Graphical Models

- **Origins:** AI, Statistical Physics, Information and Communication Theory
- **Age:** ~40 years
- **Nature:** Probability theory + graph theory
- **Abilities:** Complex models through local interactions
- **Special feats**: state-of-the-art in many domains
  - Bioinformatics
  - Coding theory
  - Combinatorial optimization
  - Vision
  - Speech recognition

Image from http://colingeller.blogspot.ca

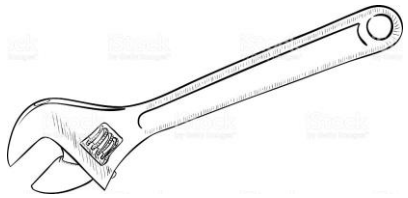
Graphical Models

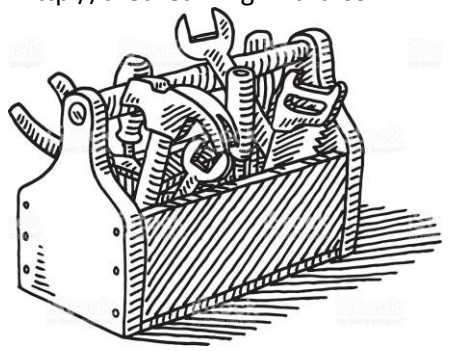
relationship to

Machine Learning ?

http://thedreamingwizard.com

- One tool in the toolbox of ML
- Many ML models are graphical models
  - E.g., PCA, HMM, ICA, LDS, LDA, RBM …
  - We will not study individual models





Tentative Syllabus

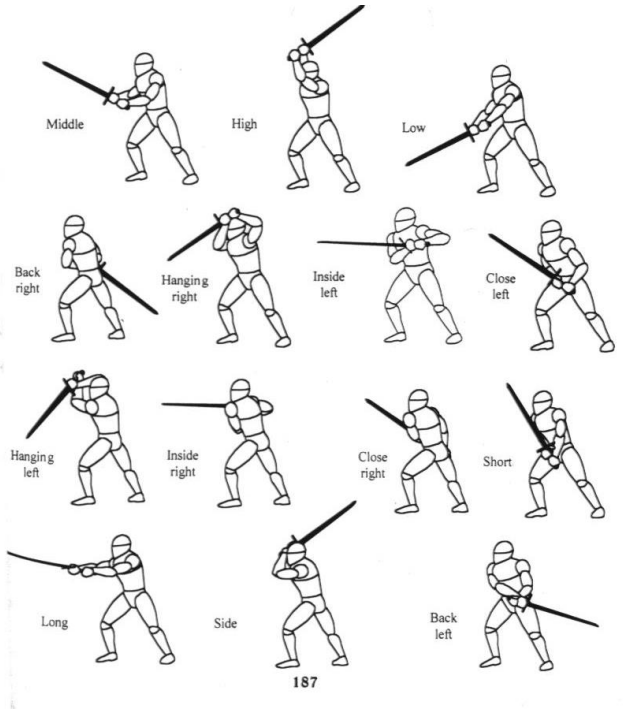
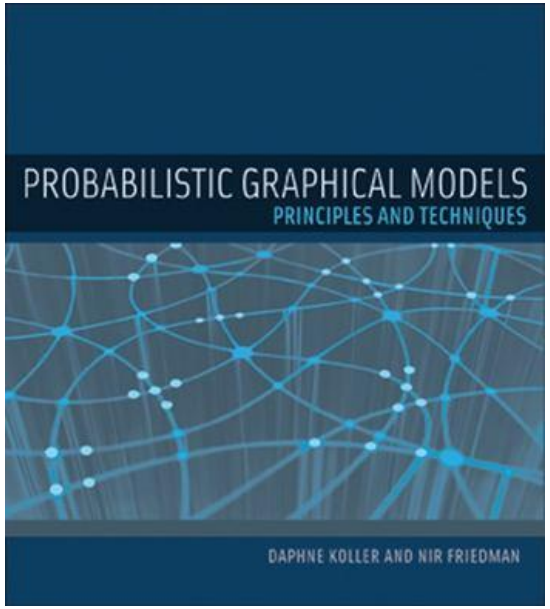


Image from www.tempera-nostra.de

- **Representation**
  - Bayesian and Markov networks
  - Algebraic generalizations and factor-graphs
  - Exponential Family
- **Inference**
  - Inference families and complexities
  - Exact Inference
  - MCMC
  - Variational Inference
- **Learning**
  - Parameter Estimation
  - Structure Learning
  - Deep Probabilistic Models (?)

Main reference: ~70% of material



By Koller and Friedman

Prerequisites

Familiarity with probability theory, algorithm design and programing
Highly Recommended: familiarity with ML and, Python

Instructor: Siamak Ravanbakhsh
XP level: beginner
Time: Tuesdays & Thursdays 3:30-5pm

Tentative **Evaluation** Plan

(Programming) Assignments: 50%
Course Project: 50%
Exam (?)

Image from http://colingeller.blogspot.ca