

towards the Llama 2-Chat models.

We are releasing the following models to the general public for research and commercial use[‡]:

1. **Llama 2**, an updated version of Llama 1, trained on a new mix of publicly available data. We also increased the size of the pretraining corpus by 40%, doubled the context length of the model, and adopted grouped-query attention (Ainslie et al., 2023). We are releasing variants of Llama 2 with 7B, 13B, and 70B parameters. We have also trained 34B variants, which we report on in this paper but are not releasing.[§]
2. **Llama 2-Chat**, a fine-tuned version of Llama 2 that is optimized for dialogue use cases. We release variants of this model with 7B, 13B, and 70B parameters as well.

We believe that the open release of LLMs, when done safely, will be a net benefit to society. Like all LLMs, Llama 2 is a new technology that carries potential risks with use (Bender et al., 2021b; Weidinger et al., 2021; Solaiman et al., 2023). Testing conducted to date has been in English and has not — and could not — cover all scenarios. Therefore, before deploying any applications of Llama 2-Chat, developers should perform safety testing and tuning tailored to their specific applications of the model. We provide a responsible use guide[¶] and code examples^{||} to facilitate the safe deployment of Llama 2 and Llama 2-Chat. More details of our responsible release strategy can be found in Section 5.3.

The remainder of this paper describes our pretraining methodology (Section 2), fine-tuning methodology (Section 3), approach to model safety (Section 4), key observations and insights (Section 5), relevant related work (Section 6), and conclusions (Section 7).

[‡]<https://ai.meta.com/resources/models-and-libraries/llama/>

[§]We are delaying the release of the 34B model due to a lack of time to sufficiently red team. [¶]<https://ai.meta.com/llama>

^{||}<https://github.com/facebookresearch/llama>

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Figure 4: Training of Llama 2-Chat: This process begins with the **pretraining** of Llama 2 using publicly available online sources. Following this, we create an initial version of Llama 2-Chat through the application of **supervised fine-tuning**. Subsequently, the model is iteratively refined using Reinforcement Learning with Human Feedback (**RLHF**) methodologies, specifically through rejection sampling and Proximal Policy Optimization (PPO). Throughout the RLHF stage, the accumulation of **iterative reward modeling data** in parallel with model enhancements is crucial to ensure the reward models remain within distribution.

2 Pretraining

To create the new family of Llama 2 models, we began with the pretraining approach described in Touvron et al. (2023), using an optimized auto-regressive transformer, but made several changes to improve performance. Specifically, we performed more robust data cleaning, updated our data mixes, trained on 40% more total tokens, doubled the context length, and used grouped-query attention (GQA) to improve inference scalability for our larger models. Table 1 compares the attributes of the new Llama 2 models with the Llama 1 models.

2.1 Pretraining Data

Our training corpus includes a new mix of data from publicly available sources, which does not include data from Meta’s products or services. We made an effort to remove data from certain sites known to contain a high volume of personal information about private individuals. We trained on 2 trillion tokens of data as this provides a good performance–cost trade-off, up-sampling the most factual sources in an effort to increase knowledge and dampen hallucinations.