Conjugate priors

Quiz, 6 questions

Congratulations! You passed!

Next Item

1 / 1 point

1.
Prior is said to be conjugate to a likelihood function if:

- (selected) the posterior would stay in the same family of distributions as prior

Correct
Posterior and prior are both distributions over θ, so they can lie in the same family

- the prior lies in the same family of distributions as the likelihood
- the prior, the likelihood function and the posterior would be in a same family of distributions
- the prior is from the same family of distributions as the likelihood

---

1 / 1 point

2.
Finding a conjugate prior is useful because:

- [ ] It leads to a better MAP estimate

Un-selected is correct

- [ ] It is the only prior for which it is possible to perform analytical inference

Un-selected is correct

- [x] As long as posterior will stay in the same family with prior, the integral $p(x_{new} \mid x) = \int p(x_{new} \mid \theta) p(\theta \mid x) d\theta$ which is used for prediction is also tractable

Correct
This integral is called the evidence and it can be computed analytically if prior, likelihood and posterior are known

- [x] We can perform analytical inference and find posterior distribution instead of taking point MAP estimate

Correct
Since posterior lies in a known family of distributions, we will be able to perform analytical inference

---

1 / 1 point

3.

Out of the following pairs of priors and likelihood functions, choose those that are conjugate:

- [x] $\Gamma(\lambda \,|\, \alpha, \beta)$ prior over parameter λ of $Exp(x \,|\, \lambda)$ likelihood ($\Gamma(x, \,|\, \alpha, \beta) = \frac{\beta^\alpha}{\Gamma(\alpha)} x^{\alpha-1} e^{-\beta x}$ and $Exp(x \,|\, \lambda) = \lambda e^{-\lambda x}$)

Correct
Multiplying these distribution and grouping the terms will lead to gamma distribution again

- [x] $\mathcal{N}(\mu_1 \,|\, m, s^2)$ prior over parameter μ_1 for $\mathcal{N}(X \,|\, \mu_1, \sigma_1^2)$ likelihood

Correct
This example was discussed in a lecture

- [ ] $\Gamma(\sigma_1^2 \,|\, \alpha, \beta)$ prior over parameter σ_1^2 of $\mathcal{N}(X \,|\, \mu_1, \sigma_1^2)$ likelihood

Un-selected is correct

- [ ] $\mathcal{N}(\sigma_1^2 \,|\, m, s^2)$ prior over parameter σ_1^2 of $\mathcal{N}(X \,|\, \mu_1, \sigma_1^2)$ likelihood

Un-selected is correct

---

1 / 1
point

4.
Which of the following prior distributions over parameter σ^2 are conjugate to likelihood $\mathcal{N}(x \,|\, \mu, \sigma^2)$?

- [ ] $Exp(\sigma^2 \,|\, \lambda) = \lambda e^{-\lambda \sigma^2}$

Un-selected is correct

- [ ] $\mathcal{N}(\sigma^2 \,|\, \mu_1, \sigma_1^2)$

Un-selected is correct

- [x] Inverse gamma with pdf $p(\sigma^2 \,|\, \alpha, \beta) = \frac{\beta^\alpha}{\Gamma(\alpha)(\sigma^2)^{-\alpha-1}\exp\left(-\frac{\beta}{\sigma^2}\right)}$

Correct
Multiplying these distribution and grouping the terms will lead to normal distribution

- [x] Scaled inverse chi-squared with pdf $f(\sigma^2 \,|\, \nu, \tau) = \frac{\left(\tau^2\nu/2\right)^{\nu/2}}{\Gamma(\nu/2)} \frac{\exp\left(-\frac{\nu\tau^2}{2\sigma^2}\right)}{(\sigma^2)^{1+\nu/2}}$

Correct
Multiplying these distribution and grouping the terms will lead to normal distribution

---

1 / 1
point

5.
Choose the correct statements:

- [x] Putting initial knowledge into prior distribution is an advantage of Bayesian approach

Correct
That's the one

Conjugate priors

Quiz, 6 questions

- [ ] Although not for every pair of prior and likelihood there is an analytical expression for posterior, we can always find a conjugate prior in some simple family and compute posterior analytically

Un-selected is correct

- [x] For some problems conjugate prior may be inadequate

Correct
That's true

- [ ] For arbitrary likelihood and prior pair, we can always perform inference and compute posterior analytically

Un-selected is correct

---

1 / 1
point

6.
Imagine that you want to pat your friend's cat Becky. Cats are really random creatures.

Becky might get grumpy and scratch you with probability p or curl up and start purring (with prob. $1-p$). You don't know Becky well yet, so you estimate prior on p to be distributed as $Beta(2,2)$. Within one evening, Becky has scratched you 6 times and only 2 times she purred. What will be the parameters for posterior distribution over p? What is the MAP-estimate for p?

Enter your answers separated by comma: e.g. if you think that correct answer is $Beta(1, 0.2)$ and MAP is 3, you should enter 1,0.2,3. Express real numbers as decimals with dot as delimiter.

8,4,0.7

Correct Response
