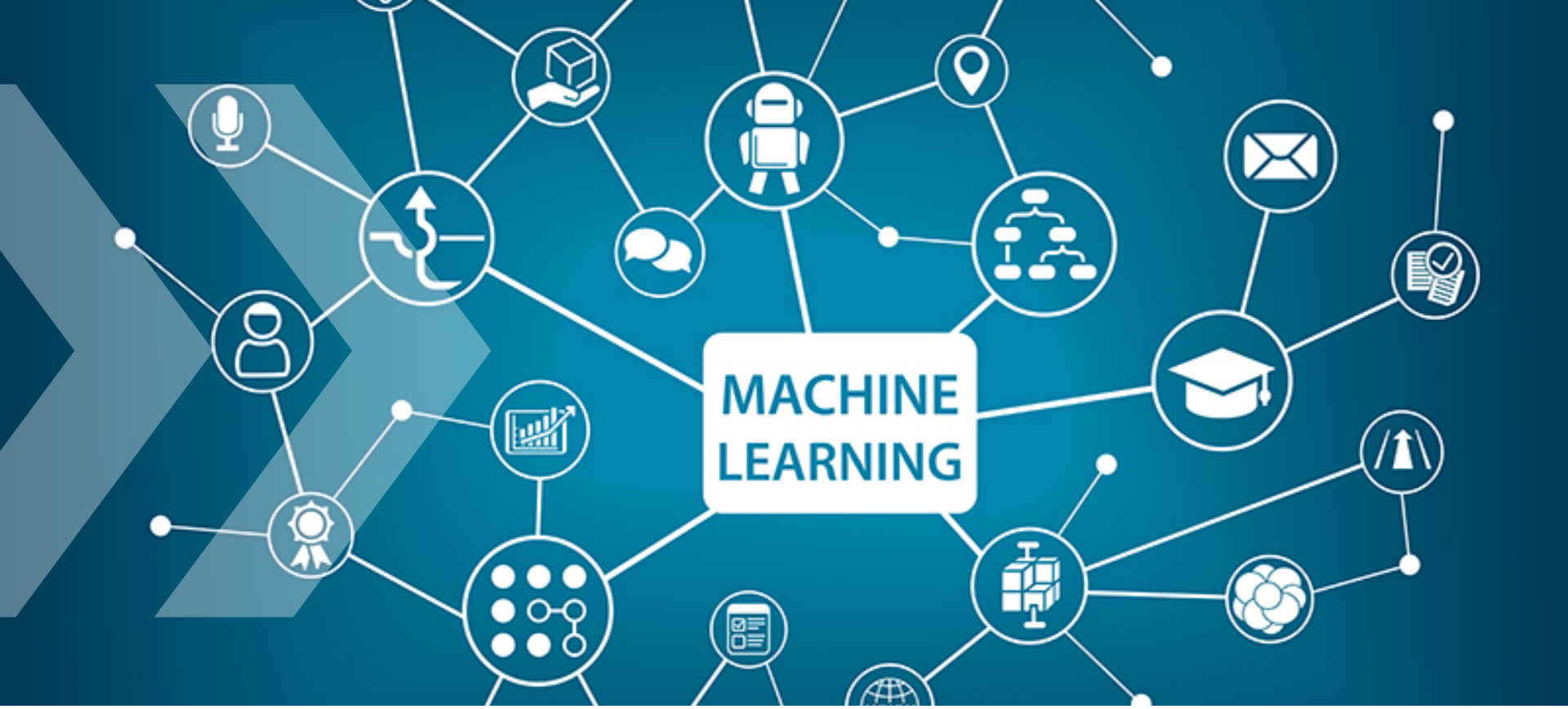

CS489/698: Intro to ML

Lecture 00: Introduction

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Outline

- Course Logistics
- Course Overview

Outline

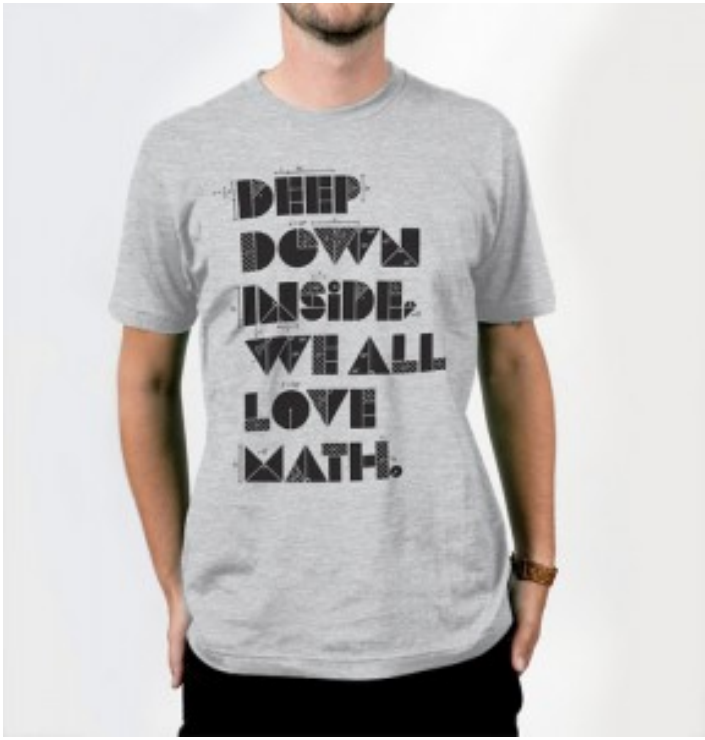
- Course Logistics
- Course Overview

Course Info

- Instructor: Yao-Liang Yu (yaoliang.yu@uwaterloo.ca)
  - Office hours: DC 3617, TTh 2:40 – 3:40
- TAs: Amir, Jingjing, Nicole, Nimesh, Shrinu
- Website: cs.uwaterloo.ca/~y328yu/mycourses/489
  - Syllabus, slides, policy, etc.
- Piazza: piazza.com/uwaterloo.ca/fall2017/cs489cs698/
  - Announcements, questions, discussions, etc.
- Learn: https://learn.uwaterloo.ca
  - Assignments, solutions, grades, etc.

Prerequisites

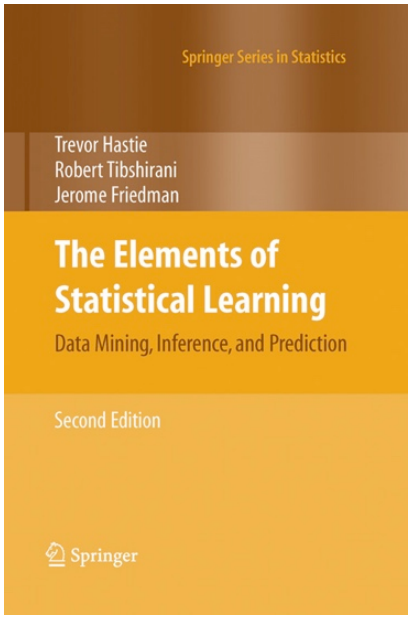
- CS341: basic understanding of algorithms and complexity analysis
- Programming

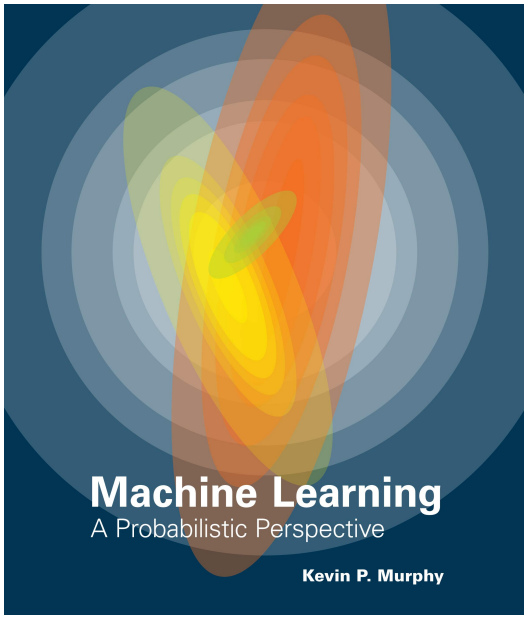


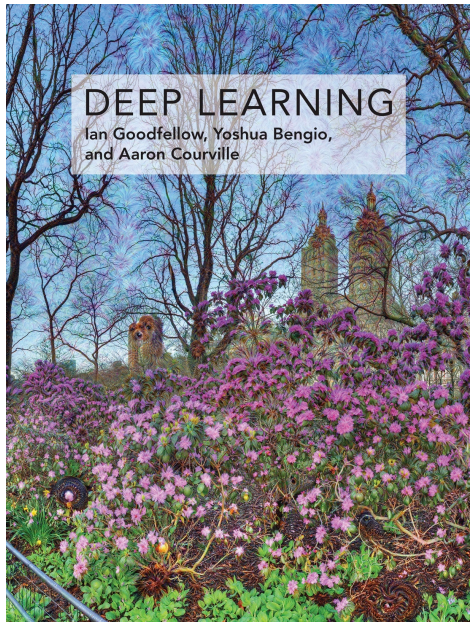
- Mathematical maturity

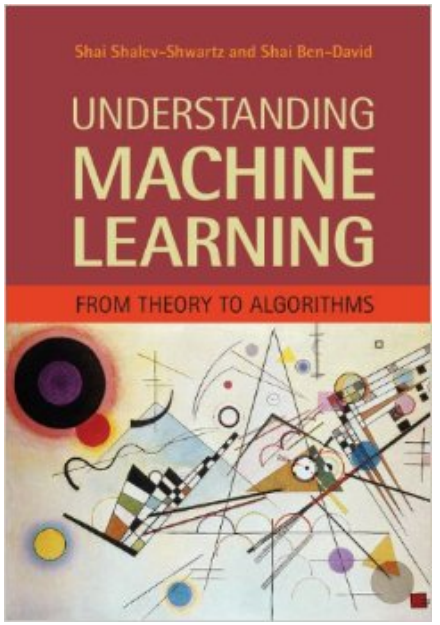
Textbook

- No required textbook
- Lecture notes or slides will be posted on course web
- Some fine textbooks:









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Assignments

- 5 assignments with the following tentative plan:

	Out date	Due date	CS489	CS698
A1	Sep. 12	Sep. 26	10%	5%
A2	Sep. 28	Oct. 12	10%	5%
A3	Oct. 17	Oct. 31	10%	5%
A4	Oct. 31	Nov. 14	10%	5%
A5	Nov. 16	Nov. 30	10%	5%
Proposal		Oct. 17	---	5%
Report		Dec. 3	5% bonus	30%

- Submit on LEARN. Submit early and often.
  - Typeset using LaTeX is recommended

Exam

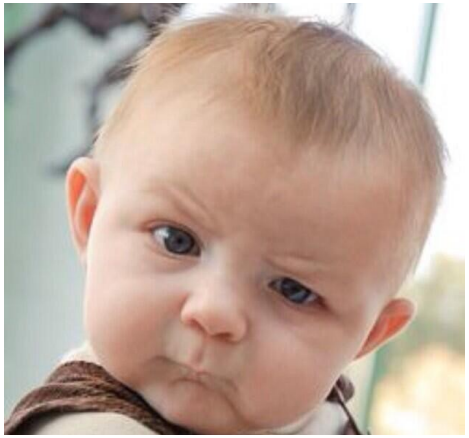
- No midterm

- Final exam
  - Open book
  - No electronics

CS489	CS698
50%	40%

Policy

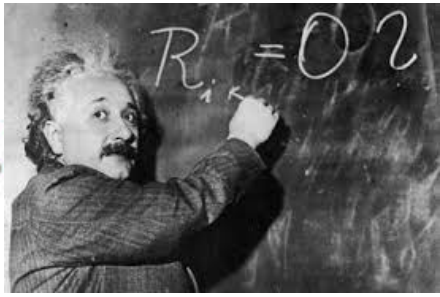
- Do your own work *independently and individually*
  - Discussion is fine, but no sharing of text or code
  - Explicitly acknowledge any source that helped you
- Ignorance is no excuse!
  - Good online discussion, more on course website
- Serious offence will result in expulsion…
- NO late submissions!
  - Except hospitalization, family urgency, …
- Appeal within two weeks, otherwise final



Project

- Required for CS698, optional for CS489 (5% bonus)
- You project should
  - Relate to machine learning (obviously)
  - Allow you to learn something new (and hopefully significant)
  - Be interesting and nontrivial (best if publishable)
- 1-page proposal and <= 8 pages report



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Questions?

Outline

- Course Logistics
- Course Overview

What is Machine Learning (ML)?

- "Machine learning is the field of study that gives computers the ability to learn without being explicitly programmed." --- Arthur Samuel (1959).

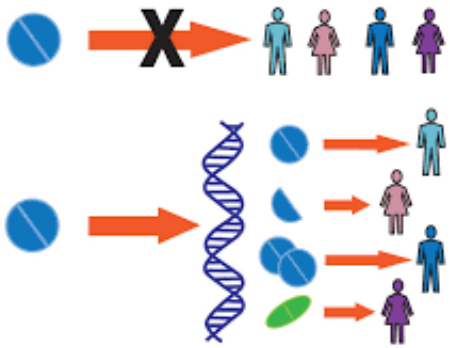
- "A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E." --- Tom Mitchell (1998)

Why is ML important for YOU?

- First off, you use ML everyday




- Lots of cool applications

- Excellent for job-hunting

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Learning Categories

Supervised

- Classification
- Regression
- Ranking

Teacher provides answer

Reinforcement

- Control
- Pricing
- Gaming

Teacher provides motivation

Unsupervised

- Clustering
- Visualization
- Representation

Surprise, surprise

Supervised learning

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Formally

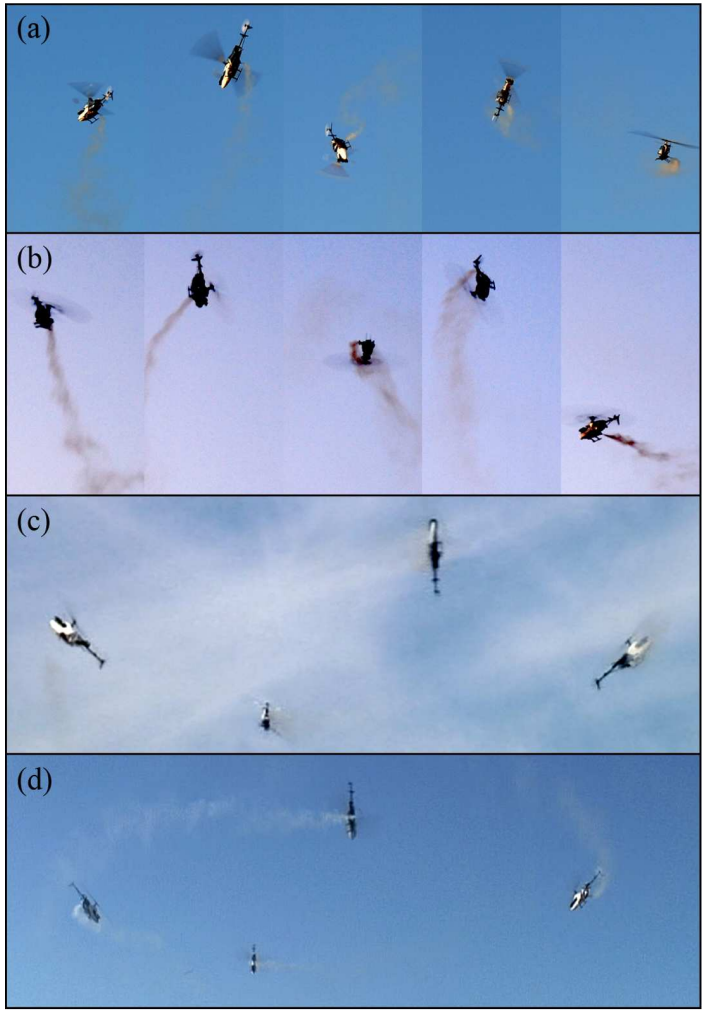
- Given a training set of pairs of examples $(\mathbf{x}_i, y_i)$
- Return a function f: X → Y
- On an unseen test example **x**, output f(**x**)
- The goal is to do well on unseen test data
  - Usually do not care about performance on training data

Reinforcement learning

- Not in this course…

- CS486/686

Silver et al., Nature'16



Abbeel et al., NIPS'06

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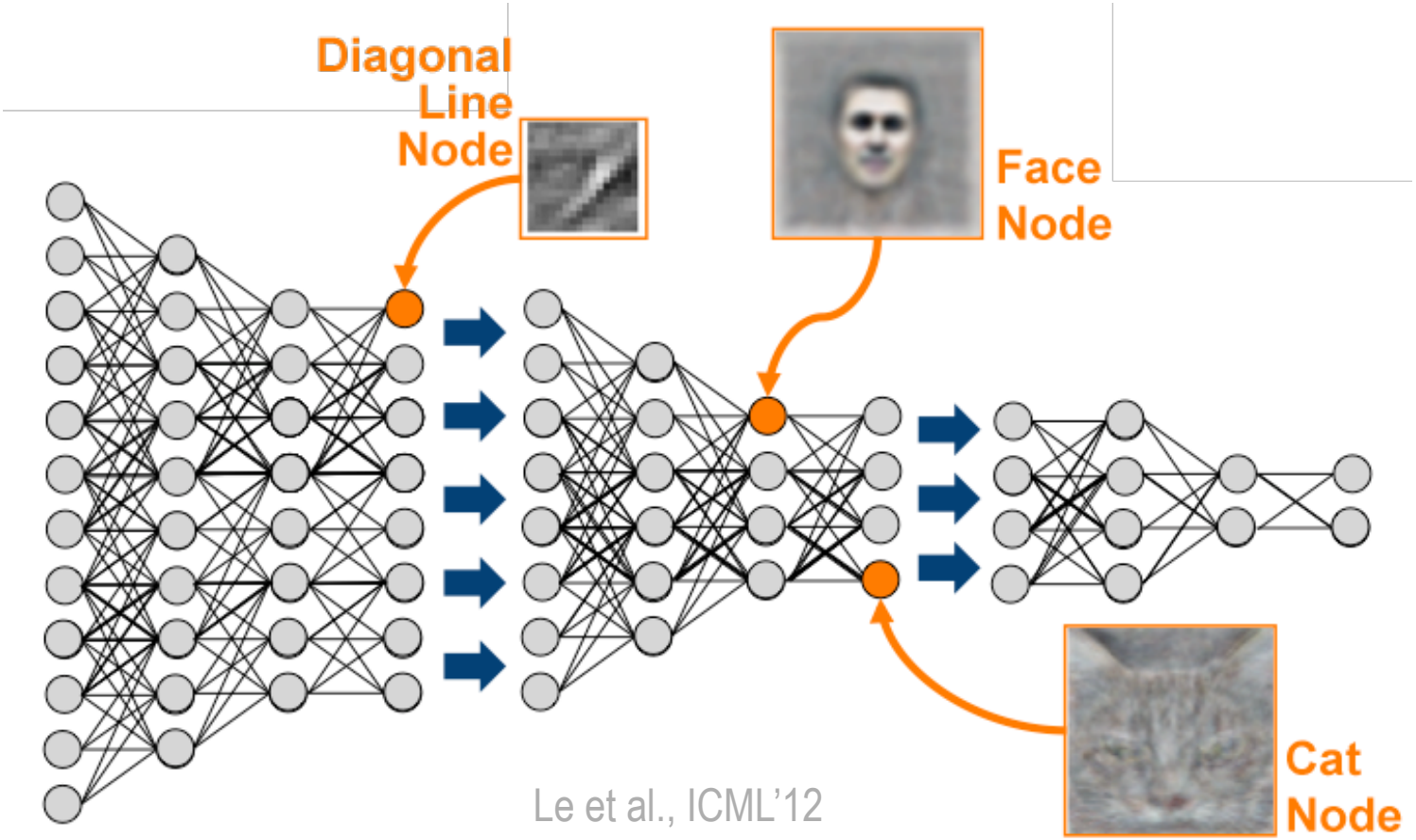
Unsupervised learning

- Let the data speak for itself!



Focus of ML research

- Representation and Interpretation
  - How to represent the data? How to interpret result?
- Generalization
  - How well can we do on test data? On a different domain?
- Complexity
  - How much time and space?
- Efficiency
  - How many samples?
- Applications

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Course Overview

	Date	Topic	Slides	Further Reading	Note
00	Sep 07, 2017	Introduction			
01	Sep 12, 2017	Statistical Learning Basics			hw1 out
02	Sep 14, 2017	Perceptron			
03	Sep 19, 2017	Multi-layer Perceptron (Neural Networks)			away
04	Sep 21, 2017	Linear Regression			away
05	Sep 26, 2017	Logistic Regression			hw1 due
06	Sep 28, 2016	K-nearest Neighbours			hw2 out
07	Oct 03, 2017	Support Vector Machines			
08	Oct 05, 2017	Structured Prediction			
09	Oct 10, 2017	Kernels			
10	Oct 12, 2017	Gaussian Processes			hw2 due
11	Oct 17, 2017	Fast Kernel Approximations			hw3 out, proposal due
12	Oct 19, 2017	Mixture of Gaussians			
13	Oct 24, 2017	Hidden Markov Models			
14	Oct 26, 2017	Deep Neural Networks			
15	Oct 31, 2017	Convolutional Neural Networks			hw3 due, hw4 out
16	Nov 02, 2017	Recurrent Neural Networks			
17	Nov 07, 2017	Autoencoders			
18	Nov 09, 2017	Generative Adversarial Networks			
19	Nov 14, 2017	Decision Trees			hw4 due
20	Nov 16, 2017	Bagging, Boosting and Random Forest			hw5 out
21	Nov 21, 2017	Sparse Methods			
22	Nov 23, 2017	Online Learning			
23	Nov 28, 2017	Collaborative Filtering			
24	Nov 30, 2017	Ranking			hw5 due
	Dec 3, 2017	no lecture			report due

Gimme, Gimme more

- Science special issue on AI
- Nature special issue on AI
- As always, google and wikipedia are your friends.

Questions?