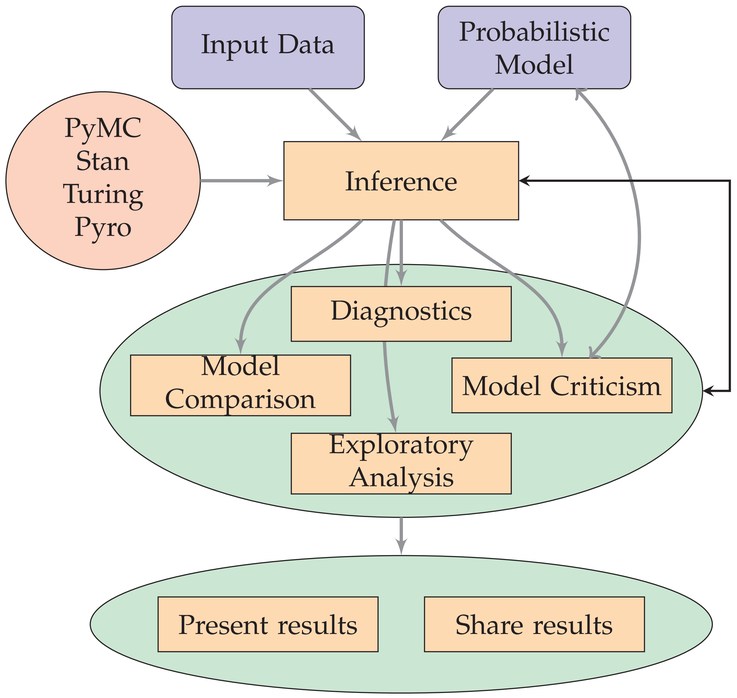
BACKEND AGNOSTIC EXPLORATORY ANALYSIS OF BAYESIAN MODELS

ORIOL ABRIL PLA*, ALEX ANDORRA, AGUSTINA ARROYUELO, SETH D AXEN, COLIN CARROLL, PIYUSH GAUTAM, ARI HARTIKAINEN, RAVIN KUMAR, OSVALDO A MARTIN, MITZI MORRIS, AKI VEHTARI

INTRODUCTION

Probabilistic programming and frameworks for it have grown significantly in recent years and become an important field on its own in both academia and industry. Robust modeling workflows require a wide set of tools beyond inference itself.



ArviZ aims to provide a comprehensive set of statistical and visualization tools to ease such tasks.

INFERENCEDATA CREATION

PyMC3 PyStan Soss

CONTACT

Contact mail: oriol.abril.pla@gmail.com
Code: github.com/OriolAbril/arviz-probprog-2020

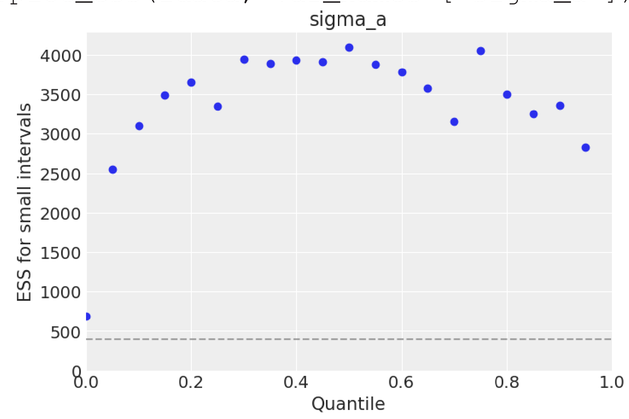
DIAGNOSTICS

ArviZ strives to set sensible defaults and to implement the latest published algorithms.

```
az.summary(idata, var_names=["g", "b"])
```

	mean	sd	hdi_3%	hdi_97%	mcse_mean	mcse_sd	ess_mean	ess_sd	ess_bulk	ess_tail	r_hat
g[0]	1.464	0.039	1.392	1.537	0.001	0.001	2126.0	2111.0	2138.0	2237.0	1.0
g[1]	0.726	0.094	0.560	0.914	0.002	0.001	2343.0	2343.0	2349.0	2485.0	1.0
b	-0.665	0.070	-0.801	-0.537	0.001	0.001	4158.0	4031.0	4162.0	2854.0	1.0

```
az.plot_ess(idata, var_names=["sigma_a"])
```



MODEL COMPARISON

ArviZ has PSIS-LOO (and reloo), WAIC and also supports them for hierarchical models

```
log_lik["y"].groupby(const["county_idx"]).sum()
az.loo(idata, var_name="by_county")
```

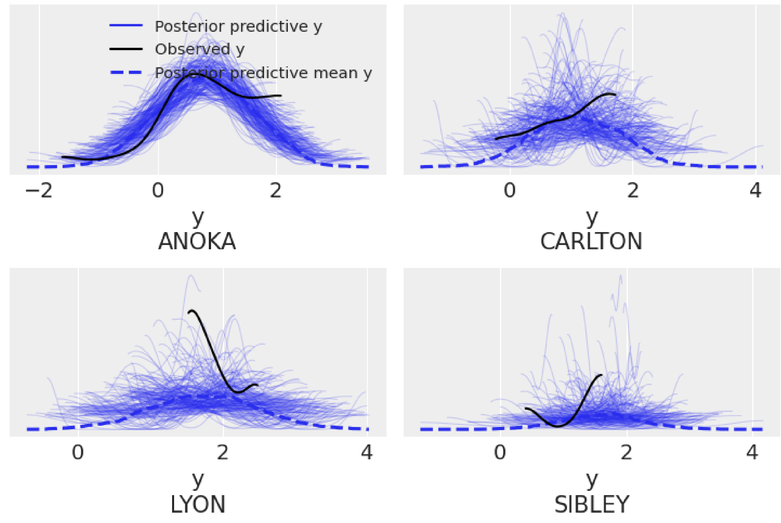
```
Computed from 4000 by 85 log-likelihood matrix

         Estimate       SE
elpd_loo -1065.82   191.54
p_loo       23.87        -

There has been a warning during the calculation.
------

Pareto k diagnostic values:
                         Count   Pct.
(-Inf, 0.5]   (good)       59   69.4%
 (0.5, 0.7]   (ok)         23   27.1%
   (0.7, 1]   (bad)         3    3.5%
   (1, Inf)   (very bad)    0    0.0%
```

REFERENCES

[1] Ravin Kumar et al. “ArviZ a unified library for exploratory analysis of Bayesian models in Python”. In: *J. Open Source Software* 4 (2019), p. 1143. DOI: 10.21105/joss.01143.

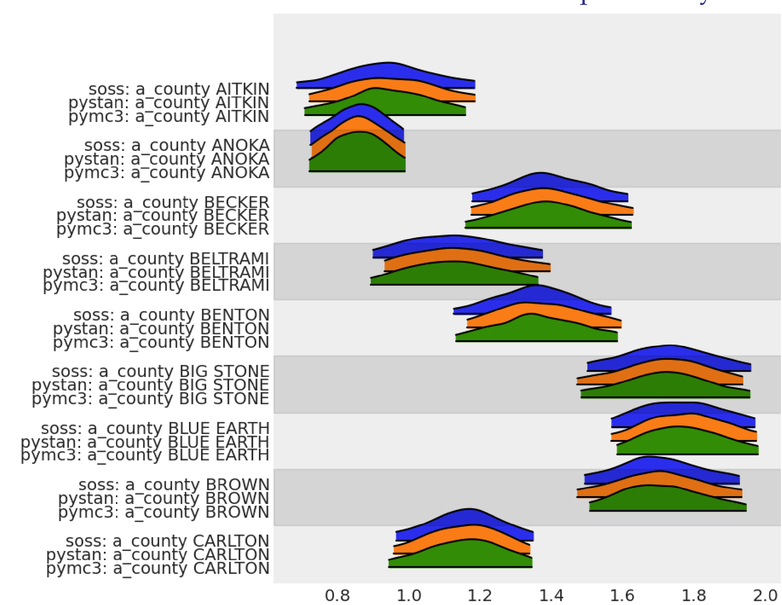
MODEL CRITICISM

There are visualizations in ArviZ for prior/posterior predictive checks, LOO-PIT, test values/Bayesian p-values for both continuous and discrete data.



POSTERIOR EXPLORATION

ArviZ provides a wide range of visualizations to explore the models and inference results. See also our Example Gallery



[2] Jonah Gabry et al. “Visualization in Bayesian workflow”. In: *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 182.2 (2019), pp. 389–402.