

Deep Learning does not Replace Bayesian Modeling : Comparing research use via citation counting

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September 25, 2021

Abstract

One could be excused for assuming that deep learning had or will soon usurp all credible work in reasoning, artificial intelligence and statistics, but like most ‘meme’ class broad generalizations the concept does not hold up to scrutiny. Memes don’t generally matter since the experts will always know better but in the case of Bayesian software like Stan and PyMC3 even its developers and advocates bemoan the apparent dominance of deep learning as manifested in popular culture, breathtaking performance and most problematically from funding agency peer review that impacts our ability to further advance the field. The facts however do not support the assumed dominance of deep learning in science upon closer examination. This letter simply makes the argument by the crudest of possible metrics, citation count, that once Computer Science is subtracted, Bayesian software accounts for nearly a third of research citations. Stan and PyMC3 dominate some fields, PyTorch, Keras and TensorFlow dominate others with lots of variation in between. Bayesian and deep learning approaches are related but very different technologies in goals, implementation and applicability with little actual overlap so this is not a surprise. While deep learning is backed by industry behemoths (Google, Facebook) the Bayesian efforts are not and it would behoove funders to recognize the impact of Bayesian software given its centrality to science.

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