

Graduate Summer School: Probabilistic Models of Cognition: The Mathematics of Mind

Monday July 9, 2007

- 8:00–8:45 *Check-in & Continental Breakfast*
- 8:45–9:00 *Introductory Remarks*
- 9:00–10:00 **Josh Tenenbaum** (Massachusetts Institute of Technology)
Introduction to Probabilistic Models of Cognition
- 10:00–10:15 *Break*
- 10:15–11:15 **Josh Tenenbaum** (Massachusetts Institute of Technology)
Basic Bayes: model fitting, model selection, and model averaging
- 11:15–11:30 *Break*
- 11:30–12:30 **Nick Chater** (University College London)
From deduction and symbols to induction and probabilities
- 12:30–1:30 *Lunch (on your own)*
- 1:45–2:45 **Tom Griffiths** (University of California, Berkeley (UC Berkeley))
Introduction to Graphical Models
- 3:00–4:00 **Robert Jacobs** (University of Rochester)
Bayesian Decision Theory
- 4:00–4:30 *Break*
- 4:30–5:30 **Ying Nian Wu** (UCLA)
Information Theory
- 5:30–7:00 *Opening Reception hosted by IPAM (IPAM Building)*
- 7:00–12:00 **Optional Evening Session - Nick Chater, Tom Griffiths, Josh Tenenbaum, "Subjective probability and Bayesian foundations"

Matlab tutorial, by Amy Perfors*

Tuesday July 10, 2007

- 8:00–9:00 *Continental Breakfast*
- 9:00–10:00 **Alan Yuille** (University of California, Los Angeles (UCLA))
Graphical Models in Vision
- 10:00–10:15 *Break*

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- 10:15–11:15 **Alan Yuille** (University of California, Los Angeles (UCLA))
HMMs and inference in graphical models I
- 11:15–11:30 *Break*
- 11:30–12:30 **Robert Jacobs** (University of Rochester)
Ideal Observers and Ideal Actors
- 12:30–1:30 *Lunch (on your own)*
- 1:45–2:45 **Hongjing Lu** (University of Hong Kong)
Comparisons between human performance and model predictions in motion perception
- 3:00–4:00 **Alan Yuille** (University of California, Los Angeles (UCLA))
HMMs and inference in graphical models II
- 4:00–4:30 *Break*
- 4:30–5:30 **Robert Jacobs** (University of Rochester)
Sensory Cue Combination
- 7:00–12:00 **Optional Evening Session - Introduction to software for Bayesian modeling: SamIAM, Bayes Net Toolbox (BNT)*

Wednesday July 11, 2007

- 8:00–9:00 *Continental Breakfast*
- 9:00–10:00 **Zoubin Ghahramani** (University of Cambridge)
Probabilistic generative models and unsupervised learning I
- 10:00–10:15 *Break*
- 10:15–11:15 **Zoubin Ghahramani** (University of Cambridge)
Probabilistic generative models and unsupervised learning II
- 11:15–11:30 *Break*
- 11:30–12:30 **Zoubin Ghahramani** (University of Cambridge)
Nonparametric Bayesian Models
- 12:30–1:30 *Lunch (on your own)*
- 1:45–2:45 *Breakout Session*
Zoubin Ghahramani
Questions on generative models and nonparametric Bayes
- 3:00–4:00 **Tom Griffiths** (University of California, Berkeley (UC Berkeley))
Modern Monte Carlo methods I: Importance sampling and sequential Monte Carlo
- 4:00–4:30 *Break*

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- 4:30–5:30 **Tom Griffiths** (University of California, Berkeley (UC Berkeley))
Modern Monte Carlo methods II: Markov chain Monte Carlo
- 7:00–12:00 *Optional Evening Session - Nick Chater, "Scale invariance in human cognition"
PowerPoint Presentation

Thursday July 12, 2007

- 8:00–9:00 *Continental Breakfast*
- 9:00–10:30 **Zoubin Ghahramani** (University of Cambridge)
Bayesian supervised learning and semi-supervised learning
- 10:30–11:00 *Break*
- 11:00–12:30 **Ying Nian Wu** (UCLA)
Hierarchical Bayesian Models
- 12:30–1:30 *Lunch (on your own)

Charles Kemp, Amy Perfors, Josh Tenenbaum
Learning overhypotheses with hierarchical Bayesian models*
- 1:45–2:45 *Breakout Sessions

Zoubin Ghahramani, Yingnian Wu

Technical questions on Bayesian models

Tom Griffiths

MCMC with humans, and other questions on MCMC

"Practical experiments with simple Bayesian models", Amy Perfors*
- 3:00–4:15 **Josh Tenenbaum** (Massachusetts Institute of Technology)
Hierarchical Bayesian models of human inductive learning
- 4:15–4:30 *Break*
- 4:30–5:30 **Nick Chater** (University College London)
Information theory, minimum description length, and human cognition
- 7:00–12:00 *Optional Evening Session - Michael Lee, "Bayesian model theoretics and BUGS"

Friday July 13, 2007

- 8:00–9:00 *Continental Breakfast*
- 9:00–9:45 **Ying Nian Wu** (UCLA)
Causal Models
- 9:50–10:45 **Tom Griffiths** (University of California, Berkeley (UC Berkeley))
Graphical models and human causal learning
- 10:45–11:15 *Break*

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- 11:15–12:00 **Hongjing Lu** (University of Hong Kong)
Model selection versus parameter estimation in Bayesian inference: An application to causal learning
- 12:05–12:50 **Patricia Cheng** (University of California, Los Angeles (UCLA))
Causal Reasoning in Humans and Rats
- 12:50–2:00 *Lunch (on your own)*
Breakout Sessions
Ed Vul
<http://www.mit.edu/~evul/ipam07/> "Bayes Net Toolbox causal model demo"
- 2:00–3:00 **Alison Gopnik** (University of California, Berkeley (UC Berkeley))
Causal Learning in Children
- 3:15–4:00 **Tom Griffiths** (University of California, Berkeley (UC Berkeley))
Modeling causal learning in children
- 4:00–4:30 *Break*
- 4:30–5:30 **Keith Holyoak** (University of California, Los Angeles (UCLA))
From Causal Models to Analogical Inference

Monday July 16, 2007

- 8:00–9:00 *Check-in & Continental Breakfast*
- 9:00–10:00 **Stuart Russell** (University of California, Berkeley (UC Berkeley))
Probability for Worlds with Things in Them
- 10:00–10:15 *Break*
- 10:15–11:15 **Brian Milch** (Massachusetts Institute of Technology)
Relational Probability Models
- 11:15–11:30 *Break*
- 11:30–12:30 **Brian Milch** (Massachusetts Institute of Technology)
Unknown Objects and BLOG
- 12:30–1:30 *Lunch (on your own)*
- 1:45–2:45 *Breakout Sessions*
Stuart Russell, Brian Milch
Questions on first-order probability and BLOG
- 3:00–4:00 **Josh Tenenbaum** (Massachusetts Institute of Technology)
First-order probabilistic models in human cognition
- 4:00–4:30 *Break*

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- 4:30–5:30 **Charles Kemp** (Massachusetts Institute of Technology)
Learning relational theories
- 7:00–12:00 *Optional Evening Session - Stanley Kok, Markov Logic Networks (MLNs) and the Alchemy system
Presentation (PowerPoint)

Tuesday July 17, 2007

- 8:00–9:00 *Continental Breakfast*
- 9:00–10:00 **Stuart Geman** (Brown University)
Hierarchy and Reusability in Image Analysis I
- 10:00–10:15 *Break*
- 10:15–11:15 **Stuart Geman** (Brown University)
Hierarchy and Reusability in Image Analysis II
- 11:15–11:30 *Break*
- 11:30–12:30 **Alan Yuille** (University of California, Los Angeles (UCLA))
Image Parsing
- 12:30–1:30 *Lunch (on your own)*
- 1:45–2:45 *Breakout Session

Stuart Geman/Alan Yuille
Questions on grammars for image parsing

Stanley Kok
Questions on MLNs and Alchemy*
- 3:00–4:00 **Fei-Fei Li** (Princeton University)
Discovering Meaning in the Visual World
- 4:00–4:30 *Break*
- 4:30–5:30 **Dan Kersten** (University of Minnesota, Twin Cities)
Human Object Perception: Bottom-up and Top-down
- 7:00–12:00 *Optional Evening Session: Stuart Russell, Brian Milch, Josh Tenenbaum, Charles Kemp, et al:
Discussion on connections between Cognitive Science and AI.

Wednesday July 18, 2007

- 8:00–9:00 *Continental Breakfast*
- 9:00–10:00 **Mark Johnson** (Brown University)
An introduction to grammars and parsing for language 1
- 10:00–10:15 *Break*

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- 10:15–11:15 **Mark Johnson** (Brown University)
An introduction to grammars and parsing for language 2
Updated Presentation
- 11:15–11:30 *Break*
- 11:30–12:30 **Roger Levy** (University of California, San Diego)
Probabilistic sentence processing 1
- 12:30–1:30 *Lunch (on your own)*
- 1:45–2:45 *Breakout Session*
Roger Levy, Mark Johnson
Questions on grammars for language, and connections between human and machine language research
Noah Goodman
Probabilistic grammars for concept learning
- 3:00–4:00 **Roger Levy** (University of California, San Diego)
Probabilistic sentence processing 2
- 4:00–4:30 *Break*
- 4:30–5:30 **Mark Steyvers** (University of California, Irvine (UCI))
Semantic Representations with Probabilistic Topic Models
- 5:30–7:00 *Reception hosted by IPAM (IPAM Building)*

Thursday July 19, 2007

- 8:00–9:00 *Continental Breakfast*
- 9:00–10:00 **Peter Dayan** (University College London)
Models of conditioning
- 10:00–10:15 *Break*
- 10:15–11:15 **John Kruschke** (Indiana University)
Locally Bayesian Learning
- 11:15–11:30 *Break*
- 11:30–12:30 **Nathaniel Daw** (New York University)
Advanced conditioning: competition and graphical models
- 12:30–1:30 *Lunch (on your own)*
- 1:45–2:45 *Breakout Session*
Stuart Russell, Peter Dayan
Questions and dialog on reinforcement learning
- 3:00–4:00 **Stuart Russell** (University of California, Berkeley (UC Berkeley))
Reinforcement Learning
- 4:00–4:30 *Break*

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4:30–5:30 **Angela Yu** (Princeton University)
Bayesian Decision Theory and Sequential Sampling

Friday July 20, 2007

8:00–9:00 *Continental Breakfast*

9:00–10:00 **Bernard Balleine** (UCLA)
Neural Substrates for Conditioning

10:00–10:15 *Break*

10:15–11:15 **Peter Dayan** (University College London)
Neural representation of value, reward and expectation

11:15–11:30 *Break*

11:30–12:30 **Nathaniel Daw** (New York University)
Reinforcement learning in human neuroimaging; uncertainty-based competition

12:30–1:30 *Lunch (on your own)*

1:45–2:45 *Breakout Session*
Peter Dayan, Josh Tenenbaum, Angela Yu, & others
Neural representations of probability distributions
Jeffrey Beck (University of Rochester)
Bayesian Inference, Action Selection, and Learning with Probabilistic Population Codes
[Presentation \(PDF File\)](http://www.ipam.ucla.edu/publications/gss2007/beck.pdf)

3:00–4:00 **Stuart Russell** (University of California, Berkeley (UC Berkeley))
Hierarchical reinforcement learning

4:00–4:30 *Break*

4:30–5:30 **Josh Tenenbaum** (Massachusetts Institute of Technology)
Models of human action understanding and social cognition as inverse decision-making

Monday July 23, 2007

8:00–9:00 *Check-in & Continental Breakfast*

9:00–10:00 **Laurence Maloney** (New York University)
Statistical decision theory as a framework for cognition and action.

10:00–10:15 *Break*

10:15–11:15 **Nathaniel Daw** (New York University)
Neuro- and behavioral economic analysis of human choice and learning

11:15–11:30 *Break*

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- 11:30–12:30 **Konrad Koerding** (Northwestern University Medical School)
Using Decision Theory to understand Motor Control
- 12:30–1:30 *Lunch (on your own)*
- 1:45–2:45 *Breakout Session*
Craig Fox (UCLA)
Prospect theory and support theory
Reading: http://www.ipam.ucla.edu/publications/gss2007/gss2007_fox.pdf "Belief and Preference in Decision Under Uncertainty", by Craig R. Fox & Kelly E. See
See http://www.ipam.ucla.edu/publications/gss2007/Fox_ProspectTheory.pdf Presentation (PDF File)
- 3:00–4:00 **Josh Tenenbaum** (Massachusetts Institute of Technology)
Rational analysis of human memory and prediction
- 4:00–4:30 *Break*
- 4:30–5:30 **Rich Shiffrin** (Indiana University)
Bayesian models of memory retrieval

Tuesday July 24, 2007

- 8:00–9:00 *Continental Breakfast*
- 9:00–10:00 **Amy Perfors** (Massachusetts Institute of Technology)
Grammar induction in language
- 10:00–10:15 *Break*
- 10:15–11:15 **Alan Yuille** (University of California, Los Angeles (UCLA))
Grammar induction in vision
- 11:15–11:30 *Break*
- 11:30–12:15 **Josh Tenenbaum** (Massachusetts Institute of Technology)
Cognitive development as a computational challenge: the grammar analogy
- 12:15–1:15 *Lunch (on your own)*
- 1:30–2:30 *Breakout Session*
Opportunities for mathematicians and statisticians in cognitive science and neuroscience, with Alan Yuille, Mark Green, Yingnian Wu, Noah Goodman, others
Faculty Center
- 2:45–3:30 **Charles Kemp** (Massachusetts Institute of Technology)
The development of structured representations
- 3:30–3:50 *Break*
- 3:50–4:25 **Tom Griffiths** (University of California, Berkeley (UC Berkeley))
Development of Causal Theories
- 4:25–4:45 *Break*

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- 4:45–5:30 **Noah Goodman** (Massachusetts Institute of Technology)
Learning to be causal
- 7:30–12:00 *Discussion and Q & A on grammar induction and unsupervised learning for structured statistical models with Alan Yuille, Josh Tenenbaum, Noah Goodman and Tom Griffiths*
Math Sci 4000A

Wednesday July 25, 2007

- 8:00–9:00 *Continental Breakfast*
- 9:00–10:00 **Konrad Koerding** (Northwestern University Medical School)
Causal Inference in Motor Learning and Adaptation
- 10:00–10:15 *Break*
- 10:15–11:15 **Ladan Shams** (UCLA)
Multisensory integration-segregation as Bayesian inference
- 11:15–11:30 *Break*
- 11:30–12:30 **Jerome Busemeyer** (Indiana University)
Challenges for Bayes
- 12:30–1:30 *Lunch (on your own)*
- 1:45–12:00 *Symposium (Future Challenges): Josh Tenenbaum, Tom Griffiths, Alan Yuille, Keith Holyoak, Rich Shiffrin*

Thursday July 26, 2007

- 8:00–9:00 *Continental Breakfast*
- 9:00–10:00 *Student Research Symposium*