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Unreproducible Research is Reproducible

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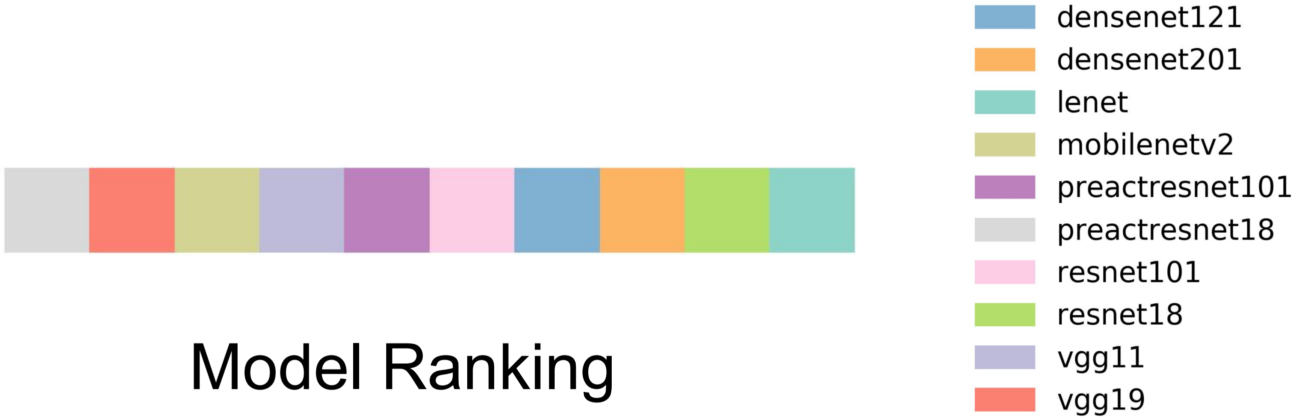
Take Home

- There is a *spectrum* of notions of reproducibility in science.

- Current focus in DL is on *one end of the spectrum*.

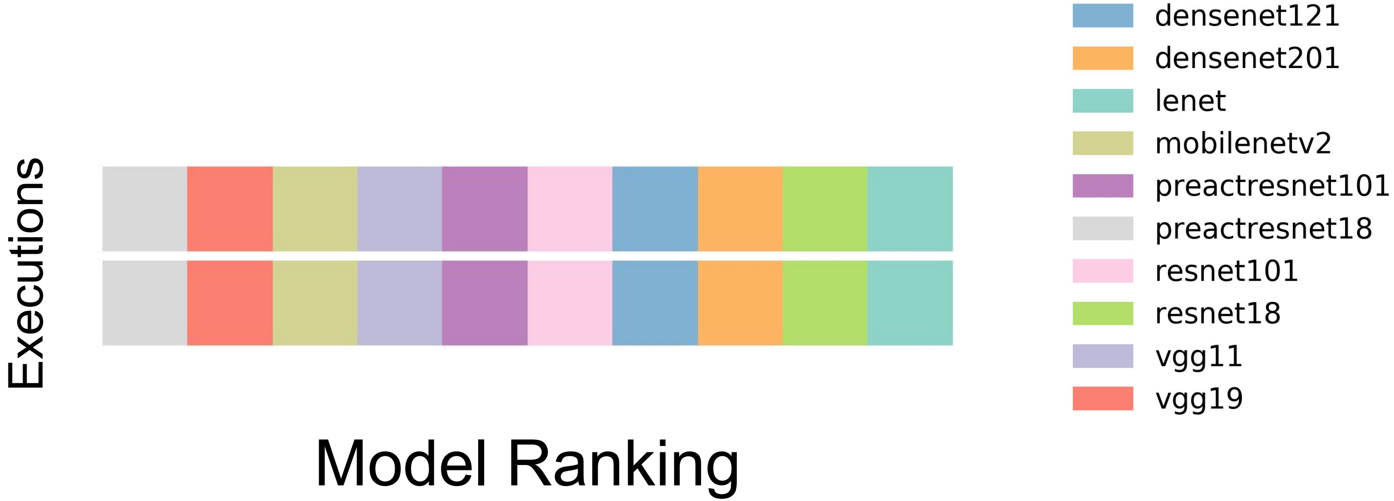
- *Inferential reproducibility* is currently neglected **but** fundamental for empirical research.

Reproducibility

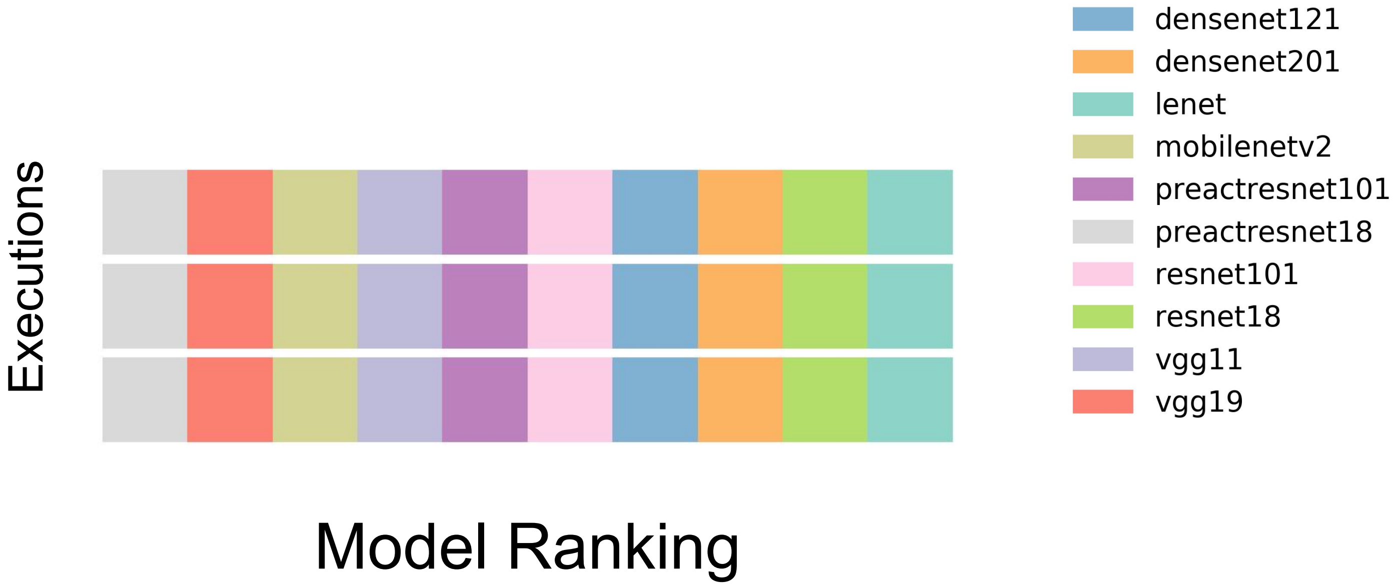


Model Ranking

Reproducibility



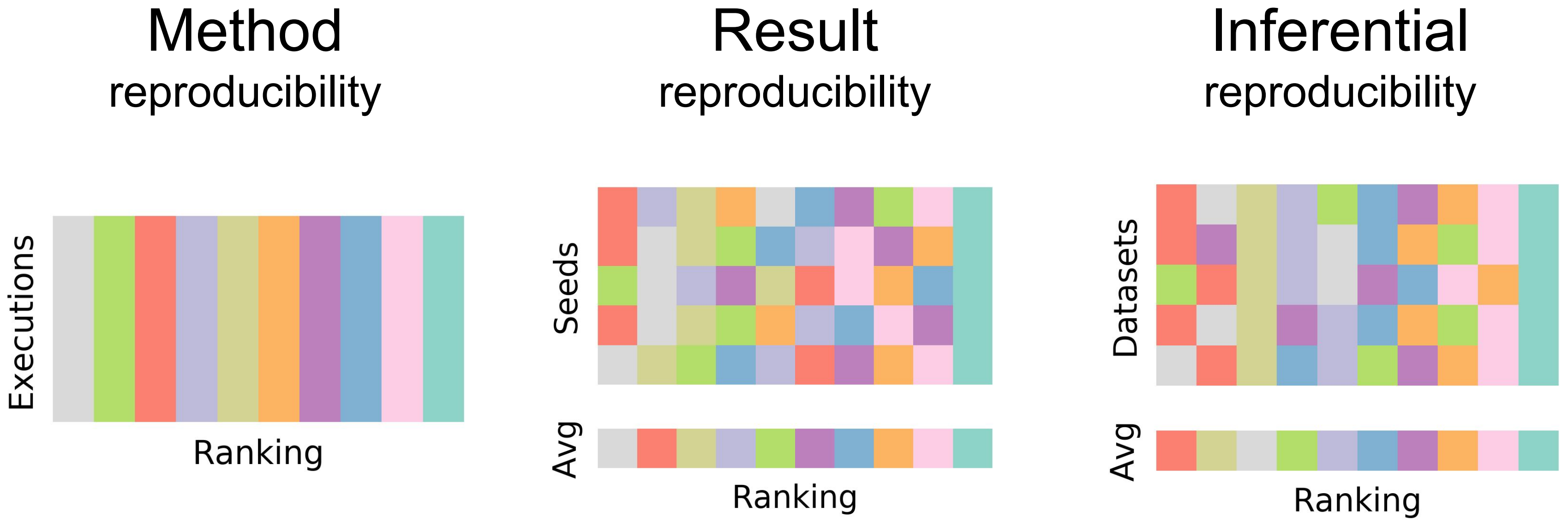
Reproducibility



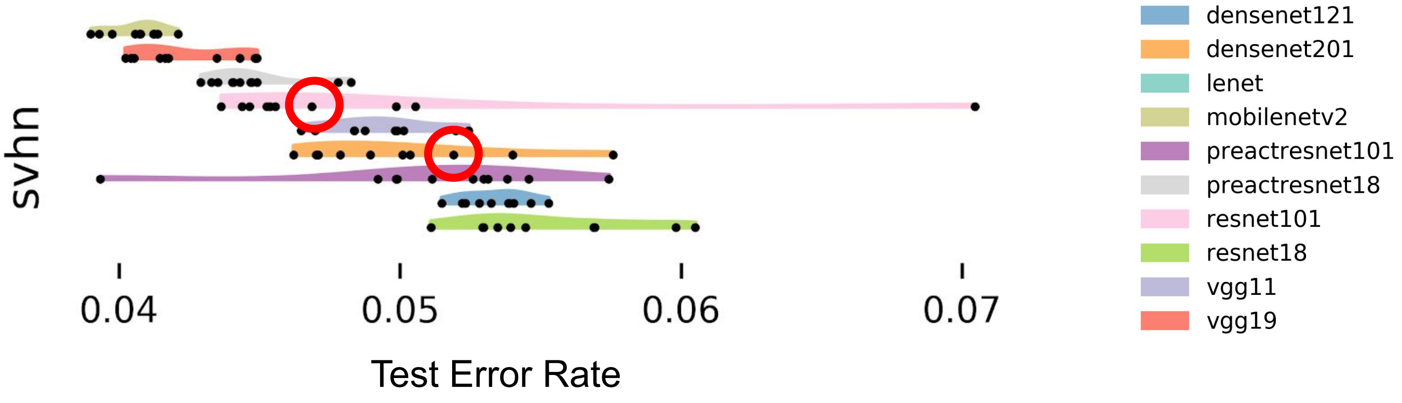
Reproducibility Spectrum

Terminology by Goodman et al. (2016)

- 🟦 densenet121
- 🟧 densenet201
- 🟩 lenet
- 🟨 mobilenetv2
- 🟪 preactresnet101
- ⬜ preactresnet18
- 🟫 resnet101
- 🟩 resnet18
- 🟪 vgg11
- 🟥 vgg19

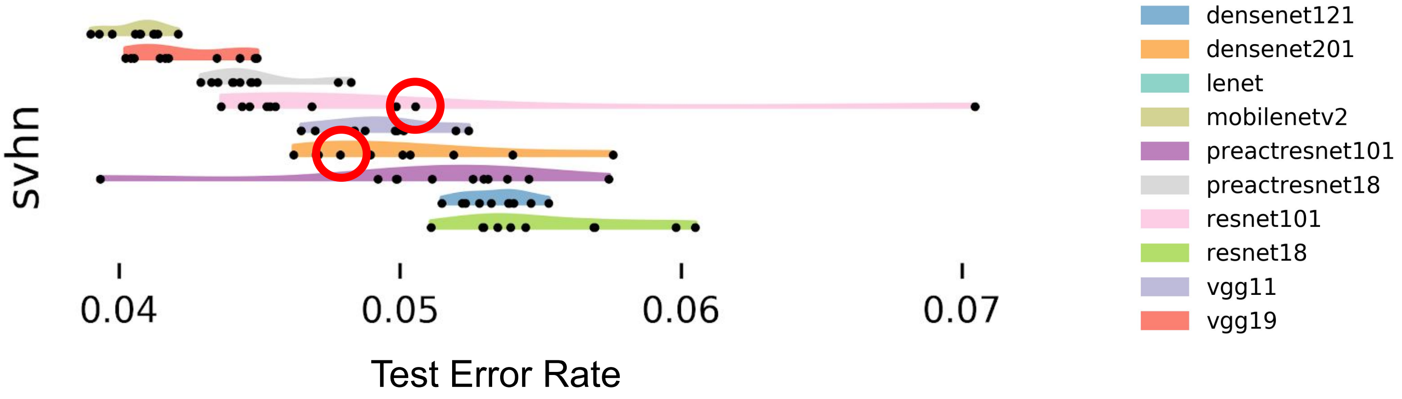


Method Reproducibility



Each black dot can be precisely reproduced

Method Reproducibility



Reproducible method != Reproducible conclusions:

> One cannot conclude that model A is better than model B with only 2 points!

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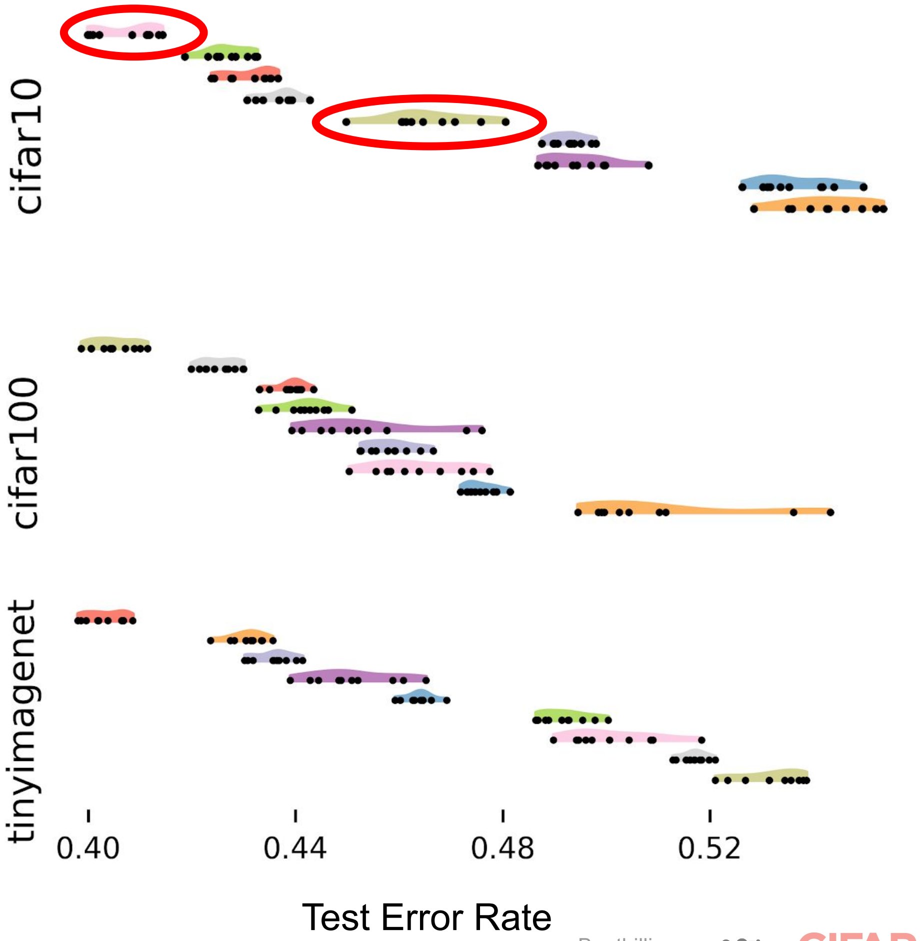
Result Reproducibility

Test performance distributions can be reproduced



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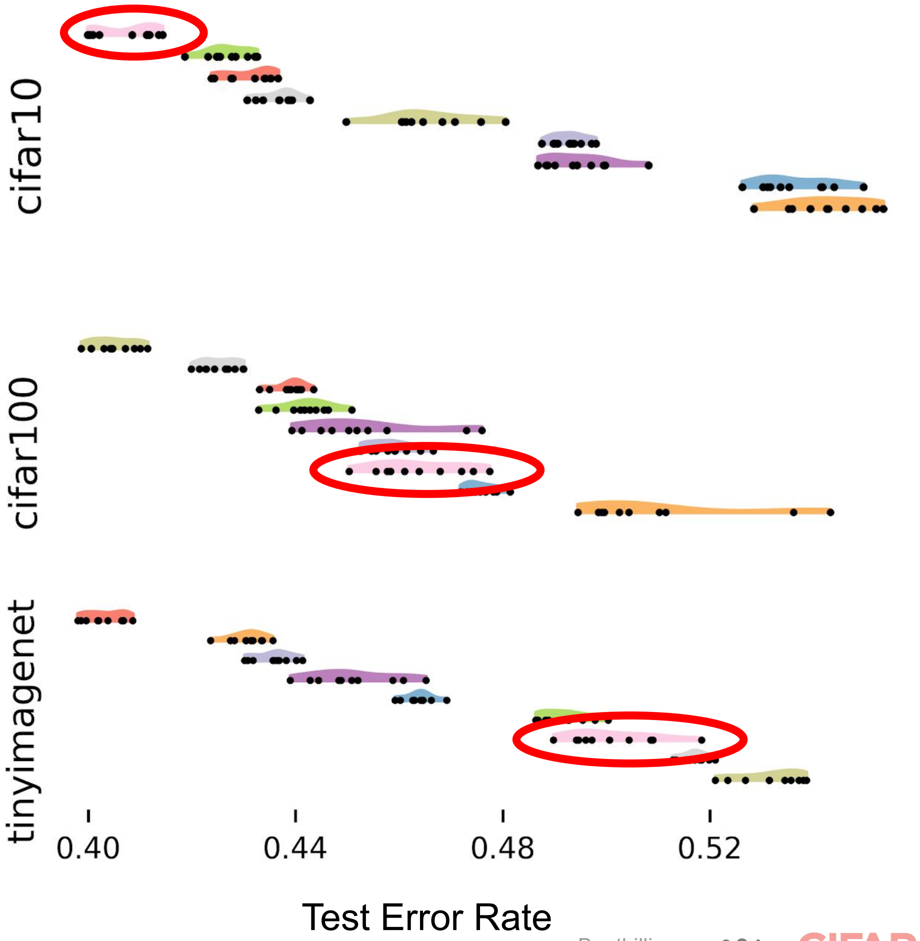
Result Reproducibility

Test performance distributions can be reproduced

Reproducible results != Reproducible conclusions:

> One cannot conclude that model A is better than model B with only 1 dataset!



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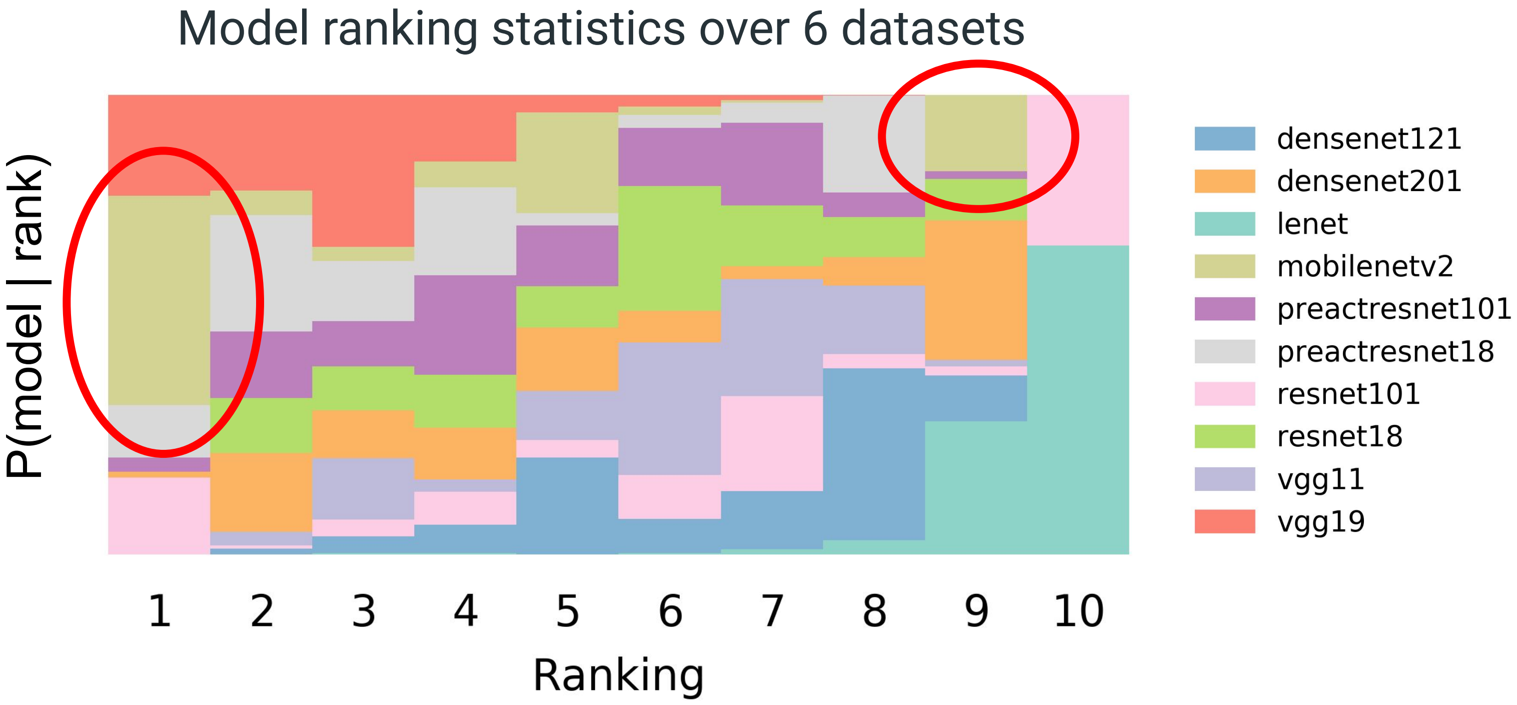
Inferential Reproducibility

A conclusion regarding which is the best architecture cannot be reproduced on different datasets.



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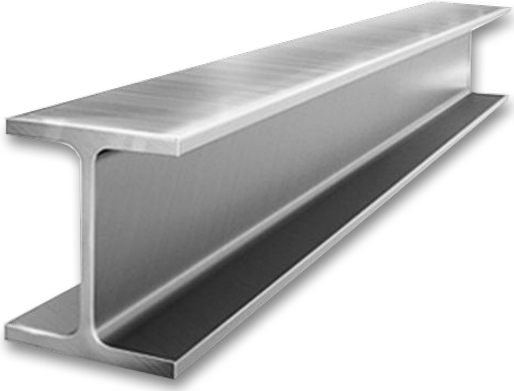
Research Methodologies and Reproducibility

Exploratory & Constructive Research

Method & Result Reproducibility

Empirical & Confirmatory Research



Inferential Reproducibility

Come see our poster

Thu June 13th
06:30 -- 09:00 PM
@ Pacific Ballroom #14

Thank you!

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References

Goodman, S. N., Fanelli, D., and Ioannidis, J. P. A. What does research reproducibility mean? *Science Translational Medicine*, 8(341):341ps12–341ps12, 2016. ISSN 1946-6234. doi: 10.1126/scitranslmed.aaf5027.

Henderson, P., Islam, R., Bachman, P., Pineau, J., Precup,D., and Meger, D. Deep reinforcement learning that matters. In *Thirty-Second AAAI Conference on Artificial Intelligence*, 2018

Lucic, M., Kurach, K., Michalski, M., Gelly, S., and Bousquet, O. Are gans created equal? a large-scale study. In *Advances in neural information processing systems*, pp. 698–707, 2018.

Melis, G., Dyer, C., and Blunsom, P. On the state of the art of evaluation in neural language models. In *International Conference on Learning Representations*, 2018.

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