

- F. Gloeckle, B. Y. Idrissi, B. Rozière, D. Lopez-Paz, and G. Synnaeve. Better & faster large language models via multi-token prediction. In Forty-first International Conference on Machine Learning, ICML 2024, Vienna, Austria, July 21-27, 2024. OpenReview.net, 2024. URL <https://openreview.net/forum?id=pEWAcEjiU2>.
- Z. Gou, Z. Shao, Y. Gong, yelong shen, Y. Yang, N. Duan, and W. Chen. CRITIC: Large language models can self-correct with tool-interactive critiquing. In The Twelfth International Conference on Learning Representations, 2024a. URL <https://openreview.net/forum?id=Sx038qxjek>.
- Z. Gou, Z. Shao, Y. Gong, yelong shen, Y. Yang, M. Huang, N. Duan, and W. Chen. ToRA: A tool-integrated reasoning agent for mathematical problem solving. In The Twelfth International Conference on Learning Representations, 2024b. URL <https://openreview.net/forum?id=Ep0TtjVoap>.
- S. Hao, Y. Gu, H. Ma, J. J. Hong, Z. Wang, D. Z. Wang, and Z. Hu. Reasoning with language model is planning with world model. In The 2023 Conference on Empirical Methods in Natural Language Processing, 2023. URL <https://openreview.net/forum?id=VTWWvYtF1R>.
- Y. He, S. Li, J. Liu, Y. Tan, W. Wang, H. Huang, X. Bu, H. Guo, C. Hu, B. Zheng, et al. Chinese simpleqa: A chinese factuality evaluation for large language models. arXiv preprint arXiv:2411.07140, 2024.
- D. Hendrycks, C. Burns, S. Basart, A. Zou, M. Mazeika, D. Song, and J. Steinhardt. Measuring massive multitask language understanding. In 9th International Conference on Learning Representations, ICLR 2021, Virtual Event, Austria, May 3-7, 2021. OpenReview.net, 2021. URL <https://openreview.net/forum?id=d7KBjmI3GmQ>.
- G. E. Hinton, O. Vinyals, and J. Dean. Distilling the knowledge in a neural network. CoRR, abs/1503.02531, 2015. URL <http://arxiv.org/abs/1503.02531>.
- Y. Huang, Y. Bai, Z. Zhu, J. Zhang, J. Zhang, T. Su, J. Liu, C. Lv, Y. Zhang, J. Lei, Y. Fu, M. Sun, and J. He. C-eval: A multi-level multi-discipline chinese evaluation suite for foundation models. In A. Oh, T. Naumann, A. Globerson, K. Saenko, M. Hardt, and S. Levine, editors, Advances in Neural Information Processing Systems 36: Annual Conference on Neural Information Processing Systems 2023, NeurIPS 2023, New Orleans, LA, USA, December 10 - 16, 2023, 2023. URL [http://papers.nips.cc/paper\\_files/paper/2023/hash/c6ec1844bec96d6d32ae95ae694e23d8-Abstract-Datasets\\_and\\_Benchmarks.html](http://papers.nips.cc/paper_files/paper/2023/hash/c6ec1844bec96d6d32ae95ae694e23d8-Abstract-Datasets_and_Benchmarks.html).
- N. Jain, K. Han, A. Gu, W. Li, F. Yan, T. Zhang, S. Wang, A. Solar-Lezama, K. Sen, and I. Stoica. Livecodebench: Holistic and contamination free evaluation of large language models for code. CoRR, abs/2403.07974, 2024. URL <https://doi.org/10.48550/arXiv.2403.07974>.
- J. Kaplan, S. McCandlish, T. Henighan, T. B. Brown, B. Chess, R. Child, S. Gray, A. Radford, J. Wu, and D. Amodei. Scaling laws for neural language models. arXiv preprint arXiv:2001.08361, 2020.
- T. Kojima, S. S. Gu, M. Reid, Y. Matsuo, and Y. Iwasawa. Large language models are zero-shot reasoners. In A. H. Oh, A. Agarwal, D. Belgrave, and K. Cho, editors, Advances in Neural Information Processing Systems, 2022. URL <https://openreview.net/forum?id=e2TBb5y0yFf>.

- S. Krishna, K. Krishna, A. Mohananey, S. Schwarcz, A. Stambler, S. Upadhyay, and M. Faruqui. Fact, fetch, and reason: A unified evaluation of retrieval-augmented generation. *CoRR*, abs/2409.12941, 2024. doi: 10.48550/ARXIV.2409.12941. URL <https://doi.org/10.48550/arXiv.2409.12941>.
- A. Kumar, V. Zhuang, R. Agarwal, Y. Su, J. D. Co-Reyes, A. Singh, K. Baumli, S. Iqbal, C. Bishop, R. Roelofs, et al. Training language models to self-correct via reinforcement learning. *arXiv preprint arXiv:2409.12917*, 2024.
- W. Kwon, Z. Li, S. Zhuang, Y. Sheng, L. Zheng, C. H. Yu, J. E. Gonzalez, H. Zhang, and I. Stoica. Efficient memory management for large language model serving with pagedattention. In *Proceedings of the ACM SIGOPS 29th Symposium on Operating Systems Principles*, 2023.
- H. Li, Y. Zhang, F. Koto, Y. Yang, H. Zhao, Y. Gong, N. Duan, and T. Baldwin. CMMLU: measuring massive multitask language understanding in chinese. In L. Ku, A. Martins, and V. Srikumar, editors, *Findings of the Association for Computational Linguistics, ACL 2024, Bangkok, Thailand and virtual meeting, August 11-16, 2024*, pages 11260–11285. Association for Computational Linguistics, 2024. doi: 10.18653/V1/2024.FINDINGS-ACL.671. URL <https://doi.org/10.18653/v1/2024.findings-acl.671>.
- J. Li, D. Guo, D. Yang, R. Xu, Y. Wu, and J. He. Codei/o: Condensing reasoning patterns via code input-output prediction. *arXiv preprint arXiv:2502.07316*, 2025.
- H. Lightman, V. Kosaraju, Y. Burda, H. Edwards, B. Baker, T. Lee, J. Leike, J. Schulman, I. Sutskever, and K. Cobbe. Let’s verify step by step. In *The Twelfth International Conference on Learning Representations, ICLR 2024, Vienna, Austria, May 7-11, 2024*. OpenReview.net, 2024. URL <https://openreview.net/forum?id=v8L0pN6E0i>.
- B. Y. Lin. ZeroEval: A Unified Framework for Evaluating Language Models, July 2024. URL <https://github.com/WildEval/ZeroEval>.
- Z. Liu, C. Chen, W. Li, T. Pang, C. Du, and M. Lin. There may not be aha moment in r1-zero-like training — a pilot study. <https://oatllm.notion.site/oat-zero>, 2025. Notion Blog.
- MAA. American invitational mathematics examination - aime. In *American Invitational Mathematics Examination - AIME 2024*, February 2024. URL <https://maa.org/math-competitions/american-invitational-mathematics-examination-aime>.
- A. Madaan, N. Tandon, P. Gupta, S. Hallinan, L. Gao, S. Wiegrefe, U. Alon, N. Dziri, S. Prabh-moye, Y. Yang, S. Gupta, B. P. Majumder, K. Hermann, S. Welleck, A. Yazdanbakhsh, and P. Clark. Self-refine: Iterative refinement with self-feedback. In *Thirty-seventh Conference on Neural Information Processing Systems*, 2023. URL <https://openreview.net/forum?id=S37h0erQLB>.
- M. Mazeika, L. Phan, X. Yin, A. Zou, Z. Wang, N. Mu, E. Sakhaee, N. Li, S. Basart, B. Li, D. A. Forsyth, and D. Hendrycks. HarmBench: A Standardized Evaluation Framework for Automated Red Teaming and Robust Refusal. In *Forty-first International Conference on Machine Learning, ICML 2024, Vienna, Austria, July 21-27, 2024*. OpenReview.net, 2024.
- M. Mirzayanov. Codeforces, 2025. URL <https://codeforces.com/>.
- N. Muennighoff, A. M. Rush, B. Barak, T. L. Scao, N. Tazi, A. Piktus, S. Pyysalo, T. Wolf, and C. Raffel. Scaling data-constrained language models. In *Thirty-seventh Conference on Neural Information Processing Systems*, 2023. URL <https://openreview.net/forum?id=j5BuTrEj35>.

- R. Nakano, J. Hilton, S. Balaji, J. Wu, L. Ouyang, C. Kim, C. Hesse, S. Jain, V. Kosaraju, W. Saunders, et al. Webgpt: Browser-assisted question-answering with human feedback. arXiv preprint arXiv:2112.09332, 2021.
- OpenAI. GPT4 technical report. arXiv preprint arXiv:2303.08774, 2023.
- OpenAI. Introducing SimpleQA, 2024a. URL <https://openai.com/index/introducing-simpleqa/>.
- OpenAI. Introducing SWE-bench verified we’re releasing a human-validated subset of swe-bench that more, 2024b. URL <https://openai.com/index/introducing-swe-bench-verified/>.
- L. Ouyang, J. Wu, X. Jiang, D. Almeida, C. L. Wainwright, P. Mishkin, C. Zhang, S. Agarwal, K. Slama, A. Ray, J. Schulman, J. Hilton, F. Kelton, L. Miller, M. Simens, A. Askell, P. Welinder, P. F. Christiano, J. Leike, and R. Lowe. Training language models to follow instructions with human feedback. In S. Koyejo, S. Mohamed, A. Agarwal, D. Belgrave, K. Cho, and A. Oh, editors, Advances in Neural Information Processing Systems 35: Annual Conference on Neural Information Processing Systems 2022, NeurIPS 2022, New Orleans, LA, USA, November 28 - December 9, 2022, 2022. URL [http://papers.nips.cc/paper\\_files/paper/2022/hash/b1efde53be364a73914f58805a001731-Abstract-Conference.html](http://papers.nips.cc/paper_files/paper/2022/hash/b1efde53be364a73914f58805a001731-Abstract-Conference.html).
- J. Pan, J. Zhang, X. Wang, L. Yuan, H. Peng, and A. Suhr. Tinyzero. <https://github.com/Jiayi-Pan/TinyZero>, 2025. Accessed: 2025-01-24.
- A. Parrish, A. Chen, N. Nangia, V. Padmakumar, J. Phang, J. Thompson, P. M. Htut, and S. R. Bowman. BBQ: A hand-built bias benchmark for question answering. In Findings of the Association for Computational Linguistics: ACL 2022, Dublin, Ireland, May 22-27, 2022, pages 2086–2105. Association for Computational Linguistics, 2022.
- Qwen. Qwq: Reflect deeply on the boundaries of the unknown, 2024a. URL <https://qwenlm.github.io/blog/qwq-32b-preview/>.
- Qwen. Qwen2.5: A party of foundation models, 2024b. URL <https://qwenlm.github.io/blog/qwen2.5>.
- A. Radford, J. Wu, R. Child, D. Luan, D. Amodei, I. Sutskever, et al. Language models are unsupervised multitask learners. OpenAI blog, 1(8):9, 2019.
- R. Rafailov, A. Sharma, E. Mitchell, C. D. Manning, S. Ermon, and C. Finn. Direct preference optimization: Your language model is secretly a reward model. In A. Oh, T. Naumann, A. Globerson, K. Saenko, M. Hardt, and S. Levine, editors, Advances in Neural Information Processing Systems 36: Annual Conference on Neural Information Processing Systems 2023, NeurIPS 2023, New Orleans, LA, USA, December 10 - 16, 2023, 2023. URL [http://papers.nips.cc/paper\\_files/paper/2023/hash/a85b405ed65c6477a4fe8302b5e06ce7-Abstract-Conference.html](http://papers.nips.cc/paper_files/paper/2023/hash/a85b405ed65c6477a4fe8302b5e06ce7-Abstract-Conference.html).
- D. Rein, B. L. Hou, A. C. Stickland, J. Petty, R. Y. Pang, J. Dirani, J. Michael, and S. R. Bowman. GPQA: A graduate-level google-proof q&a benchmark. arXiv preprint arXiv:2311.12022, 2023.
- P. Röttger, H. Kirk, B. Vidgen, G. Attanasio, F. Bianchi, and D. Hovy. XSTest: A Test Suite for Identifying Exaggerated Safety Behaviours in Large Language Models. In Proceedings of the 2024 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies (Volume 1: Long Papers), NAACL 2024, Mexico

- City, Mexico, June 16-21, 2024, pages 5377–5400. Association for Computational Linguistics, 2024.
- T. Schick, J. Dwivedi-Yu, R. Dessi, R. Raileanu, M. Lomeli, E. Hambro, L. Zettlemoyer, N. Cancedda, and T. Scialom. Toolformer: Language models can teach themselves to use tools. In *Thirty-seventh Conference on Neural Information Processing Systems*, 2023. URL <https://openreview.net/forum?id=Yacmpz84TH>.
- J. Schulman. Approximating kl divergence, 2020. URL <http://joschu.net/blog/kl-approx.html>.
- J. Schulman, P. Moritz, S. Levine, M. Jordan, and P. Abbeel. High-dimensional continuous control using generalized advantage estimation. *arXiv preprint arXiv:1506.02438*, 2015.
- J. Schulman, F. Wolski, P. Dhariwal, A. Radford, and O. Klimov. Proximal policy optimization algorithms. *arXiv preprint arXiv:1707.06347*, 2017.
- Z. Shao, P. Wang, Q. Zhu, R. Xu, J. Song, M. Zhang, Y. Li, Y. Wu, and D. Guo. Deepseekmath: Pushing the limits of mathematical reasoning in open language models. *arXiv preprint arXiv:2402.03300*, 2024.
- D. Silver, T. Hubert, J. Schrittwieser, I. Antonoglou, M. Lai, A. Guez, M. Lanctot, L. Sifre, D. Kumaran, T. Graepel, T. P. Lillicrap, K. Simonyan, and D. Hassabis. Mastering chess and shogi by self-play with a general reinforcement learning algorithm. *CoRR*, abs/1712.01815, 2017a. URL <http://arxiv.org/abs/1712.01815>.
- D. Silver, J. Schrittwieser, K. Simonyan, I. Antonoglou, A. Huang, A. Guez, T. Hubert, L. Baker, M. Lai, A. Bolton, Y. Chen, T. P. Lillicrap, F. Hui, L. Sifre, G. van den Driessche, T. Graepel, and D. Hassabis. Mastering the game of go without human knowledge. *Nat.*, 550(7676):354–359, 2017b. doi: 10.1038/NATURE24270. URL <https://doi.org/10.1038/nature24270>.
- A. Singh, J. D. Co-Reyes, R. Agarwal, A. Anand, P. Patil, X. Garcia, P. J. Liu, J. Harrison, J. Lee, K. Xu, A. T. Parisi, A. Kumar, A. A. Alemi, A. Rizkowsky, A. Nova, B. Adlam, B. Bohnet, G. F. Elsayed, H. Sedghi, I. Mordatch, I. Simpson, I. Gur, J. Snoek, J. Pennington, J. Hron, K. Kenealy, K. Swersky, K. Mahajan, L. A. Culp, L. Xiao, M. Bileschi, N. Constant, R. Novak, R. Liu, T. Warkentin, Y. Bansal, E. Dyer, B. Neyshabur, J. Sohl-Dickstein, and N. Fiedel. Beyond human data: Scaling self-training for problem-solving with language models. *Transactions on Machine Learning Research*, 2024. ISSN 2835-8856. URL <https://openreview.net/forum?id=1NAyUngGFK>. Expert Certification.
- C. Snell, J. Lee, K. Xu, and A. Kumar. Scaling llm test-time compute optimally can be more effective than scaling model parameters, 2024. URL <https://arxiv.org/abs/2408.03314>.
- C. V. Snell, J. Lee, K. Xu, and A. Kumar. Scaling LLM test-time compute optimally can be more effective than scaling parameters for reasoning. In *The Thirteenth International Conference on Learning Representations*, 2025. URL <https://openreview.net/forum?id=4FWAwZtd2n>.
- Y. Sun, X. Wang, Z. Liu, J. Miller, A. Efros, and M. Hardt. Test-time training with self-supervision for generalization under distribution shifts. In *International conference on machine learning*, pages 9229–9248. PMLR, 2020.

- M. Suzgun, N. Scales, N. Schärli, S. Gehrmann, Y. Tay, H. W. Chung, A. Chowdhery, Q. Le, E. Chi, D. Zhou, and J. Wei. Challenging BIG-bench tasks and whether chain-of-thought can solve them. In A. Rogers, J. Boyd-Graber, and N. Okazaki, editors, *Findings of the Association for Computational Linguistics: ACL 2023*, pages 13003–13051, Toronto, Canada, July 2023. Association for Computational Linguistics. doi: 10.18653/v1/2023.findings-acl.824. URL <https://aclanthology.org/2023.findings-acl.824/>.
- H. Touvron, L. Martin, K. Stone, P. Albert, A. Almahairi, Y. Babaei, N. Bashlykov, S. Batra, P. Bhargava, S. Bhosale, et al. Llama 2: Open foundation and fine-tuned chat models. *arXiv preprint arXiv:2307.09288*, 2023.
- T. Trinh, Y. Wu, Q. Le, H. He, and T. Luong. Solving olympiad geometry without human demonstrations. *Nature*, 2024. doi: 10.1038/s41586-023-06747-5.
- J. Uesato, N. Kushman, R. Kumar, F. Song, N. Siegel, L. Wang, A. Creswell, G. Irving, and I. Higgins. Solving math word problems with process-and outcome-based feedback. *arXiv preprint arXiv:2211.14275*, 2022.
- B. Vidgen, H. R. Kirk, R. Qian, N. Scherrer, A. Kannappan, S. A. Hale, and P. Röttger. SimpleSafetyTests: a Test Suite for Identifying Critical Safety Risks in Large Language Models. *CoRR*, abs/2311.08370, 2023.
- P. Wang, L. Li, Z. Shao, R. Xu, D. Dai, Y. Li, D. Chen, Y. Wu, and Z. Sui. Math-shepherd: A label-free step-by-step verifier for llms in mathematical reasoning. *arXiv preprint arXiv:2312.08935*, 2023a.
- X. Wang, J. Wei, D. Schuurmans, Q. V. Le, E. H. Chi, S. Narang, A. Chowdhery, and D. Zhou. Self-consistency improves chain of thought reasoning in language models. In *The Eleventh International Conference on Learning Representations, ICLR 2023, Kigali, Rwanda, May 1-5, 2023*. OpenReview.net, 2023b. URL <https://openreview.net/forum?id=1PL1NIMMrw>.
- X. Wang, J. Wei, D. Schuurmans, Q. V. Le, E. H. Chi, S. Narang, A. Chowdhery, and D. Zhou. Self-consistency improves chain of thought reasoning in language models. In *The Eleventh International Conference on Learning Representations, ICLR 2023, Kigali, Rwanda, May 1-5, 2023*. OpenReview.net, 2023c. URL <https://openreview.net/forum?id=1PL1NIMMrw>.
- Y. Wang, H. Li, X. Han, P. Nakov, and T. Baldwin. Do-Not-Answer: A Dataset for Evaluating Safeguards in LLMs. *CoRR*, abs/2308.13387, 2023d.
- Y. Wang, X. Ma, G. Zhang, Y. Ni, A. Chandra, S. Guo, W. Ren, A. Arulraj, X. He, Z. Jiang, T. Li, M. Ku, K. Wang, A. Zhuang, R. Fan, X. Yue, and W. Chen. Mmlu-pro: A more robust and challenging multi-task language understanding benchmark. In A. Globersons, L. Mackey, D. Belgrave, A. Fan, U. Paquet, J. M. Tomczak, and C. Zhang, editors, *Advances in Neural Information Processing Systems 38: Annual Conference on Neural Information Processing Systems 2024, NeurIPS 2024, Vancouver, BC, Canada, December 10 - 15, 2024*, 2024. URL [http://papers.nips.cc/paper\\_files/paper/2024/hash/ad236edc564f3e3156e1b2feafb99a24-Abstract-Datasets\\_and\\_Benchmarks\\_Track.html](http://papers.nips.cc/paper_files/paper/2024/hash/ad236edc564f3e3156e1b2feafb99a24-Abstract-Datasets_and_Benchmarks_Track.html).
- J. Wei, Y. Tay, R. Bommasani, C. Raffel, B. Zoph, S. Borgeaud, D. Yogatama, M. Bosma, D. Zhou, D. Metzler, E. H. Chi, T. Hashimoto, O. Vinyals, P. Liang, J. Dean, and W. Fedus. Emergent abilities of large language models. *Trans. Mach. Learn. Res.*, 2022, 2022a. URL <https://openreview.net/forum?id=yzkSU5zdWd>.