OctoPack: Instruction Tuning Code Large Language Models

1) CommitPack

Code Before

```
import numpy as np
import matplotlib.pyplot as plt

# generate sample data
x_data = np.linspace(-5, 5, 20)
y_data = np.random.normal(0.0, 1.0, x_data.size)

plt.plot(x_data, y_data, 'o')
plt.show()
```

Commit Message

Change to sin() function with noise

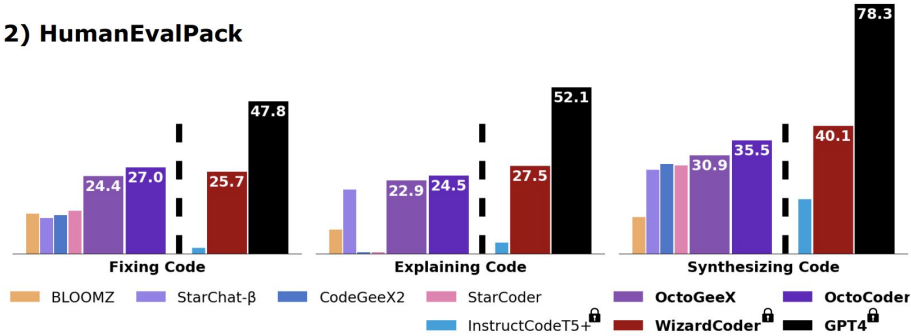
Code After

```
import math
import numpy as np
import matplotlib.pyplot as plt

# generate sample data
x_data = np.linspace(-math.pi, math.pi, 30)
y_data = np.sin(x_data) + np.random.normal(0.0, 0.1, x_data.size)

plt.plot(x_data, y_data, 'o')
plt.show()
```

2) HumanEvalPack



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ICLR

Motivation

Code LLMs only excel at code continuation

User

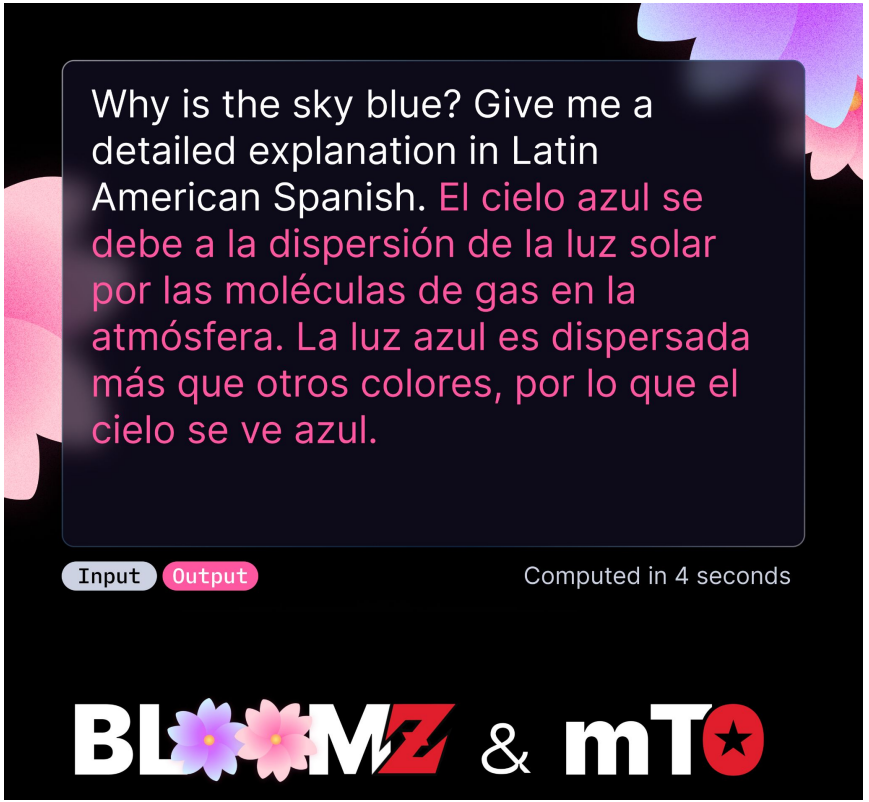
def sum(x, y): return x+y

Could you explain the function to me?

def sum(x, y): return x+y
def sum(x, y): return x+y

Code LLM

Success of instruction tuning non-code LLMs



Commits

Code Before

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import numpy as np
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Commit Message

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Code After

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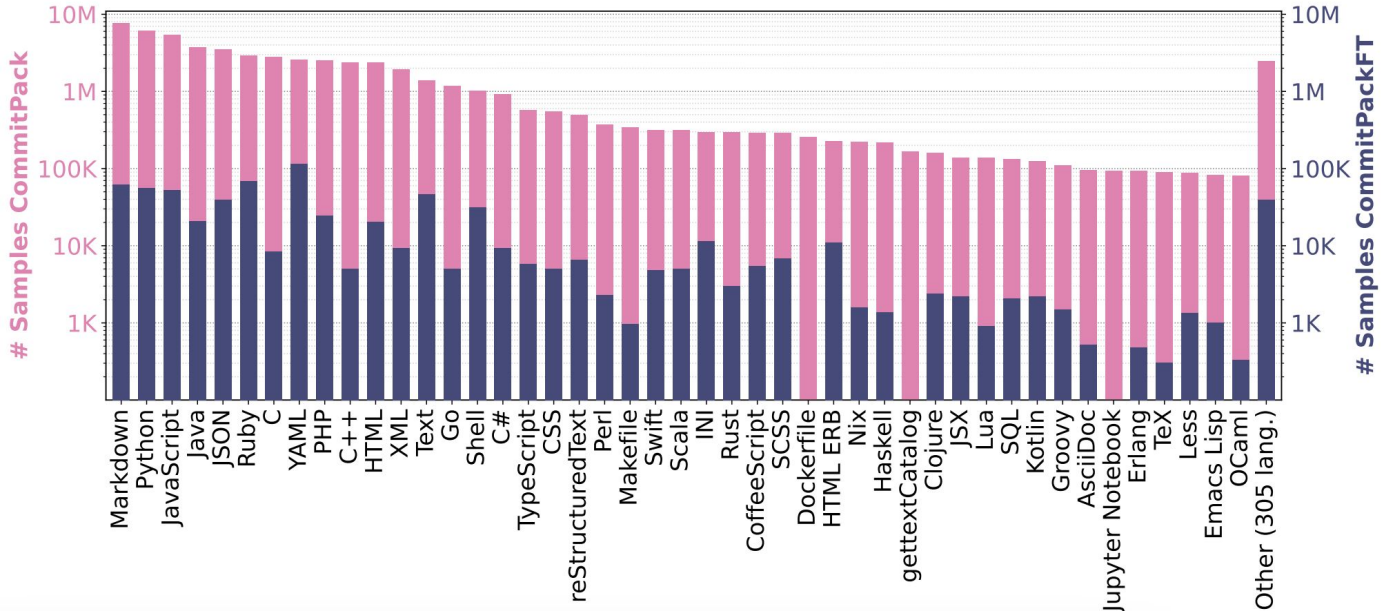
x_data = np.linspace(-math.pi, math.pi, 30)
y_data = np.sin(x_data) + np.random.normal(0.0, 0.1, x_data.size)

plt.plot(x_data, y_data, 'o')
plt.show()
```

CommitPack: Code Instruction Data

CommitPack - 4TB of scraped commits:

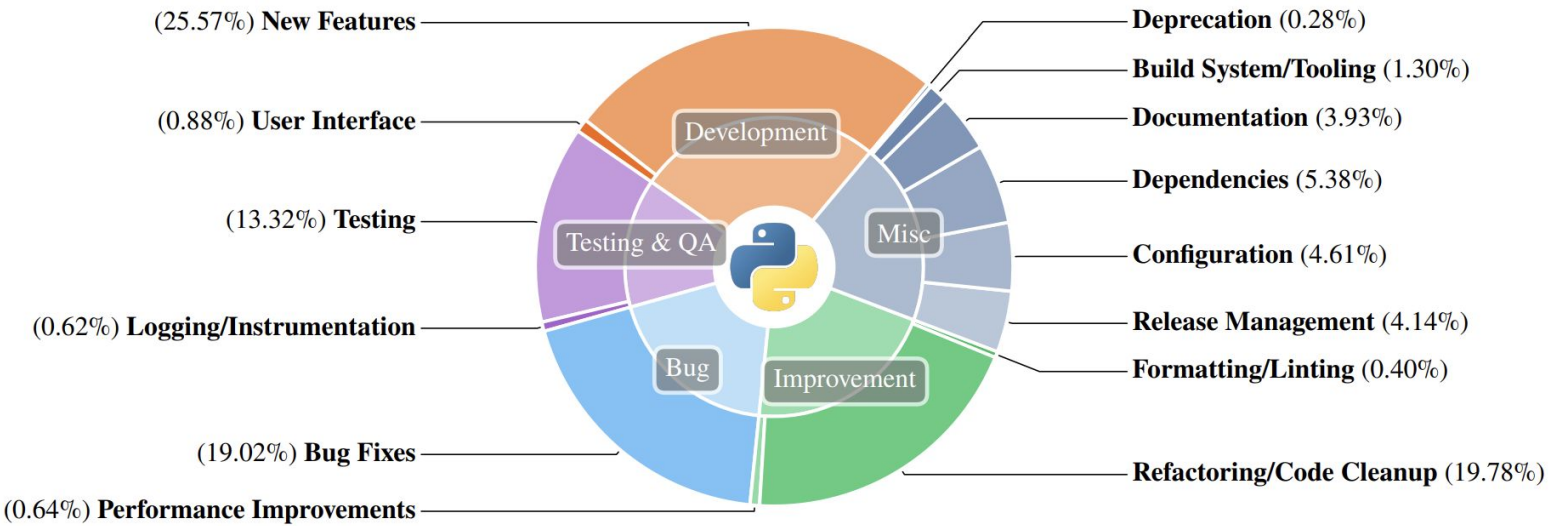
- Only commercially licensed code
- Only single-file commits to avoid complexity
- Filtered out low-quality commits (e.g. merges)



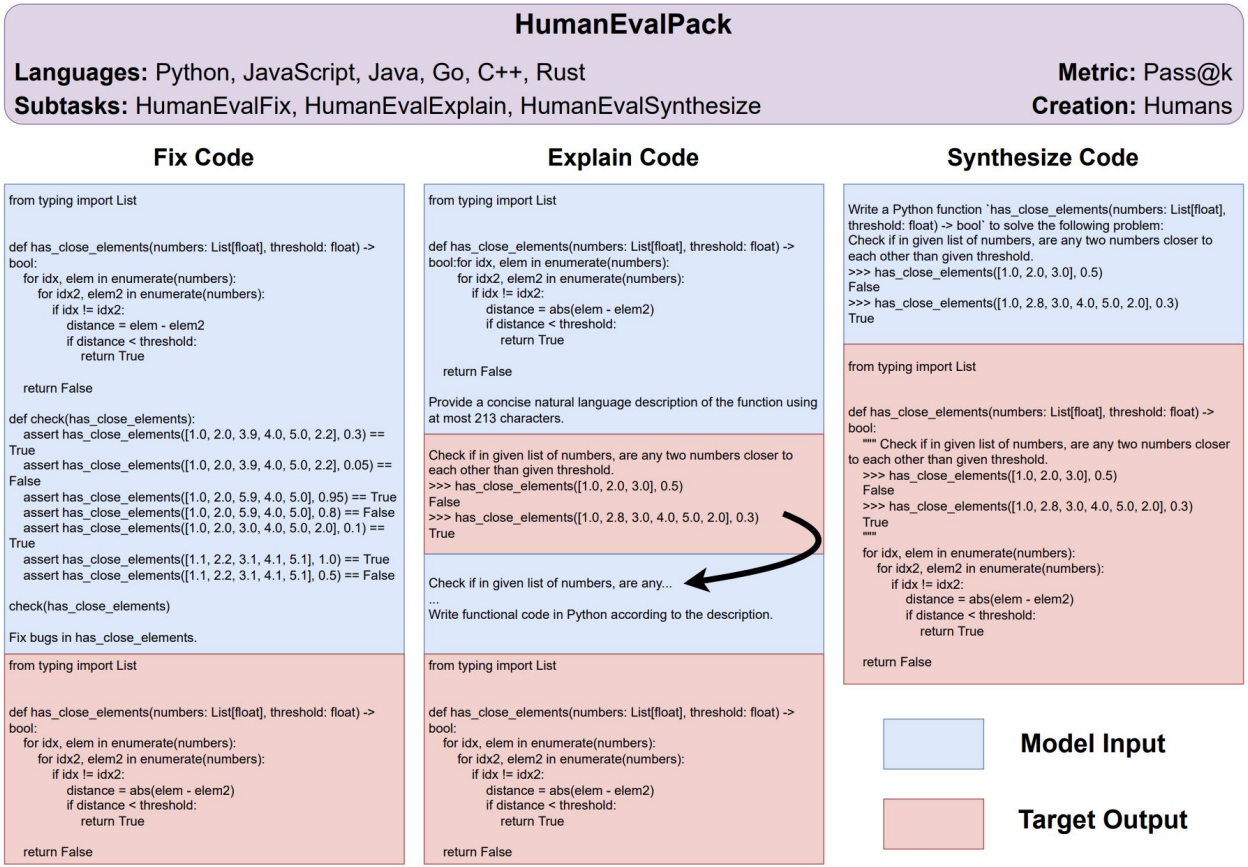
CommitPackFT: Code Instruction Data

CommitPackFT - 2GB high-quality selection:

- Only commits that resemble instructions (e.g. `Increase beta2 value in optimizer`)
- No commits with external references like issues
- Only detailed commits within certain word limits

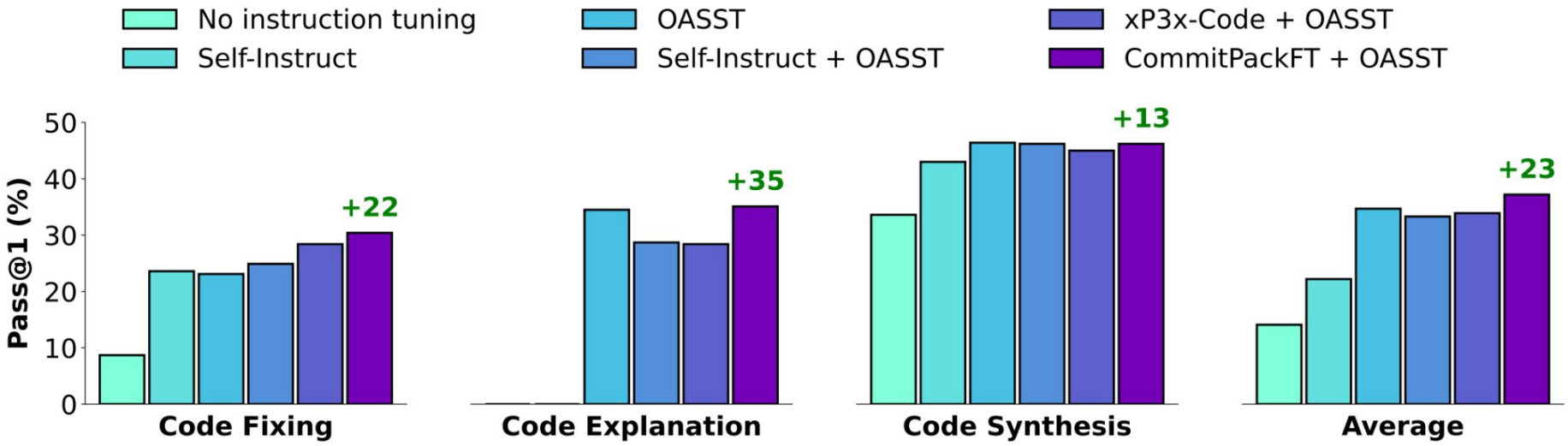


HumanEvalPack: Code Evaluation



HumanEvalPack: Code Evaluation

Benchmarking code instruction datasets on **HumanEvalPack** (Py) by instruction tuning StarCoder:



CommitPackFT + conversational data (OASST) leads to the highest average performance.

OctoCoder: Instruction Code Model

Model (↓)	Python	JavaScript	Java	Go	C++	Rust	Avg.
HUMANEVALFIX							
Non-permissive models							
InstructCodeT5+†	2.7	1.2	4.3	2.1	0.2	0.5	1.8
WizardCoder†	31.8	29.5	30.7	30.4	18.7	13.0	25.7
GPT-4	47.0	48.2	50.0	50.6	47.6	43.3	47.8
Permissive models							
BLOOMZ	16.6	15.5	15.2	16.4	6.7	5.7	12.5
StarChat-β	18.1	18.1	24.1	18.1	8.2	3.6	11.2
CodeGeeX2*	15.9	14.7	18.0	13.6	4.3	6.1	12.1
StarCoder	8.7	15.7	13.3	20.1	15.6	6.7	13.4
OCTOGEEX*	28.1	27.7	30.4	27.6	22.9	9.6	24.4
OCTOCODER	**30.4**	**28.4**	**30.6**	**30.2**	**26.1**	**16.5**	**27.0**

OctoCoder: Instruction Code Model

Model (↓)	Python	JavaScript	Java	Go	C++	Rust	Avg.
HUMANEVALEXPLAIN							
Non-permissive models							
InstructCodeT5+†	20.8	0.0	0.0	0.0	0.1	0.0	3.5
WizardCoder†	32.5	33.0	27.4	26.7	28.2	16.9	27.5
GPT-4	64.6	57.3	51.2	58.5	38.4	42.7	52.1
Permissive models							
BLOOMZ	14.7	8.8	12.1	8.5	0.6	0.0	7.5
StarChat-β	25.4	21.5	24.5	18.4	17.6	13.2	20.1
CodeGeeX2*	0.0	0.0	0.0	0.0	0.0	0.0	0.0
StarCoder	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OCTOGEEX*	30.4	24.0	24.7	**21.7**	21.0	**15.9**	22.9
OCTOCODER	**35.1**	**24.5**	**27.3**	21.1	**24.1**	14.8	**24.5**

OctoCoder: Instruction Code Model

Model (↓)	Python	JavaScript	Java	Go	C++	Rust	Avg.
HUMANEVALSYNTHESIZE							
Non-permissive models							
InstructCodeT5+†	37.0	18.9	17.4	9.5	19.8	0.3	17.1
WizardCoder†	57.3	49.5	36.1	36.4	40.9	20.2	40.1
GPT-4	86.6	82.9	81.7	72.6	78.7	67.1	78.3
Permissive models							
BLOOMZ	15.6	14.8	18.4	8.4	6.5	5.5	11.5
StarChat-β	33.5	31.4	26.7	25.5	26.6	14.0	26.3
CodeGeeX2*	35.9	32.2	30.8	22.5	29.3	18.1	28.1
StarCoder	33.6	30.8	30.2	17.6	31.6	21.8	27.6
OCTOGEEX*	44.7	33.8	36.9	21.9	32.3	15.7	30.9
OCTOCODER	**46.2**	**39.2**	**38.2**	**30.4**	**35.6**	**23.4**	**35.5**

Thanks!

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