alpaca_lora

April 25, 2023

The alpaca model and tokenizer code is taken as is without modification from the source.

Credits : https://www.mlexpert.io/machine-learning/tutorials/alpaca-and-llama-inference

[1]:
```
!git clone https://github.com/tloen/alpaca-lora.git
%cd alpaca-lora/
!git checkout 683810b

!pip install -U pip
!pip install -r requirements.txt
!pip install torch==2.0.0

import torch
from peft import PeftModel
import transformers
import textwrap
from transformers import LlamaTokenizer, LlamaForCausalLM, GenerationConfig
from transformers.generation.utils import GreedySearchDecoderOnlyOutput

DEVICE = "cuda" if torch.cuda.is_available() else "cpu"
DEVICE

tokenizer = LlamaTokenizer.from_pretrained("decapoda-research/llama-7b-hf")

model = LlamaForCausalLM.from_pretrained(
    "decapoda-research/llama-7b-hf",
    load_in_8bit=True,
    device_map="auto",
)

model = PeftModel.from_pretrained(model, "tloen/alpaca-lora-7b",␣
 ↪torch_dtype=torch.float16)

model.config.pad_token_id = tokenizer.pad_token_id = 0  # unk
model.config.bos_token_id = 1
model.config.eos_token_id = 2

model = model.eval()
```

```
model = torch.compile(model)

PROMPT_TEMPLATE = f"""
Below is an instruction that describes a task. Write a response that␣
 ↪appropriately completes the request.

### Instruction:
[INSTRUCTION]

### Response:
"""

def format_response(response: GreedySearchDecoderOnlyOutput) -> str:
    decoded_output = tokenizer.decode(response.sequences[0])
    response = decoded_output.split("### Response:")[1].strip()
    return "\n".join(textwrap.wrap(response))

def ask_alpaca(prompt: str, model: PeftModel = model) -> str:
    prompt = create_prompt(prompt)
    response = generate_response(prompt, model)
    # print(format_response(response))
    return format_response(response)

def generate_response(prompt: str, model: PeftModel) ->␣
 ↪GreedySearchDecoderOnlyOutput:
    encoding = tokenizer(prompt, return_tensors="pt")
    input_ids = encoding["input_ids"].to(DEVICE)

    generation_config = GenerationConfig(
        temperature=0.1,
        top_p=0.75,
        repetition_penalty=1.1,
    )
    with torch.inference_mode():
        return model.generate(
            input_ids=input_ids,
            generation_config=generation_config,
            return_dict_in_generate=True,
            output_scores=True,
            max_new_tokens=256,
        )

def create_prompt(instruction: str) -> str:
    return PROMPT_TEMPLATE.replace("[INSTRUCTION]", instruction)

print(create_prompt("What is the meaning of life?"))
```

```
Cloning into 'alpaca-lora'…
remote: Enumerating objects: 607, done.
remote: Counting objects: 100% (51/51), done.
remote: Compressing objects: 100% (32/32), done.
remote: Total 607 (delta 28), reused 34 (delta 19), pack-reused 556
Receiving objects: 100% (607/607), 27.78 MiB | 5.12 MiB/s, done.
Resolving deltas: 100% (360/360), done.
Updating files: 100% (27/27), done.
/content/alpaca-lora
Note: switching to '683810b'.

You are in 'detached HEAD' state. You can look around, make experimental
changes and commit them, and you can discard any commits you make in this
state without impacting any branches by switching back to a branch.

If you want to create a new branch to retain commits you create, you may
do so (now or later) by using -c with the switch command. Example:

  git switch -c <new-branch-name>

Or undo this operation with:

  git switch -

Turn off this advice by setting config variable advice.detachedHead to false

HEAD is now at 683810b Print warning on checkpoint not found
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-
wheels/public/simple/
Requirement already satisfied: pip in /usr/local/lib/python3.9/dist-packages
(23.0.1)
Collecting pip
  Downloading pip-23.1.1-py3-none-any.whl (2.1 MB)
                             2.1/2.1 MB
26.0 MB/s eta 0:00:00
Installing collected packages: pip
  Attempting uninstall: pip
    Found existing installation: pip 23.0.1
    Uninstalling pip-23.0.1:
      Successfully uninstalled pip-23.0.1
Successfully installed pip-23.1.1
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-
wheels/public/simple/
Collecting git+https://github.com/huggingface/transformers.git (from -r
requirements.txt (line 4))
  Cloning https://github.com/huggingface/transformers.git to /tmp/pip-req-build-
xzm9hiq7
  Running command git clone --filter=blob:none --quiet
```

```
https://github.com/huggingface/transformers.git /tmp/pip-req-build-xzm9hiq7
  Resolved https://github.com/huggingface/transformers.git to commit
073baf7f2289dbbf99e29f375e40c3e270ba6e85
  Installing build dependencies … done
  Getting requirements to build wheel … done
  Preparing metadata (pyproject.toml) … done
Collecting git+https://github.com/huggingface/peft.git (from -r requirements.txt
(line 7))
  Cloning https://github.com/huggingface/peft.git to /tmp/pip-req-build-z9aq7ff6
  Running command git clone --filter=blob:none --quiet
https://github.com/huggingface/peft.git /tmp/pip-req-build-z9aq7ff6
  Resolved https://github.com/huggingface/peft.git to commit
2822398fbe896f25d4dac5e468624dc5fd65a51b
  Installing build dependencies … done
  Getting requirements to build wheel … done
  Preparing metadata (pyproject.toml) … done
Collecting datasets (from -r requirements.txt (line 1))
  Downloading datasets-2.11.0-py3-none-any.whl (468 kB)
                           468.7/468.7 kB
34.1 MB/s eta 0:00:00
Collecting loralib (from -r requirements.txt (line 2))
  Downloading loralib-0.1.1-py3-none-any.whl (8.8 kB)
Collecting sentencepiece (from -r requirements.txt (line 3))
  Downloading
sentencepiece-0.1.98-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl
(1.3 MB)
                            1.3/1.3 MB
51.7 MB/s eta 0:00:00
Collecting accelerate (from -r requirements.txt (line 5))
  Downloading accelerate-0.18.0-py3-none-any.whl (215 kB)
                           215.3/215.3 kB
25.6 MB/s eta 0:00:00
Collecting bitsandbytes (from -r requirements.txt (line 6))
  Downloading bitsandbytes-0.38.1-py3-none-any.whl (104.3 MB)
                            104.3/104.3

MB 9.4 MB/s eta 0:00:00
Collecting gradio (from -r requirements.txt (line 8))
  Downloading gradio-3.27.0-py3-none-any.whl (17.3 MB)
                            17.3/17.3 MB
83.3 MB/s eta 0:00:00
Requirement already satisfied: appdirs in /usr/local/lib/python3.9/dist-
packages (from -r requirements.txt (line 9)) (1.4.4)
Collecting fire (from -r requirements.txt (line 10))
  Downloading fire-0.5.0.tar.gz (88 kB)
                            88.3/88.3 kB
13.8 MB/s eta 0:00:00
  Preparing metadata (setup.py) … done
```

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Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.9/dist-
packages (from datasets->-r requirements.txt (line 1)) (1.22.4)
Requirement already satisfied: pyarrow>=8.0.0 in /usr/local/lib/python3.9/dist-
packages (from datasets->-r requirements.txt (line 1)) (9.0.0)
Collecting dill<0.3.7,>=0.3.0 (from datasets->-r requirements.txt (line 1))
  Downloading dill-0.3.6-py3-none-any.whl (110 kB)
                           110.5/110.5 kB
16.8 MB/s eta 0:00:00
Requirement already satisfied: pandas in /usr/local/lib/python3.9/dist-
packages (from datasets->-r requirements.txt (line 1)) (1.5.3)
Requirement already satisfied: requests>=2.19.0 in
/usr/local/lib/python3.9/dist-packages (from datasets->-r requirements.txt (line
1)) (2.27.1)
Requirement already satisfied: tqdm>=4.62.1 in /usr/local/lib/python3.9/dist-
packages (from datasets->-r requirements.txt (line 1)) (4.65.0)
Collecting xxhash (from datasets->-r requirements.txt (line 1))
  Downloading
xxhash-3.2.0-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (212 kB)
                           212.2/212.2 kB
30.9 MB/s eta 0:00:00
Collecting multiprocess (from datasets->-r requirements.txt (line 1))
  Downloading multiprocess-0.70.14-py39-none-any.whl (132 kB)
                           132.9/132.9 kB
21.8 MB/s eta 0:00:00
Requirement already satisfied: fsspec[http]>=2021.11.1 in
/usr/local/lib/python3.9/dist-packages (from datasets->-r requirements.txt (line
1)) (2023.4.0)
Collecting aiohttp (from datasets->-r requirements.txt (line 1))
  Downloading
aiohttp-3.8.4-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (1.0 MB)
                            1.0/1.0 MB
76.8 MB/s eta 0:00:00
Collecting huggingface-hub<1.0.0,>=0.11.0 (from datasets->-r
requirements.txt (line 1))
  Downloading huggingface_hub-0.14.0-py3-none-any.whl (224 kB)
                           224.2/224.2 kB
33.4 MB/s eta 0:00:00
Requirement already satisfied: packaging in /usr/local/lib/python3.9/dist-
packages (from datasets->-r requirements.txt (line 1)) (23.1)
Collecting responses<0.19 (from datasets->-r requirements.txt (line 1))
  Downloading responses-0.18.0-py3-none-any.whl (38 kB)
Requirement already satisfied: pyyaml>=5.1 in /usr/local/lib/python3.9/dist-
packages (from datasets->-r requirements.txt (line 1)) (6.0)
Requirement already satisfied: filelock in /usr/local/lib/python3.9/dist-
packages (from transformers==4.29.0.dev0->-r requirements.txt (line 4)) (3.11.0)
Requirement already satisfied: regex!=2019.12.17 in
/usr/local/lib/python3.9/dist-packages (from transformers==4.29.0.dev0->-r
requirements.txt (line 4)) (2022.10.31)
```

```
Collecting tokenizers!=0.11.3,<0.14,>=0.11.1 (from transformers==4.29.0.dev0->-r
requirements.txt (line 4))
  Downloading
tokenizers-0.13.3-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (7.8
MB)
                           7.8/7.8 MB
101.5 MB/s eta 0:00:00
Requirement already satisfied: psutil in /usr/local/lib/python3.9/dist-
packages (from accelerate->-r requirements.txt (line 5)) (5.9.5)
Requirement already satisfied: torch>=1.4.0 in /usr/local/lib/python3.9/dist-
packages (from accelerate->-r requirements.txt (line 5)) (2.0.0+cu118)
Collecting aiofiles (from gradio->-r requirements.txt (line 8))
  Downloading aiofiles-23.1.0-py3-none-any.whl (14 kB)
Requirement already satisfied: altair>=4.2.0 in /usr/local/lib/python3.9/dist-
packages (from gradio->-r requirements.txt (line 8)) (4.2.2)
Collecting fastapi (from gradio->-r requirements.txt (line 8))
  Downloading fastapi-0.95.1-py3-none-any.whl (56 kB)
                           57.0/57.0 kB
8.3 MB/s eta 0:00:00
Collecting ffmpy (from gradio->-r requirements.txt (line 8))
  Downloading ffmpy-0.3.0.tar.gz (4.8 kB)
  Preparing metadata (setup.py) … done
Collecting gradio-client>=0.1.3 (from gradio->-r requirements.txt (line 8))
  Downloading gradio_client-0.1.3-py3-none-any.whl (286 kB)
                          286.2/286.2 kB
35.2 MB/s eta 0:00:00
Collecting httpx (from gradio->-r requirements.txt (line 8))
  Downloading httpx-0.24.0-py3-none-any.whl (75 kB)
                           75.3/75.3 kB
6.7 MB/s eta 0:00:00
Requirement already satisfied: jinja2 in /usr/local/lib/python3.9/dist-
packages (from gradio->-r requirements.txt (line 8)) (3.1.2)
Requirement already satisfied: markdown-it-py[linkify]>=2.0.0 in
/usr/local/lib/python3.9/dist-packages (from gradio->-r requirements.txt (line
8)) (2.2.0)
Requirement already satisfied: markupsafe in /usr/local/lib/python3.9/dist-
packages (from gradio->-r requirements.txt (line 8)) (2.1.2)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.9/dist-
packages (from gradio->-r requirements.txt (line 8)) (3.7.1)
Collecting mdit-py-plugins<=0.3.3 (from gradio->-r requirements.txt (line 8))
  Downloading mdit_py_plugins-0.3.3-py3-none-any.whl (50 kB)
                           50.5/50.5 kB
7.0 MB/s eta 0:00:00
Collecting orjson (from gradio->-r requirements.txt (line 8))
  Downloading orjson-3.8.10-cp39-cp39-manylinux_2_28_x86_64.whl (140 kB)
                          140.5/140.5 kB
16.4 MB/s eta 0:00:00
Requirement already satisfied: pillow in /usr/local/lib/python3.9/dist-
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packages (from gradio->-r requirements.txt (line 8)) (8.4.0)
Requirement already satisfied: pydantic in /usr/local/lib/python3.9/dist-
packages (from gradio->-r requirements.txt (line 8)) (1.10.7)
Collecting pydub (from gradio->-r requirements.txt (line 8))
  Downloading pydub-0.25.1-py2.py3-none-any.whl (32 kB)
Collecting python-multipart (from gradio->-r requirements.txt (line 8))
  Downloading python_multipart-0.0.6-py3-none-any.whl (45 kB)
                           45.7/45.7 kB
6.0 MB/s eta 0:00:00
Collecting semantic-version (from gradio->-r requirements.txt (line 8))
  Downloading semantic_version-2.10.0-py2.py3-none-any.whl (15 kB)
Requirement already satisfied: typing-extensions in
/usr/local/lib/python3.9/dist-packages (from gradio->-r requirements.txt (line
8)) (4.5.0)
Collecting uvicorn (from gradio->-r requirements.txt (line 8))
  Downloading uvicorn-0.21.1-py3-none-any.whl (57 kB)
                           57.8/57.8 kB
7.2 MB/s eta 0:00:00
Collecting websockets>=10.0 (from gradio->-r requirements.txt (line 8))
  Downloading websockets-11.0.2-cp39-cp39-manylinux_2_5_x86_64.manylinux1_x86_64
.manylinux_2_17_x86_64.manylinux2014_x86_64.whl (129 kB)
                          129.7/129.7 kB
18.8 MB/s eta 0:00:00
Requirement already satisfied: six in /usr/local/lib/python3.9/dist-
packages (from fire->-r requirements.txt (line 10)) (1.16.0)
Requirement already satisfied: termcolor in /usr/local/lib/python3.9/dist-
packages (from fire->-r requirements.txt (line 10)) (2.2.0)
Requirement already satisfied: entrypoints in /usr/local/lib/python3.9/dist-
packages (from altair>=4.2.0->gradio->-r requirements.txt (line 8)) (0.4)
Requirement already satisfied: jsonschema>=3.0 in /usr/local/lib/python3.9/dist-
packages (from altair>=4.2.0->gradio->-r requirements.txt (line 8)) (4.3.3)
Requirement already satisfied: toolz in /usr/local/lib/python3.9/dist-packages
(from altair>=4.2.0->gradio->-r requirements.txt (line 8)) (0.12.0)
Requirement already satisfied: attrs>=17.3.0 in /usr/local/lib/python3.9/dist-
packages (from aiohttp->datasets->-r requirements.txt (line 1)) (23.1.0)
Requirement already satisfied: charset-normalizer<4.0,>=2.0 in
/usr/local/lib/python3.9/dist-packages (from aiohttp->datasets->-r
requirements.txt (line 1)) (2.0.12)
Collecting multidict<7.0,>=4.5 (from aiohttp->datasets->-r requirements.txt
(line 1))
  Downloading
multidict-6.0.4-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (114
kB)
                          114.2/114.2 kB
13.9 MB/s eta 0:00:00
Collecting async-timeout<5.0,>=4.0.0a3 (from aiohttp->datasets->-r
requirements.txt (line 1))
  Downloading async_timeout-4.0.2-py3-none-any.whl (5.8 kB)
```

```
Collecting yarl<2.0,>=1.0 (from aiohttp->datasets->-r requirements.txt (line 1))
  Downloading
yarl-1.9.1-cp39-cp39-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (269 kB)
                           269.3/269.3 kB
26.9 MB/s eta 0:00:00
Collecting frozenlist>=1.1.1 (from aiohttp->datasets->-r requirements.txt
(line 1))
  Downloading frozenlist-1.3.3-cp39-cp39-manylinux_2_5_x86_64.manylinux1_x86_64.
manylinux_2_17_x86_64.manylinux2014_x86_64.whl (158 kB)
                           158.8/158.8 kB
21.1 MB/s eta 0:00:00
Collecting aiosignal>=1.1.2 (from aiohttp->datasets->-r requirements.txt
(line 1))
  Downloading aiosignal-1.3.1-py3-none-any.whl (7.6 kB)
Requirement already satisfied: mdurl~=0.1 in /usr/local/lib/python3.9/dist-
packages (from markdown-it-py[linkify]>=2.0.0->gradio->-r requirements.txt (line
8)) (0.1.2)
Collecting linkify-it-py<3,>=1 (from markdown-it-py[linkify]>=2.0.0->gradio->-r
requirements.txt (line 8))
  Downloading linkify_it_py-2.0.0-py3-none-any.whl (19 kB)
Requirement already satisfied: python-dateutil>=2.8.1 in
/usr/local/lib/python3.9/dist-packages (from pandas->datasets->-r
requirements.txt (line 1)) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.9/dist-
packages (from pandas->datasets->-r requirements.txt (line 1)) (2022.7.1)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in
/usr/local/lib/python3.9/dist-packages (from requests>=2.19.0->datasets->-r
requirements.txt (line 1)) (1.26.15)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.9/dist-packages (from requests>=2.19.0->datasets->-r
requirements.txt (line 1)) (2022.12.7)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.9/dist-
packages (from requests>=2.19.0->datasets->-r requirements.txt (line 1)) (3.4)
Requirement already satisfied: sympy in /usr/local/lib/python3.9/dist-packages
(from torch>=1.4.0->accelerate->-r requirements.txt (line 5)) (1.11.1)
Requirement already satisfied: networkx in /usr/local/lib/python3.9/dist-
packages (from torch>=1.4.0->accelerate->-r requirements.txt (line 5)) (3.1)
Requirement already satisfied: triton==2.0.0 in /usr/local/lib/python3.9/dist-
packages (from torch>=1.4.0->accelerate->-r requirements.txt (line 5)) (2.0.0)
Requirement already satisfied: cmake in /usr/local/lib/python3.9/dist-packages
(from triton==2.0.0->torch>=1.4.0->accelerate->-r requirements.txt (line 5))
(3.25.2)
Requirement already satisfied: lit in /usr/local/lib/python3.9/dist-packages
(from triton==2.0.0->torch>=1.4.0->accelerate->-r requirements.txt (line 5))
(16.0.1)
Collecting starlette<0.27.0,>=0.26.1 (from fastapi->gradio->-r requirements.txt
(line 8))
  Downloading starlette-0.26.1-py3-none-any.whl (66 kB)
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                              66.9/66.9 kB
9.8 MB/s eta 0:00:00
Collecting httpcore<0.18.0,>=0.15.0 (from httpx->gradio->-r
requirements.txt (line 8))
  Downloading httpcore-0.17.0-py3-none-any.whl (70 kB)
                              70.6/70.6 kB
11.5 MB/s eta 0:00:00
Requirement already satisfied: sniffio in /usr/local/lib/python3.9/dist-
packages (from httpx->gradio->-r requirements.txt (line 8)) (1.3.0)
Requirement already satisfied: contourpy>=1.0.1 in
/usr/local/lib/python3.9/dist-packages (from matplotlib->gradio->-r
requirements.txt (line 8)) (1.0.7)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.9/dist-
packages (from matplotlib->gradio->-r requirements.txt (line 8)) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in
/usr/local/lib/python3.9/dist-packages (from matplotlib->gradio->-r
requirements.txt (line 8)) (4.39.3)
Requirement already satisfied: kiwisolver>=1.0.1 in
/usr/local/lib/python3.9/dist-packages (from matplotlib->gradio->-r
requirements.txt (line 8)) (1.4.4)
Requirement already satisfied: pyparsing>=2.3.1 in
/usr/local/lib/python3.9/dist-packages (from matplotlib->gradio->-r
requirements.txt (line 8)) (3.0.9)
Requirement already satisfied: importlib-resources>=3.2.0 in
/usr/local/lib/python3.9/dist-packages (from matplotlib->gradio->-r
requirements.txt (line 8)) (5.12.0)
Requirement already satisfied: click>=7.0 in /usr/local/lib/python3.9/dist-
packages (from uvicorn->gradio->-r requirements.txt (line 8)) (8.1.3)
Collecting h11>=0.8 (from uvicorn->gradio->-r requirements.txt (line 8))
  Downloading h11-0.14.0-py3-none-any.whl (58 kB)
                              58.3/58.3 kB
8.5 MB/s eta 0:00:00
Requirement already satisfied: anyio<5.0,>=3.0 in
/usr/local/lib/python3.9/dist-packages (from
httpcore<0.18.0,>=0.15.0->httpx->gradio->-r requirements.txt (line 8)) (3.6.2)
Requirement already satisfied: zipp>=3.1.0 in /usr/local/lib/python3.9/dist-
packages (from importlib-resources>=3.2.0->matplotlib->gradio->-r
requirements.txt (line 8)) (3.15.0)
Requirement already satisfied: pyrsistent!=0.17.0,!=0.17.1,!=0.17.2,>=0.14.0 in
/usr/local/lib/python3.9/dist-packages (from
jsonschema>=3.0->altair>=4.2.0->gradio->-r requirements.txt (line 8)) (0.19.3)
Collecting uc-micro-py (from linkify-it-py<3,>=1->markdown-it-
py[linkify]>=2.0.0->gradio->-r requirements.txt (line 8))
  Downloading uc_micro_py-1.0.1-py3-none-any.whl (6.2 kB)
Requirement already satisfied: mpmath>=0.19 in /usr/local/lib/python3.9/dist-
packages (from sympy->torch>=1.4.0->accelerate->-r requirements.txt (line 5))
(1.3.0)
Building wheels for collected packages: transformers, peft, fire, ffmpy
```

```
  Building wheel for transformers (pyproject.toml) … done
  Created wheel for transformers: filename=transformers-4.29.0.dev0-py3-none-
any.whl size=6989816
sha256=b2ff73295f70c9c70b42fb27f2a38574103deda2573f5bd07464f69555ffab52
  Stored in directory: /tmp/pip-ephem-wheel-cache-
uhbpd0vp/wheels/f7/92/8c/752ff3bfcd3439805d8bbf641614da38ef3226e127ebea86ee
  Building wheel for peft (pyproject.toml) … done
  Created wheel for peft: filename=peft-0.3.0.dev0-py3-none-any.whl size=50500
sha256=49a8b2fbfae855ecf4c462a2203c73452a2be98ca04a0a98dc478eb9b4d4f823
  Stored in directory: /tmp/pip-ephem-wheel-cache-
uhbpd0vp/wheels/2d/60/1b/0edd9dc0f0c489738b1166bc1b0b560ee368f7721f89d06e3a
  Building wheel for fire (setup.py) … done
  Created wheel for fire: filename=fire-0.5.0-py2.py3-none-any.whl size=116952
sha256=926447d20bad1b1c0cefd1aea9a6ef7f04bc3e71856df32b38a98ec995bdc49f
  Stored in directory: /root/.cache/pip/wheels/f7/f1/89/b9ea2bf8f80ec027a88fef1d
354b3816b4d3d29530988972f6
  Building wheel for ffmpy (setup.py) … done
  Created wheel for ffmpy: filename=ffmpy-0.3.0-py3-none-any.whl size=4707
sha256=fb3bdac3d5691279014f62a6df03aeb53608dc8ab8f0995e5e9d3338646e6379
  Stored in directory: /root/.cache/pip/wheels/91/e2/96/f676aa08bfd789328c6576cd
0f1fde4a3d686703bb0c247697
Successfully built transformers peft fire ffmpy
Installing collected packages: tokenizers, sentencepiece, pydub, ffmpy,
bitsandbytes, xxhash, websockets, uc-micro-py, semantic-version, python-
multipart, orjson, multidict, loralib, h11, frozenlist, fire, dill, async-
timeout, aiofiles, yarl, uvicorn, starlette, responses, multiprocess, mdit-py-
plugins, linkify-it-py, huggingface-hub, httpcore, aiosignal, transformers,
httpx, fastapi, aiohttp, gradio-client, gradio, datasets, accelerate, peft
Successfully installed accelerate-0.18.0 aiofiles-23.1.0 aiohttp-3.8.4
aiosignal-1.3.1 async-timeout-4.0.2 bitsandbytes-0.38.1 datasets-2.11.0
dill-0.3.6 fastapi-0.95.1 ffmpy-0.3.0 fire-0.5.0 frozenlist-1.3.3 gradio-3.27.0
gradio-client-0.1.3 h11-0.14.0 httpcore-0.17.0 httpx-0.24.0 huggingface-
hub-0.14.0 linkify-it-py-2.0.0 loralib-0.1.1 mdit-py-plugins-0.3.3
multidict-6.0.4 multiprocess-0.70.14 orjson-3.8.10 peft-0.3.0.dev0 pydub-0.25.1
python-multipart-0.0.6 responses-0.18.0 semantic-version-2.10.0
sentencepiece-0.1.98 starlette-0.26.1 tokenizers-0.13.3 transformers-4.29.0.dev0
uc-micro-py-1.0.1 uvicorn-0.21.1 websockets-11.0.2 xxhash-3.2.0 yarl-1.9.1
WARNING: Running pip as the 'root' user can result in broken permissions
and conflicting behaviour with the system package manager. It is recommended to
use a virtual environment instead: https://pip.pypa.io/warnings/venv

Looking in indexes: https://pypi.org/simple, https://us-
python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: torch==2.0.0 in /usr/local/lib/python3.9/dist-
packages (2.0.0+cu118)
Requirement already satisfied: filelock in /usr/local/lib/python3.9/dist-
packages (from torch==2.0.0) (3.11.0)
```

```
Requirement already satisfied: typing-extensions in
/usr/local/lib/python3.9/dist-packages (from torch==2.0.0) (4.5.0)
Requirement already satisfied: sympy in /usr/local/lib/python3.9/dist-packages
(from torch==2.0.0) (1.11.1)
Requirement already satisfied: networkx in /usr/local/lib/python3.9/dist-
packages (from torch==2.0.0) (3.1)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.9/dist-packages
(from torch==2.0.0) (3.1.2)
Requirement already satisfied: triton==2.0.0 in /usr/local/lib/python3.9/dist-
packages (from torch==2.0.0) (2.0.0)
Requirement already satisfied: cmake in /usr/local/lib/python3.9/dist-packages
(from triton==2.0.0->torch==2.0.0) (3.25.2)
Requirement already satisfied: lit in /usr/local/lib/python3.9/dist-packages
(from triton==2.0.0->torch==2.0.0) (16.0.1)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.9/dist-
packages (from jinja2->torch==2.0.0) (2.1.2)
Requirement already satisfied: mpmath>=0.19 in /usr/local/lib/python3.9/dist-
packages (from sympy->torch==2.0.0) (1.3.0)
WARNING: Running pip as the 'root' user can result in broken permissions
and conflicting behaviour with the system package manager. It is recommended to
use a virtual environment instead: https://pip.pypa.io/warnings/venv

================================BUG REPORT================================
Welcome to bitsandbytes. For bug reports, please run

python -m bitsandbytes

 and submit this information together with your error trace to:
https://github.com/TimDettmers/bitsandbytes/issues
==========================================================================
bin /usr/local/lib/python3.9/dist-
packages/bitsandbytes/libbitsandbytes_cuda118.so
CUDA_SETUP: WARNING! libcudart.so not found in any environmental path. Searching
in backup paths…
CUDA SETUP: CUDA runtime path found: /usr/local/cuda/lib64/libcudart.so.11.0
CUDA SETUP: Highest compute capability among GPUs detected: 7.5
CUDA SETUP: Detected CUDA version 118
CUDA SETUP: Loading binary /usr/local/lib/python3.9/dist-
packages/bitsandbytes/libbitsandbytes_cuda118.so…
/usr/local/lib/python3.9/dist-packages/bitsandbytes/cuda_setup/main.py:145:
UserWarning: /usr/lib64-nvidia did not contain ['libcudart.so',
'libcudart.so.11.0', 'libcudart.so.12.0'] as expected! Searching further
paths…
  warn(msg)
/usr/local/lib/python3.9/dist-packages/bitsandbytes/cuda_setup/main.py:145:
```

```
UserWarning: WARNING: The following directories listed in your path were found
to be non-existent: {PosixPath('/sys/fs/cgroup/memory.events
/var/colab/cgroup/jupyter-children/memory.events')}
  warn(msg)
/usr/local/lib/python3.9/dist-packages/bitsandbytes/cuda_setup/main.py:145:
UserWarning: WARNING: The following directories listed in your path were found
to be non-existent: {PosixPath('http'), PosixPath('//172.28.0.1'),
PosixPath('8013')}
  warn(msg)
/usr/local/lib/python3.9/dist-packages/bitsandbytes/cuda_setup/main.py:145:
UserWarning: WARNING: The following directories listed in your path were found
to be non-existent: {PosixPath('--listen_host=172.28.0.12
--target_host=172.28.0.12 --tunnel_background_save_url=https'), PosixPath('//col
ab.research.google.com/tun/m/cc48301118ce562b961b3c22d803539adc1e0c19/gpu-t4-s-1
inbcxe74tej7 --tunnel_background_save_delay=10s
--tunnel_periodic_background_save_frequency=30m0s
--enable_output_coalescing=true --output_coalescing_required=true')}
  warn(msg)
/usr/local/lib/python3.9/dist-packages/bitsandbytes/cuda_setup/main.py:145:
UserWarning: WARNING: The following directories listed in your path were found
to be non-existent: {PosixPath('/env/python')}
  warn(msg)
/usr/local/lib/python3.9/dist-packages/bitsandbytes/cuda_setup/main.py:145:
UserWarning: WARNING: The following directories listed in your path were found
to be non-existent: {PosixPath('module'),
PosixPath('//ipykernel.pylab.backend_inline')}
  warn(msg)
/usr/local/lib/python3.9/dist-packages/bitsandbytes/cuda_setup/main.py:145:
UserWarning: Found duplicate ['libcudart.so', 'libcudart.so.11.0',
'libcudart.so.12.0'] files:
{PosixPath('/usr/local/cuda/lib64/libcudart.so.11.0'),
PosixPath('/usr/local/cuda/lib64/libcudart.so')}.. We'll flip a coin and try one
of these, in order to fail forward.
Either way, this might cause trouble in the future:
If you get `CUDA error: invalid device function` errors, the above might be the
cause and the solution is to make sure only one ['libcudart.so',
'libcudart.so.11.0', 'libcudart.so.12.0'] in the paths that we search based on
your env.
  warn(msg)

Downloading tokenizer.model:   0%|          | 0.00/500k [00:00<?, ?B/s]

Downloading (…)cial_tokens_map.json:   0%|          | 0.00/2.00 [00:00<?, ?B/s]

Downloading (…)okenizer_config.json:   0%|          | 0.00/141 [00:00<?, ?B/s]

The tokenizer class you load from this checkpoint is not the same type as the
class this function is called from. It may result in unexpected tokenization.
The tokenizer class you load from this checkpoint is 'LLaMATokenizer'.
The class this function is called from is 'LlamaTokenizer'.
```

```
Overriding torch_dtype=None with `torch_dtype=torch.float16` due to requirements
of `bitsandbytes` to enable model loading in mixed int8. Either pass
torch_dtype=torch.float16 or don't pass this argument at all to remove this
warning.
Downloading (…)lve/main/config.json:   0%|          | 0.00/427 [00:00<?, ?B/s]
Downloading (…)model.bin.index.json:   0%|          | 0.00/25.5k [00:00<?, ?B/s]
Downloading shards:   0%|          | 0/33 [00:00<?, ?it/s]
Downloading (…)l-00001-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00002-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00003-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00004-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00005-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00006-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00007-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00008-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00009-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00010-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00011-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00012-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00013-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00014-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00015-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00016-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00017-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00018-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00019-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00020-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00021-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00022-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00023-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00024-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00025-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00026-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
```

```
Downloading (…)l-00027-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00028-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00029-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00030-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00031-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00032-of-00033.bin:   0%|          | 0.00/405M [00:00<?, ?B/s]
Downloading (…)l-00033-of-00033.bin:   0%|          | 0.00/524M [00:00<?, ?B/s]
Loading checkpoint shards:   0%|          | 0/33 [00:00<?, ?it/s]
Downloading (…)neration_config.json:   0%|          | 0.00/124 [00:00<?, ?B/s]
Downloading (…)/adapter_config.json:   0%|          | 0.00/399 [00:00<?, ?B/s]
Downloading adapter_model.bin:   0%|          | 0.00/67.2M [00:00<?, ?B/s]

Below is an instruction that describes a task. Write a response that
appropriately completes the request.

### Instruction:
What is the meaning of life?

### Response:
```

[2]:
```
ask_alpaca("2+2=")
```

```
4
```

[ ]:
```

```

[ ]:
```

```

[38]:
```
import torch as t
from transformers import GPT2LMHeadModel, GPT2Tokenizer # pip install␣
 ↪transformers
from transformers import AutoModelForCausalLM, AutoTokenizer, AutoConfig
import matplotlib.pyplot as plt
import time
import numpy as np
import sklearn
import pickle
import re # regular expressions, useful for decoding the output
import pandas as pd
```

[39]:
```python
def create_dataset(i_start=0, i_end=50, operation=t.add):

    """(1 pt) Create a dataset of pairs of numbers to calculate an operation
    on.
    DO NOT USE A FOR LOOP.
    Use pytorch functions, possibilities include
    meshgrid, stack, reshape, repeat, tile.
    (Note you'll have to use for loops on string stuff in other functions)
    The dataset should be a tuple of two tensors, X and y, where X is a Nx2
    tensor of numbers to add,
    and y is a N tensor of the correct answers.
    E.g., if i_start=0, i_end=2, then X should be
    tensor([[0,0,1,1],[0,1,0,1]]).T and y should be tensor([0,1,1,2]).

    I recommend doing all pairs of sums involving 0-49, but you may modify
    this.
    """
    # TODO

    # Create tensors for the x and y values
    x1 = t.arange(i_start, i_end)
    x2 = t.arange(i_start, i_end)

    # # Using MeshGrid
    # x1, x2 = t.meshgrid(x1, x2)
    # x1 = x1.reshape(-1)
    # x2 = x2.reshape(-1)
    # X = t.stack((x1, x2), dim=1)

    # Using Tile
    x1 = x1.tile(((i_end - i_start),1))
    x1 = x1.T.reshape(-1,)
    x2 = x2.tile(((i_end - i_start)))
    X = t.stack((x1, x2), dim=0)

    # Perform the desired operation (addition in this case)

    if operation == t.add:
        y = x1 + x2


    return X, y
```

[40]:
```python
def encode_problems(X, strategy='baseline'):
    """(1 pts) Encode the problems as strings. For example, if X is
    [[0,0,1,1],[0,1,0,1]],
    then the baseline output should be ["0+0=", "0+1=", "1+0=", "1+1="]"""
```

```
    # Encode the problem based on various prompts.
    # In case nothing is provided, use baseline

    output_strings = []

    for xi in X.T:
        if strategy == 'word_problem':
            encode_string ="Add {} and {}".format(xi[0], xi[1])
        elif strategy == 'code':
            encode_string ="A={}, B={}, A+B=".format(xi[0], xi[1])
        elif strategy == 'algebra':
            encode_string ="if x={} and y={} and z=x+y, then what is z?".
↪format(xi[0], xi[1])
        elif strategy == 'in_context':
            encode_string ="if 7+11=18 and 4+12=16 then {}+{}=".format(xi[0],␣
↪xi[1])
        else:
            encode_string = "{}+{}=".format(xi[0],xi[1])

        output_strings.append(encode_string)

    return output_strings
```

[41]:
```
def generate_text(model, tokenizer, prompts, verbose=True, device='cpu'):
    """(3 pts) Complete the prompt using the LLM.
    1. Tokenize the prompts:
    https://huggingface.co/docs/transformers/preprocessing
        Put data and model on device to speed up computations
        (Note that in real life, you'd use a dataloader to do this efficiently
    in the background during training.)
    2. Generate text using the model.
        Turn off gradient tracking to save memory.
        Determine the sampling hyper-parameters.
        You may need to do it in batches, depending on memory constraints
    3. Use the tokenizer to decode the output.
    You will need to optionally print out the tokenization of the input and
    output strings for use in the write-up.
    """

    t0 = time.time()

    # TODO: tokenize
    encoded_input = tokenizer(prompts, return_tensors="pt").input_ids.to(device)

    print ()
    # # TODO: generate text, turn off gradient tracking
```

```
    output = []
    batch = 2
    with t.no_grad():
        for i in range(0,encoded_input.shape[0],batch):
            if i + batch <= encoded_input.shape[0]:
                output.extend(model.generate(encoded_input[i:i+batch]))
            else:
                output.extend(model.generate(encoded_input[i:encoded_input.
↪shape[0]]))

    # # TODO: decode output, output_strings = ...
    output_strings = []

    for out in output:
        output_strings.append(tokenizer.decode(out))

    if verbose:

        # TODO: print example tokenization for write-up
        print ('____________')
        print ('input')
        print (prompts[0])
        print ('____________')
        print ('____________')
        print ('output')
        print (output_strings[0])
        print ('____________')
        print("Time to generate text: ", time.time() - t0) # It took 4 minutes␣
↪to do 25000 prompts on an NVIDIA 1080Ti.

    return output_strings
```

[42]:
```
def decode_output(output_strings, strategy='baseline', verbose=True):
    """(1 pt) Decode the output strings into a list of integers. Use "t.nan"
    for failed responses.
    One suggestion is to split on non-numeric characters, then convert to int.
    And use try/except to catch errors.
    """

    # Use regex to get the first numerical value.
    # In case no numerical value, store nan
    # We only look at first value as we have removed the input string from this␣
↪output
    import re

    # TODO:
    y_hat = []
```

```
    for s in output_strings:
        y = re.findall(r'-?\d+(?:\.\d+)?', s)
        y_hat.append(float(y[-1]) if len(y)>0 else t.nan)

    return y_hat
```

[49]:
```
def linear_classifier(X,y, strategy):

    import numpy as np
    import matplotlib.pyplot as plt
    from sklearn.neural_network import MLPClassifier
    from sklearn.metrics import confusion_matrix, classification_report

    clf = MLPClassifier(hidden_layer_sizes=(64,64,64,64,32,16,8,),␣
 ↪activation='relu', solver='lbfgs', max_iter = 1000, )
    clf.fit(X, y)

    y_pred = clf.predict(X)
    acc = np.sum(y_pred == y)/y_pred.shape[0]

    cm = confusion_matrix(y, y_pred)
    fnr = cm[1, 0] / (cm[1, 0] + cm[1, 1])

    print(f"False negative rate: {fnr}")
    print ('acc of classifier is {}'.format(acc))

    def plot_decision_regions(clf, X, y, resolution=0.1):
        x_min, x_max = X[:, 0].min() - 1, X[:, 0].max() + 1
        y_min, y_max = X[:, 1].min() - 1, X[:, 1].max() + 1
        xx, yy = np.meshgrid(np.arange(x_min, x_max, resolution),
                             np.arange(y_min, y_max, resolution))
        Z = clf.predict(np.c_[xx.ravel(), yy.ravel()])
        Z = Z.reshape(xx.shape)
        plt.contourf(xx, yy, Z, alpha=0.3)

    plt.title('{}, addition, MLP Classifier'.format(strategy))
    plt.xlabel('x1')
    plt.ylabel('x2')
    x_min, x_max = X[:, 0].min() - 1, X[:, 0].max() + 1
    plt.xticks(np.arange(x_min, x_max, step=2))
    plt.yticks(np.arange(x_min, x_max, step=2))
    plt.scatter(X[:, 0], X[:, 1], c=y, cmap=plt.cm.Paired)
    plot_decision_regions(clf, X, y)
    plt.legend()
    plt.show()

    return acc, fnr
```

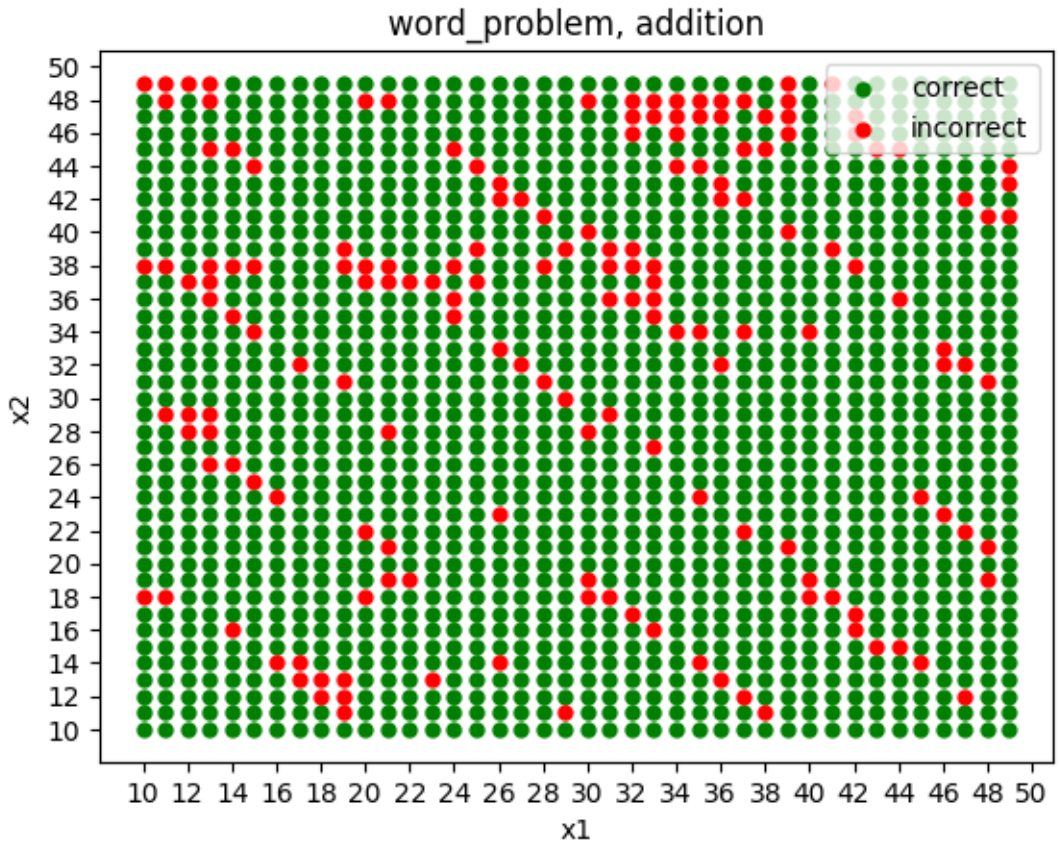
[47]:
```
def analyze_results(X, y, y_hats, strategies):
    """(3 pts) Analyze the results.
    Output the accuracy of each strategy.
    Plot a scatter plot of the problems "x1+x2" with x1,x2 on each axis,
    and different plot markers to indicate whether the answer from your LLM was
    correct.
    (See write-up instructions for requirements on plots)
    Train a classifier to predict whether the LLM gave the correct response
    (using scikit-learn, for example)
    and plot the classifier boundary over the scatter plot with "contour". (Use
    whatever classifier looks appropriate)"""


    results_list = []


    for strategy, y_hat in zip(strategies, y_hats):

        print ()
        print (' ____________ ')
        print (strategy)
        # accuracy of strategies
        accuracy = t.sum(t.tensor(y_hat) == y)/ len(y_hat)
        print ('accuracy of {} is {}'.format(strategy, accuracy))

        # scatter plot
        correct = []
        incorrect = []
        for x1, x2, true,pred in zip(X[0], X[1], y,y_hat):
            if true == pred:
                correct.append([x1,x2])
            else:
                incorrect.append([x1,x2])

        correct = t.tensor(correct)
        incorrect = t.tensor(incorrect)

        plt.title('{}, Multiplication'.format(strategy))
        plt.xlabel('x1')
        plt.ylabel('x2')
        plt.xticks(np.arange(min(X[0])-2, max(X[0])+2, step=2))
        plt.yticks(np.arange(min(X[1])-2, max(X[1])+2, step=2))
        if len(correct):
            plt.scatter(correct[:,0], correct[:,1], c='green', s=25,␣
↪label='correct')
        if len(incorrect):
```

```
            plt.scatter(incorrect[:,0], incorrect[:,1], c='red', s=25,␣
↪label='incorrect')
        plt.legend()
        plt.show()

        # classifier
        # create a dataset for classifier

        x_train = X.T
        y_train = [1 if i else 0 for i in y == t.tensor(y_hat)]
        if len(correct):
            acc, fnr = linear_classifier(x_train, y_train, strategy)
            results_list.append({'strategy':strategy, 'miss_rate (in %)':
↪fnr*100, 'accuracy (in %)':accuracy.item()*100, 'classifier_accuracy (in %)':
↪acc*100})
        else:
            results_list.append({'strategy':strategy, 'miss_rate (in %)':'N/A',␣
↪'accuracy (in %)':accuracy.item()*100, 'classifier_accuracy (in %)':0})

    df = pd.DataFrame.from_records(results_list)
    print ('The resultant Accuracies')
    print ()
    print ()
    print (df)
```

[34]:
```
if __name__ == "__main__":
    device = t.device("cuda" if t.cuda.is_available() else "cpu") # Use GPU if␣
↪available

    # Create Dataset of X and Y
    X, y = create_dataset(10, 50)

    # As the model and tokenizer work a little differently on Alpaca, so we␣
↪will directly be running inference on the model. Otherwise we would need to␣
↪do the input formatting ourselves.


    # list of lists of predicted answers, y_hat, for each strategy
    y_hats = []

    # Various strategies to be used
    strategies = ['word_problem', 'code', 'algebra', 'in_context', 'baseline']

    for strategy in strategies:

        # encode string based on strategy
        input_strings = encode_problems(X, strategy=strategy)
```

```
        # print ()
        # print ('-----------')
        # print ('input_strings')
        # print (input_strings)

        output_strings = []
        # generate output by passing it through the model
        for input_str in input_strings:
          output_strings.append(ask_alpaca(input_str))

        # print ('output_strings')
        # print (output_strings)

        # decode the output to get first numerical number or nan
        y_hat = decode_output(output_strings, strategy=strategy)
        # print ('y_hat')
        # print (y_hat)

        # append to lists
        y_hats.append(y_hat)

    # analyze the output
    analyze_results(X, y, y_hats, strategies)
```

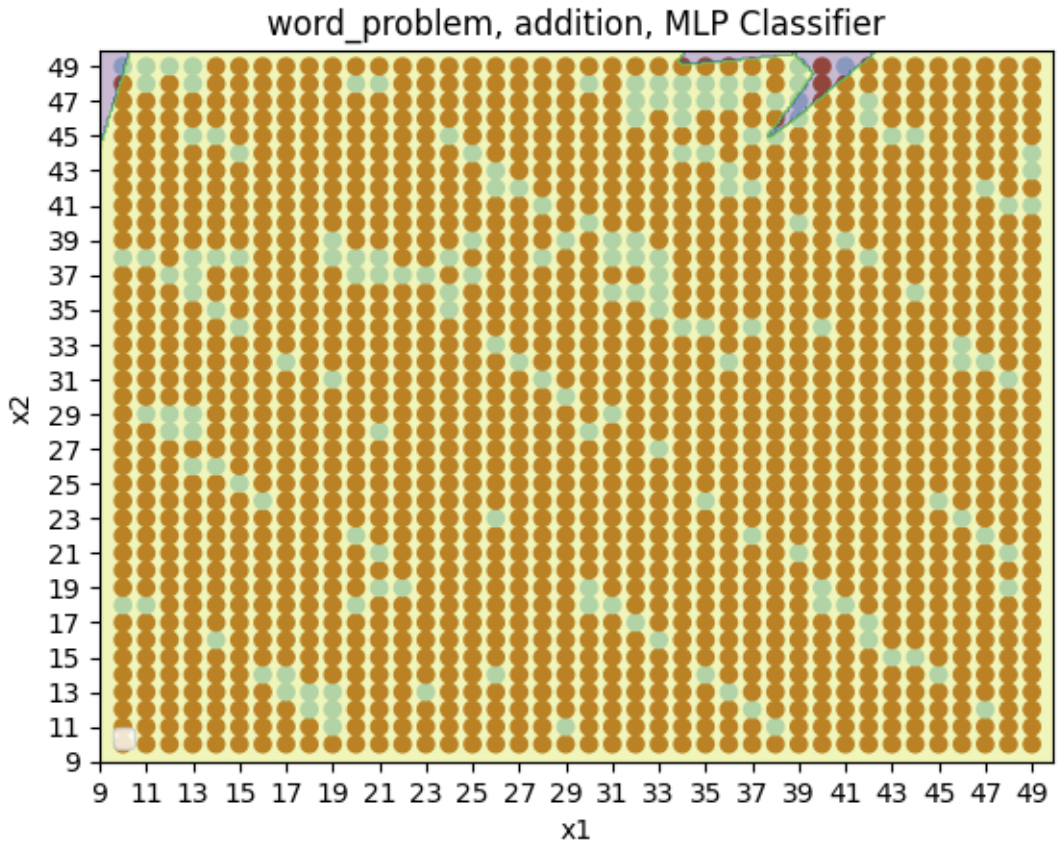
```
 ------------
word_problem
accuracy of word_problem is 0.8956249952316284
```




```
/usr/local/lib/python3.9/dist-
packages/sklearn/neural_network/_multilayer_perceptron.py:541:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
  self.n_iter_ = _check_optimize_result("lbfgs", opt_res, self.max_iter)
```

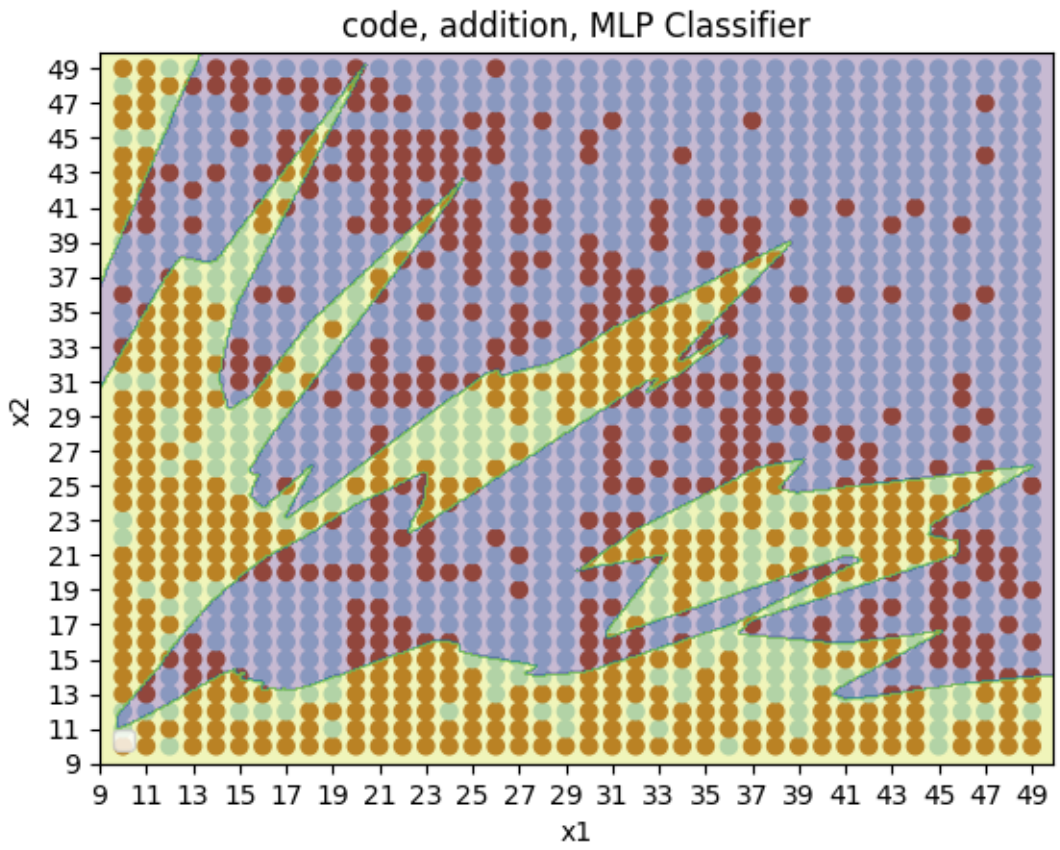
```
acc of classifier is 0.89625
```

```
WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
that artists whose label start with an underscore are ignored when legend() is
called with no argument.
```

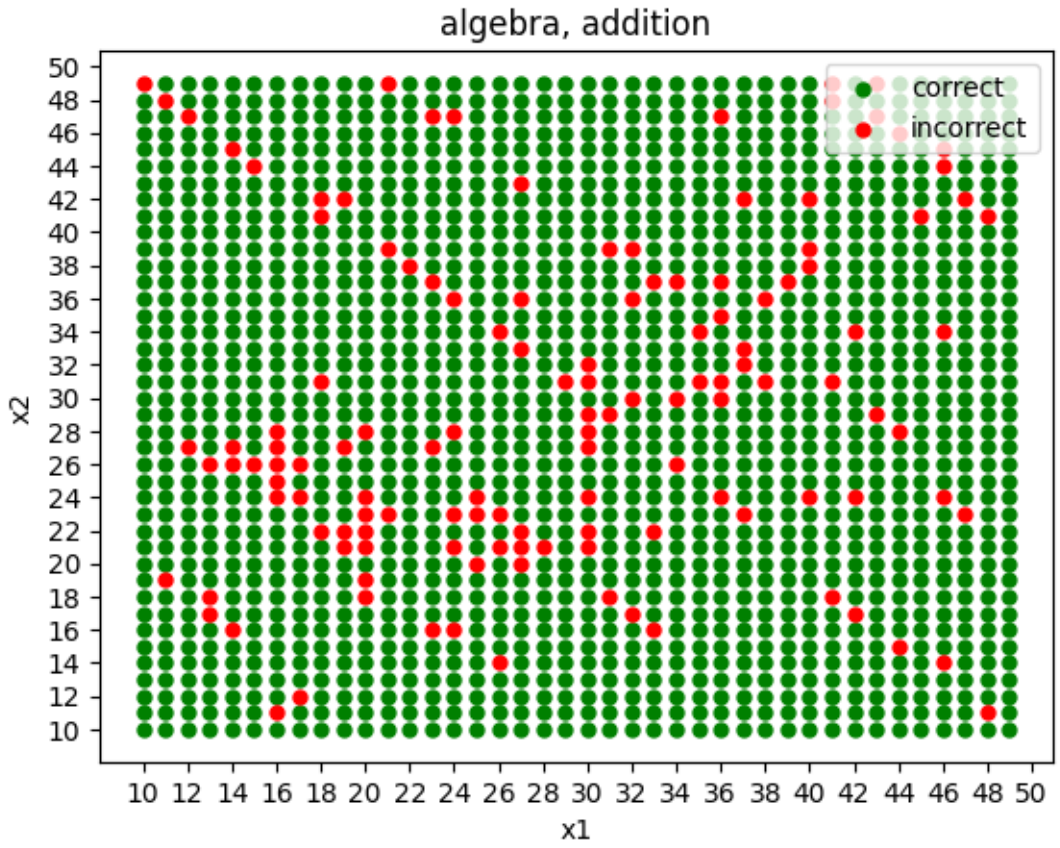



```
 ------------
code
accuracy of code is 0.4181250035762787
```

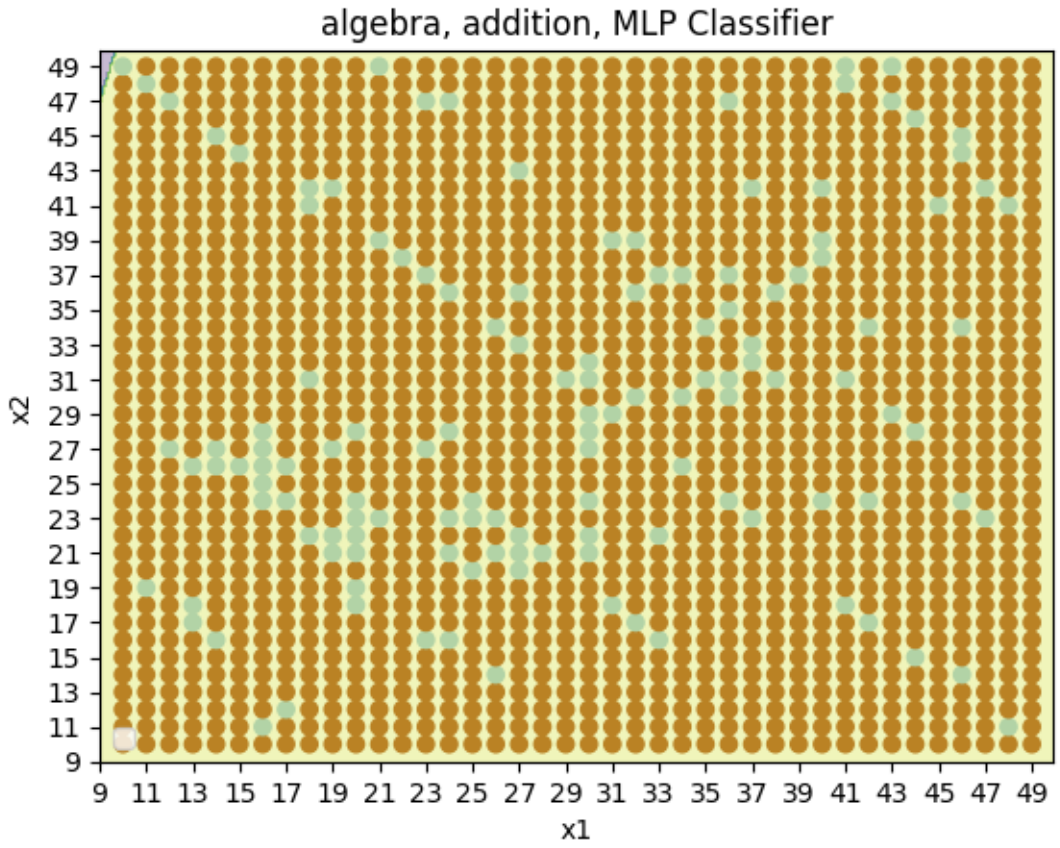
```
/usr/local/lib/python3.9/dist-
packages/sklearn/neural_network/_multilayer_perceptron.py:541:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
  self.n_iter_ = _check_optimize_result("lbfgs", opt_res, self.max_iter)

acc of classifier is 0.71

WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
that artists whose label start with an underscore are ignored when legend() is
called with no argument.
```




```
 ------------
algebra
accuracy of algebra is 0.918749988079071
```




```
/usr/local/lib/python3.9/dist-
packages/sklearn/neural_network/_multilayer_perceptron.py:541:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
  self.n_iter_ = _check_optimize_result("lbfgs", opt_res, self.max_iter)

acc of classifier is 0.91875

WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
that artists whose label start with an underscore are ignored when legend() is
called with no argument.
```

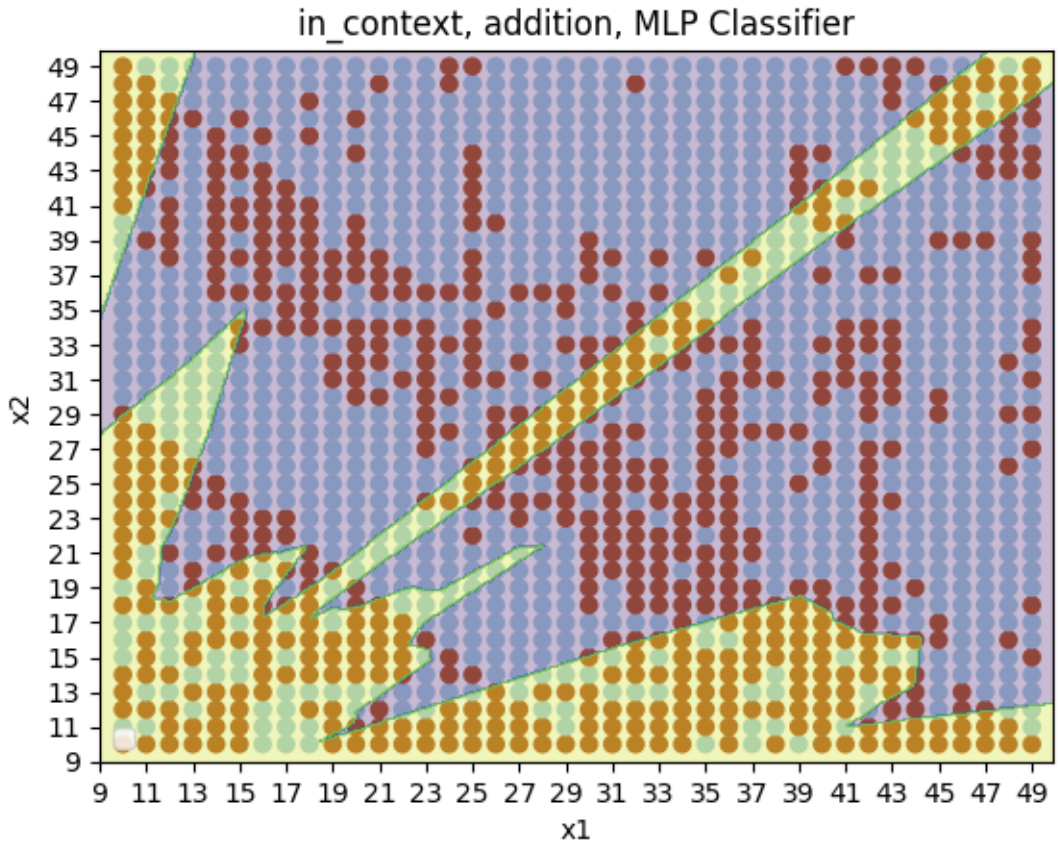



```
 ------------
in_context
accuracy of in_context is 0.40312498807907104
```

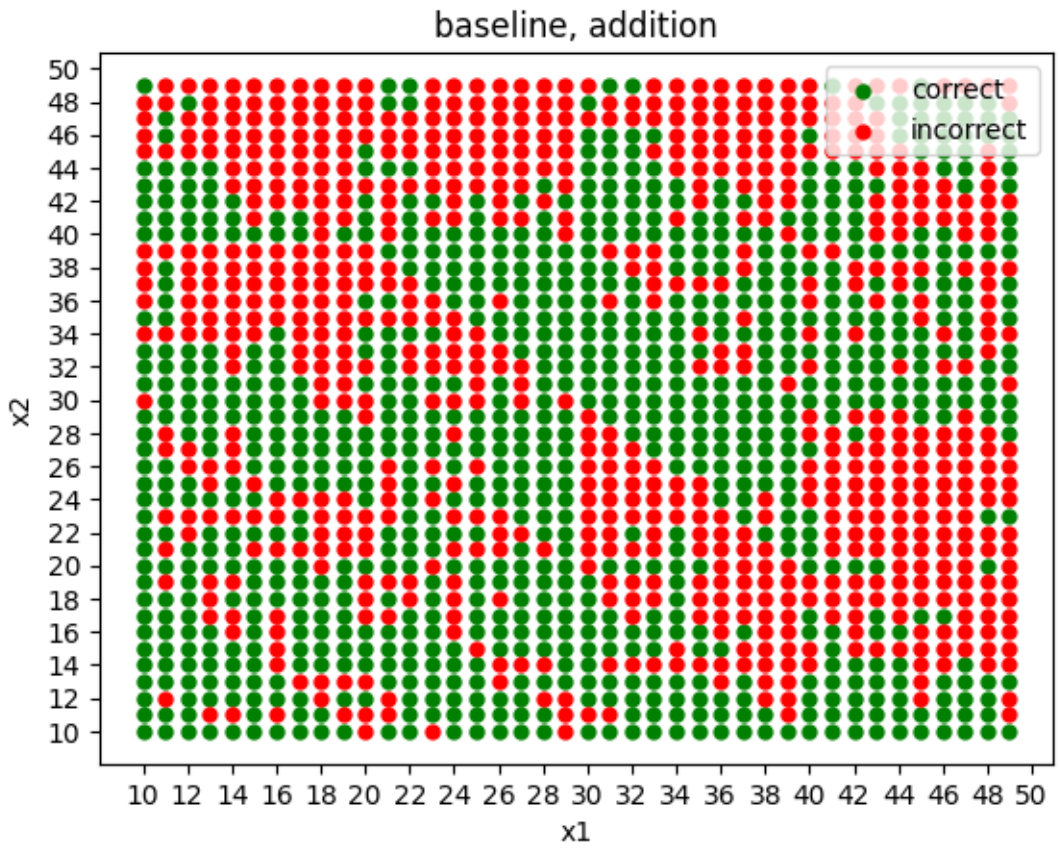
```
/usr/local/lib/python3.9/dist-
packages/sklearn/neural_network/_multilayer_perceptron.py:541:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
  self.n_iter_ = _check_optimize_result("lbfgs", opt_res, self.max_iter)
```

```
acc of classifier is 0.68625
```

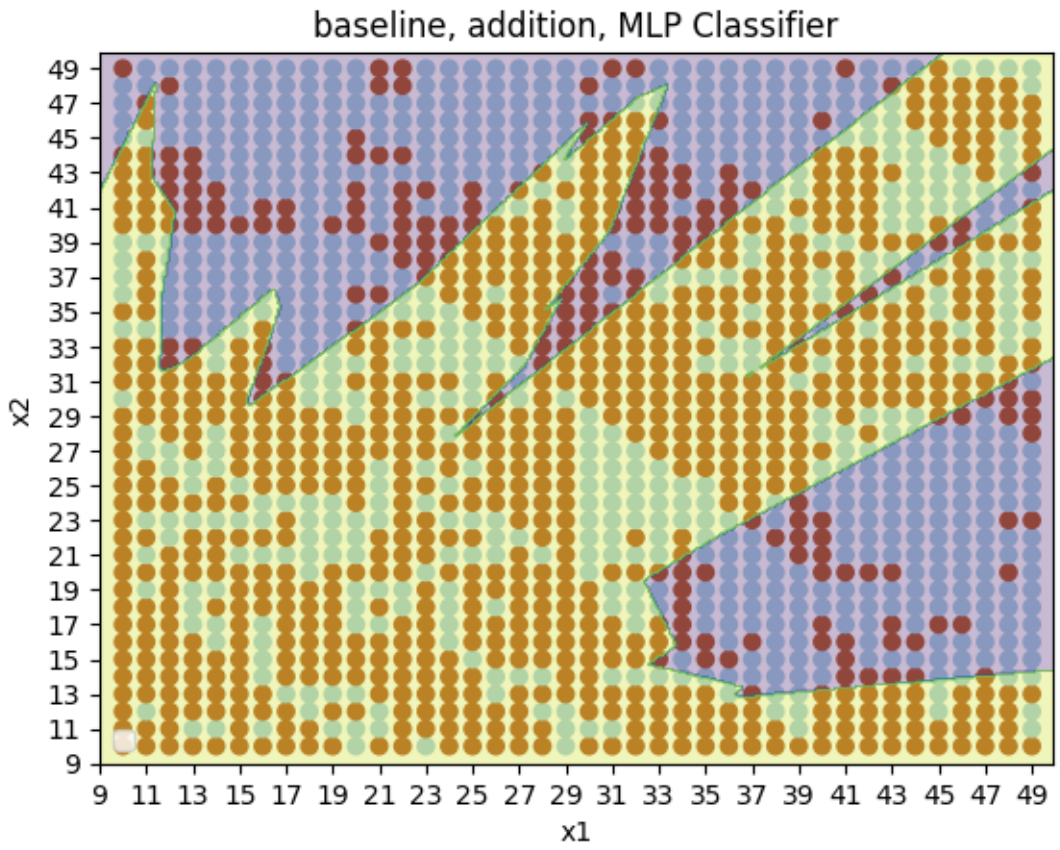
```
WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
that artists whose label start with an underscore are ignored when legend() is
called with no argument.
```




```
 ------------
baseline
accuracy of baseline is 0.5431249737739563
```




```
/usr/local/lib/python3.9/dist-
packages/sklearn/neural_network/_multilayer_perceptron.py:541:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
  self.n_iter_ = _check_optimize_result("lbfgs", opt_res, self.max_iter)

acc of classifier is 0.71

WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
that artists whose label start with an underscore are ignored when legend() is
called with no argument.
```

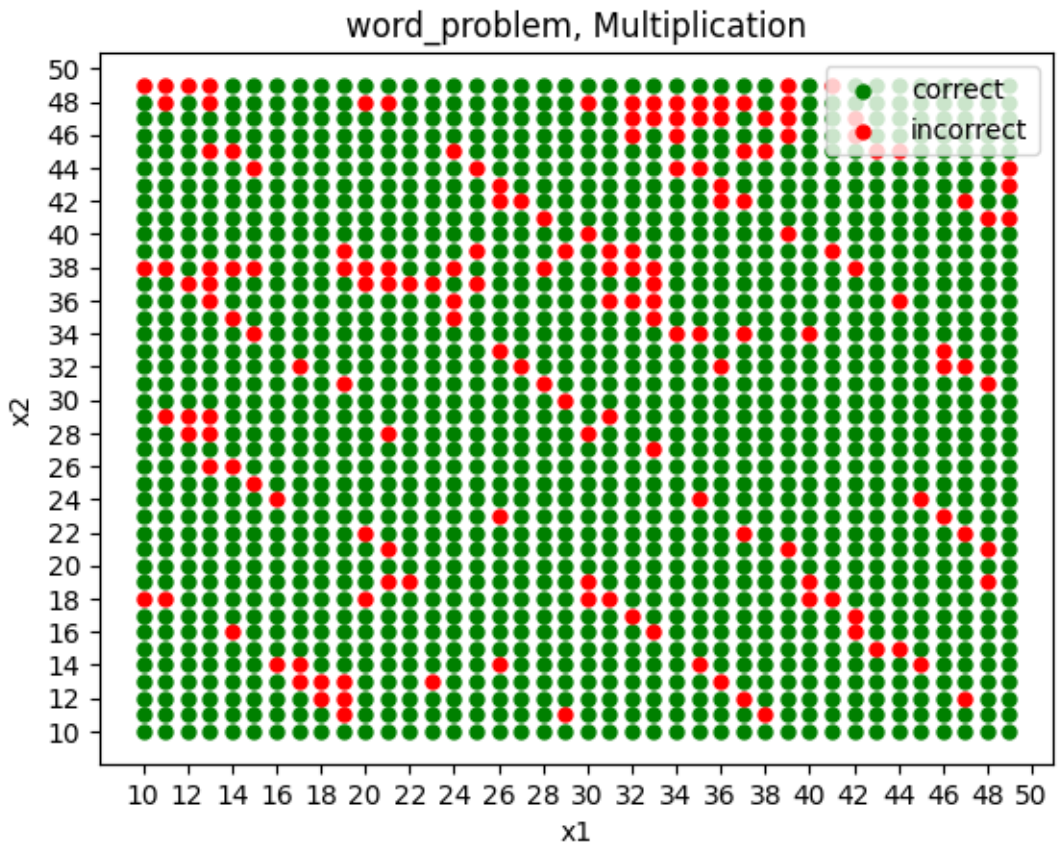


The resultant Accuracies

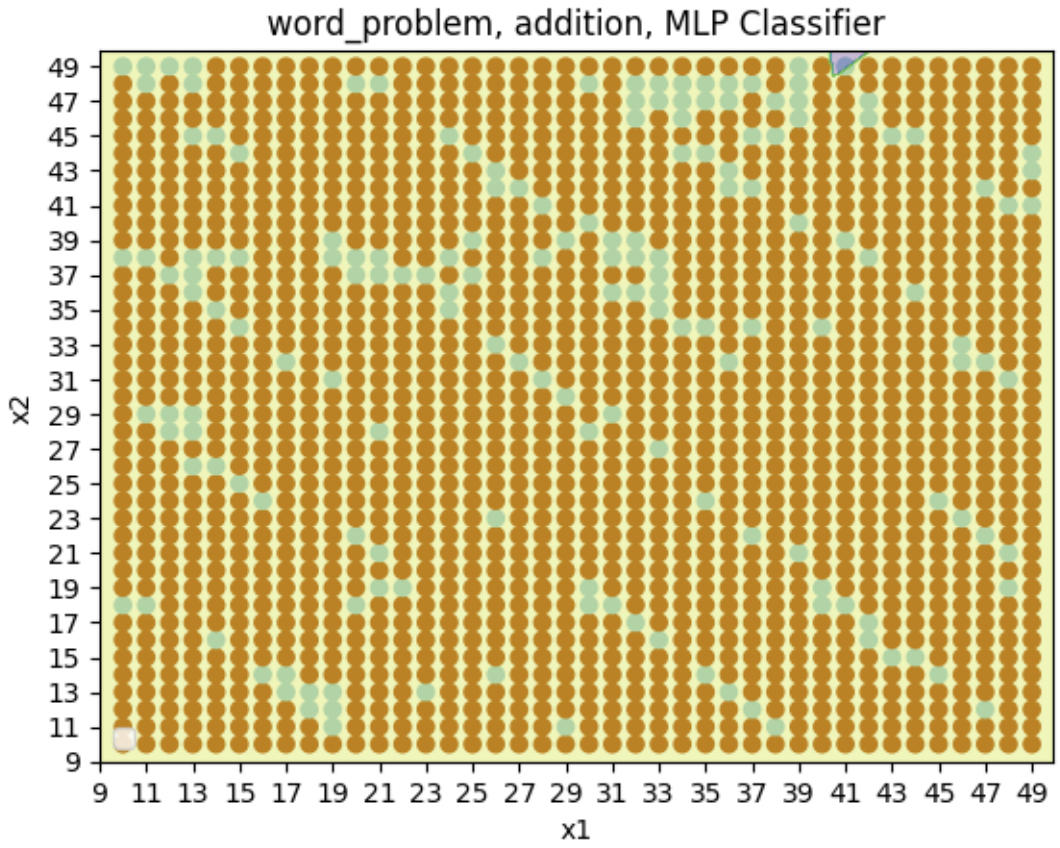
	strategy	accuracy (in %)	classifier_accuracy (in %)
0	word_problem	89.562500	89.625
1	code	41.812500	71.000
2	algebra	91.874999	91.875
3	in_context	40.312499	68.625
4	baseline	54.312497	71.000

[50]:
```
analyze_results(X, y, y_hats, strategies)
```

```
 ------------
word_problem
accuracy of word_problem is 0.8956249952316284
```




```
/usr/local/lib/python3.9/dist-
packages/sklearn/neural_network/_multilayer_perceptron.py:541:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
  self.n_iter_ = _check_optimize_result("lbfgs", opt_res, self.max_iter)

False negative rate: 0.0
acc of classifier is 0.89625

WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
that artists whose label start with an underscore are ignored when legend() is
called with no argument.
```

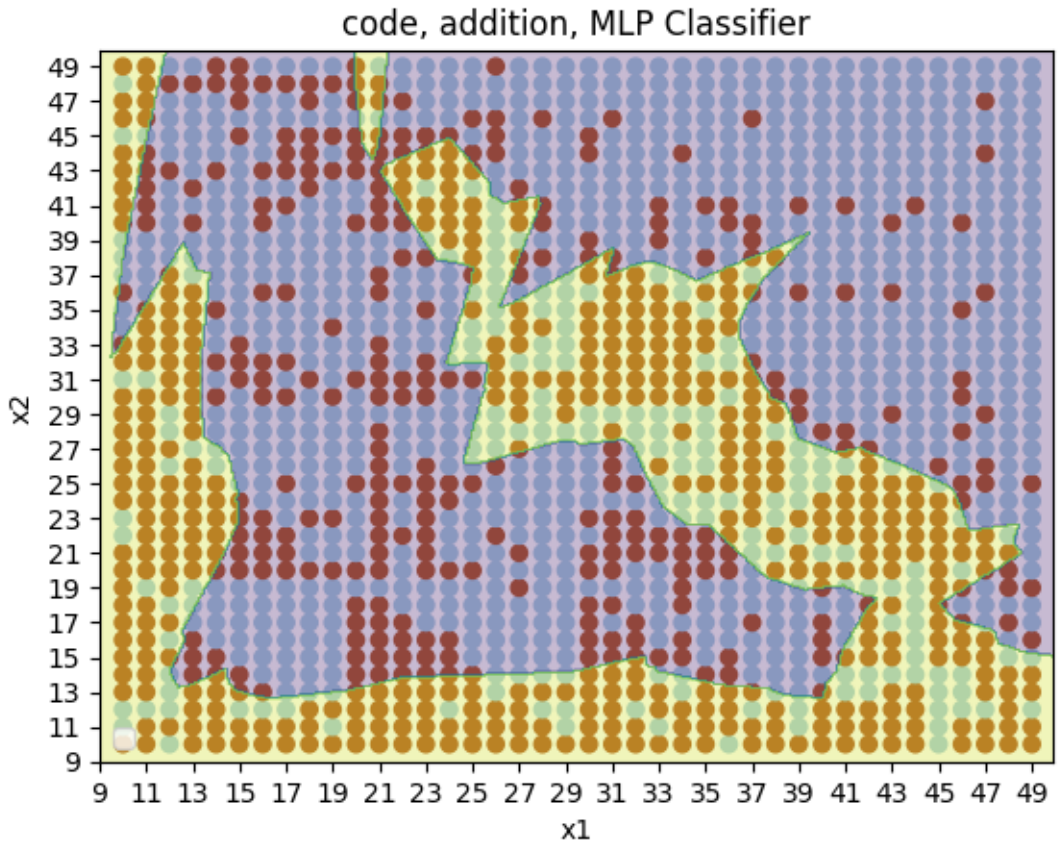



```
 ------------
code
accuracy of code is 0.4181250035762787
```

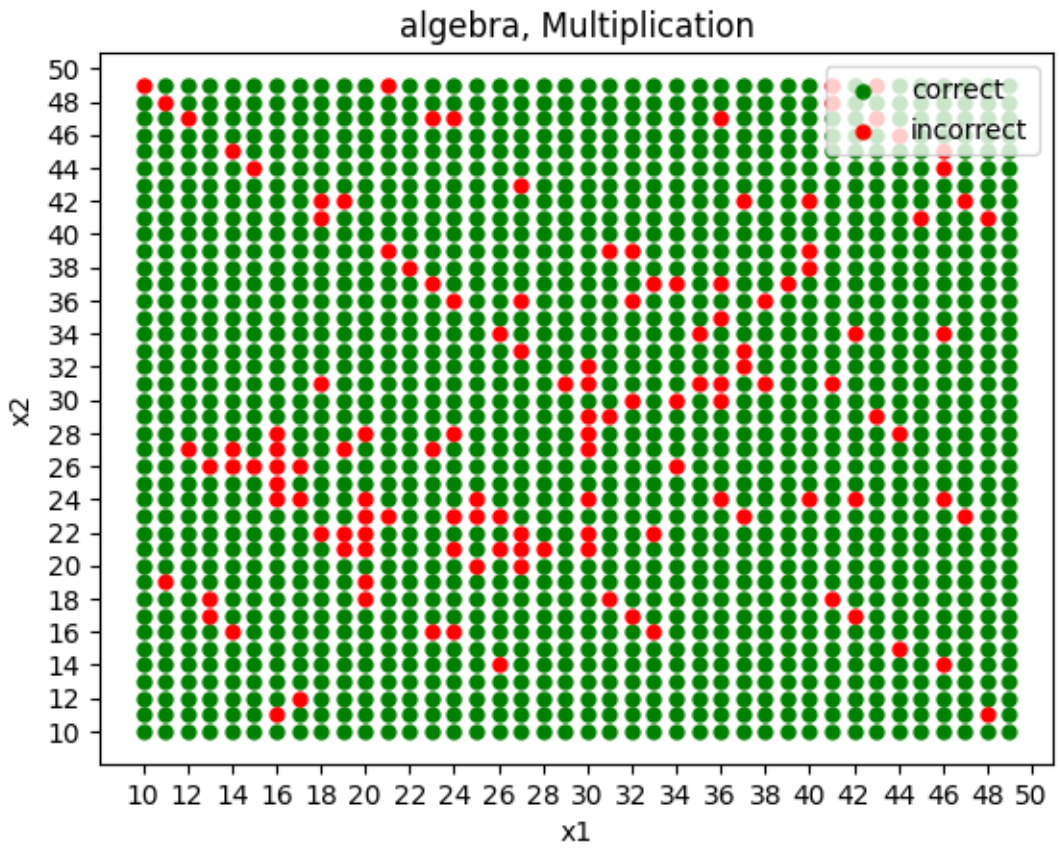
```
/usr/local/lib/python3.9/dist-
packages/sklearn/neural_network/_multilayer_perceptron.py:541:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
  self.n_iter_ = _check_optimize_result("lbfgs", opt_res, self.max_iter)
```

```
False negative rate: 0.40956651718983555
acc of classifier is 0.72
```

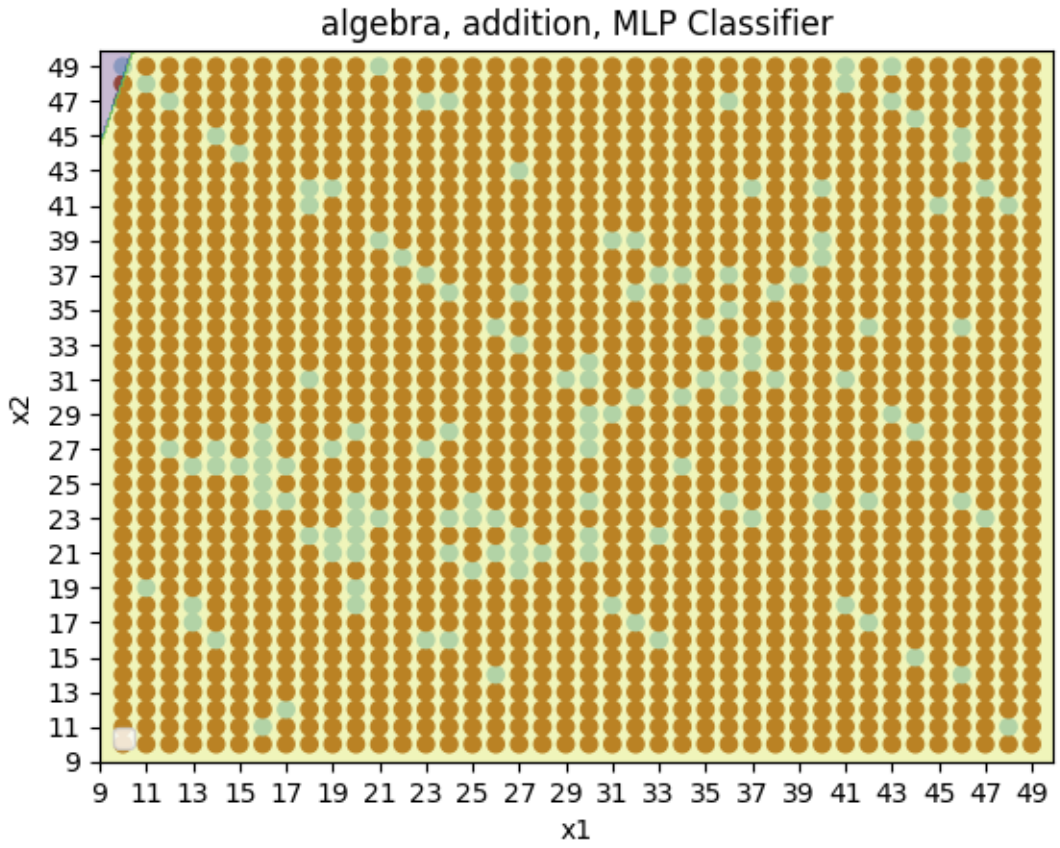
```
WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
that artists whose label start with an underscore are ignored when legend() is
called with no argument.
```




```
 ------------
algebra
accuracy of algebra is 0.918749988079071
```



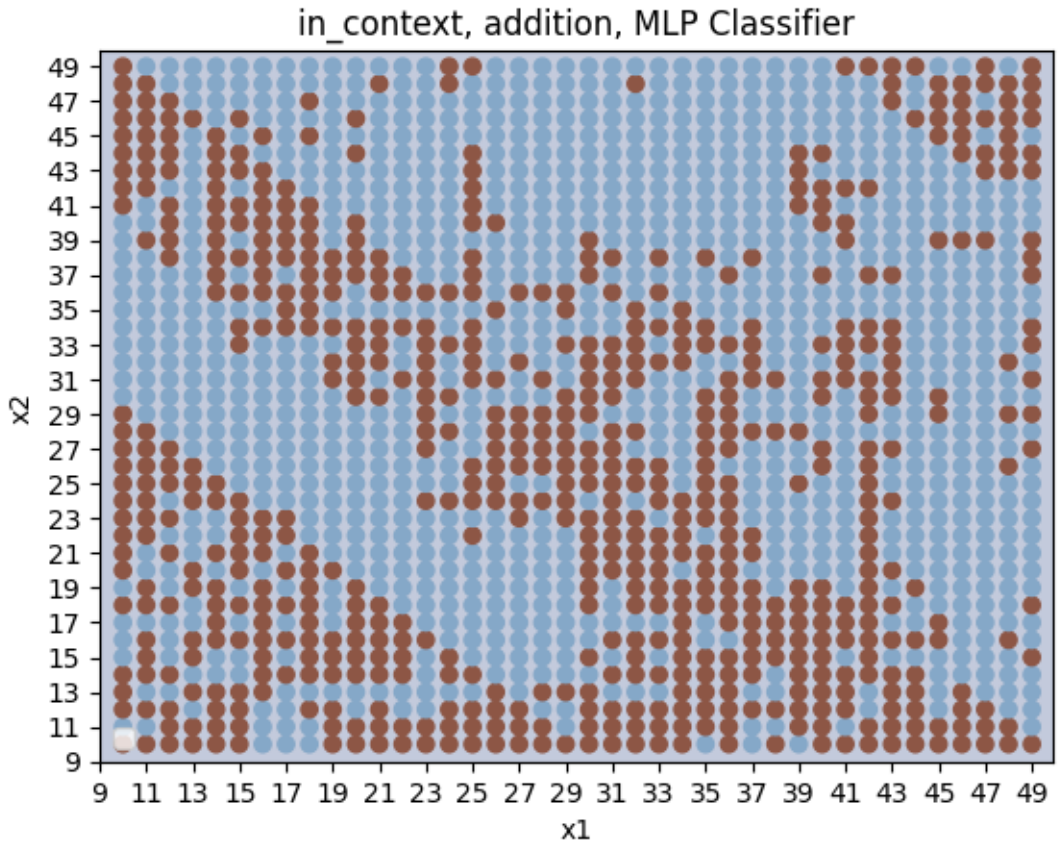

```
/usr/local/lib/python3.9/dist-
packages/sklearn/neural_network/_multilayer_perceptron.py:541:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
  self.n_iter_ = _check_optimize_result("lbfgs", opt_res, self.max_iter)

False negative rate: 0.0
acc of classifier is 0.919375

WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
that artists whose label start with an underscore are ignored when legend() is
called with no argument.
```



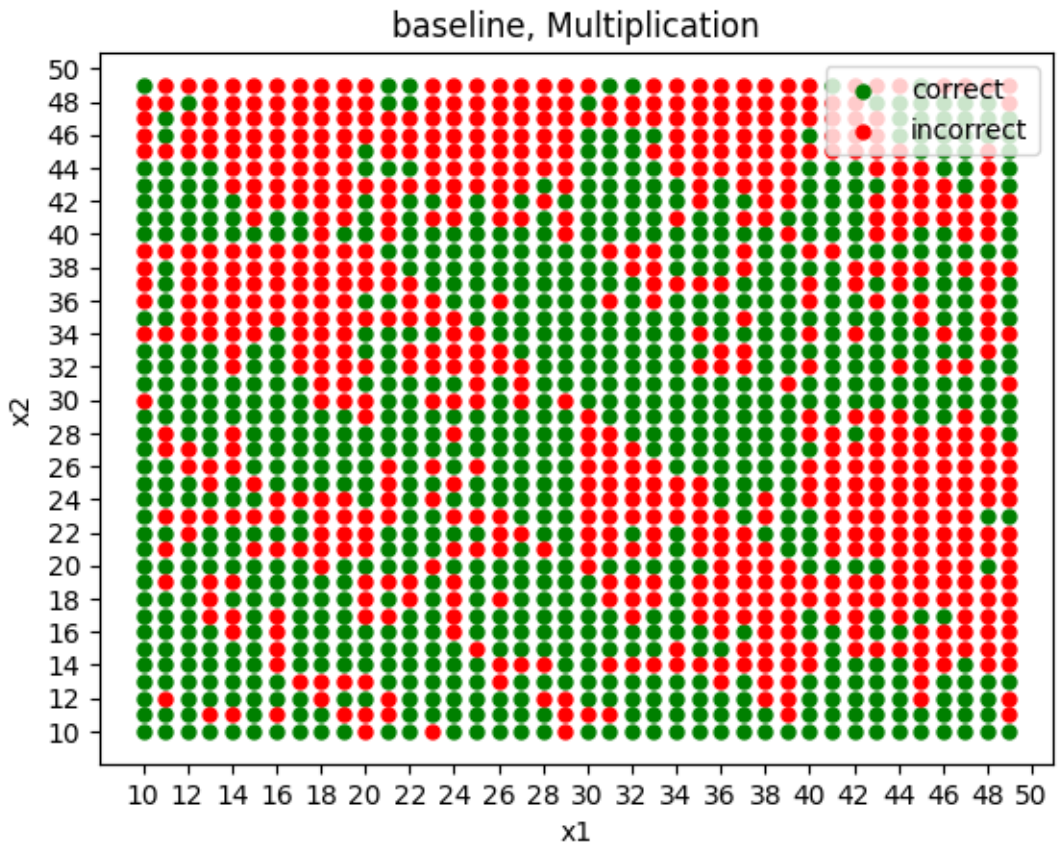

```
 ------------
in_context
accuracy of in_context is 0.40312498807907104
```

```
False negative rate: 1.0
acc of classifier is 0.596875
```

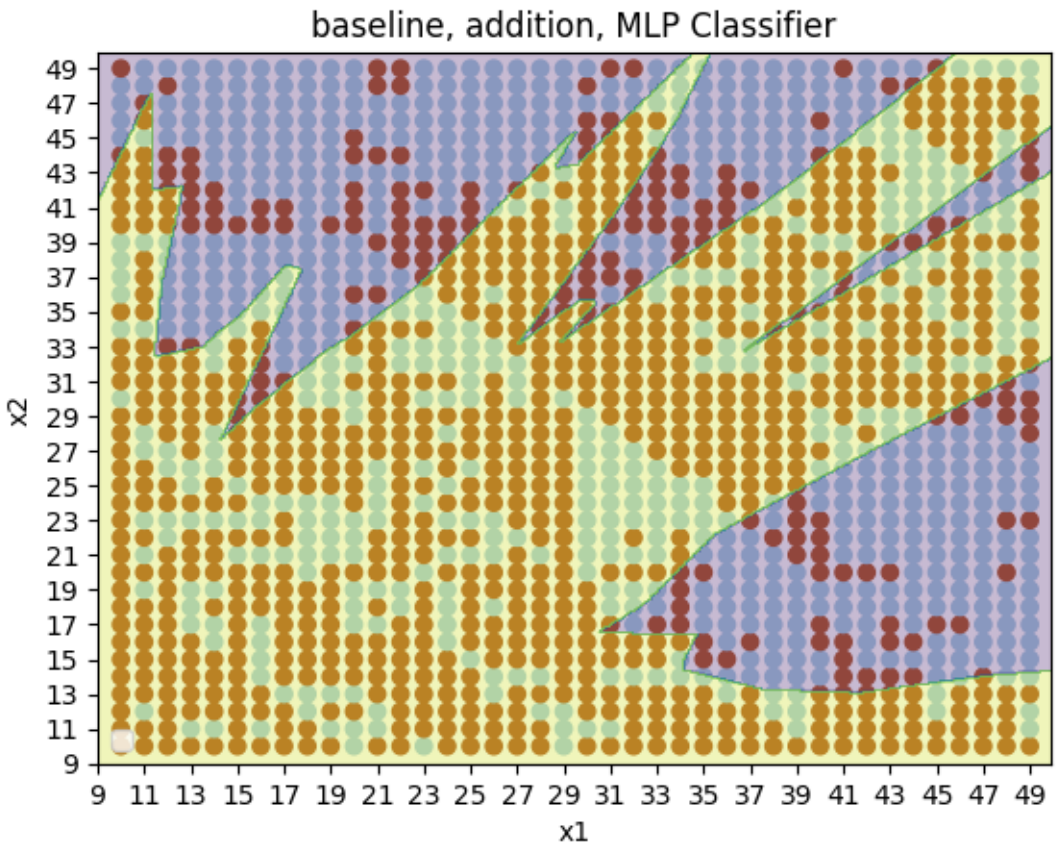
```
WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
that artists whose label start with an underscore are ignored when legend() is
called with no argument.
```




```
 ------------
baseline
accuracy of baseline is 0.5431249737739563
```




```
/usr/local/lib/python3.9/dist-
packages/sklearn/neural_network/_multilayer_perceptron.py:541:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
  self.n_iter_ = _check_optimize_result("lbfgs", opt_res, self.max_iter)

False negative rate: 0.17261219792865362
acc of classifier is 0.71375

WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
that artists whose label start with an underscore are ignored when legend() is
called with no argument.
```



The resultant Accuracies

	strategy	miss_rate (in %)	accuracy (in %)	classifier_accuracy (in %)
0	word_problem	0.000000	89.562500	89.6250
1	code	40.956652	41.812500	72.0000
2	algebra	0.000000	91.874999	91.9375
3	in_context	100.000000	40.312499	59.6875
4	baseline	17.261220	54.312497	71.3750

[51]:
```
import locale
locale.getpreferredencoding = lambda: "UTF-8"
```

[37]:
```
!sudo apt-get update
!sudo apt-get install texlive-xetex texlive-fonts-recommended
```

```
Get:1 https://cloud.r-project.org/bin/linux/ubuntu focal-cran40/ InRelease
[3,622 B]
Get:2 https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2004/x86_64
InRelease [1,581 B]
```

```
Get:3 https://cloud.r-project.org/bin/linux/ubuntu focal-cran40/ Packages [76.4
kB]
Get:4 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:5 https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2004/x86_64
Packages [995 kB]
Get:6 http://ppa.launchpad.net/c2d4u.team/c2d4u4.0+/ubuntu focal InRelease [18.1
kB]
Hit:7 http://archive.ubuntu.com/ubuntu focal InRelease
Get:8 http://archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Hit:9 http://ppa.launchpad.net/cran/libgit2/ubuntu focal InRelease
Get:10 http://security.ubuntu.com/ubuntu focal-security/universe amd64 Packages
[1,034 kB]
Hit:11 http://ppa.launchpad.net/deadsnakes/ppa/ubuntu focal InRelease
Get:12 http://archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Hit:13 http://ppa.launchpad.net/graphics-drivers/ppa/ubuntu focal InRelease
Get:14 http://archive.ubuntu.com/ubuntu focal-updates/universe amd64 Packages
[1,331 kB]
Hit:15 http://ppa.launchpad.net/ubuntugis/ppa/ubuntu focal InRelease
Get:16 http://ppa.launchpad.net/c2d4u.team/c2d4u4.0+/ubuntu focal/main Sources
[2,499 kB]
Get:17 http://archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [3,114
kB]
Get:18 http://archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages
[2,283 kB]
Get:19 http://ppa.launchpad.net/c2d4u.team/c2d4u4.0+/ubuntu focal/main amd64
Packages [1,182 kB]
Fetched 12.9 MB in 5s (2,411 kB/s)
Reading package lists… Done
Reading package lists… Done
Building dependency tree
Reading state information… Done
The following additional packages will be installed:
  dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono
  fonts-texgyre fonts-urw-base35 javascript-common libapache-pom-java
  libcommons-logging-java libcommons-parent-java libfontbox-java libfontenc1
  libgs9 libgs9-common libharfbuzz-icu0 libidn11 libijs-0.35 libjbig2dec0
  libjs-jquery libkpathsea6 libpdfbox-java libptexenc1 libruby2.7 libsynctex2
  libteckit0 libtexlua53 libtexluajit2 libwoff1 libzzip-0-13 lmodern
  poppler-data preview-latex-style rake ruby ruby-minitest ruby-net-telnet
  ruby-power-assert ruby-test-unit ruby-xmlrpc ruby2.7 rubygems-integration
  t1utils teckit tex-common tex-gyre texlive-base texlive-binaries
  texlive-latex-base texlive-latex-extra texlive-latex-recommended
  texlive-pictures texlive-plain-generic tipa xfonts-encodings xfonts-utils
Suggested packages:
  fonts-noto fonts-freefont-otf | fonts-freefont-ttf apache2 | lighttpd
  | httpd libavalon-framework-java libcommons-logging-java-doc
  libexcalibur-logkit-java liblog4j1.2-java poppler-utils ghostscript
  fonts-japanese-mincho | fonts-ipafont-mincho fonts-japanese-gothic
```

```
  | fonts-ipafont-gothic fonts-arphic-ukai fonts-arphic-uming fonts-nanum ri
  ruby-dev bundler debhelper gv | postscript-viewer perl-tk xpdf | pdf-viewer
  xzdec texlive-fonts-recommended-doc texlive-latex-base-doc python3-pygments
  icc-profiles libfile-which-perl libspreadsheet-parseexcel-perl
  texlive-latex-extra-doc texlive-latex-recommended-doc texlive-luatex
  texlive-pstricks dot2tex prerex ruby-tcltk | libtcltk-ruby
  texlive-pictures-doc vprerex default-jre-headless
The following NEW packages will be installed:
  dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono
  fonts-texgyre fonts-urw-base35 javascript-common libapache-pom-java
  libcommons-logging-java libcommons-parent-java libfontbox-java libfontenc1
  libgs9 libgs9-common libharfbuzz-icu0 libidn11 libijs-0.35 libjbig2dec0
  libjs-jquery libkpathsea6 libpdfbox-java libptexenc1 libruby2.7 libsynctex2
  libteckit0 libtexlua53 libtexluajit2 libwoff1 libzzip-0-13 lmodern
  poppler-data preview-latex-style rake ruby ruby-minitest ruby-net-telnet
  ruby-power-assert ruby-test-unit ruby-xmlrpc ruby2.7 rubygems-integration
  t1utils teckit tex-common tex-gyre texlive-base texlive-binaries
  texlive-fonts-recommended texlive-latex-base texlive-latex-extra
  texlive-latex-recommended texlive-pictures texlive-plain-generic
  texlive-xetex tipa xfonts-encodings xfonts-utils
0 upgraded, 58 newly installed, 0 to remove and 33 not upgraded.
Need to get 169 MB of archives.
After this operation, 537 MB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu focal/main amd64 fonts-droid-fallback all
1:6.0.1r16-1.1 [1,805 kB]
Get:2 http://archive.ubuntu.com/ubuntu focal/main amd64 fonts-lato all 2.0-2
[2,698 kB]
Get:3 http://archive.ubuntu.com/ubuntu focal/main amd64 poppler-data all 0.4.9-2
[1,475 kB]
Get:4 http://archive.ubuntu.com/ubuntu focal/universe amd64 tex-common all 6.13
[32.7 kB]
Get:5 http://archive.ubuntu.com/ubuntu focal/main amd64 fonts-urw-base35 all
20170801.1-3 [6,333 kB]
Get:6 http://archive.ubuntu.com/ubuntu focal-updates/main amd64 libgs9-common
all 9.50~dfsg-5ubuntu4.7 [681 kB]
Get:7 http://archive.ubuntu.com/ubuntu focal/main amd64 libidn11 amd64
1.33-2.2ubuntu2 [46.2 kB]
Get:8 http://archive.ubuntu.com/ubuntu focal/main amd64 libijs-0.35 amd64
0.35-15 [15.7 kB]
Get:9 http://archive.ubuntu.com/ubuntu focal/main amd64 libjbig2dec0 amd64
0.18-1ubuntu1 [60.0 kB]
Get:10 http://archive.ubuntu.com/ubuntu focal-updates/main amd64 libgs9 amd64
9.50~dfsg-5ubuntu4.7 [2,173 kB]
Get:11 http://archive.ubuntu.com/ubuntu focal/main amd64 libkpathsea6 amd64
2019.20190605.51237-3build2 [57.0 kB]
Get:12 http://archive.ubuntu.com/ubuntu focal/main amd64 libwoff1 amd64
1.0.2-1build2 [42.0 kB]
Get:13 http://archive.ubuntu.com/ubuntu focal/universe amd64 dvisvgm amd64
```

```
2.8.1-1build1 [1,048 kB]
Get:14 http://archive.ubuntu.com/ubuntu focal/universe amd64 fonts-lmodern all
2.004.5-6 [4,532 kB]
Get:15 http://archive.ubuntu.com/ubuntu focal-updates/main amd64 fonts-noto-mono
all 20200323-1build1~ubuntu20.04.1 [80.6 kB]
Get:16 http://archive.ubuntu.com/ubuntu focal/universe amd64 fonts-texgyre all
20180621-3 [10.2 MB]
Get:17 http://archive.ubuntu.com/ubuntu focal/main amd64 javascript-common all
11 [6,066 B]
Get:18 http://archive.ubuntu.com/ubuntu focal/universe amd64 libapache-pom-java
all 18-1 [4,720 B]
Get:19 http://archive.ubuntu.com/ubuntu focal/universe amd64 libcommons-parent-
java all 43-1 [10.8 kB]
Get:20 http://archive.ubuntu.com/ubuntu focal/universe amd64 libcommons-logging-
java all 1.2-2 [60.3 kB]
Get:21 http://archive.ubuntu.com/ubuntu focal/main amd64 libfontenc1 amd64
1:1.1.4-0ubuntu1 [14.0 kB]
Get:22 http://archive.ubuntu.com/ubuntu focal-updates/main amd64 libharfbuzz-
icu0 amd64 2.6.4-1ubuntu4.2 [5,580 B]
Get:23 http://archive.ubuntu.com/ubuntu focal/main amd64 libjs-jquery all
3.3.1~dfsg-3 [329 kB]
Get:24 http://archive.ubuntu.com/ubuntu focal/main amd64 libptexenc1 amd64
2019.20190605.51237-3build2 [35.5 kB]
Get:25 http://archive.ubuntu.com/ubuntu focal/main amd64 rubygems-integration
all 1.16 [5,092 B]
Get:26 http://archive.ubuntu.com/ubuntu focal-updates/main amd64 ruby2.7 amd64
2.7.0-5ubuntu1.8 [95.6 kB]
Get:27 http://archive.ubuntu.com/ubuntu focal/main amd64 ruby amd64 1:2.7+1
[5,412 B]
Get:28 http://archive.ubuntu.com/ubuntu focal/main amd64 rake all 13.0.1-4 [61.6
kB]
Get:29 http://archive.ubuntu.com/ubuntu focal/main amd64 ruby-minitest all
5.13.0-1 [40.9 kB]
Get:30 http://archive.ubuntu.com/ubuntu focal/main amd64 ruby-net-telnet all
0.1.1-2 [12.6 kB]
Get:31 http://archive.ubuntu.com/ubuntu focal/main amd64 ruby-power-assert all
1.1.7-1 [11.4 kB]
Get:32 http://archive.ubuntu.com/ubuntu focal/main amd64 ruby-test-unit all
3.3.5-1 [73.2 kB]
Get:33 http://archive.ubuntu.com/ubuntu focal/main amd64 ruby-xmlrpc all 0.3.0-2
[23.8 kB]
Get:34 http://archive.ubuntu.com/ubuntu focal-updates/main amd64 libruby2.7
amd64 2.7.0-5ubuntu1.8 [3,532 kB]
Get:35 http://archive.ubuntu.com/ubuntu focal/main amd64 libsynctex2 amd64
2019.20190605.51237-3build2 [55.0 kB]
Get:36 http://archive.ubuntu.com/ubuntu focal/universe amd64 libteckit0 amd64
2.5.8+ds2-5ubuntu2 [320 kB]
Get:37 http://archive.ubuntu.com/ubuntu focal/main amd64 libtexlua53 amd64
```

```
2019.20190605.51237-3build2 [105 kB]
Get:38 http://archive.ubuntu.com/ubuntu focal/main amd64 libtexluajit2 amd64
2019.20190605.51237-3build2 [235 kB]
Get:39 http://archive.ubuntu.com/ubuntu focal/universe amd64 libzzip-0-13 amd64
0.13.62-3.2ubuntu1 [26.2 kB]
Get:40 http://archive.ubuntu.com/ubuntu focal/main amd64 xfonts-encodings all
1:1.0.5-0ubuntu1 [573 kB]
Get:41 http://archive.ubuntu.com/ubuntu focal/main amd64 xfonts-utils amd64
1:7.7+6 [91.5 kB]
Get:42 http://archive.ubuntu.com/ubuntu focal/universe amd64 lmodern all
2.004.5-6 [9,474 kB]
Get:43 http://archive.ubuntu.com/ubuntu focal/universe amd64 preview-latex-style
all 11.91-2ubuntu2 [184 kB]
Get:44 http://archive.ubuntu.com/ubuntu focal/main amd64 t1utils amd64 1.41-3
[56.1 kB]
Get:45 http://archive.ubuntu.com/ubuntu focal/universe amd64 teckit amd64
2.5.8+ds2-5ubuntu2 [687 kB]
Get:46 http://archive.ubuntu.com/ubuntu focal/universe amd64 tex-gyre all
20180621-3 [6,209 kB]
Get:47 http://archive.ubuntu.com/ubuntu focal/universe amd64 texlive-binaries
amd64 2019.20190605.51237-3build2 [8,041 kB]
Get:48 http://archive.ubuntu.com/ubuntu focal/universe amd64 texlive-base all
2019.20200218-1 [20.8 MB]
Get:49 http://archive.ubuntu.com/ubuntu focal/universe amd64 texlive-fonts-
recommended all 2019.20200218-1 [4,972 kB]
Get:50 http://archive.ubuntu.com/ubuntu focal/universe amd64 texlive-latex-base
all 2019.20200218-1 [990 kB]
Get:51 http://archive.ubuntu.com/ubuntu focal/universe amd64 libfontbox-java all
1:1.8.16-2 [207 kB]
Get:52 http://archive.ubuntu.com/ubuntu focal/universe amd64 libpdfbox-java all
1:1.8.16-2 [5,199 kB]
Get:53 http://archive.ubuntu.com/ubuntu focal/universe amd64 texlive-latex-
recommended all 2019.20200218-1 [15.7 MB]
Get:54 http://archive.ubuntu.com/ubuntu focal/universe amd64 texlive-pictures
all 2019.20200218-1 [4,492 kB]
Get:55 http://archive.ubuntu.com/ubuntu focal/universe amd64 texlive-latex-extra
all 2019.202000218-1 [12.5 MB]
Get:56 http://archive.ubuntu.com/ubuntu focal/universe amd64 texlive-plain-
generic all 2019.202000218-1 [24.6 MB]
Get:57 http://archive.ubuntu.com/ubuntu focal/universe amd64 tipa all 2:1.3-20
[2,978 kB]
Get:58 http://archive.ubuntu.com/ubuntu focal/universe amd64 texlive-xetex all
2019.20200218-1 [14.6 MB]
Fetched 169 MB in 22s (7,703 kB/s)
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based
frontend cannot be used. at /usr/share/perl5/Debconf/FrontEnd/Dialog.pm line 76,
<> line 58.)
```

```
debconf: falling back to frontend: Readline
debconf: unable to initialize frontend: Readline
debconf: (This frontend requires a controlling tty.)
debconf: falling back to frontend: Teletype
dpkg-preconfigure: unable to re-open stdin:
Selecting previously unselected package fonts-droid-fallback.
(Reading database … 122352 files and directories currently installed.)
Preparing to unpack …/00-fonts-droid-fallback_1%3a6.0.1r16-1.1_all.deb …
Unpacking fonts-droid-fallback (1:6.0.1r16-1.1) …
Selecting previously unselected package fonts-lato.
Preparing to unpack …/01-fonts-lato_2.0-2_all.deb …
Unpacking fonts-lato (2.0-2) …
Selecting previously unselected package poppler-data.
Preparing to unpack …/02-poppler-data_0.4.9-2_all.deb …
Unpacking poppler-data (0.4.9-2) …
Selecting previously unselected package tex-common.
Preparing to unpack …/03-tex-common_6.13_all.deb …
Unpacking tex-common (6.13) …
Selecting previously unselected package fonts-urw-base35.
Preparing to unpack …/04-fonts-urw-base35_20170801.1-3_all.deb …
Unpacking fonts-urw-base35 (20170801.1-3) …
Selecting previously unselected package libgs9-common.
Preparing to unpack …/05-libgs9-common_9.50~dfsg-5ubuntu4.7_all.deb …
Unpacking libgs9-common (9.50~dfsg-5ubuntu4.7) …
Selecting previously unselected package libidn11:amd64.
Preparing to unpack …/06-libidn11_1.33-2.2ubuntu2_amd64.deb …
Unpacking libidn11:amd64 (1.33-2.2ubuntu2) …
Selecting previously unselected package libijs-0.35:amd64.
Preparing to unpack …/07-libijs-0.35_0.35-15_amd64.deb …
Unpacking libijs-0.35:amd64 (0.35-15) …
Selecting previously unselected package libjbig2dec0:amd64.
Preparing to unpack …/08-libjbig2dec0_0.18-1ubuntu1_amd64.deb …
Unpacking libjbig2dec0:amd64 (0.18-1ubuntu1) …
Selecting previously unselected package libgs9:amd64.
Preparing to unpack …/09-libgs9_9.50~dfsg-5ubuntu4.7_amd64.deb …
Unpacking libgs9:amd64 (9.50~dfsg-5ubuntu4.7) …
Selecting previously unselected package libkpathsea6:amd64.
Preparing to unpack …/10-libkpathsea6_2019.20190605.51237-3build2_amd64.deb
…
Unpacking libkpathsea6:amd64 (2019.20190605.51237-3build2) …
Selecting previously unselected package libwoff1:amd64.
Preparing to unpack …/11-libwoff1_1.0.2-1build2_amd64.deb …
Unpacking libwoff1:amd64 (1.0.2-1build2) …
Selecting previously unselected package dvisvgm.
Preparing to unpack …/12-dvisvgm_2.8.1-1build1_amd64.deb …
Unpacking dvisvgm (2.8.1-1build1) …
Selecting previously unselected package fonts-lmodern.
Preparing to unpack …/13-fonts-lmodern_2.004.5-6_all.deb …
```

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Unpacking fonts-lmodern (2.004.5-6) …
Selecting previously unselected package fonts-noto-mono.
Preparing to unpack …/14-fonts-noto-
mono_20200323-1build1~ubuntu20.04.1_all.deb …
Unpacking fonts-noto-mono (20200323-1build1~ubuntu20.04.1) …
Selecting previously unselected package fonts-texgyre.
Preparing to unpack …/15-fonts-texgyre_20180621-3_all.deb …
Unpacking fonts-texgyre (20180621-3) …
Selecting previously unselected package javascript-common.
Preparing to unpack …/16-javascript-common_11_all.deb …
Unpacking javascript-common (11) …
Selecting previously unselected package libapache-pom-java.
Preparing to unpack …/17-libapache-pom-java_18-1_all.deb …
Unpacking libapache-pom-java (18-1) …
Selecting previously unselected package libcommons-parent-java.
Preparing to unpack …/18-libcommons-parent-java_43-1_all.deb …
Unpacking libcommons-parent-java (43-1) …
Selecting previously unselected package libcommons-logging-java.
Preparing to unpack …/19-libcommons-logging-java_1.2-2_all.deb …
Unpacking libcommons-logging-java (1.2-2) …
Selecting previously unselected package libfontenc1:amd64.
Preparing to unpack …/20-libfontenc1_1%3a1.1.4-0ubuntu1_amd64.deb …
Unpacking libfontenc1:amd64 (1:1.1.4-0ubuntu1) …
Selecting previously unselected package libharfbuzz-icu0:amd64.
Preparing to unpack …/21-libharfbuzz-icu0_2.6.4-1ubuntu4.2_amd64.deb …
Unpacking libharfbuzz-icu0:amd64 (2.6.4-1ubuntu4.2) …
Selecting previously unselected package libjs-jquery.
Preparing to unpack …/22-libjs-jquery_3.3.1~dfsg-3_all.deb …
Unpacking libjs-jquery (3.3.1~dfsg-3) …
Selecting previously unselected package libptexenc1:amd64.
Preparing to unpack …/23-libptexenc1_2019.20190605.51237-3build2_amd64.deb …
Unpacking libptexenc1:amd64 (2019.20190605.51237-3build2) …
Selecting previously unselected package rubygems-integration.
Preparing to unpack …/24-rubygems-integration_1.16_all.deb …
Unpacking rubygems-integration (1.16) …
Selecting previously unselected package ruby2.7.
Preparing to unpack …/25-ruby2.7_2.7.0-5ubuntu1.8_amd64.deb …
Unpacking ruby2.7 (2.7.0-5ubuntu1.8) …
Selecting previously unselected package ruby.
Preparing to unpack …/26-ruby_1%3a2.7+1_amd64.deb …
Unpacking ruby (1:2.7+1) …
Selecting previously unselected package rake.
Preparing to unpack …/27-rake_13.0.1-4_all.deb …
Unpacking rake (13.0.1-4) …
Selecting previously unselected package ruby-minitest.
Preparing to unpack …/28-ruby-minitest_5.13.0-1_all.deb …
Unpacking ruby-minitest (5.13.0-1) …
Selecting previously unselected package ruby-net-telnet.
```

```
Preparing to unpack …/29-ruby-net-telnet_0.1.1-2_all.deb …
Unpacking ruby-net-telnet (0.1.1-2) …
Selecting previously unselected package ruby-power-assert.
Preparing to unpack …/30-ruby-power-assert_1.1.7-1_all.deb …
Unpacking ruby-power-assert (1.1.7-1) …
Selecting previously unselected package ruby-test-unit.
Preparing to unpack …/31-ruby-test-unit_3.3.5-1_all.deb …
Unpacking ruby-test-unit (3.3.5-1) …
Selecting previously unselected package ruby-xmlrpc.
Preparing to unpack …/32-ruby-xmlrpc_0.3.0-2_all.deb …
Unpacking ruby-xmlrpc (0.3.0-2) …
Selecting previously unselected package libruby2.7:amd64.
Preparing to unpack …/33-libruby2.7_2.7.0-5ubuntu1.8_amd64.deb …
Unpacking libruby2.7:amd64 (2.7.0-5ubuntu1.8) …
Selecting previously unselected package libsynctex2:amd64.
Preparing to unpack …/34-libsynctex2_2019.20190605.51237-3build2_amd64.deb …
Unpacking libsynctex2:amd64 (2019.20190605.51237-3build2) …
Selecting previously unselected package libteckit0:amd64.
Preparing to unpack …/35-libteckit0_2.5.8+ds2-5ubuntu2_amd64.deb …
Unpacking libteckit0:amd64 (2.5.8+ds2-5ubuntu2) …
Selecting previously unselected package libtexlua53:amd64.
Preparing to unpack …/36-libtexlua53_2019.20190605.51237-3build2_amd64.deb …
Unpacking libtexlua53:amd64 (2019.20190605.51237-3build2) …
Selecting previously unselected package libtexluajit2:amd64.
Preparing to unpack …/37-libtexluajit2_2019.20190605.51237-3build2_amd64.deb
…
Unpacking libtexluajit2:amd64 (2019.20190605.51237-3build2) …
Selecting previously unselected package libzzip-0-13:amd64.
Preparing to unpack …/38-libzzip-0-13_0.13.62-3.2ubuntu1_amd64.deb …
Unpacking libzzip-0-13:amd64 (0.13.62-3.2ubuntu1) …
Selecting previously unselected package xfonts-encodings.
Preparing to unpack …/39-xfonts-encodings_1%3a1.0.5-0ubuntu1_all.deb …
Unpacking xfonts-encodings (1:1.0.5-0ubuntu1) …
Selecting previously unselected package xfonts-utils.
Preparing to unpack …/40-xfonts-utils_1%3a7.7+6_amd64.deb …
Unpacking xfonts-utils (1:7.7+6) …
Selecting previously unselected package lmodern.
Preparing to unpack …/41-lmodern_2.004.5-6_all.deb …
Unpacking lmodern (2.004.5-6) …
Selecting previously unselected package preview-latex-style.
Preparing to unpack …/42-preview-latex-style_11.91-2ubuntu2_all.deb …
Unpacking preview-latex-style (11.91-2ubuntu2) …
Selecting previously unselected package t1utils.
Preparing to unpack …/43-t1utils_1.41-3_amd64.deb …
Unpacking t1utils (1.41-3) …
Selecting previously unselected package teckit.
Preparing to unpack …/44-teckit_2.5.8+ds2-5ubuntu2_amd64.deb …
Unpacking teckit (2.5.8+ds2-5ubuntu2) …
```

```
Selecting previously unselected package tex-gyre.
Preparing to unpack …/45-tex-gyre_20180621-3_all.deb …
Unpacking tex-gyre (20180621-3) …
Selecting previously unselected package texlive-binaries.
Preparing to unpack …/46-texlive-
binaries_2019.20190605.51237-3build2_amd64.deb …
Unpacking texlive-binaries (2019.20190605.51237-3build2) …
Selecting previously unselected package texlive-base.
Preparing to unpack …/47-texlive-base_2019.20200218-1_all.deb …
Unpacking texlive-base (2019.20200218-1) …
Selecting previously unselected package texlive-fonts-recommended.
Preparing to unpack …/48-texlive-fonts-recommended_2019.20200218-1_all.deb …
Unpacking texlive-fonts-recommended (2019.20200218-1) …
Selecting previously unselected package texlive-latex-base.
Preparing to unpack …/49-texlive-latex-base_2019.20200218-1_all.deb …
Unpacking texlive-latex-base (2019.20200218-1) …
Selecting previously unselected package libfontbox-java.
Preparing to unpack …/50-libfontbox-java_1%3a1.8.16-2_all.deb …
Unpacking libfontbox-java (1:1.8.16-2) …
Selecting previously unselected package libpdfbox-java.
Preparing to unpack …/51-libpdfbox-java_1%3a1.8.16-2_all.deb …
Unpacking libpdfbox-java (1:1.8.16-2) …
Selecting previously unselected package texlive-latex-recommended.
Preparing to unpack …/52-texlive-latex-recommended_2019.20200218-1_all.deb …
Unpacking texlive-latex-recommended (2019.20200218-1) …
Selecting previously unselected package texlive-pictures.
Preparing to unpack …/53-texlive-pictures_2019.20200218-1_all.deb …
Unpacking texlive-pictures (2019.20200218-1) …
Selecting previously unselected package texlive-latex-extra.
Preparing to unpack …/54-texlive-latex-extra_2019.202000218-1_all.deb …
Unpacking texlive-latex-extra (2019.202000218-1) …
Selecting previously unselected package texlive-plain-generic.
Preparing to unpack …/55-texlive-plain-generic_2019.202000218-1_all.deb …
Unpacking texlive-plain-generic (2019.202000218-1) …
Selecting previously unselected package tipa.
Preparing to unpack …/56-tipa_2%3a1.3-20_all.deb …
Unpacking tipa (2:1.3-20) …
Selecting previously unselected package texlive-xetex.
Preparing to unpack …/57-texlive-xetex_2019.20200218-1_all.deb …
Unpacking texlive-xetex (2019.20200218-1) …
Setting up javascript-common (11) …
Setting up libharfbuzz-icu0:amd64 (2.6.4-1ubuntu4.2) …
Setting up fonts-lato (2.0-2) …
Setting up fonts-noto-mono (20200323-1build1~ubuntu20.04.1) …
Setting up libwoff1:amd64 (1.0.2-1build2) …
Setting up ruby-power-assert (1.1.7-1) …
Setting up libtexlua53:amd64 (2019.20190605.51237-3build2) …
Setting up libijs-0.35:amd64 (0.35-15) …
```

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Setting up libtexluajit2:amd64 (2019.20190605.51237-3build2) …
Setting up libfontbox-java (1:1.8.16-2) …
Setting up rubygems-integration (1.16) …
Setting up libzzip-0-13:amd64 (0.13.62-3.2ubuntu1) …
Setting up fonts-urw-base35 (20170801.1-3) …
Setting up poppler-data (0.4.9-2) …
Setting up ruby-minitest (5.13.0-1) …
Setting up tex-common (6.13) …
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based
frontend cannot be used. at /usr/share/perl5/Debconf/FrontEnd/Dialog.pm line
76.)
debconf: falling back to frontend: Readline
update-language: texlive-base not installed and configured, doing nothing!
Setting up libfontenc1:amd64 (1:1.1.4-0ubuntu1) …
Setting up ruby-test-unit (3.3.5-1) …
Setting up libjbig2dec0:amd64 (0.18-1ubuntu1) …
Setting up libidn11:amd64 (1.33-2.2ubuntu2) …
Setting up libteckit0:amd64 (2.5.8+ds2-5ubuntu2) …
Setting up libapache-pom-java (18-1) …
Setting up ruby-net-telnet (0.1.1-2) …
Setting up xfonts-encodings (1:1.0.5-0ubuntu1) …
Setting up t1utils (1.41-3) …
Setting up fonts-texgyre (20180621-3) …
Setting up libkpathsea6:amd64 (2019.20190605.51237-3build2) …
Setting up fonts-lmodern (2.004.5-6) …
Setting up fonts-droid-fallback (1:6.0.1r16-1.1) …
Setting up libjs-jquery (3.3.1~dfsg-3) …
Setting up ruby-xmlrpc (0.3.0-2) …
Setting up libsynctex2:amd64 (2019.20190605.51237-3build2) …
Setting up libgs9-common (9.50~dfsg-5ubuntu4.7) …
Setting up teckit (2.5.8+ds2-5ubuntu2) …
Setting up libpdfbox-java (1:1.8.16-2) …
Setting up libgs9:amd64 (9.50~dfsg-5ubuntu4.7) …
Setting up preview-latex-style (11.91-2ubuntu2) …
Setting up libcommons-parent-java (43-1) …
Setting up dvisvgm (2.8.1-1build1) …
Setting up libcommons-logging-java (1.2-2) …
Setting up xfonts-utils (1:7.7+6) …
Setting up libptexenc1:amd64 (2019.20190605.51237-3build2) …
Setting up texlive-binaries (2019.20190605.51237-3build2) …
update-alternatives: using /usr/bin/xdvi-xaw to provide /usr/bin/xdvi.bin
(xdvi.bin) in auto mode
update-alternatives: using /usr/bin/bibtex.original to provide /usr/bin/bibtex
(bibtex) in auto mode
Setting up lmodern (2.004.5-6) …
Setting up texlive-base (2019.20200218-1) …
mktexlsr: Updating /var/lib/texmf/ls-R-TEXLIVEDIST…
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mktexlsr: Updating /var/lib/texmf/ls-R-TEXMFMAIN…
mktexlsr: Updating /var/lib/texmf/ls-R…
mktexlsr: Done.
tl-paper: setting paper size for dvips to a4:
/var/lib/texmf/dvips/config/config-paper.ps
tl-paper: setting paper size for dvipdfmx to a4:
/var/lib/texmf/dvipdfmx/dvipdfmx-paper.cfg
tl-paper: setting paper size for xdvi to a4: /var/lib/texmf/xdvi/XDvi-paper
tl-paper: setting paper size for pdftex to a4:
/var/lib/texmf/tex/generic/config/pdftexconfig.tex
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based
frontend cannot be used. at /usr/share/perl5/Debconf/FrontEnd/Dialog.pm line
76.)
debconf: falling back to frontend: Readline
Setting up tex-gyre (20180621-3) …
Setting up texlive-plain-generic (2019.202000218-1) …
Setting up texlive-latex-base (2019.20200218-1) …
Setting up texlive-latex-recommended (2019.20200218-1) …
Setting up texlive-pictures (2019.20200218-1) …
Setting up texlive-fonts-recommended (2019.20200218-1) …
Setting up tipa (2:1.3-20) …
Regenerating '/var/lib/texmf/fmtutil.cnf-DEBIAN'… done.
Regenerating '/var/lib/texmf/fmtutil.cnf-TEXLIVEDIST'… done.
update-fmtutil has updated the following file(s):
        /var/lib/texmf/fmtutil.cnf-DEBIAN
        /var/lib/texmf/fmtutil.cnf-TEXLIVEDIST
If you want to activate the changes in the above file(s),
you should run fmtutil-sys or fmtutil.
Setting up texlive-latex-extra (2019.202000218-1) …
Setting up texlive-xetex (2019.20200218-1) …
Setting up rake (13.0.1-4) …
Setting up libruby2.7:amd64 (2.7.0-5ubuntu1.8) …
Setting up ruby2.7 (2.7.0-5ubuntu1.8) …
Setting up ruby (1:2.7+1) …
Processing triggers for fontconfig (2.13.1-2ubuntu3) …
Processing triggers for mime-support (3.64ubuntu1) …
Processing triggers for libc-bin (2.31-0ubuntu9.9) …
Processing triggers for man-db (2.9.1-1) …
Processing triggers for tex-common (6.13) …
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based
frontend cannot be used. at /usr/share/perl5/Debconf/FrontEnd/Dialog.pm line
76.)
debconf: falling back to frontend: Readline
Running updmap-sys. This may take some time… done.
Running mktexlsr /var/lib/texmf … done.
Building format(s) --all.
```

This may take some time… done.

[ ]:
```
!jupyter nbconvert --log-level CRITICAL --to pdf ./alpaca_lora.ipynb
```