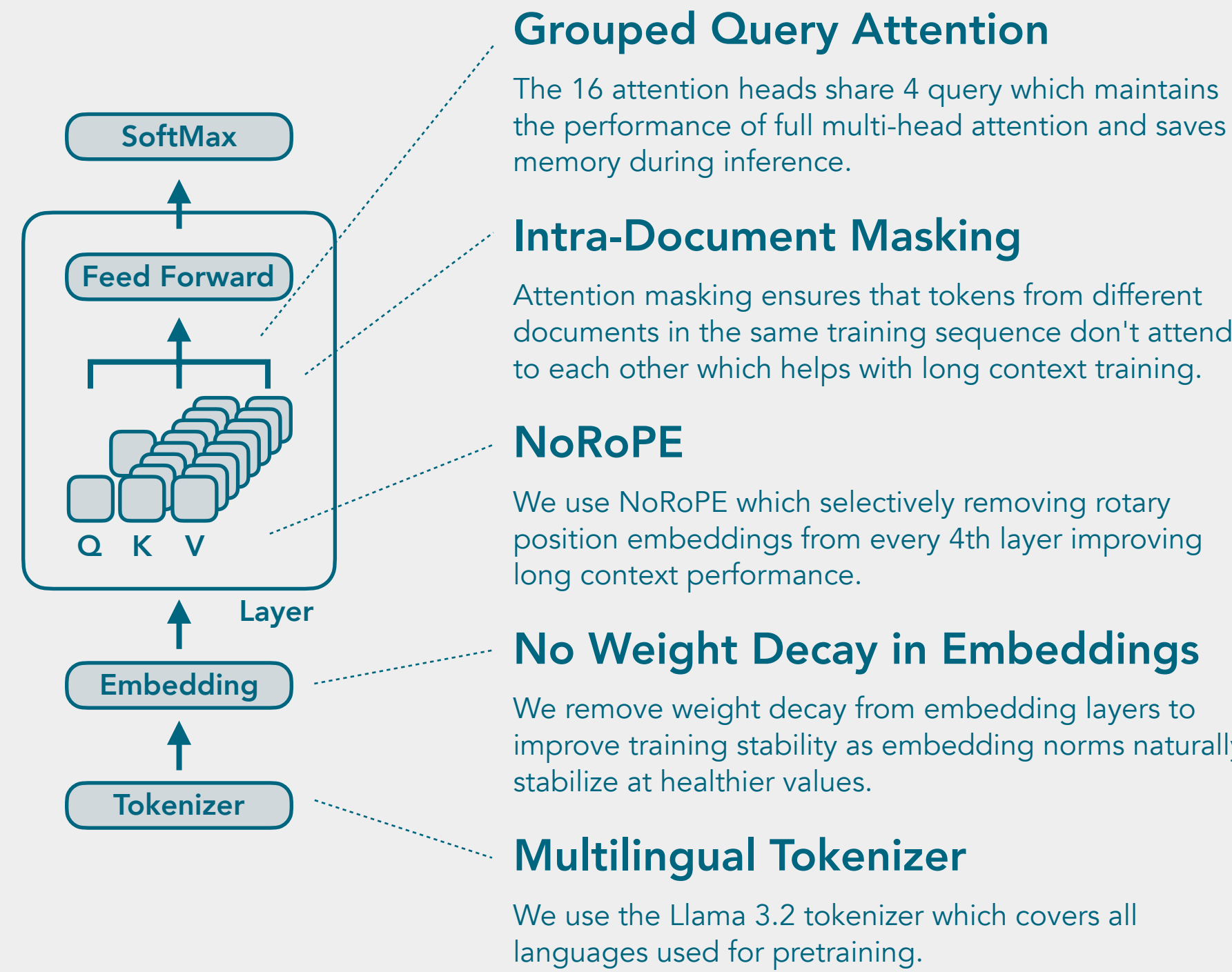


Model Anatomy



Training Configuration

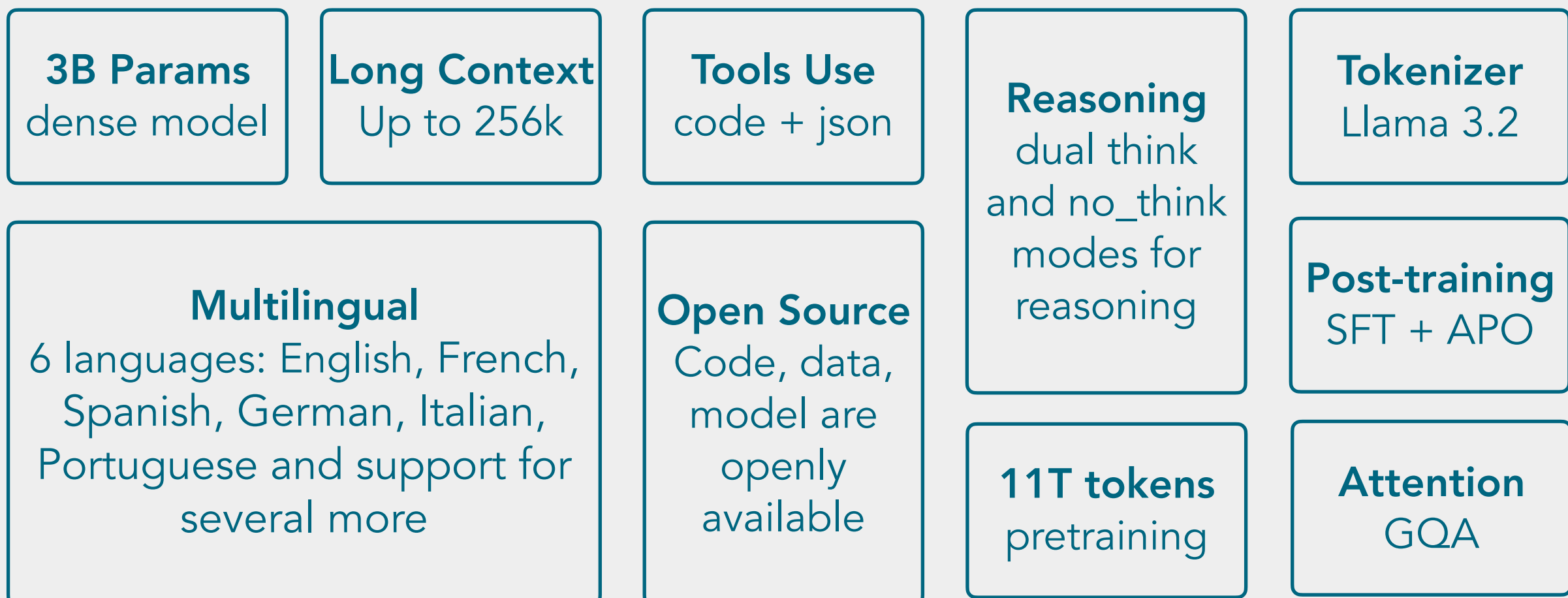
Parameter count: 3.08B
Initialization: N(0, std=0.02)
Layers: 36
Rope theta: 50k

Sequence length: 4096
Batch size: 2.36M Tokens
Optimizer: AdamW (eps=1e-8, beta1=0.8, beta2=0.95)
Learning rate (peak): 2e-4
Gradient Clipping: 1.0
Weight decay: 0.1
Gradient accumulation: 1
Micro batch size: 3
Precision: bf16
Tensor parallel: 2
Data parallel: 192

Throughput: 14k tokens/sec/gpu
MFU: 29.43 %
Training duration: 24 days

SmolLM3: Blueprint

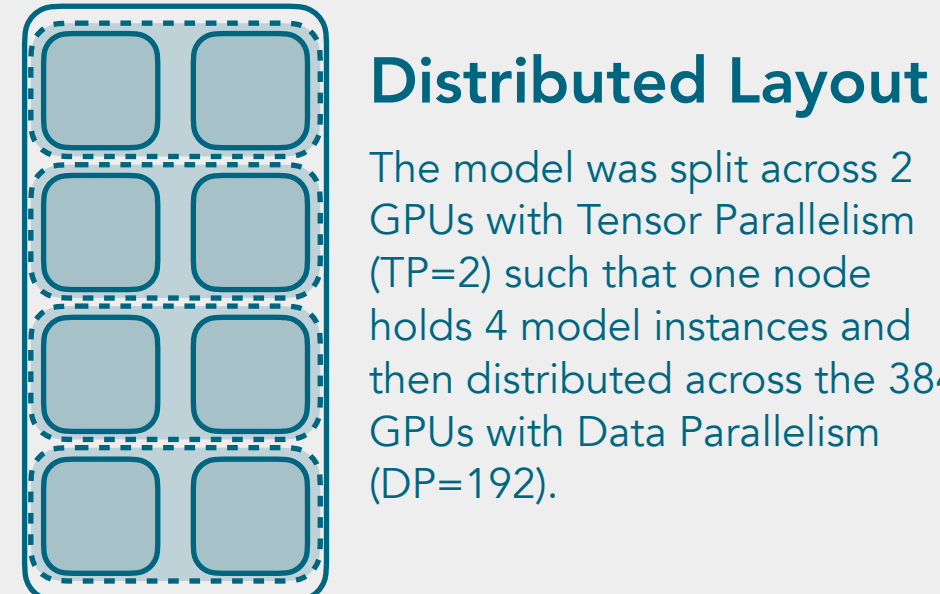
Small, multilingual, long-context reasoner



Distributed Training

Training Cluster

48 nodes of 8 x H100 (80 GB) for 24 days at the pretraining stage with a total of 220k GPUh.

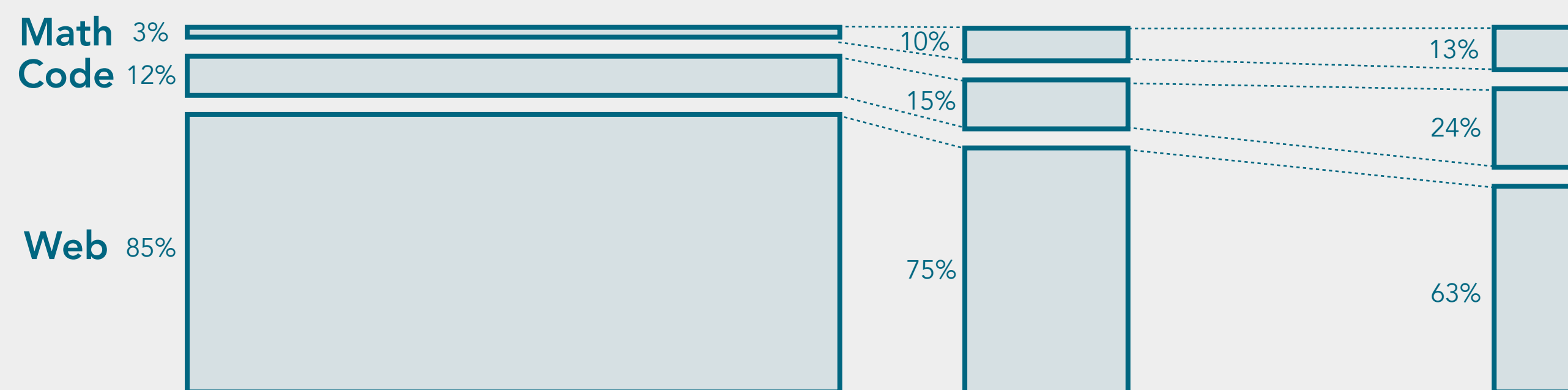


Logging and Checkpointing

Training and evaluation metrics are logged to W&B while checkpoints are stored on S3 every 2k steps. Evaluation runs asynchronously independent of training



Pretraining Recipe



Phase I

Description: Base training
Duration: 8T tokens
Datasets: Base mix for pretraining
Web: FineWeb-Edu, DCLM, FineWeb2, FineWeb2-HQ
Code: The Stack v2 (16 langs), StarCoder2 PRs, Jupyter/Kaggle NBs, GH issues, StackExchange
Math: FineMath3+ | InfWebMath3+

Phase II

Description: High quality injection
Duration: 2T tokens
Datasets: Adding Stack-Edu, FineMath4+, InfWebMath4+, MegaMath (incl. Qwen Q&A, Pro synthetic rewrites, and text code interleaved blocks)

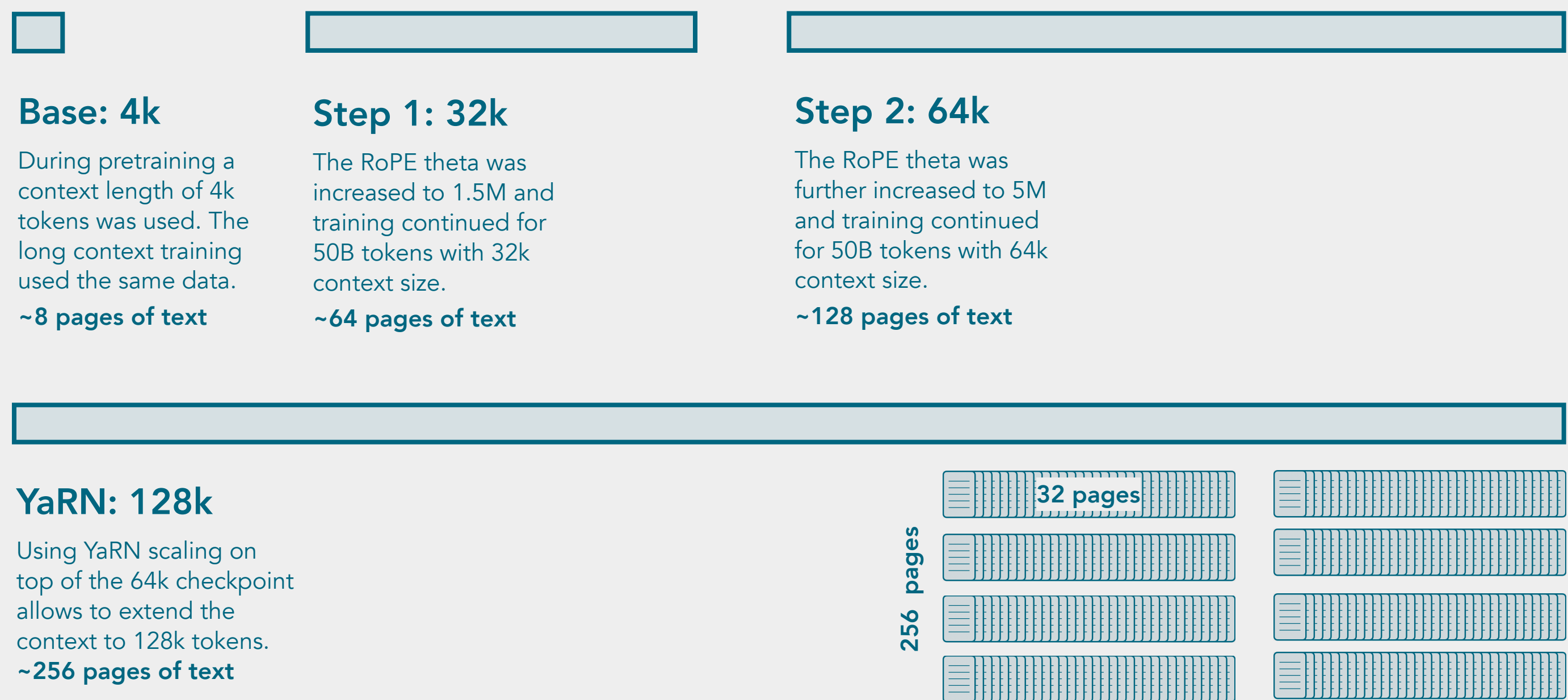
Phase III

Description: LR Decay
Duration: 1.1T tokens
Datasets: Upsampling high quality code/math datasets and adding instruction/reasoning data such as OpenMathReasoning

LR Schedule



Long Context Training



Evaluation

Base Model

	Hella Swag	ARC	MMLU Pro	BoolQ	MATH	Human Eval+	Global MMLU	Flores	Ruler 64k
Llama 3.2 3B	75.5	58.9	16.4	75.3	7.5	25.0	33.6	53.1	72.9
Qwen 2.5 3B	74.2	59.8	16.7	73.6	40.1	34.1	34.4	54.9	64.9
Qwen3 4B	74.4	62.1	24.9	74.3	51.2	54.9	40.3	55.8	60.3
SmolLM3 3B	76.2	65.6	19.6	79.0	46.1	30.5	32.2	56.3	67.9

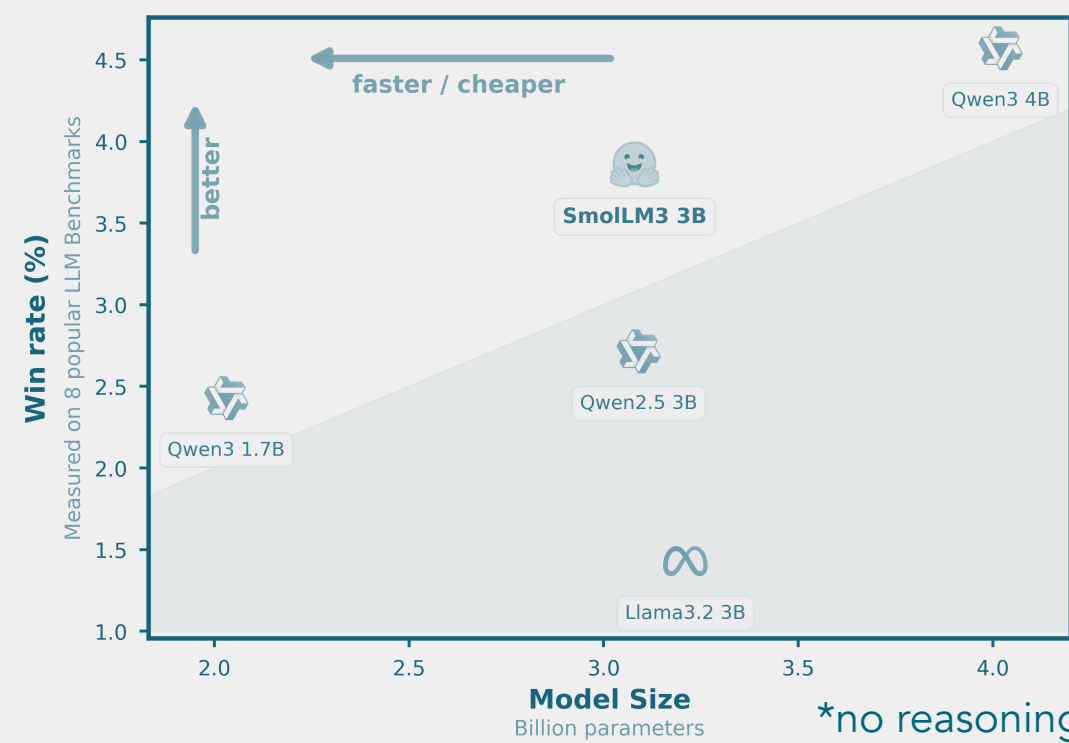
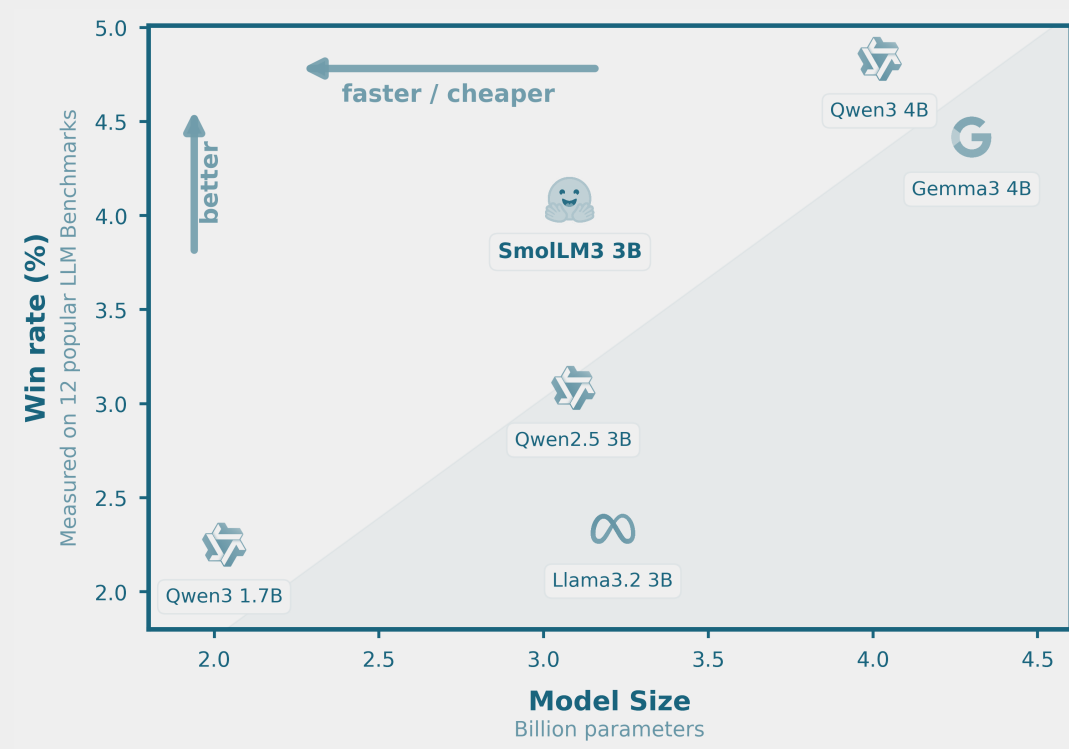
Knowledge & Reasoning Math & Code Multilingual fr/es/de/it/pt Long Context

Instruct Model

	AIME 2025	GSM Plus	LCB v4	GPOA diam.	IFEval	MixEval Hard	MMLU Pro	Global MMLU
SmolLM3 3B	36.7	84.4	30.5	41.7	71.2	30.8	58.4	64.1
Qwen3 1.7B	30.7	79.4	34.4	39.9	74.2	33.9	57.8	62.3
Qwen3 4B	58.8	88.2	52.9	55.3	85.4	38.0	70.2	73.3

	Non-Reasoning	Reasoning
SmolLM3 3B	2.3	72.8
Qwen3 1.7B	2.9	74.1
Llama 3.2 3B	0.3	59.2
Qwen3 1.7B	8.0	68.3
Qwen3 4B	17.1	82.1

	2025	Plus	v4	diam.	Hard	Pro	Global
SmolLM3 3B	2.3	72.8	15.2	35.7	76.7	26.9	45.0
Qwen3 1.7B	2.9	74.1	10.5	32.2	65.6	27.6	41.9
Llama 3.2 3B	0.3	59.2	3.4	29.4	71.6	24.9	36.6
Qwen3 1.7B	8.0	68.3	15.0	31.8	74.0	24.3	45.6
Qwen3 4B	17.1	82.1	24.9	44.4	68.9	31.6	60.9

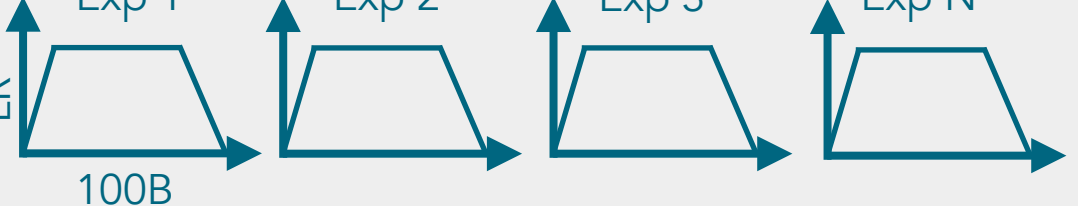


Data Ablations and Synthetic Generation

From Scratch Ablations

Before starting the pretraining run we ran ablations to determine the appropriate data mix. Each ablation trained from scratch for 100B tokens to decide

- ratio for FineWeb-Edu / DCLM
- impact of datasets like wiki, pes2o, StackExchange
- fraction of multilingual data without hurting English
- percentage of code data used in pretraining



Annealing Ablations

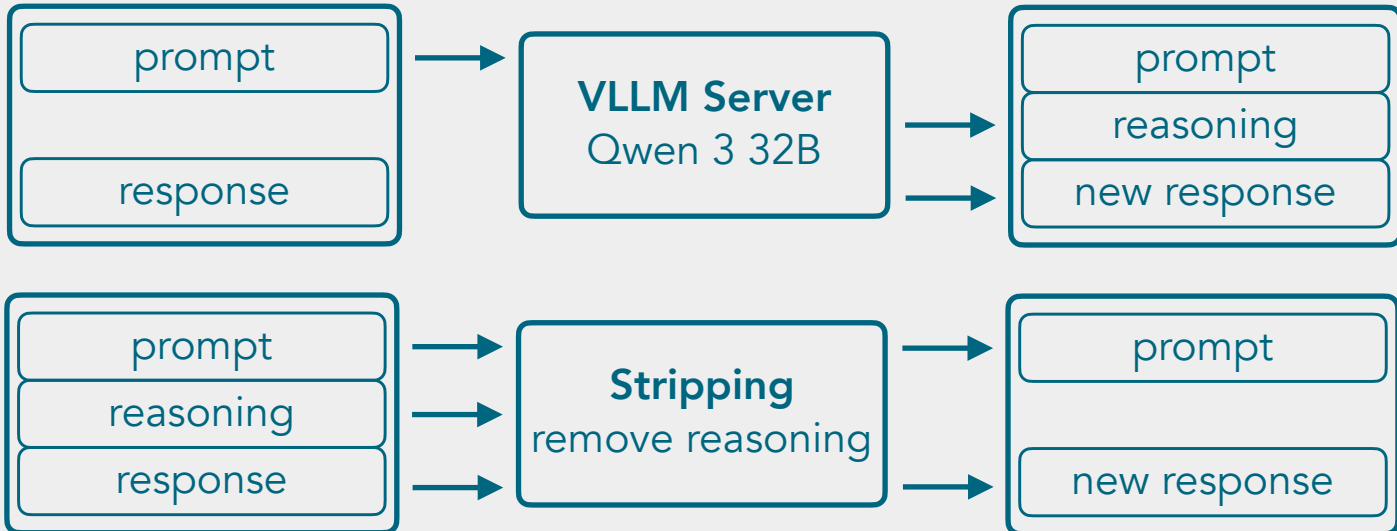
Between pretraining phases at 8 and 10T we ran additional ablations to adjust the data mix. Each ablation was based on the latest checkpoint and the LR was decayed for 50B tokens. We investigated:

- mixing in high quality data for math and code
- impact of adding reasoning data at later stages



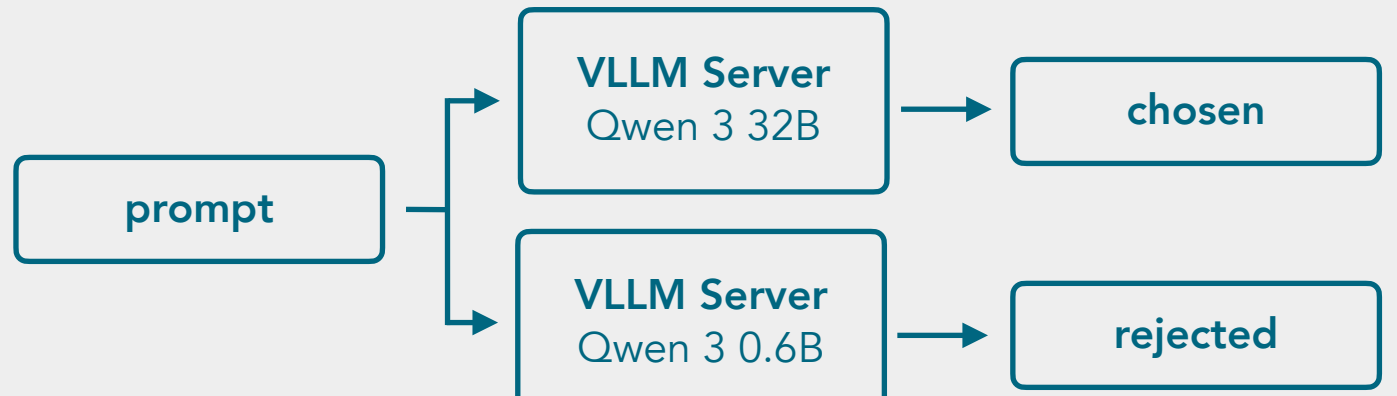
Synthetic SFT Data

For dual reasoning mode to work reliably it was necessary to generate synthetic data for datasets which had not reasoning traces and create a reasoning stripped version of reasoning datasets:



Synthetic Preference Data

For the APO step preference data is necessary which we generated using a strong (Qwen 3 32B) and a weak model (Qwen 3 0.6B):

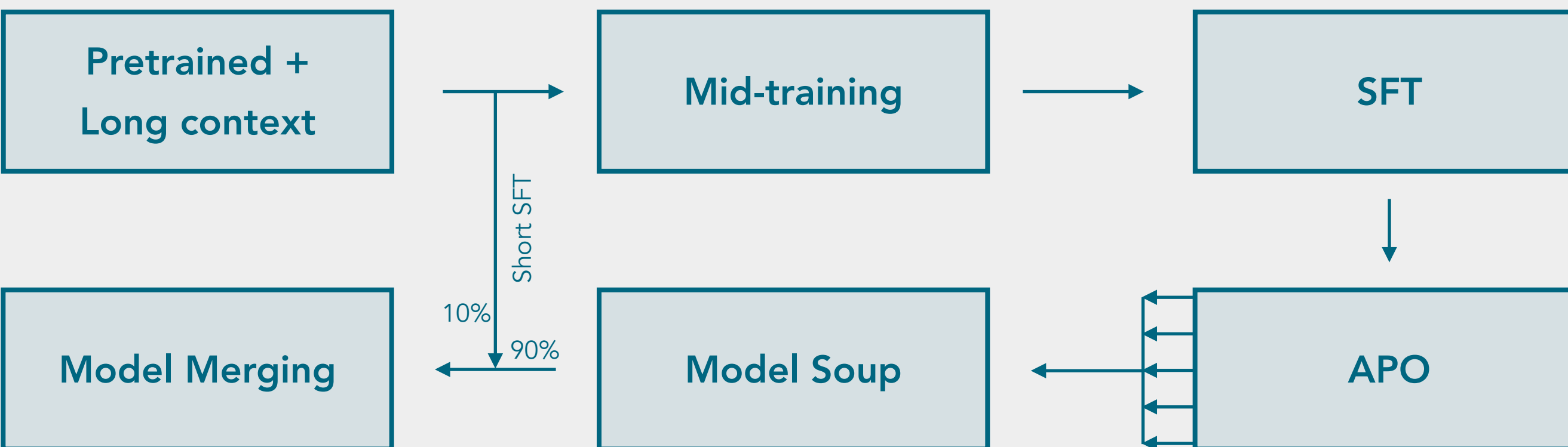


Post-training Recipe

The post-training recipe starts with the checkpoint after pretraining and long context adaptation. The optimizer state is not re-used from earlier training.

During mid-training the model is trained for 5 epochs on a mix of OpenThoughts and Nemotron post-training data totalling 175B tokens (35B unique).

The model is further trained on a mix of 25 high quality datasets mixing reasoning/non-reasoning post-training data totalling 175B tokens (2.5B unique).



Finally, we linearly merge the model soup checkpoint with long context checkpoint using a 90/10 ratio to recover the long context capabilities.

We found that model souping, where intermediate checkpoints from the APO stage are merged together further improves the downstream performance.

We apply Anchored Preference Optimization (APO), a variant of DPO, for 1 epoch with a thinking preference pair for every non-thinking preference pair.

Model Usage

transformers

from transformers import pipeline

```
model = "HuggingFaceTB/SmolLM3-3B"
pipe = pipeline("text-generation", model=model)

pipe("Is the earth flat?")
```

transformers-cli

```
transformers chat HuggingFaceTB/SmolLM3-3B
```

vllm

```
vllm serve "HuggingFaceTB/SmolLM3-3B" --model-impl transformers
```

llama.cpp

```
llama-server -hf HuggingFaceTB/SmolLM3-3B
```

mlx-lm

```
mlx_lm.chat --model "HuggingFaceTB/SmolLM3-3B"
```

Chat Template

```
1 # Default chat template
2 # This template is used for the chat completion task.
3 # It defines the system, user, and assistant roles, and the format for the messages.
4 # The template is used to format the input and output of the chat completion task.
5 # The input is a list of messages, and the output is a list of messages.
6 # The messages are formatted as follows:
7 # - System messages: "system: [message]"
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