to provide practical, hands-on experience with the ideas presented in the course.
6. Late assignments, when properly justified, will receive reduced credit in accordance with the late assignment policy (below in this document). No points will be awarded if the assignment is turned in after solutions have been posted.

7. Religious observances are one common example of events that might impact students' activities. Students are responsible for planning ahead. Please, refer to the GMU's calendar of religious holidays at [http://ulife.gmu.edu/religious\\_calendar.php](http://ulife.gmu.edu/religious_calendar.php).
8. Academic Policy: All academic policies as given in the Honor System and code will be strictly followed. These are available at <http://catalog.gmu.edu/content.php?catoid=19&navoid=4113>.
9. General Policies: All general policies defined in the University Catalog are in place for this course. You can access those at <http://catalog.gmu.edu/content.php?catoid=19&navoid=4114>.
10. George Mason University is an Honor Code university. Please see the Office of Academic Integrity website (<http://oai.gmu.edu/the-mason-honor-code-2/>) for a full description of the honor code and the honor committee process.

**Exercise planning, be proactive and do your best to stay ahead of schedule.**

### Course Outline:

Week 1	1/19	Unit 1: Introduction to Heterogeneous Data Fusion.
Week 2	1/26	Unit 2: Knowledge Engineering and Modeling.
Week 3	2/2	Unit 2: Graphical Probability Models. <b>Paper selection due.</b>
Week 4	2/9	Unit 3: Graphical Probability Models.
Week 5	2/16	Unit 4: Learning from Data. Invited Speaker
Week 6	2/23	Unit 4: Learning from Data
Week 7	3/1	Midterm review. <b>Midterm Exam handed.</b>
Spring Break	3/8	No Classes
Week 8	3/15	Unit 5: Uncertainty in HLIF: Other Approaches <b>Paper Presentations</b>
Week 9	3/22	Unit 6: Semantic Technologies. Invited Speaker. <b>Paper Presentations</b>
Week 10	3/29	Unit 6: Semantic Technologies. <b>Paper Presentations.</b>
Week 11	4/5	Unit 7: Analytics in Information Fusion. <b>Paper Presentations.</b>
Week 12	4/12	Unit 7: Analytics in Information Fusion. <b>Paper Presentations.</b>
Week 13	4/19	Unit 8: Evaluation of Information Fusion Systems. <b>Paper Presentations.</b>
Week 14	4/26	Unit 8: Evaluation of Information Fusion Systems. <b>Final Exam handed.</b>

## Textbook

The course will be mostly based on class notes and reading assignments provided by the instructor. However, the following two books, which are available in both online and printed format from the GMU library, will be the main texts:



High-Level Data Fusion  
Subrata Das  
Artech House, 1<sup>st</sup> Edition (August 30, 2008). 373 pp.  
ISBN-10: 1596932813  
ISBN-13: 978-1596932814



High-Level Information Fusion Management and Systems Design  
Erik Blasch, Éloi Bossé, and Dale A. Lambert  
Artech House, 1<sup>st</sup> Edition (April 30, 2012). 364 pp.  
ISBN-10: 1608071510  
ISBN-13: 978-1608071517

## Grading

The grading structure of this course is as follows:

- Assignments (20% of grade)
- Midterm Exam (25% of course grade)
- Paper Review (30% of grade)
- Final Exam (25% of course grade)

## Assignments

There will be assignments posted via Blackboard during the course. Each assignment will have its respective due date defined during the announcement.

You are not prevented from working with your peers on the assignments, and are even encouraged to do so. However, each student must provide his/her own answers, and I might verify whether he/she actually worked in his/her respective exercise and understood the solution provided. In any case, past experience consistently shows that students who didn't keep up with the assignments had a less than stellar performance with their grades.

Assignments must be submitted via Blackboard.

## Paper Review

Each student will choose an article from a peer-reviewed source (conference or academic journal) related to the field of data fusion. Students are expected to present their respective assessment and conclusions about the paper to the class via 20 min oral presentation followed by a 5-min questioning session; as well as to provide fair, well-founded peer reviews of some of their peer's paper presentations. The Paper Review grading is structured as follows:

- Oral presentation: 90% of the Paper Review grade.
- Evaluations of other presentations: 10% of Paper Review grade.

*Oral presentation.* The presenter must upload his slides to the Blackboard system no later than 2 p.m. Eastern Time of the day before his/her presentation. Minor changes to the submitted slides are allowed, but the submitted version must be very close to the actual presentation. All students are expected to read the abstracts and view the slides prior to each presentation. However, those really interested in maximizing their learning experience are advised to read the actual paper before the presentation and fully use their participation rights at the questioning session.

*Peer Evaluations.* During the paper evaluation phase a schedule of reviews will be posted. Each student is expected to provide a number of professional, well founded, and impartial critique. The goal is to exercise your critical side, and demonstrate your ability to provide proper support your evaluations, being it positive or not.

Weak or empty evaluations will be returned, and may deduct from your grade. You will be evaluated on your ability to provide a thoughtful and well-supported review.

Paper choices are up to each student, but must be approved by the instructor. **Students must choose their paper by week 3** of the course. Students that did not submit their choices will be assigned to a paper by the instructor and are subjected to grade deductions if no plausible justification is offered.

## Exams

Both the Midterm and the Final exams will be take-home. Tentative dates are:

- Midterm: March 1, 2015.
- Final: April 26, 2015.

**BEST WISHES FOR A GREAT SEMESTER!!!**

Tuesday, January 19, 2016.