

Explainable Deep-learning: Monte Carlo methods for Gravitational-Wave Inference

Project No: 628
 SUPA, School of Physics and Astronomy
 University of Glasgow
 Glasgow G12 8QQ, United Kingdom
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My 250 word abstract goes here...

I. INTRODUCTION

Figs: Hunter's Vit Schematic

Tables: Compare inference speeds like in vit paper

Remember to signpost rest of paper at end of this section!

A. Parameter Estimation

B. Deep-learning Approaches

C. VITAMIN: User-friendly Inference

Tables: Compare Gen Model abilities

Use gen pap to intro CVAE in context, CONTEXT IS KEY HERE

Need to mention metropolis hastings it seems!

Introduce equations directly to our specifics, we don't have space to intro them blind then again to specifics...

Do theory on normal IS and then say that SIR is an monte carlo approach/approx to normal IS then give equations for bot (talk about the NEW IMPROVED SIR method (link to Section ??))

II. METHODOLOGY

Apply the intro/theory material to our case, JUSTIFY scientific decisions like number of samples, batch size, npars!!

A. Model Training

Figs: loss plot

Tables: training hypers in table

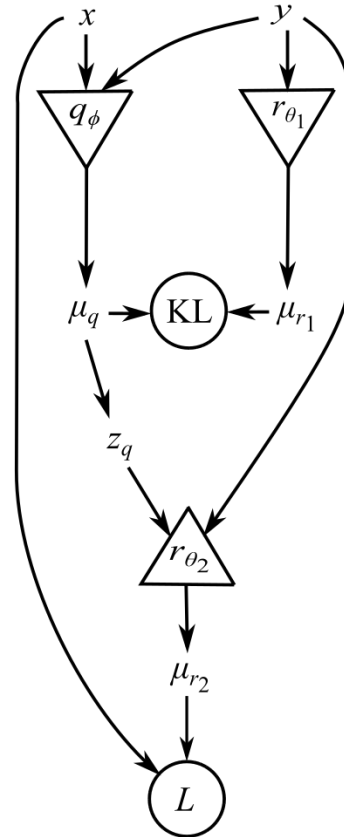
Figs: initial corner plot? (to talk about params and how posteriors aren't perfect)

Need this cornerplot here to talk about how it doesn't 'get' the multimodal dists, which after resampling it does!

B. Likelihood Estimates

Figs: Monte flowchart

Train



Test

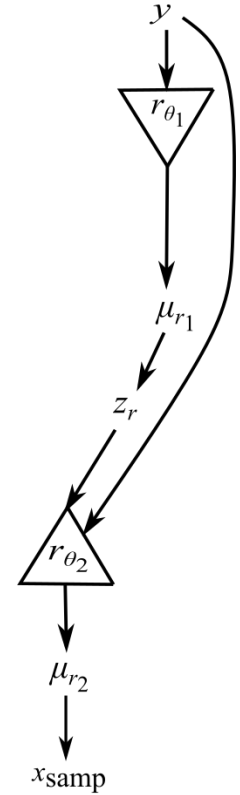


FIG. 1.

C. Likelihood Reweighting

III. RESULTS

A. Self-consistency

Figs: Self consist corner plot

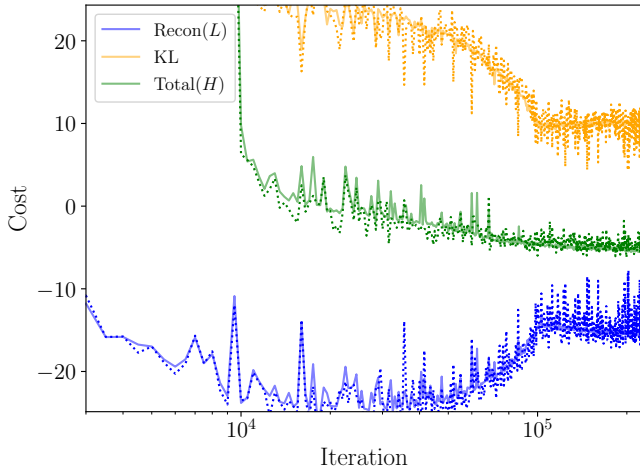


FIG. 2.

B. Reproducibility

Talk about how 'binning' is preventing proper error profile across the likelihood range, (not present in the DYNesty case)

C. Importance Resampling

Figs: Final corner plot (big)

IV. CONCLUSIONS

This section has to encapsulate everything we did so that after the abstract a reader can go here and see if they want to buy the paper or not!

As we find ourselves in a proof-of-concept mode, there is justification of a section dedicated to the next steps leading towards production of this code.

ACKNOWLEDGEMENTS

Thanks to Chris and Hunter and Michael and Daniel. Paragraph on the software used BILBY [1]

[1] G. Ashton, M. Huebner, P. D. Lasky, Colm Talbot, K. Ackley, Sylvia Biscoveanu, Q. Chu, A. Divarkala, P. J. Easter, Boris Goncharov, Francisco Hernandez Vivanco, J. Harms, M. E. Lower, Grant D. Meadors, D. Melchor,

E. Payne, M. D. Pitkin, J. Powell, N. Sarin, Rory J. E. Smith, and E. Thrane, *Astrophys. J. Supp.* **241**, 27 (2019).

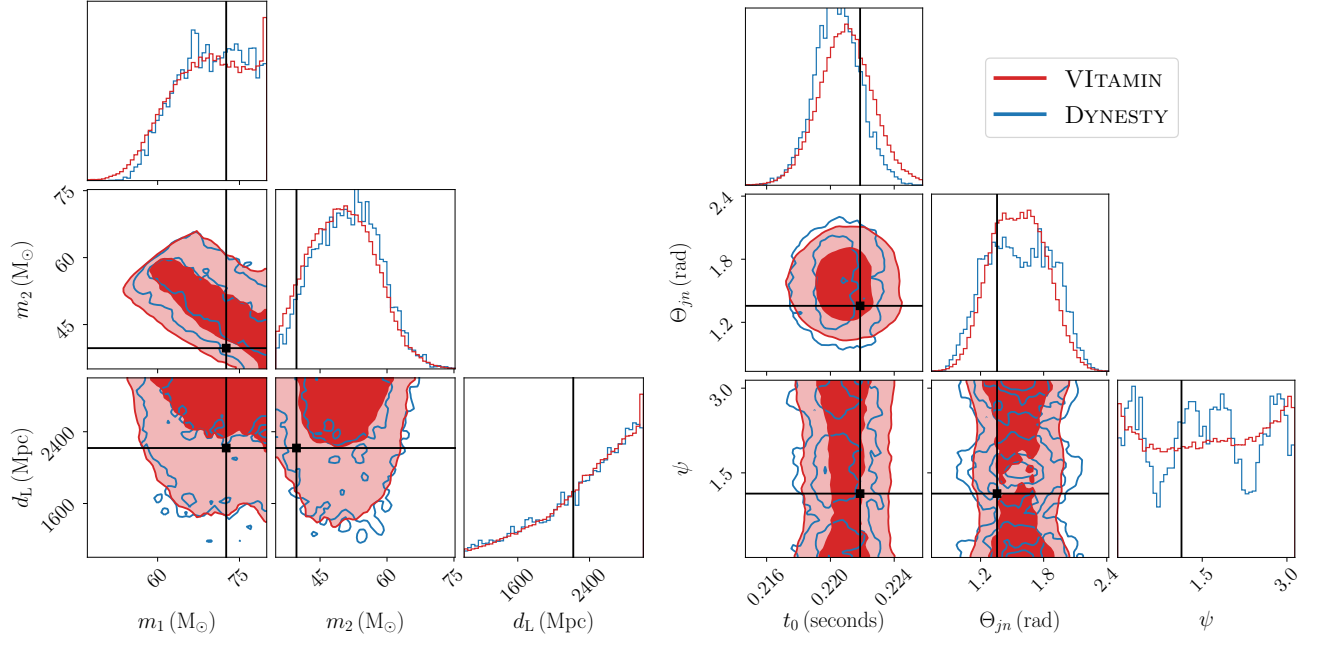


FIG. 3. Probability-probability (P-P) plot showing the confidence interval versus the fraction of the events within that confidence interval for the posterior distributions obtained using our analysis NESSAI for 128 simulated compact binary coalescence signals produced with BILBY and BILBY_PIPE. The 1-, 2- and 3- σ confidence intervals are indicated by the shaded regions and p -values are shown for each of the parameters and the combined p -value is also shown.

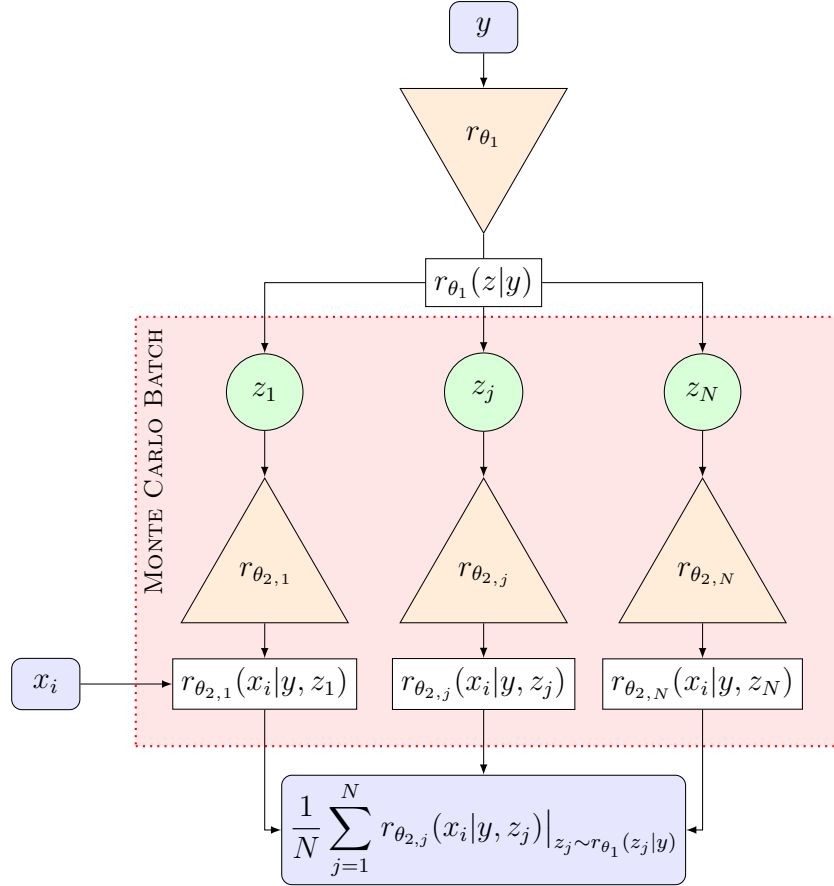


FIG. 4.

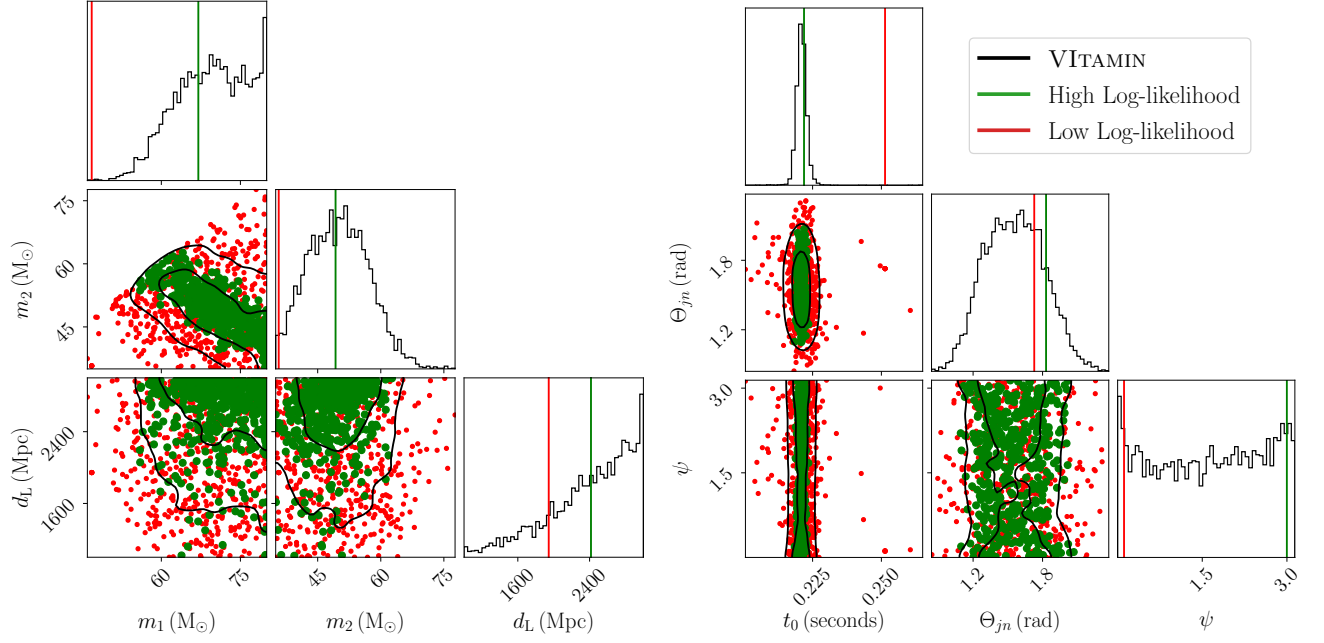


FIG. 5. Probability-probability (P-P) plot showing the confidence interval versus the fraction of the events within that confidence interval for the posterior distributions obtained using our analysis NESSAI for 128 simulated compact binary coalescence signals produced with BILBY and BILBY_PIPE. The 1-, 2- and 3- σ confidence intervals are indicated by the shaded regions and p -values are shown for each of the parameters and the combined p -value is also shown.

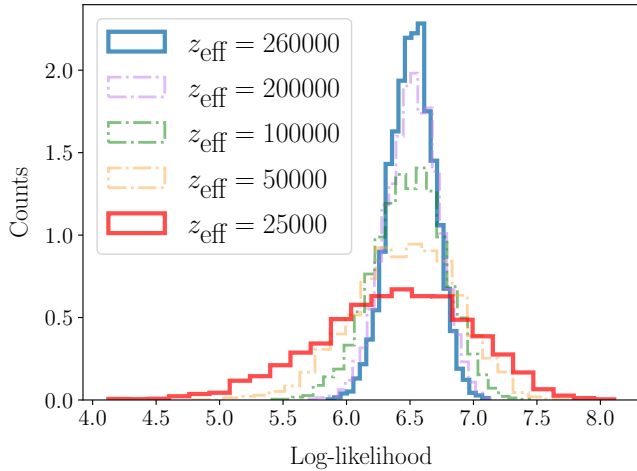


FIG. 6.

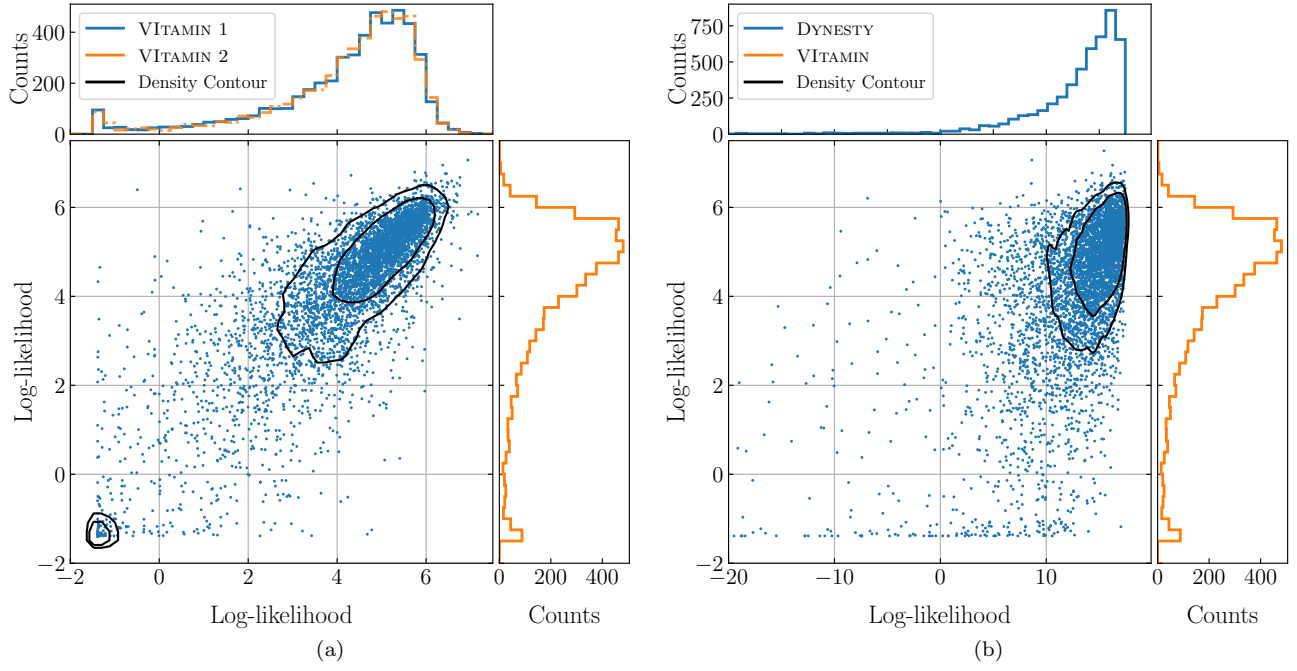


FIG. 7. Probability-probability (P-P) plot showing the confidence interval versus the fraction of the events within that confidence interval for the posterior distributions obtained using our analysis NESSAI for 128 simulated compact binary coalescence signals produced with BILBY and BILBY_PIPE. The 1-, 2- and 3- σ confidence intervals are indicated by the shaded regions and p -values are shown for each of the parameters and the combined p -value is also shown.

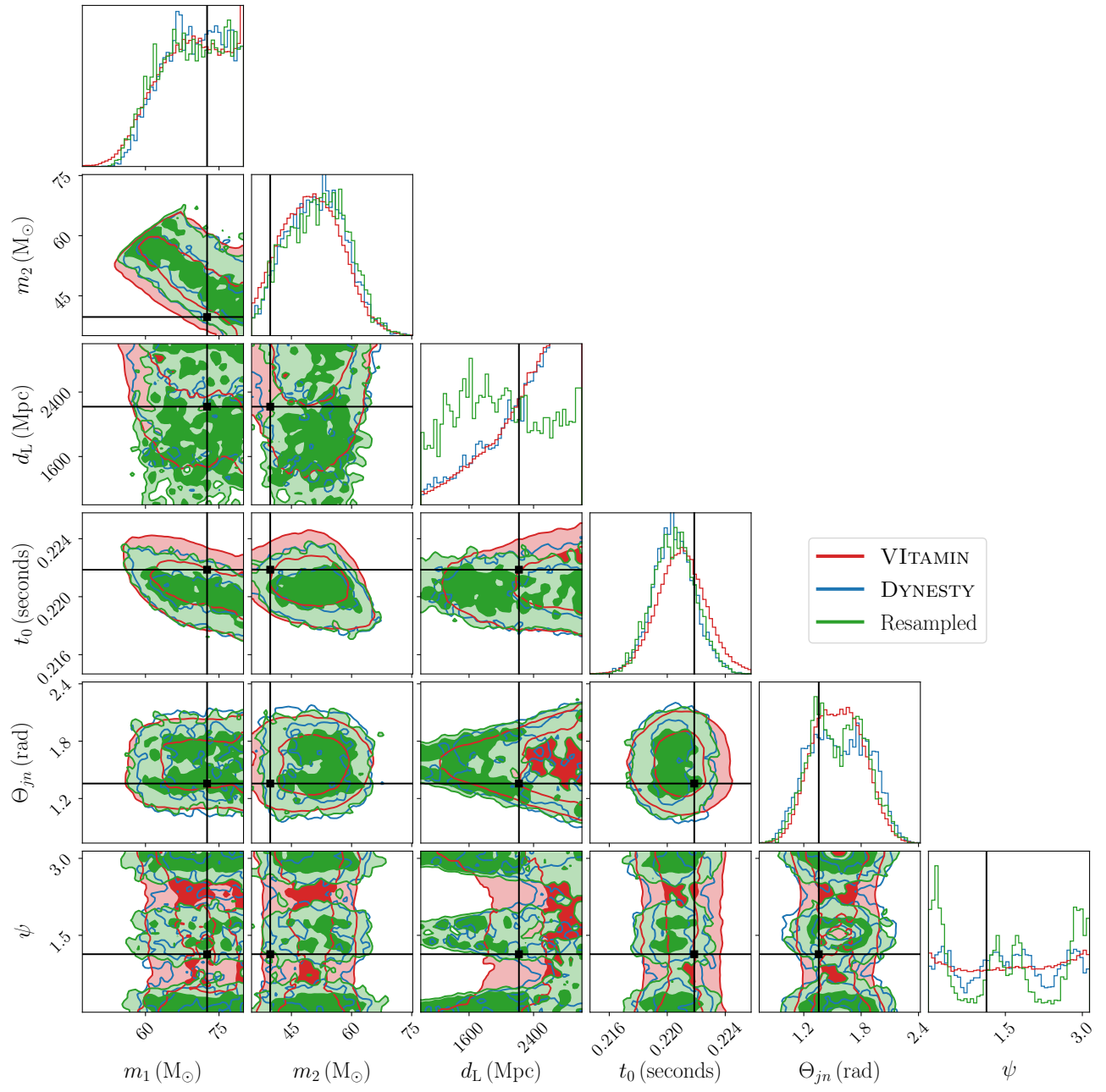


FIG. 8.