Bayesian data analysis – reading instructions 7

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Chapter 7

Outline of the chapter 7

- 7.1 Measures of predictive accuracy
- 7.2 Information criteria and cross-validation
- 7.3 Model comparison based on predictive performance
- 7.4 Model comparison using Bayes factors
- 7.5 Continuous model expansion / sensitivity analysis
- 7.5 Example (may be skipped)

See also updated information on computation of cross-validation and comparison to WAIC

- Basics of cross-validation tutorial at StanCon 2018 Helsinki https://www.youtube.com/watch?v=hpr8pxqkCH8
- Model selection tutorial at StanCon 2018 Asilomar https://www.youtube.com/watch?v=FUROJM3u5HQ
- Aki Vehtari, Andrew Gelman and Jonah Gabry (2016). Efficient implementation of leave-one-out cross-validation and WAIC for evaluating fitted Bayesian models. In Statistics and Computing, 27(5):1413-1432, doi:10.1007/s11222-016-9696-4. arXiv preprint arXiv:1507.04544. http://arxiv.org/abs/1507.04544

Find all the terms and symbols listed below. When reading the chapter, write down questions related to things unclear for you or things you think might be unclear for others.

- predictive accuracy/fit/error
- external validation
- cross-validation
- information criteria
- overfitting
- measures of predictive accuracy
- point prediction
- scoring function
- mean squared error
- probabilistic prediction
- scoring rule
- logarithmic score
- log-predictive density
- out-of-sample predictive fit
- elpd, elppd, lppd
- deviance
- within-sample predictive accuracy

- adjusted within-sample predictive accuracy
- AIC, DIC (less important)
- WAIC (important)
- effective number of parameters
- singular model
- BIC (less important)
- leave-one-out cross-validation
- evaluating predictive error comparisons
- bias induced by model selection
- Bayes factors
- continuous model expansion
- sensitivity analysis

Additional reading

See more theoretical details in

- Aki Vehtari and Janne Ojanen (2012). A survey of Bayesian predictive methods for model assessment, selection and comparison. In Statistics Surveys, 6:142-228. http://dx.doi.org/10.1214/12-SS102

See more experimental comparisons in

- Juho Piironen and Aki Vehtari (2017). Comparison of Bayesian predictive methods for model selection. Statistics and Computing, 27(3):711-735. doi:10.1007/s11222-016-9649-y. http://link.springer.com/article/10.1007/s11222-016-9649-y

Posterior probability of the model vs. predictive performance

Gelman: "To take a historical example, I don't find it useful, from a statistical perspective, to say that in 1850, say, our posterior probability that Newton's laws were true was 99%, then in 1900 it was 50%, then by 1920, it was 0.01% or whatever. I'd rather say that Newton's laws were a good fit to the available data and prior information back in 1850, but then as more data and a clearer understanding became available, people focused on areas of lack of fit in order to improve the model."