COMS E6998-1: Advanced Machine Learning

This graduate course covers current research level topics in machine learning for both generative and discriminative estimation. Material will include exponential family distributions, Bayesian networks, Bayesian inference, maximum likelihood, maximum entropy, mixture models, the EM algorithm, graphical models, hidden Markov models, variational methods, linear classifiers, regression, generalization bounds, support vector machines, kernel methods and transduction.

Projects Powerpoint Files

Readings Schedule

Readings on Variational Methods:
Jordan's Intro (ps.gz)
Jaakkola's Tutorial on Mean Field (ps)
Jaakkola on QMR-DT (pdf)

Readings on Support Vector Machines:
Chris Burges' Tutorial (ps.gz)

Assignment 1: as Postscript or as PDF
Assignment 2: as Postscript or as PDF and data: Dataset1 Dataset2 Dataset3 Dataset4
Assignment 3: as Postscript or as PDF and data: Dataset5 Dataset6 Dataset7 and code: sampleNet likeNet learnNet
Assignment 4: as Postscript or as PDF
Class Project: as Postscript or as PDF

Matlab Tutorial and Useful Functions

Scanned Class Notes (pdf) pages: (1-5) (6-8) (9-16) (17-25) (26-35) (36-40) (41-46) (47-54)

WHAT'S NEW

- *April 15, 2002:* Assignment 4 (a short one) is online, due April 29th.
- *April 15, 2002:* Note the link for tutorial on support vector machines.
- *April 11, 2002:* Note links above on variational methods papers to learn more about details.
- *April 1-5, 2002:* Regular office hours cancelled. Office hours April 1st 10-11am, 6-7pm, or by appointment.
- *March 31, 2002:* Class lecture on April 22nd is MOVED to 4pm on April 26th (MUDD 1024).
- *March 18-22, 2002:* Office hours are by appointment only during the spring break (no regular).
- *March 15th, 2002:* The class project is now online, due May 6th (abstract due April 1st).
- *March 15th, 2002:* Problem Set 3 is now online, due April 1st.
- *March 5th, 2002:* Office hours on Thursdays have been moved to 2:30-3:30.
- *February 28th, 2002:* By popular request, class notes are available (sorry about low scan quality).
- *February 28th, 2002:* Due to Matlab being new for many, the deadline for Assignment 2 is extended to March 12th. Please take a look at the new pdf and ps files which have a few more details to make things clearer.
- *February 20th, 2002:* Assignment 2 is available above.
- *February 14th, 2002:* CVN students may also fax the assignment to me at 212-666-0140. Write on the cover sheet ATTN: Tony Jebara, CEPSR 605.
- *February 6th, 2002:* Please download assignment 1 from the links above. It will be due on February 19th. The reading schedule is above if you want to get a head start for next class.
- *February 4th, 2002:* My computer crashed so email response time and so forth will be slow for the next few days.
- *January 25, 2002:* Make sure you include a NEW password with your email so that I can give you access to the class web page for the text book. Your username will be the email address you mail me with (i.e. if your email address is 'joe@columbia.edu', then your username will be 'joe'). As usual, please use '6998' as the title of your email. The link to the text book is at the bottom of this web page.
- *January 23, 2002:* Please email jebaraATcsDOTcolumbiaDOTedu with the subject "6998". This email will add you the class mail list and give you permission to download the text. Include a short blurb about your background, previous courses, and your current projects.

COURSE BENEFITS

- Formal treatment of machine learning with statistics and graphical models
- Classification, modeling and prediction for many applied domains
- Research level exploration of current issues and trends in the field

PROFESSOR JEBARA

- Assistant Professor of Computer Science
- Various publications and research in machine learning community
- Applications in human-computer interfaces, computer vision

Lecturer/Manager:	Tony Jebara
Office Hours:	CEPSR 605, Tuesdays 2pm-4pm and Thursdays 2:30pm-3:30pm
Office Phone:	212-939-7079
E-mail Address:	jebaraATcsDOTcolumbiaDOTedu

Day & Time of Class:	Mondays 16:10-18:00
Class Location:	1024 MUDD
Class Homepage:	http://www.cs.columbia.edu/~jebara/6998-01
Credits for Course:	3
Class Type:	Lecture

Prerequisites:	Linear Algebra, Introductory Machine Learning or Introductory Statistics
Required Text(s):	• Introduction to Graphical Models by M. Jordan and C. Bishop. The authors have agreed to let us use the current online draft of the text which is scheduled to be published shortly. The files will be made available through a secure web page however, they have asked that these do not circulate outside the course. Please respect this while you use the online version. You will need to send me an email with a password (make up a NEW password just for this class) to see the book (as postscript or pdf files). A couple of days after you have mailed me, you should be able to follow this link: http://www.cs.columbia.edu/~jebara/6998-01/book . I will setup your user name from the first part of your email address which you send me the email with (i.e. 'joe@columbia.edu' will have a username 'joe'). Include a new made up password in the body of your email which will be attributed to your username. Please use '6998' as the title of your email.
Reference Text(s):	• Pattern Classification by Duda, Hart and Stork • Neural Networks for Pattern Recognition by Chris Bishop • Papers and handouts will be made available later in the term
Homework(s):	Roughly 5 problem sets. These will be assigned and due every 2 weeks.
Project(s):	A research project is required that uses course material in an applied setting or develops it further
Paper(s):	A conference style paper describing the project will be due at the end of the term.
Grading:	Problem Sets 50% and Project (paper & presentation) 50%
Software Requirements:	Programming (Matlab or C)
Homework Submission:	Due in class or email by start of class

COURSE OUTLINE FOR CURRENT SEMESTER

Tentative schedule (subject to change)

Course Outline for COMS E6998-1: Advanced Machine Learning

Original Date	Class No.	Semester Date	Topics/Chapters Covered	Assigned	Due
Jan. 28	1		Distributions, Bayesian Inference		
Feb. 4	2		Exponential Family and ML		
Feb. 11	3		Mixture Models and the EM Algorithm		
Feb. 18	4		Generative and Discriminative Learning		
Feb. 25	5		Graphical Models		
Mar. 4	6		Junction Tree Algorithm		
Mar. 11	7		Hidden Markov Models		
Mar. 25	8		Approximate and Variational Methods		
Apr. 1	9		Loopy Propagation		
Apr. 8	10		Generalization and Model Selection		
Apr. 15	11		Support Vector Machines, Kernels		
Apr. 22	12		Transduction, Feature Selection		
Apr. 29	13		Maximum Entropy, Duality		
May 6	14		Project Presentations		