

3 Ingredients to cook MOMENT



The Time-series Pile

Public time-series datasets are small, task-specific and scattered



The Time-series Pile: Large repository of public time-series spanning diverse domains, frequencies & modeling tasks

Collection of 4 task-specific public benchmarks for long & short-horizon forecasting, anomaly detection, and classification



Multi-dataset pre-training



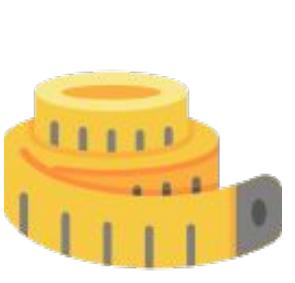
Diverse time-series characteristics (lengths, amplitudes, frequencies) make multi-dataset pre-training hard



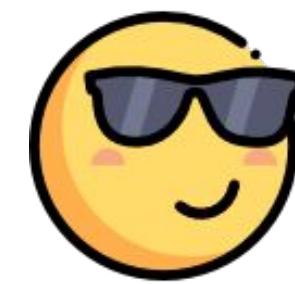
Systematically solutions to time-series challenges: Channel independence, fixed-length inputs, reversible instance normalization



Evaluation



Holistic benchmarks to evaluate models on diverse datasets and tasks in limited supervision settings in early stages



Carefully designed benchmark on 5 time-series modeling tasks: short- and long-horizon forecasting, anomaly detection, classification, and imputation

Focus on evaluating MOMENT against both SoTA deep learning and statistical baselines, on many task-specific datasets, using multiple evaluation metrics, exclusively in limited supervision settings (e.g., zero-shot imputation)

MOMENT: A Family of Open Time-series Foundation Models

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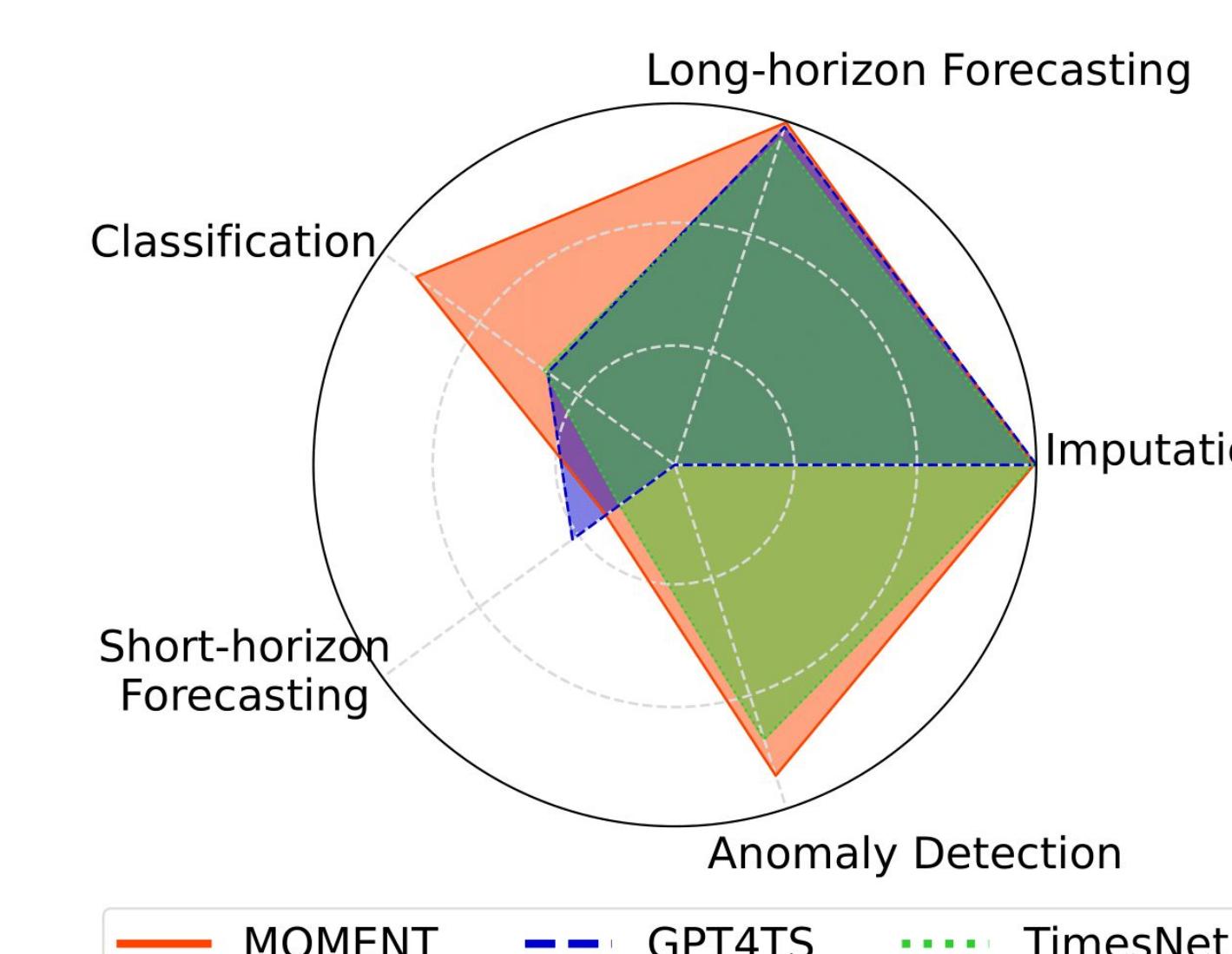
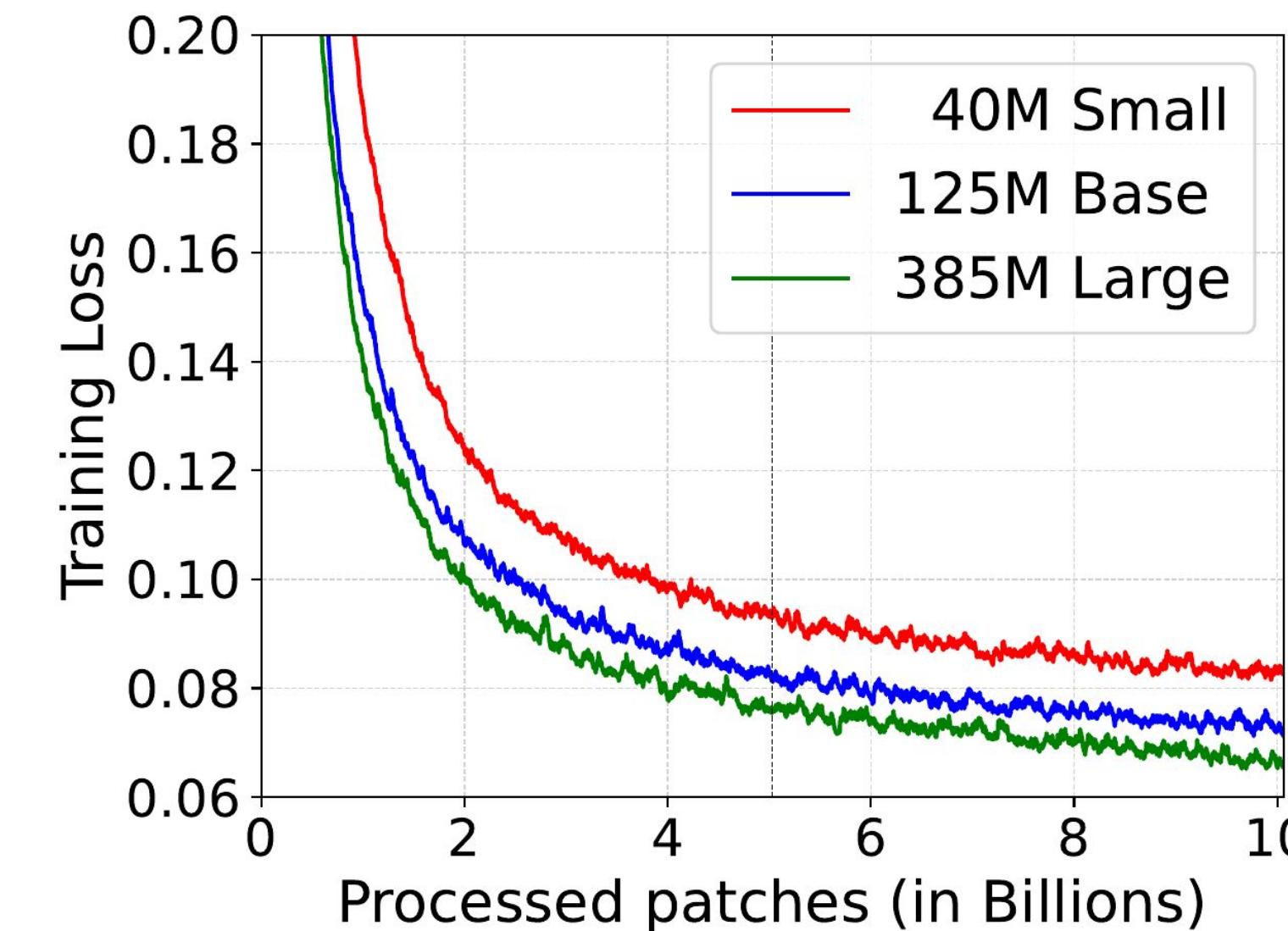
²University of Pennsylvania

TL;DR

We introduce the Time-series Pile, a large repository of public time-series, use it to pre-train a family of large models. We test these models on a benchmark with diverse tasks and datasets in limited supervision settings.



*Modeling time-series data,
now just a MOMENT away!*



Paper



Research code



Model Weights
Time-series Pile

Auton Lab

THE ROBOTICS INSTITUTE

Carnegie Mellon University

Findings



MOMENT does well on multiple tasks

Long-horizon forecasting

Methods	Metric	MOMENT ₀ MSE MAE	Time-LLM MSE MAE	GPT4TS MSE MAE	PatchTST MSE MAE	DLInar MSE MAE	TimesNet MSE MAE	FEDFormer MSE MAE	Stationary MSE MAE	LightTTS MSE MAE	N-BEATS MSE MAE
96	0.154 0.209	-	0.162 0.212	0.149 0.198	0.176 0.237	0.172 0.220	0.217 0.296	0.173 0.223	0.182 0.242	0.152 0.210	
Weather	192 326 720	0.197 0.246 0.315	0.248 0.285 0.336	0.204 0.242 0.326	0.194 0.241 0.337	0.220 0.282 0.319	0.219 0.261 0.306	0.226 0.236 0.338	0.225 0.285 0.334	0.199 0.260 0.311	
192	0.387 0.410 0.422 0.452	0.410 0.426 0.437 0.472	0.408 0.429 0.442 0.514	0.376 0.397 0.420 0.477	0.397 0.400 0.421 0.497	0.370 0.399 0.416 0.457	0.375 0.399 0.436 0.493	0.376 0.396 0.429 0.490	0.376 0.396 0.465 0.535	0.377 0.398 0.462 0.518	
ETTh1	326 720	0.349 0.403	0.369 0.408	-	0.354 0.373	0.389 0.390	0.379 0.380	0.340 0.349	0.355 0.379	0.327 0.387	
720	0.409 0.439	0.399 0.435	0.406 0.440	-	0.404 0.441	0.402 0.439	0.416 0.443	0.429 0.469	0.439 0.474	0.400 0.435	
96	0.293 0.295 0.326 0.352	0.349 0.349 0.368 0.384	0.384 0.384 0.403 0.403	0.292 0.294 0.346 0.366	0.346 0.346 0.392 0.392	0.290 0.290 0.342 0.366	0.338 0.338 0.375 0.396	0.379 0.379 0.419 0.445	0.398 0.398 0.444 0.464	0.318 0.367 0.391 0.438	
ETTm1	326 720	0.326 0.416	0.368 0.416	-	0.332 0.366	0.372 0.394	0.332 0.369	0.365 0.392	0.374 0.406	0.355 0.387	
720	0.405 0.416	0.437 0.429	0.417 0.421	-	0.421 0.457	0.416 0.420	0.420 0.427	0.450 0.453	0.508 0.533	0.448 0.448	
192	0.170 0.227 0.275	0.260 0.297 0.328	0.181 0.239 0.286	0.269 0.301 0.324	0.165 0.220 0.274	0.255 0.292 0.328	0.167 0.209 0.238	0.267 0.280 0.328	0.192 0.243 0.285	0.197 0.271 0.328	
ETTm2	326 720	0.365 0.387	0.368 0.388	-	0.373 0.407	0.379 0.408	0.380 0.408	0.365 0.397	0.355 0.382	0.321 0.366	
720	0.409 0.416	0.437 0.429	0.417 0.421	-	0.421 0.457	0.416 0.420	0.421 0.450	0.451 0.487	0.417 0.441	0.413 0.446	
24	0.723 0.669 0.728	1.114 1.092 1.098	3.025 3.025 3.245	1.195 1.195 1.221	0.603 1.398 1.790	0.881 1.319 1.892	0.754 2.215 1.430	2.215 0.801 1.310	0.894 3.224 2.238	8.313 5.39 7.299	
IL1	48 60 60	0.728 0.883 0.883	1.098 1.126 1.126	-	0.882 0.963 0.979	1.430 1.963 2.057	0.834 0.963 0.975	1.260 1.825 2.072	0.945 0.848 0.857	3.144 4.628 7.283	
60	0.883 0.883	1.126 1.126	1.221 1.221	-	0.979 0.979	1.470 1.788	0.788 2.368	1.260 2.096	0.900 2.857	7.090 5.278	
ECL	96 326 720	0.136 0.167 0.205	0.233 0.264 0.295	-	0.139 0.169 0.206	0.129 0.163 0.197	0.222 0.259 0.290	0.140 0.169 0.220	0.237 0.261 0.302	0.168 0.207 0.207	
720	0.205 0.295	0.251 0.295	-	-	0.153 0.169 0.206	0.251 0.266 0.297	0.240 0.261 0.297	0.249 0.261 0.302	0.184 0.210 0.245	0.207 0.247 0.270	
96	0.391 0.400 0.404	0.282 0.287 0.292	-	-	0.388 0.407 0.414	0.282 0.290 0.294	0.360 0.379 0.392	0.249 0.287 0.346	0.532 0.607 0.624	0.336 0.382 0.386	
192	0.400 0.404 0.414	0.287 0.292 0.292	-	-	0.407 0.412 0.450	0.290 0.294 0.312	0.256 0.264 0.286	0.248 0.264 0.346	0.532 0.607 0.653	0.310 0.382 0.407	
720	0.450 0.450	0.310 0.310	-	-	0.450 0.450	0.312 0.312	0.432 0.432	0.286 0.315	0.640 0.640	0.350 0.350	

Anomaly detection

Metric	MOMENT ₀	MOMENT _{1b}	GPT4TS	TimesNet	Anomaly Transformer	DGHL	k-NN
Mean	0.585	0.628	0.24	0.537	0.492	0.425	0.554
Median	0.683	0.778	0.31	0.541	0.432	0.331	0.594
Std.	0.377	0.373	0.366	0.389	0.401	0.365	0.393
Adj. F ₁	3.410	3.005	4.862	3.642	4.326	5.071	3.681
Mean rank	3.00	3.00	5.00	3.50	4.00	5.25	3.75
Median rank	4.00	3.00	6.00	4.00	4.00	4.50	3.00
Wins/Losses	57/599	709/467	419/757	658/518	524/652	378/798	650/335

Statistical or