- Hugo Touvron, Louis Martin, Kevin Stone, Peter Albert, Amjad Almahairi, Yasmine Babaei, Nikolay Bashlykov, Soumya Batra, Prajjwal Bhargava, Shruti Bhosale, et al. Llama 2: Open foundation and fine-tuned chat models. *arXiv preprint arXiv:2307.09288*, 2023b.
- Ashish Vaswani, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N Gomez, Łukasz Kaiser, and Illia Polosukhin. Attention is all you need. *Advances in neural information processing systems*, 30, 2017.
- Yizhong Wang, Yeganeh Kordi, Swaroop Mishra, Alisa Liu, Noah A Smith, Daniel Khashabi, and Hannaneh Hajishirzi. Self-instruct: Aligning language model with self generated instructions. arXiv preprint arXiv:2212.10560, 2022.
- Zhenhailong Wang, Shaoguang Mao, Wenshan Wu, Tao Ge, Furu Wei, and Heng Ji. Unleashing the emergent cognitive synergy in large language models: A task-solving agent through multi-persona self-collaboration. *arXiv* preprint arXiv:2307.05300, 2023.
- Jason Wei, Maarten Bosma, Vincent Y Zhao, Kelvin Guu, Adams Wei Yu, Brian Lester, Nan Du, Andrew M Dai, and Quoc V Le. Finetuned language models are zero-shot learners. *arXiv* preprint arXiv:2109.01652, 2021.
- Jason Wei, Xuezhi Wang, Dale Schuurmans, Maarten Bosma, Fei Xia, Ed Chi, Quoc V Le, Denny Zhou, et al. Chain-of-thought prompting elicits reasoning in large language models. *Advances in neural information processing systems*, 35:24824–24837, 2022.
- David Wingate, Mohammad Shoeybi, and Taylor Sorensen. Prompt compression and contrastive conditioning for controllability and toxicity reduction in language models. *arXiv* preprint *arXiv*:2210.03162, 2022.
- Yuhuai Wu, Markus N Rabe, DeLesley Hutchins, and Christian Szegedy. Memorizing transformers. arXiv preprint arXiv:2203.08913, 2022.
- Yadong Zhang, Shaoguang Mao, Tao Ge, Xun Wang, Yan Xia, Man Lan, and Furu Wei. K-level reasoning with large language models. arXiv preprint arXiv:2402.01521, 2024.
- Hao Zhao, Maksym Andriushchenko, Francesco Croce, and Nicolas Flammarion. Long is more for alignment: A simple but tough-to-beat baseline for instruction fine-tuning. *arXiv* preprint *arXiv*:2402.04833, 2024.
- Lin Zheng, Chong Wang, and Lingpeng Kong. Linear complexity randomized self-attention mechanism. In *International Conference on Machine Learning*, 2022.

A MODEL TRAINING CONFIGURATION

We show how to perform pretraining with the text continuation objective and instruction fine-tuning in Figure 7 and 8.

We train the ICAE on 8 Nvidia A100 GPUs (80GB). The hyperparameters for pretraining and fine-tuning ICAE are presented in Table 8. We by default train the ICAE with bf16.

Table 8: Hyperparameters for training

Hyperparameter	Value
Optimizer	AdamW
learning rate	1e-4 (pretrain); 5e-5 (fine-tuning)
batch size	256
warmup	300
#updates	200k (pretrain); 30k (fine-tuning)
clip norm	2.0