



PLATYPUS

research paper explained

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A stylized, light gray illustration of a plant with a fan-like top and a textured, leafy base, positioned on the left side of the slide.

SECTIONS

Here are the sections we are going to see about

Abstract

Introduction

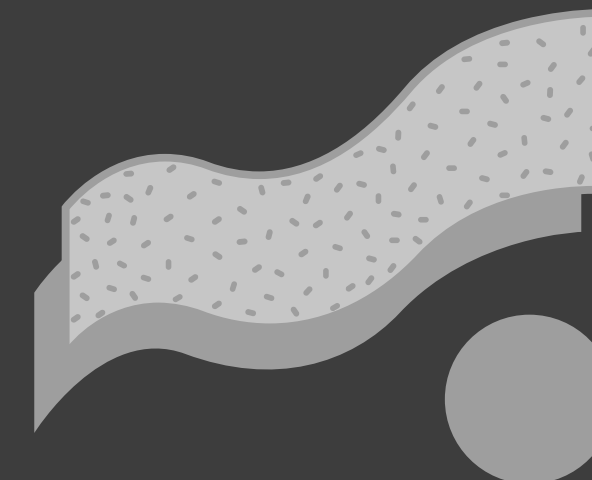
Methods

Result

Broader Impact and Future Works

Limitations

ABSTRACT



Platypus is a family of finetuned and merged LLMs that achieves the strongest performance and stands first in the Huggingface's Open LLM leaderboard

The work describes: Open Platypus Dataset Curation, the process of finetuning and merging LoRA modules preserving pre trained LLM knowledge and adding domain-specific knowledge on top of it, Quality check process on training data to check for data leaks and contamination

Training a 13B Platypus model on 1 A100 GPU for 25k questions with Llama2-13B being its base variant takes only 5 hrs

Resultant model achieves strong performance in quantitative LLM metrics

INTRODUCTION

- **Challenge Existing:** Platypus work centers around improving the performance of base LLM by finetuning the model using PEFT methods on a small curated dataset called Open Platypus In the recent advancements of the LLM domain, there have been releases of models like Llama, BLOOM, and Falcon, and many more. Large models are good generalists and are well-suited for many NLP tasks but smaller models struggle to maintain their versatility.
- **Existing Solution and Problem in it:** To bridge the divide between smaller and larger models there have been lots of strategies lately like knowledge distillation, instruction tuning, MoE, QLoRA, and many more each focusing on a different perspective to solve different problems. Other approaches follow specialized training of LLMs for specific tasks like coding or medical-related use cases. Though it has its own merits the problem is that it is highly time-consuming and costly.

INTRODUCTION

The work aims at creating a training recipe that maintains the generalized knowledge from instruction tuning and impart specific domain knowledge on top of it at the surface level reducing time and cost



INTRODUCTION

CONTRIBUTIONS OF PLATYPUS

01

Open Platypus a small curated dataset from 11 different open source datasets to improve STEM and logic knowledge

02

Deduplication - Removal of duplicate data from training set

03

Procedure of Data Contamination check and removal

04

LoRA module selection and merging process

METHODS - CURATING OPEN PLATYPUS

- Open Platypus involves the selection of some data points from 11 different data sources and curating them into a single final dataset
- Reasons for the data selection:
 - (a) Superficial Alignment Hypothesis states that model entire knowledge is almost learned during pretraining
 - (b) Llama2 paper stating that the base model hasn't reached saturation
 - (c) Textbooks are All You Need paper highlighting the importance of high-quality datasets for training

Now let's see how the dataset is shaped up and the code for creating such a mixture

Dataset Name	License Type	# Leaked Questions
PRM800K: A Process Supervision Dataset [23]	MIT	77
Measuring Mathematical Problem Solving With the MATH Dataset [14]	MIT	77
ScienceQA: Science Question Answering [24]	Creative Commons Attribution-NonCommercial-ShareAlike 4.0	0
SciBench: Evaluating College-Level Scientific Problem-Solving Abilities of Large Language Models [42]	MIT	0
ReClor: A Reading Comprehension Dataset Requiring Logical Reasoning[50]	Non-commercial	0
*SciQ: Crowdsourcing Multiple Choice Science Questions [45]	Creative Commons Attribution-NonCommercial 3.0	71
TheoremQA: A Theorem-driven Question Answering Dataset [5]	MIT	0
leetcode-solutions-python-testgen-gpt4 [20]	None listed	0
airoboros-gpt4-1.4.1 [9]	other	13
tigerbot-kaggle-leetcode-solutions-en-2k[32]	apache-2.0	0
OpenBookQA: A New Dataset for Open Book Question Answering [28]	apache-2.0	6
ARB: Advanced Reasoning Benchmark for Large Language Models [33]	MIT	0
Openassistant-guanaco [8]	apache-2.0	13
*ehartford/dolphin (first 25k rows) [10]	apache-2.0	0

METHODS -

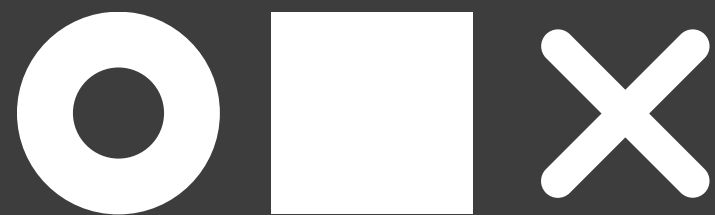
DEDUPLICATION

Deduplication - Removing similar and duplicate questions

To remove duplicate questions since the dataset is taken from various sources, Sentence Transformer is used

Any instances with a cosine similarity of at least 80% is considered duplicate and is removed

METHODS- CONTAMINATION CHECK AND REMOVAL



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To avoid memorization of data a heuristic algorithm was created to guide the manual filtering of questions from the dataset that has similarity greater than 80% with benchmark questions

There are three categories of contamination

- (a) Duplicate - Exact copy of questions
- (b) Gray area - questions, not the exact copy but requires the same knowledge
- (c) Similar but different - Questions of high cosine similarity but answers are very different

METHODS - FINETUNING

The LoRA method is used to train the model with reduced trainable parameters

13B model was finetuned using 1 A100 80GB GPU in 5 hrs, 70B model in 4A100 80 GB GPUS in 22 hrs for 25k qns

For prompting, Alpaca prompting template is used

Instead of attention modules (v_proj, q_proj, k_proj) as target modules gate_proj, down_proj, and up_proj are used based on the recommendation from Towards Unified View of Parameter Efficient Transfer Learning

Now lets see about the training hyperparameters

TRAINING HYPERPARAMS

Hyperparameter	Platypus2-13B / 70B
batch size	16
micro batch size	1
num epochs	1
learning rate	4e-4 / 3e-4
cutoff len	4096
lora rank	16
lora alpha	16
lora dropout	0.05
lora target modules	gate_proj, down_proj, up_proj
train on inputs	False
add eos token	False
group by length	False
prompt template	alpaca
lr scheduler	cosine
warmup steps	100

METHODS - MERGING

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While merging it is important to ensure that the base model does not have any contamination data.

Eg: Dolphin

Results in HF Open LLM Leaderboard

RESULTS

Model	Average 	ARC	HellaSwag	MMLU	TruthfulQA
garage-bAInd/Platypus2-70B-instruct	73.13	71.84	87.94	70.48	62.26
upstage/Llama-2-70b-instruct-v2	72.95	71.08	87.89	70.58	62.25
deepnight-research/llama-2-70B-inst	72.95	71.08	87.89	70.58	62.25
psmathur/model_007	72.72	71.08	87.65	69.04	63.12
upstage/Llama-2-70b-instruct	72.29	70.9	87.48	69.8	60.97
stabilityai/StableBeluga2	71.42	71.08	86.37	68.79	59.44
quantumaikr/llama-2-70b-fb16-guanaco-1k	71.41	70.48	87.33	70.25	57.56
augtoma/qCamel-70-x	70.97	68.34	87.87	70.18	57.47
jondurbin/airoboros-l2-70b-gpt4-1.4.1	70.93	70.39	87.82	70.31	55.2
dfurman/llama-2-70b-dolphin-peft	70.76	69.62	86.82	69.18	57.43
garage-bAInd/Dolphin-Platypus2-70B	70.69	70.39	86.7	69.04	56.65
TheBloke/llama-2-70b-Guanaco-QLoRA-fp16	70.63	68.26	88.32	70.23	55.69
psmathur/model_420	70.55	70.14	87.73	70.35	54
psmathur/model_51	70.41	68.43	86.71	69.31	57.18
garage-bAInd/Platypus2-70B	70.06	70.65	87.15	70.08	52.37

BROADER IMPACTS AND FUTURE WORKS

Modern LLMs require computational resources while techniques like LoRA provide a solution still smaller models are successful on specific tasks and larger models for a variety of NLP tasks

MoE presents a promising avenue for further enhancing the performance of models in terms of accuracy in domain-specific training

Another avenue would be to explore LIMA strategy within PEFT and LoRA landscapes

There is another exploration in the merging of various modules together like Lazarus which is a successful combination of 6 modules

LIMITATIONS

As Platypus is a finetuned version of Llama2 all the limitations of the predecessor is possible to be a limitation in Platypus as well like the generation of non-factual content with misleading prompt, generating biased content, and not working well in multilingual scenarios since the predecessor was trained mostly on English dataset

Since Platypus is trained especially on STEM and logic questions it exhibits limitations to out-of-domain topics

While combining it is hard to ensure that there is no contamination.

Filtering methods using Sentence transformers and cosine similarity may not be exhaustive. Though there is confidence there is unlikely to be contamination in data, it is not impossible