

Seben: Morphotactic-Guided Preference Alignment for Extremely Low-Resource Language

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kv:2610.00041v1 · Published 2026-10-13

Official implementation · Research paper · Machine learning

Abstract

Preference-based post-training improves language models, but the standard methods use surface tokens as the training signal and target high-resource languages. We present S?b?n, a post-training framework that adds morphotactic verification to the alignment loop for small language models in extremely low-resource languages. A rule-based morphological analyzer checks each generated analysis against a per-language grammar and dictionary, and a morpheme-level reward turns the check into a training signal for supervised fine-tuning, DPO, APO, and GRPO. The framework also gates automatic grammar and dictionary updates behind an integrity threshold. We run S?b?n on the 13 national languages of Mali with five small models from 135M to 2B parameters and report morphological integrity, morpheme error rate, consistency, and an uncertainty-weighted cost on a seed-fixed held-out split. GRPO gives the lowest morpheme error rate for SmolLM2-135M, Gemma-4-E2B, and TinyLlama-1.1B, while the four arms tie for LFM2.5-230M. We record and seal every run with K-Veritas, so each reported score is bound to the computation that produced it and can be verified publicly. We report the full configuration and evaluation records so that others can reproduce the matrix.

About this record

Title, authors and abstract were provided by the authors and reviewed for completeness, not for scientific soundness. Every number in this record is copied from the signed data of the sealed reports [2], [3], [4], [5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [15], [16], [17], [18], [19], [20], [21], [22], [23], which remain authoritative.

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1 Sealed reports

The experiments were sealed with K-Veritas [1], which binds each result to the code, hardware and time that produced it.

Report	Label	Sealed	Runs	Invocations	Signer
r1 [2]	sebeni-gemma-4-e2b-apo-50	2026-10-12	1	1	Signed by the K-Veritas server
r2 [3]	sebeni-gemma-4-e2b-dpo-50	2026-10-12	1	1	Signed by the K-Veritas server
r3 [4]	sebeni-gemma-4-e2b-grpo-50	2026-10-13	1	1	Signed by the K-Veritas server
r4 [5]	sebeni-gemma-4-e2b-sft-50	2026-10-12	1	1	Signed by the K-Veritas server
r5 [6]	sebeni-lfm2.5-230-apo-100	2026-10-11	1	1	Signed by the K-Veritas server
r6 [7]	sebeni-lfm2.5-230-dpo-100	2026-10-11	1	1	Signed by the K-Veritas server
r7 [8]	sebeni-lfm2.5-230-grpo-100	2026-10-11	1	1	Signed by the K-Veritas server
r8 [9]	sebeni-lfm2.5-230-sft-100	2026-10-11	1	1	Signed by the K-Veritas server
r9 [10]	sebeni-qwen2.5-0.5b-sft-100	2026-10-11	1	1	Signed by the K-Veritas server

Report	Label	Sealed	Runs	Invocations	Signer
r10 [11]	sebeni-qwen3-0.6b-apo-50	2026-10-12	1	1	Signed by the K-Veritas server
r11 [12]	sebeni-qwen3-0.6b-dpo-50	2026-10-12	1	1	Signed by the K-Veritas server
r12 [13]	sebeni-qwen3-0.6b-grpo-50	2026-10-12	1	1	Signed by the K-Veritas server
r13 [14]	sebeni-qwen3-0.6b-sft-100	2026-10-12	1	1	Signed by the K-Veritas server
r14 [15]	sebeni-qwen3-0.6b-sft-50	2026-10-12	1	1	Signed by the K-Veritas server
r15 [16]	sebeni-smollm2-135-apo-100	2026-10-11	1	1	Signed by the K-Veritas server
r16 [17]	sebeni-smollm2-135-dpo-100	2026-10-11	1	1	Signed by the K-Veritas server
r17 [18]	sebeni-smollm2-135-grpo-100	2026-10-11	1	1	Signed by the K-Veritas server
r18 [19]	sebeni-smollm2-135-sft-100	2026-10-11	1	1	Signed by the K-Veritas server
r19 [20]	sebeni-tinyllama-1.1b-apo-50	2026-10-12	1	1	Signed by the K-Veritas server
r20 [21]	sebeni-tinyllama-1.1b-dpo-50	2026-10-12	1	1	Signed by the K-Veritas server
r21 [22]	sebeni-tinyllama-1.1b-grpo-50	2026-10-12	1	1	Signed by the K-Veritas server
r22 [23]	sebeni-tinyllama-1.1b-sft-50	2026-10-12	1	1	Signed by the K-Veritas server

2 Results

r1: sebeni-gemma-4-e2b-apo-50

Run	Metric	Final value	Step
1	phi	0.500696	0
1	phi_bam	0.542398	0
1	phi_bmq	0.722896	0
1	phi_boz	0.367929	0
1	phi_dtm	0.576727	0
1	phi_ful	0.476789	0
1	phi_mey	0.256	0
1	phi_mku	0.428211	0
1	phi_kao	0.807126	0
1	phi_myk	0.403434	0
1	phi_ses	0.364965	0
1	phi_spp	0.364618	0
1	phi_snk	0.468311	0
1	phi_taq	0.72964	0

r2: sebeni-gemma-4-e2b-dpo-50

Run	Metric	Final value	Step
1	phi	0.490894	0
1	phi_bam	0.531287	0
1	phi_bmq	0.716173	0
1	phi_boz	0.366731	0
1	phi_dtm	0.580731	0
1	phi_ful	0.469334	0
1	phi_mey	0.25935	0
1	phi_mku	0.459184	0
1	phi_kao	0.777122	0
1	phi_myk	0.359593	0
1	phi_ses	0.380133	0
1	phi_spp	0.365613	0
1	phi_snk	0.42287	0

Run	Metric	Final value	Step
1	phi_taq	0.693508	0

r3: sebeni-gemma-4-e2b-grpo-50

Run	Metric	Final value	Step
1	phi	0.50172	0
1	phi_bam	0.561899	0
1	phi_bmq	0.693351	0
1	phi_boz	0.438394	0
1	phi_dtm	0.511633	0
1	phi_ful	0.410578	0
1	phi_mey	0.30068	0
1	phi_mku	0.409287	0
1	phi_kao	0.802235	0
1	phi_myk	0.359868	0
1	phi_ses	0.440817	0
1	phi_spp	0.391609	0
1	phi_snk	0.486494	0
1	phi_taq	0.715518	0

r4: sebeni-gemma-4-e2b-sft-50

Run	Metric	Final value	Step
1	phi	0.514043	0
1	phi_bam	0.571181	0
1	phi_bmq	0.76255	0
1	phi_boz	0.411667	0
1	phi_dtm	0.699308	0
1	phi_ful	0.380613	0
1	phi_mey	0.274569	0
1	phi_mku	0.414502	0
1	phi_kao	0.852257	0
1	phi_myk	0.380295	0
1	phi_ses	0.364299	0
1	phi_spp	0.425676	0
1	phi_snk	0.386128	0
1	phi_taq	0.759513	0

r5: sebeni-lfm2.5-230-apo-100

Run	Metric	Final value	Step
1	phi	0.804974	0
1	phi_bam	0.823658	0
1	phi_bmq	0.695688	0
1	phi_boz	0.892011	0
1	phi_dtm	0.758926	0
1	phi_ful	0.974206	0
1	phi_mey	0.768726	0
1	phi_mku	0.884478	0
1	phi_kao	0.970238	0
1	phi_myk	0.763677	0
1	phi_ses	0.806021	0

Run	Metric	Final value	Step
1	phi_spp	0.496919	0
1	phi_snk	0.781673	0
1	phi_taq	0.84844	0

r6: sebeni-lfm2.5-230-dpo-100

Run	Metric	Final value	Step
1	phi	0.804974	0
1	phi_bam	0.823658	0
1	phi_bmq	0.695688	0
1	phi_boz	0.892011	0
1	phi_dtm	0.758926	0
1	phi_ful	0.974206	0
1	phi_mey	0.768726	0
1	phi_mku	0.884478	0
1	phi_kao	0.970238	0
1	phi_myk	0.763677	0
1	phi_ses	0.806021	0
1	phi_spp	0.496919	0
1	phi_snk	0.781673	0
1	phi_taq	0.84844	0

r7: sebeni-lfm2.5-230-grpo-100

Run	Metric	Final value	Step
1	phi	0.804974	0
1	phi_bam	0.823658	0
1	phi_bmq	0.695688	0
1	phi_boz	0.892011	0
1	phi_dtm	0.758926	0
1	phi_ful	0.974206	0
1	phi_mey	0.768726	0
1	phi_mku	0.884478	0
1	phi_kao	0.970238	0
1	phi_myk	0.763677	0
1	phi_ses	0.806021	0
1	phi_spp	0.496919	0
1	phi_snk	0.781673	0
1	phi_taq	0.84844	0

r8: sebeni-lfm2.5-230-sft-100

Run	Metric	Final value	Step
1	phi	0.48328	0
1	phi_bam	0.515217	0
1	phi_bmq	0.689472	0
1	phi_boz	0.325034	0
1	phi_dtm	0.566503	0
1	phi_ful	0.324842	0
1	phi_mey	0.214444	0
1	phi_mku	0.649702	0
1	phi_kao	0.870567	0

Run	Metric	Final value	Step
1	phi_myk	0.342347	0
1	phi_ses	0.368177	0
1	phi_spp	0.328663	0
1	phi_snk	0.346684	0
1	phi_taq	0.740981	0

r9: sebeni-qwen2.5-0.5b-sft-100

Run	Metric	Final value	Step
1	phi	0.644057	0
1	phi_bam	0.586164	0
1	phi_bmq	0.889136	0
1	phi_boz	0.80303	0
1	phi_dtm	0.723584	0
1	phi_ful	0.78921	0
1	phi_mey	0.428105	0
1	phi_mku	0.63627	0
1	phi_kao	0.872754	0
1	phi_myk	0.498514	0
1	phi_ses	0.457255	0
1	phi_spp	0.371716	0
1	phi_snk	0.543597	0
1	phi_taq	0.773411	0

r10: sebeni-qwen3-0.6b-apo-50

Run	Metric	Final value	Step
1	phi	0.51067	0
1	phi_bam	0.574067	0
1	phi_bmq	0.715822	0
1	phi_boz	0.360562	0
1	phi_dtm	0.594784	0
1	phi_ful	0.551	0
1	phi_mey	0.299815	0
1	phi_mku	0.433409	0
1	phi_kao	0.865789	0
1	phi_myk	0.313592	0
1	phi_ses	0.384177	0
1	phi_spp	0.417665	0
1	phi_snk	0.450497	0
1	phi_taq	0.67753	0

r11: sebeni-qwen3-0.6b-dpo-50

Run	Metric	Final value	Step
1	phi	0.508411	0
1	phi_bam	0.531762	0
1	phi_bmq	0.71156	0
1	phi_boz	0.395144	0
1	phi_dtm	0.560063	0
1	phi_ful	0.536991	0
1	phi_mey	0.314502	0

Run	Metric	Final value	Step
1	phi_mku	0.448062	0
1	phi_kao	0.877949	0
1	phi_myk	0.309261	0
1	phi_ses	0.380018	0
1	phi_spp	0.378648	0
1	phi_snk	0.46078	0
1	phi_taq	0.704609	0

r12: sebeni-qwen3-0.6b-grpo-50

Run	Metric	Final value	Step
1	phi	0.504376	0
1	phi_bam	0.550204	0
1	phi_bmq	0.705471	0
1	phi_boz	0.368103	0
1	phi_dtm	0.588395	0
1	phi_ful	0.496525	0
1	phi_mey	0.379906	0
1	phi_mku	0.394684	0
1	phi_kao	0.841474	0
1	phi_myk	0.333167	0
1	phi_ses	0.381402	0
1	phi_spp	0.401826	0
1	phi_snk	0.446357	0
1	phi_taq	0.669377	0

r13: sebeni-qwen3-0.6b-sft-100

Run	Metric	Final value	Step
1	phi	0.5256	0
1	phi_bam	0.579857	0
1	phi_bmq	0.743126	0
1	phi_boz	0.40078	0
1	phi_dtm	0.60896	0
1	phi_ful	0.56789	0
1	phi_mey	0.332941	0
1	phi_mku	0.427132	0
1	phi_kao	0.854803	0
1	phi_myk	0.331227	0
1	phi_ses	0.415598	0
1	phi_spp	0.412775	0
1	phi_snk	0.436358	0
1	phi_taq	0.72136	0

r14: sebeni-qwen3-0.6b-sft-50

Run	Metric	Final value	Step
1	phi	0.524288	0
1	phi_bam	0.580331	0
1	phi_bmq	0.785655	0
1	phi_boz	0.380148	0
1	phi_dtm	0.606802	0

Run	Metric	Final value	Step
1	phi_ful	0.515136	0
1	phi_mey	0.334913	0
1	phi_mku	0.416787	0
1	phi_kao	0.875303	0
1	phi_myk	0.317416	0
1	phi_ses	0.441342	0
1	phi_spp	0.408253	0
1	phi_snk	0.466966	0
1	phi_taq	0.686685	0

r15: sebeni-smollm2-135-apo-100

Run	Metric	Final value	Step
1	phi	0.804974	0
1	phi_bam	0.823658	0
1	phi_bmq	0.695688	0
1	phi_boz	0.892011	0
1	phi_dtm	0.758926	0
1	phi_ful	0.974206	0
1	phi_mey	0.768726	0
1	phi_mku	0.884478	0
1	phi_kao	0.970238	0
1	phi_myk	0.763677	0
1	phi_ses	0.806021	0
1	phi_spp	0.496919	0
1	phi_snk	0.781673	0
1	phi_taq	0.84844	0

r16: sebeni-smollm2-135-dpo-100

Run	Metric	Final value	Step
1	phi	0.804974	0
1	phi_bam	0.823658	0
1	phi_bmq	0.695688	0
1	phi_boz	0.892011	0
1	phi_dtm	0.758926	0
1	phi_ful	0.974206	0
1	phi_mey	0.768726	0
1	phi_mku	0.884478	0
1	phi_kao	0.970238	0
1	phi_myk	0.763677	0
1	phi_ses	0.806021	0
1	phi_spp	0.496919	0
1	phi_snk	0.781673	0
1	phi_taq	0.84844	0

r17: sebeni-smollm2-135-grpo-100

Run	Metric	Final value	Step
1	phi	0.804974	0
1	phi_bam	0.823658	0
1	phi_bmq	0.695688	0

Run	Metric	Final value	Step
1	phi_boz	0.892011	0
1	phi_dtm	0.758926	0
1	phi_ful	0.974206	0
1	phi_mey	0.768726	0
1	phi_mku	0.884478	0
1	phi_kao	0.970238	0
1	phi_myk	0.763677	0
1	phi_ses	0.806021	0
1	phi_spp	0.496919	0
1	phi_snk	0.781673	0
1	phi_taq	0.84844	0

r18: sebeni-smollm2-135-sft-100

Run	Metric	Final value	Step
1	phi	0.804974	0
1	phi_bam	0.823658	0
1	phi_bmq	0.695688	0
1	phi_boz	0.892011	0
1	phi_dtm	0.758926	0
1	phi_ful	0.974206	0
1	phi_mey	0.768726	0
1	phi_mku	0.884478	0
1	phi_kao	0.970238	0
1	phi_myk	0.763677	0
1	phi_ses	0.806021	0
1	phi_spp	0.496919	0
1	phi_snk	0.781673	0
1	phi_taq	0.84844	0

r19: sebeni-tinyllama-1.1b-apo-50

Run	Metric	Final value	Step
1	phi	0.449859	0
1	phi_bam	0.459196	0
1	phi_bmq	0.737672	0
1	phi_boz	0.383668	0
1	phi_dtm	0.629466	0
1	phi_ful	0.369023	0
1	phi_mey	0.241557	0
1	phi_mku	0.213298	0
1	phi_kao	0.811908	0
1	phi_myk	0.320214	0
1	phi_ses	0.242411	0
1	phi_spp	0.395844	0
1	phi_snk	0.385623	0
1	phi_taq	0.658282	0

r20: sebeni-tinyllama-1.1b-dpo-50

Run	Metric	Final value	Step
1	phi	0.439655	0
1	phi_bam	0.460386	0
1	phi_bmq	0.737672	0
1	phi_boz	0.439545	0
1	phi_dtm	0.517174	0
1	phi_ful	0.372382	0
1	phi_mey	0.23003	0
1	phi_mku	0.212097	0
1	phi_kao	0.842144	0
1	phi_myk	0.304299	0
1	phi_ses	0.232788	0
1	phi_spp	0.384497	0
1	phi_snk	0.315231	0
1	phi_taq	0.667272	0

r21: sebeni-tinyllama-1.1b-grpo-50

Run	Metric	Final value	Step
1	phi	0.49631	0
1	phi_bam	0.515023	0
1	phi_bmq	0.644887	0
1	phi_boz	0.426366	0
1	phi_dtm	0.572217	0
1	phi_ful	0.34976	0
1	phi_mey	0.205956	0
1	phi_mku	0.49062	0
1	phi_kao	0.763131	0
1	phi_myk	0.354474	0
1	phi_ses	0.440974	0
1	phi_spp	0.432305	0
1	phi_snk	0.408532	0
1	phi_taq	0.847779	0

r22: sebeni-tinyllama-1.1b-sft-50

Run	Metric	Final value	Step
1	phi	0.499372	0
1	phi_bam	0.565924	0
1	phi_bmq	0.709444	0
1	phi_boz	0.390159	0
1	phi_dtm	0.569545	0
1	phi_ful	0.423977	0
1	phi_mey	0.336661	0
1	phi_mku	0.351723	0
1	phi_kao	0.783419	0
1	phi_myk	0.329046	0
1	phi_ses	0.348706	0
1	phi_spp	0.490032	0
1	phi_snk	0.380257	0
1	phi_taq	0.812938	0

3 Setup

Report	Item	Value
r1	Operating system	linux / amd64
r1	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores
r1	GPU	NVIDIA L4, 23034 MiB
r1	Memory	31.3 GB
r1	Total run time	1.8 s
r2	Operating system	linux / amd64
r2	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores
r2	GPU	NVIDIA L4, 23034 MiB
r2	Memory	31.3 GB
r2	Total run time	1.9 s
r3	Operating system	linux / amd64
r3	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores
r3	GPU	NVIDIA L4, 23034 MiB
r3	Memory	31.3 GB
r3	Total run time	1.8 s
r4	Operating system	linux / amd64
r4	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores
r4	GPU	NVIDIA L4, 23034 MiB
r4	Memory	31.3 GB
r4	Total run time	2.2 s
r5	Operating system	linux / amd64
r5	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 4 cores
r5	GPU	NVIDIA L4, 23034 MiB
r5	Memory	15.6 GB
r5	Total run time	0.6 s
r6	Operating system	linux / amd64
r6	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 4 cores
r6	GPU	NVIDIA L4, 23034 MiB
r6	Memory	15.6 GB
r6	Total run time	0.6 s
r7	Operating system	linux / amd64
r7	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 4 cores
r7	GPU	NVIDIA L4, 23034 MiB
r7	Memory	15.6 GB
r7	Total run time	0.6 s
r8	Operating system	linux / amd64
r8	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 4 cores
r8	GPU	NVIDIA L4, 23034 MiB
r8	Memory	15.6 GB
r8	Total run time	0.6 s
r9	Operating system	linux / amd64
r9	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 4 cores
r9	GPU	NVIDIA L4, 23034 MiB
r9	Memory	15.6 GB
r9	Total run time	1.0 s
r10	Operating system	linux / amd64
r10	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores

Report	Item	Value
r10	GPU	NVIDIA L4, 23034 MiB
r10	Memory	31.3 GB
r10	Total run time	1.1 s
r11	Operating system	linux / amd64
r11	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores
r11	GPU	NVIDIA L4, 23034 MiB
r11	Memory	31.3 GB
r11	Total run time	0.9 s
r12	Operating system	linux / amd64
r12	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores
r12	GPU	NVIDIA L4, 23034 MiB
r12	Memory	31.3 GB
r12	Total run time	1.0 s
r13	Operating system	linux / amd64
r13	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores
r13	GPU	NVIDIA L4, 23034 MiB
r13	Memory	31.3 GB
r13	Total run time	1.0 s
r14	Operating system	linux / amd64
r14	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores
r14	GPU	NVIDIA L4, 23034 MiB
r14	Memory	31.3 GB
r14	Total run time	1.0 s
r15	Operating system	linux / amd64
r15	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 4 cores
r15	GPU	NVIDIA L4, 23034 MiB
r15	Memory	15.6 GB
r15	Total run time	0.5 s
r16	Operating system	linux / amd64
r16	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 4 cores
r16	GPU	NVIDIA L4, 23034 MiB
r16	Memory	15.6 GB
r16	Total run time	0.5 s
r17	Operating system	linux / amd64
r17	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 4 cores
r17	GPU	NVIDIA L4, 23034 MiB
r17	Memory	15.6 GB
r17	Total run time	0.5 s
r18	Operating system	linux / amd64
r18	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 4 cores
r18	GPU	NVIDIA L4, 23034 MiB
r18	Memory	15.6 GB
r18	Total run time	0.5 s
r19	Operating system	linux / amd64
r19	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores
r19	GPU	NVIDIA L4, 23034 MiB
r19	Memory	31.3 GB
r19	Total run time	0.5 s
r20	Operating system	linux / amd64
r20	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores

Report	Item	Value
r20	GPU	NVIDIA L4, 23034 MiB
r20	Memory	31.3 GB
r20	Total run time	0.5 s
r21	Operating system	linux / amd64
r21	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores
r21	GPU	NVIDIA L4, 23034 MiB
r21	Memory	31.3 GB
r21	Total run time	0.4 s
r22	Operating system	linux / amd64
r22	CPU	Intel(R) Xeon(R) CPU @ 2.20GHz, 8 cores
r22	GPU	NVIDIA L4, 23034 MiB
r22	Memory	31.3 GB
r22	Total run time	0.5 s

4 Files

Each report and code bundle must hash to these values. A bundle belongs to the report whose signed data names its hash.

File	SHA-256	Size
r1.pdf	86cacd14970cdea9c30d9142bd90b0db4effb7ea5fc147429b7073c5cffe411f	71 KB
r1.kvbundle.zip	54bfccd0bcc3b2c671c45dd223d7793bc649d6fd3b25937616f74fbd0e1c309e	5.4 MB
r2.pdf	b5753492f3fb0b015dace3955ff37831602c3aa46229d411d16d57eed8181ea9	71 KB
r2.kvbundle.zip	4f29186b5eaf7337f3ada815ac99e3b68143bdba070d3c0201df1873ac0817ad	5.4 MB
r3.pdf	5b51b64a9366c0dcca6ffcebec7d447173e9be471e2e4d68afffd7f195a515a3	70 KB
r3.kvbundle.zip	e5346341e95937da495125d82d4e19d780111ea0cce86a8f2049d7e49890f54d	5.4 MB
r4.pdf	8e2fd349b6e460747043777dbc5f608247476ff77fee660821caa6d45c93fb8d	74 KB
r4.kvbundle.zip	31327cd5c82af61685ad4727e37474d5c03ea6c6e7c0c795838d1e5c22ea39d9	5.4 MB
r5.pdf	1b106fc1f6376a9477659f4417edfb7b984ee5139dfd7d2eaa4c88146ab10d5	70 KB
r5.kvbundle.zip	e412a902153d43eedde941b3922070553e6a64fde95ed9ade7ceb40eaf624280	939 KB
r6.pdf	c9abf7c54d6cb8fb3ca64859a0c45ab102f592697adb2f28fd24de041f1ac8be	70 KB
r6.kvbundle.zip	fd5b959e02ea446698070bef091cb03a573845b5a0ecf5fbd9f8315ea3a2e88f	939 KB
r7.pdf	78dfd64bdb40ad3b50da8adf76820e8f95fee75d8416e48695417e7c02175d05	70 KB
r7.kvbundle.zip	cfdf5f67fdbf543bf64309b639de927831d1c4f97e4e01f21bb3dcfd1ebaac092	942 KB
r8.pdf	9effc847bab906e500bc2236c39ccc0bdd2a1832cab37d6fe98202d126b0c789	71 KB
r8.kvbundle.zip	c0a8da50811d44193cb82d21a00bc816bcb92049ee13ce9c1e347b1ebab141ea	927 KB
r9.pdf	7afb4460784ac71468dacbe7ea87668a1739bbb797b4d8f63a79e36e9d55d4e5	71 KB
r9.kvbundle.zip	1b82d8b9baf7bf8657dd0b5326556ed23856203f4a7d21f6b6e6a05a14158422	2.1 MB
r10.pdf	4e3927e43c3521c17142b753fc1272dbb335fea23e24290c4630b32720a64496	73 KB
r10.kvbundle.zip	224375ae8bc00d344039fd054786a2fa92178a00eb0a03e450cebeda3b64dbe1	2.1 MB
r11.pdf	a6f5bb1d9384c0969467a27bf4c586e82801907e81510e555ad0a468344d0eb2	70 KB
r11.kvbundle.zip	120837266c2eb4685c5f92c7b86225d66025a9af9fd19ae834ec6daad9f487f1	2.1 MB
r12.pdf	4f7b1fe996e92d4c6b7912601fddd7e84584df1cb641a5342077fd8abbb054	72 KB
r12.kvbundle.zip	a08efbd5da2593f93db9bd700e8ff0b0145f60f9104e3916d57b61a61491792c	2.1 MB
r13.pdf	4a41c34807884f25ac440214e6a0462e31ea8dd78d40a5f68f319a4fab101226	71 KB
r13.kvbundle.zip	6130ae6f6358397b16e6a048c23e38f94f38a6dfc2abcb9f71c4649125b6ad38	2.1 MB
r14.pdf	ef840347dd35c582e61aa4416ce09c0eb5944cd15dd96dfd29534d5b34fe7886	71 KB
r14.kvbundle.zip	72fa046766e9d7f9d5970b4df32ee6c3a76bb236290735637375e5d2198db33	2.1 MB
r15.pdf	5dcd2963714e84f545f72cb11bdf19b69523afe95c9dafbe0d2c89ced4faf16	69 KB
r15.kvbundle.zip	a285f1833819f25cd74d23ff6a888105e6e7781c0c5d3c8f9629d5ec11eae074	691 KB
r16.pdf	3f46f56089327bf840d24d8b14c84ed24b0c7e61aec1569beee57bfceafcb6ab	69 KB

File	SHA-256	Size
r16.kvbundle.zip	2ce9e21b046b05de06eb9ca9c5251b38045a1cac188df4a5a7120b9c504c3d16	691 KB
r17.pdf	7f2469771737d0ca53e7a53d509b183244012993f7592367ae98754eea3f62db	69 KB
r17.kvbundle.zip	4f6357f8ba3534b71c9a365f3cfa0a02a83b37b48ec7d5f2286a7c9dfffe229ed	664 KB
r18.pdf	4a4f656985732cb00c1951d5c6000ac388a2d5f9be343264e4c132ffb0901a51	68 KB
r18.kvbundle.zip	d24548a35bc6e48a86d0fd63431f401491c3b5471ca650c786747e36a3eb3db0	670 KB
r19.pdf	1051b69d0cfc0af8407a89058d83cc17af286da2457870493f33fd53a276e842	72 KB
r19.kvbundle.zip	320a8c9cb3f873b9870dcb9dd0115f9a6df93fe4fbcbb41646a0d0a565583090	568 KB
r20.pdf	0b9f5750c49fb0fb1e235780d8ac89fe3e09d0f092a0201f6596f2001eaf7b7a	72 KB
r20.kvbundle.zip	9b85cb69d6db2bfd1f64156054eda14d34c3a664360fdb5dc3b02b6355c85b98	568 KB
r21.pdf	cc6c72fe3e4c8af72033fe8a161a7dbebbc785d4675342fa66c12ccee4f0d4d6	68 KB
r21.kvbundle.zip	6eeadb91f8931cb0541628154092b687bd754911c29316718007b9cf5380790c	565 KB
r22.pdf	5d80d6171cd60ab2205dacb14bd36f4e1b776f5109f81b30f579e65bf85a86fb	71 KB
r22.kvbundle.zip	d601ea47d5f5a3494ba0d683ea18649e25d8ba997ac42acb2b331b048e0403d3	565 KB

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<https://kveritas.org/records/2610.00041v1/r1.pdf>
- [3] Sealed experiment report r2 (sebeni-gemma-4-e2b-dpo-50), kv:2610.00041v1/r2. Data hash 13ccb04c72f4dd55b2c3da9c9cef6a29a86c36df53449d5298a80701d3cd52d1.
<https://kveritas.org/records/2610.00041v1/r2.pdf>
- [4] Sealed experiment report r3 (sebeni-gemma-4-e2b-grpo-50), kv:2610.00041v1/r3. Data hash d00670226ba6aceff75b860e724a719cc5d5e2185c658fafbe9755c448af0773.
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<https://kveritas.org/records/2610.00041v1/r5.pdf>
- [7] Sealed experiment report r6 (sebeni-lfm2.5-230-dpo-100), kv:2610.00041v1/r6. Data hash a8eca3de408a2638a22650827693ba3c3b6ca01ec0dd1d738779e820f63ae7cd.
<https://kveritas.org/records/2610.00041v1/r6.pdf>
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<https://kveritas.org/records/2610.00041v1/r7.pdf>
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73105e4d2253c922bec34d48e64fe1f5df26520f6e822912ba8045a5ad17d070.

<https://kveritas.org/records/2610.00041v1/r8.pdf>

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<https://kveritas.org/records/2610.00041v1/r9.pdf>

[11] Sealed experiment report r10 (sebeni-qwen3-0.6b-apo-50), kv:2610.00041v1/r10. Data hash bc797885a7ffd31fee42961eeb2393e204aab725e676299a40204f76b384afd6.

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[12] Sealed experiment report r11 (sebeni-qwen3-0.6b-dpo-50), kv:2610.00041v1/r11. Data hash d614230166a544a2dca4b6f2b2116bfebe4d4d3c4cad21012e2d029627c5926e.

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[13] Sealed experiment report r12 (sebeni-qwen3-0.6b-grpo-50), kv:2610.00041v1/r12. Data hash c4a8a550ff62b34391812a4dab80c7b5a04870b5deab8cfa40aecc3f26a5f32f.

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[14] Sealed experiment report r13 (sebeni-qwen3-0.6b-sft-100), kv:2610.00041v1/r13. Data hash b24282941316fec2cd171e99e22a5b5868dc4205550e6ed78bf02310fd7d20fe.

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[16] Sealed experiment report r15 (sebeni-smollm2-135-apo-100), kv:2610.00041v1/r15. Data hash a7fab9cc3ac4fd339aa2655d6e02e7ef1c28bc6505679bfcd335118adfcbe270.

<https://kveritas.org/records/2610.00041v1/r15.pdf>

[17] Sealed experiment report r16 (sebeni-smollm2-135-dpo-100), kv:2610.00041v1/r16. Data hash f63156e409a6b4efd4eb75204f6278276d8184d53e244f0bcfd4dfb4136bddc0.

<https://kveritas.org/records/2610.00041v1/r16.pdf>

[18] Sealed experiment report r17 (sebeni-smollm2-135-grpo-100), kv:2610.00041v1/r17. Data hash 206dd6d83034ce30e08fae242162d9028312d5d3fb0c2f433aad3df7e9b9e1b9.

<https://kveritas.org/records/2610.00041v1/r17.pdf>

[19] Sealed experiment report r18 (sebeni-smollm2-135-sft-100), kv:2610.00041v1/r18. Data hash 568d840347201178166f981a0733fbdcf644551cae66705728148f8892748ee6.

<https://kveritas.org/records/2610.00041v1/r18.pdf>

[20] Sealed experiment report r19 (sebeni-tinyllama-1.1b-apo-50), kv:2610.00041v1/r19. Data hash dae92f7046d21d8eba122bfebc2cac0b0c6f54d39ce5135f1d9835fe1e2f2231.

<https://kveritas.org/records/2610.00041v1/r19.pdf>

[21] Sealed experiment report r20 (sebeni-tinyllama-1.1b-dpo-50), kv:2610.00041v1/r20. Data hash fc816fad926bc175c5e36204931fdc87c2569dc6c97e48ba97eeb2fd32ceae79.

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[22] Sealed experiment report r21 (sebeni-tinyllama-1.1b-grpo-50), kv:2610.00041v1/r21. Data hash f8ab933aaf6092f14eab8b4a8ca77a55314b7f8afc95df541f524c5997dd1804.

<https://kveritas.org/records/2610.00041v1/r21.pdf>

[23] Sealed experiment report r22 (sebeni-tinyllama-1.1b-sft-50), kv:2610.00041v1/r22. Data hash 22537d944a5cf42522146bc324dc63c2befdd841bea0d46cb229859c324d9aef.

<https://kveritas.org/records/2610.00041v1/r22.pdf>