Discussion of homework due beginning of Class 12b

- Computing problem
- Computing problem
- Applied problem
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- Computing problem
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- Applied problem
Computing problem

- Spline model predicting $\Pr(\text{know someone gay})$, given age, sex, and race
- MCMC, variational Bayes, expectation propagation, Stan, or any other method
Computing problem

- Spline model predicting $Pr$ (know someone gay), given age, sex, and race
- MCMC, variational Bayes, expectation propagation, Stan, or any other method
Computing problem

- Spline model predicting $\text{Pr}$ (know someone gay), given age, sex, and race
- MCMC, variational Bayes, expectation propagation, Stan, or any other method
Computing problem

- Gaussian process model
Computing problem

- Gaussian process model
Applied problem

- Attitudes toward gay marriage given party ID and # gay people known
- What did you find?
Applied problem

- Attitudes toward gay marriage given party ID and # gay people known
- What did you find?
Applied problem

- Attitudes toward gay marriage given party ID and # gay people known
- What did you find?
23. Dirichlet process models

- Mixtures with (potentially) infinite number of components
- New classes of probability models
23. Dirichlet process models

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- New classes of probability models
23.1. Bayesian histograms

- Histogram density estimator with fixed number of knots
- Nonparametric or flexibly parametric?
23.1. Bayesian histograms

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- Nonparametric or flexibly parametric?
23.1. Bayesian histograms

- Histogram density estimator with fixed number of knots
- Nonparametric or flexibly parametric?
Is hierarchical Bayes nonparametric?

- 8-schools model
  - Normal distribution, thus parametric?
  - Estimates are not restricted to a subspace, thus nonparametric?
- Hierarchical regression with group-level predictors
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  - AP and math grades example
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23.2. Dirichlet process prior distributions

- Potentially infinite number of bins
- Stick-breaking process
- Infinite set of probabilities
- For any finite $n$, only a finite number of components appear
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Samples from the stick-breaking process

\[ \alpha = 0.5 \]

\[ \alpha = 1 \]

\[ \alpha = 5 \]

\[ \alpha = 10 \]
23.3. Dirichlet process mixtures

- Dirichlet process for mixture model
- Chinese restaurant process
- Computing using Gibbs sampler
- Weakly-informative hyperprior?
23.3. Dirichlet process mixtures

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23.4. Beyond density estimation

- Residuals for regressions
- Nonparametric distributions for hierarchical models
- Basis-function models
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- Residuals for regressions
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23.5. Hierarchical dependence

- Estimating multiple unknown distributions
- Dependent Dirichlet process (DDP)
- Restricted DDP
- Hierarchical DDP
- Nested Dirichlet process
23.5. Hierarchical dependence

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Estimating multiple unknown distributions

0 micromoles

5 micromoles

20 micromoles

50 micromoles
Restricted DDP

0 mm H₂O₂

20 mm H₂O₂

100 mm H₂O₂

0 minutes repair

60 minutes repair

90 minutes repair

andrew gelman
bayesian data analysis, class 12b
23.6. Density regression

- Dependent stick-breaking processes
- Kernel stick-breaking process
- Probit stick-breaking process
23.6. Density regression

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  - Kernel stick-breaking process
  - Probit stick-breaking process
23.6. Density regression

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- Kernel stick-breaking process
- Probit stick-breaking process
23.6. Density regression

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- Kernel stick-breaking process
- Probit stick-breaking process
Summary of Chapter 23

- Potentially infinite number of mixture components
- Density estimation as a starting point
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- Potentially infinite number of mixture components
- Density estimation as a starting point
Bayesian data analysis

- The three steps!
- Building confidence in classes of models
- What is the role of theory?
- Open questions
- Where will statistics be in 20 years?
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