DA6400_Tutorial_2_MENACE

February 14, 2025

```python
[1]: import numpy as np
     import matplotlib.pyplot as plt
     from typing import NamedTuple
     from google.colab import output
```

```python
[2]: SEED = 0

     BOARD_COL = 3
     BOARD_ROW = 3
     BOARD_SIZE = BOARD_COL * BOARD_ROW

     """
     Game board and actions are: {q, w, e, a, s, d, z, x, c}

     q | w | e
     --|---|--
     a | s | d
     --|---|--
     z | x | c
     """
     ACTIONS_KEY_MAP = {'q': 0, 'w': 1, 'e': 2,
                        'a': 3, 's': 4, 'd': 5,
                        'z': 6, 'x': 7, 'c': 8}
```

```python
[3]: np.random.seed(SEED)
```

State Definition

```python
[4]: def print_state(board, clear_output=False):
       if clear_output:
         output.clear()
       for i in range(BOARD_ROW):
         print('-------------')
         out = '| '
         for j in range(BOARD_COL):
           if board[i, j] == 1:
               token = 'x'
           elif board[i, j] == -1:
```

```python
                token = 'o'
            else:
                token = ' '   # empty position
            out += token + ' | '
        print(out)
    print('-------------')


class State:
    def __init__(self, symbol):
        # the board is represented by an n * n array,
        #  1 represents the player who moves first,
        # -1 represents another player
        #  0 represents an empty position
        self.board = np.zeros((BOARD_ROW, BOARD_COL))
        self.symbol = symbol
        self.winner = 0
        self.end = None

    @property
    def hash_value(self):
        hash = 0
        for x in np.nditer(self.board):
            hash = 3*hash + x + 1    # unique hash
        return hash

    def next(self, action: str):
        id = ACTIONS_KEY_MAP[action]
        i, j = id // BOARD_COL, id % BOARD_COL
        return self.next_by_pos(i, j)

    def next_by_pos(self, i: int, j: int):
        assert self.board[i, j] == 0
        new_state = State(-self.symbol)       # another player turn
        new_state.board = np.copy(self.board)
        new_state.board[i, j] = self.symbol  # current player choose to play at (i,
↪j) pos
        return new_state

    @property
    def possible_actions(self):
        rev_action_map = {id: key for key, id in ACTIONS_KEY_MAP.items()}
        actions = []
        for i in range(BOARD_ROW):
            for j in range(BOARD_COL):
                if self.board[i, j] == 0:
                    actions.append(rev_action_map[BOARD_COL*i+j])
```

```python
        return actions

    def is_end(self):
        if self.end is not None:
            return self.end

        check = []
        # check row
        for i in range(BOARD_ROW):
            check.append(sum(self.board[i, :]))

        # check col
        for i in range(BOARD_COL):
            check.append(sum(self.board[:, i]))

        # check diagonal
        diagonal = 0; reverse_diagonal = 0
        for i in range(BOARD_ROW):
            diagonal += self.board[i, i]
            reverse_diagonal += self.board[BOARD_ROW-i-1, i]
        check.append(diagonal)
        check.append(reverse_diagonal)

        for x in check:
            if x == 3:
                self.end = True
                self.winner = 1    # player 1 wins
                return self.end
            elif x == -3:
                self.end = True
                self.winner = 2    # player 2 wins
                return self.end

        for x in np.nditer(self.board):
            if x == 0:             # play available
                self.end = False
                return self.end

        self.winner = 0        # draw
        self.end = True
        return self.end
```

Environment

```python
[5]: class Env:
    def __init__(self):
        self.all_states = self.get_all_states()
```

```python
        self.curr_state = State(symbol=1)

    def get_all_states(self):
        all_states = {}  # is a dict with key as state_hash_value and value as␣
↪State object.
        def explore_all_substates(state):
            for i in range(BOARD_ROW):
                for j in range(BOARD_COL):
                    if state.board[i, j] == 0:
                        next_state = state.next_by_pos(i, j)
                        if next_state.hash_value not in all_states:
                            all_states[next_state.hash_value] = next_state
                            if not next_state.is_end():
                                explore_all_substates(next_state)
        curr_state = State(symbol=1)
        all_states[curr_state.hash_value] = curr_state
        explore_all_substates(curr_state)
        return all_states

    def reset(self):
        self.curr_state = State(symbol=1)
        return self.curr_state

    def step(self, action):
        assert action in self.curr_state.possible_actions, f"Invalid {action} for␣
↪the current state \n{self.curr_state.print_state()}"
        next_state_hash = self.curr_state.next(action).hash_value
        next_state = self.all_states[next_state_hash]
        self.curr_state = next_state
        reward = 0
        return self.curr_state, reward

    def is_end(self):
        return self.curr_state.is_end()

    @property
    def winner(self):
        result_id = self.curr_state.winner
        result = 'draw'
        if result_id == 1:
            result = 'player1'
        elif result_id == 2:
            result = 'player2'
        return result
```

Policy

```python
[6]: class BasePolicy:
        def reset(self):
            pass

        def update_values(self, *args):
            pass

        def select_action(self, state):
            raise Exception('Not Implemented Error')
```

```python
[7]: class HumanPolicy(BasePolicy):
        def __init__(self, symbol):
            self.symbol = symbol

        def select_action(self, state):
            assert state.symbol == self.symbol, f"Its not {self.symbol} symbol's turn"
            print_state(state.board, clear_output=True)
            key = input("Input your position: ")
            return key
```

```python
[8]: class RandomPolicy(BasePolicy):
        def __init__(self, symbol):
            self.symbol = symbol

        def select_action(self, state):
            assert state.symbol == self.symbol, f"Its not {self.symbol} symbol's turn"
            return np.random.choice(state.possible_actions)
```

```python
[9]: class ActionPlayed(NamedTuple):
        hash_value: str
        action: str


    class MenacePolicy(BasePolicy):
        def __init__(self, all_states, symbol, tau=5.0):
            self.all_states = all_states
            self.symbol = symbol
            self.tau = tau

            # It store the number of stones for each action for each state
            self.state_action_value = self.initialize()
            # variable to store the history for updating the number of stones
            self.history = []

        def initialize(self):
            state_action_value = {}
            for hash_value, state in self.all_states.items():
```

```python
        # initially all actions have 0 stones
        state_action_value[hash_value] = {action: 0 for action in state.
↪possible_actions}
    return state_action_value

  def reset(self):
    for action_value in self.state_action_value.values():
      for action in action_value.keys():
        action_value[action] = 0

  def print_updates(self, reward):
    print(f'Player with symbol {self.symbol} updates the following history with
↪{reward} stone')
    for item in self.history:
      board = np.copy(self.all_states[item.hash_value].board)
      id = ACTIONS_KEY_MAP[item.action]
      i, j = id//BOARD_COL, id%BOARD_COL
      board[i, j] = self.symbol
      print_state(board)

  def update_values(self, reward, show_update=False):
    # reward: if wins receive reward of 1 stone for the chosen action
    #         else -1 stone.
    # reward is either 1 or -1 depending upon if the player has won or lost the
↪game.

    if show_update:
      self.print_updates(reward)
    for item in self.history:
      # your code here
      current_count = self.state_action_value[item.hash_value][item.action]
      new_count = current_count + reward
      if new_count < 1:
          new_count = 1
      self.state_action_value[item.hash_value][item.action] = new_count #
↪update state_action with appropriate term.

    self.history = []

  def select_action(self, state):  # Softmax action probability
    assert state.symbol == self.symbol, f"Its not {self.symbol} symbol's turn"
    action_value = self.state_action_value[state.hash_value]
    max_value = action_value[max(action_value, key=action_value.get)]
    exp_values = {action: np.exp((v-max_value) / self.tau) for action, v in
↪action_value.items()}
    normalizer = np.sum([v for v in exp_values.values()])
    prob = {action: v/normalizer for action, v in exp_values.items()}
```

```python
        action = np.random.choice(list(prob.keys()), p=list(prob.values()))
        self.history.append(ActionPlayed(state.hash_value, action))
        return action
```

Game Board

```python
[10]: class Game:
    def __init__(self, env, player1, player2):
        self.env = env
        self.player1 = player1
        self.player2 = player2
        self.show_updates = False

    def alternate(self):
        while True:
            yield self.player1
            yield self.player2

    def train(self, epochs=1_00_000):
        game_results = []
        player1_reward_map = {'player1': 1, 'player2': -1, 'draw': 0}
        for _ in range(epochs):
            result = self.play()

            # if player1 wins add 1 stone for the action chosen
            player1_reward = player1_reward_map[result]
            player2_reward = -player1_reward   # if player2 wins add 1 stone

            self.player1.update_values(player1_reward)
            self.player2.update_values(player2_reward)

    def play(self):
        alternate = self.alternate()
        state = self.env.reset()
        while not self.env.is_end():
            player = next(alternate)
            action = player.select_action(state)
            state, _ = self.env.step(action)
        result = self.env.winner
        return result
```

Experiment

```python
[11]: env = Env()

player1 = MenacePolicy(env.all_states, symbol=1)
player2 = MenacePolicy(env.all_states, symbol=-1)
# player2 = RandomPolicy(symbol=-1)
```

```
[18]:  game = Game(env, player1, player2)
       game.train(epochs=1_00_000)
```

```
[19]:  game_with_human_player = Game(env, player1, HumanPolicy(symbol=-1))

       game_with_human_player.play()

       result = env.winner
       print(f"winner: {result}")

       player1_reward_map = {'player1': 1, 'player2': -1, 'draw': 0}
       player1.update_values(player1_reward_map[result], show_update=True)
```

```
-------------
| o | x | x |
-------------
| x | x | o |
-------------
|   | o |   |
-------------
Input your position: z
winner: draw
Player with symbol 1 updates the following history with 0 stone
-------------
|   |   |   |
-------------
|   | x |   |
-------------
|   |   |   |
-------------
-------------
| o |   |   |
-------------
| x | x |   |
-------------
|   |   |   |
-------------
-------------
| o | x |   |
-------------
| x | x | o |
-------------
|   |   |   |
-------------
-------------
| o | x | x |
-------------
```

```
| x | x | o |
-------------
|   | o |   |
-------------
-------------
| o | x | x |
-------------
| x | x | o |
-------------
| o | o | x |
-------------
```

```python
# Step 1: Mount Google Drive (skip if already mounted)
from google.colab import drive
drive.mount('/content/drive')

# Step 2: Install all required dependencies
!apt-get update
!apt-get install -y pandoc texlive-xetex texlive-fonts-recommended
  texlive-plain-generic

# Step 3: Convert with proper path handling (notice quotes for spaces)
!jupyter nbconvert --to pdf "/content/drive/My Drive/Colab Notebooks/
  DA6400_Tutorial_2_MENACE.ipynb"

# Step 4: Download the PDF
from google.colab import files
files.download("/content/drive/My Drive/Colab Notebooks/
  DA6400_Tutorial-2_MENACE_SuharshKumar.pdf")
```

```
Mounted at /content/drive
Get:1 https://cloud.r-project.org/bin/linux/ubuntu jammy-cran40/ InRelease
[3,632 B]
Get:2 https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/x86_64
InRelease [1,581 B]
Get:3 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Hit:4 http://archive.ubuntu.com/ubuntu jammy InRelease
Hit:5 https://ppa.launchpadcontent.net/deadsnakes/ppa/ubuntu jammy InRelease
Get:6 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [128 kB]
Hit:7 https://ppa.launchpadcontent.net/graphics-drivers/ppa/ubuntu jammy
InRelease
Hit:8 https://ppa.launchpadcontent.net/ubuntugis/ppa/ubuntu jammy InRelease
Get:9 https://r2u.stat.illinois.edu/ubuntu jammy InRelease [6,555 B]
Get:10
https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/x86_64
Packages [1,313 kB]
Get:11 http://archive.ubuntu.com/ubuntu jammy-backports InRelease [127 kB]
Get:12 http://security.ubuntu.com/ubuntu jammy-security/restricted amd64
```

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Packages [3,612 kB]
Get:13 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [2,911
kB]
Get:14 https://r2u.stat.illinois.edu/ubuntu jammy/main amd64 Packages [2,657 kB]
Get:15 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages
[2,609 kB]
Get:16 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages
[1,526 kB]
Get:17 https://r2u.stat.illinois.edu/ubuntu jammy/main all Packages [8,676 kB]
Fetched 23.7 MB in 3s (7,876 kB/s)
Reading package lists… Done
W: Skipping acquire of configured file 'main/source/Sources' as repository
'https://r2u.stat.illinois.edu/ubuntu jammy InRelease' does not seem to provide
it (sources.list entry misspelt?)
Reading package lists… Done
Building dependency tree… Done
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 libapache-pom-java libcmark-gfm-extensions0.29.0.gfm.3
libcmark-gfm0.29.0.gfm.3
  libcommons-logging-java libcommons-parent-java libfontbox-java libfontenc1
libgs9 libgs9-common
  libidn12 libijs-0.35 libjbig2dec0 libkpathsea6 libpdfbox-java libptexenc1
libruby3.0 libsynctex2
  libteckit0 libtexlua53 libtexluajit2 libwoff1 libzzip-0-13 lmodern pandoc-data
poppler-data
  preview-latex-style rake ruby ruby-net-telnet ruby-rubygems ruby-webrick ruby-
xmlrpc ruby3.0
  rubygems-integration t1utils teckit tex-common tex-gyre texlive-base texlive-
binaries
  texlive-latex-base texlive-latex-extra texlive-latex-recommended texlive-
pictures tipa
  xfonts-encodings xfonts-utils
Suggested packages:
  fonts-noto fonts-freefont-otf | fonts-freefont-ttf libavalon-framework-java
  libcommons-logging-java-doc libexcalibur-logkit-java liblog4j1.2-java texlive-
luatex
  pandoc-citeproc context wkhtmltopdf librsvg2-bin groff ghc nodejs php python
libjs-mathjax
  libjs-katex citation-style-language-styles 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-pstricks dot2tex prerex texlive-
pictures-doc vprerex
  default-jre-headless tipa-doc
The following NEW packages will be installed:
  dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono fonts-
texgyre
  fonts-urw-base35 libapache-pom-java libcmark-gfm-extensions0.29.0.gfm.3
libcmark-gfm0.29.0.gfm.3
  libcommons-logging-java libcommons-parent-java libfontbox-java libfontenc1
libgs9 libgs9-common
  libidn12 libijs-0.35 libjbig2dec0 libkpathsea6 libpdfbox-java libptexenc1
libruby3.0 libsynctex2
  libteckit0 libtexlua53 libtexluajit2 libwoff1 libzzip-0-13 lmodern pandoc
pandoc-data
  poppler-data preview-latex-style rake ruby ruby-net-telnet ruby-rubygems ruby-
webrick ruby-xmlrpc
  ruby3.0 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 22 not upgraded.
Need to get 202 MB of archives.
After this operation, 728 MB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu jammy/main amd64 fonts-droid-fallback all
1:6.0.1r16-1.1build1 [1,805 kB]
Get:2 http://archive.ubuntu.com/ubuntu jammy/main amd64 fonts-lato all 2.0-2.1
[2,696 kB]
Get:3 http://archive.ubuntu.com/ubuntu jammy/main amd64 poppler-data all
0.4.11-1 [2,171 kB]
Get:4 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tex-common all 6.17
[33.7 kB]
Get:5 http://archive.ubuntu.com/ubuntu jammy/main amd64 fonts-urw-base35 all
20200910-1 [6,367 kB]
Get:6 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libgs9-common
all 9.55.0~dfsg1-0ubuntu5.10 [752 kB]
Get:7 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libidn12 amd64
1.38-4ubuntu1 [60.0 kB]
Get:8 http://archive.ubuntu.com/ubuntu jammy/main amd64 libijs-0.35 amd64
0.35-15build2 [16.5 kB]
Get:9 http://archive.ubuntu.com/ubuntu jammy/main amd64 libjbig2dec0 amd64
0.19-3build2 [64.7 kB]
Get:10 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libgs9 amd64
9.55.0~dfsg1-0ubuntu5.10 [5,031 kB]
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amd64 2021.20210626.59705-1ubuntu0.2 [60.4 kB]
Get:12 http://archive.ubuntu.com/ubuntu jammy/main amd64 libwoff1 amd64
1.0.2-1build4 [45.2 kB]
Get:13 http://archive.ubuntu.com/ubuntu jammy/universe amd64 dvisvgm amd64
2.13.1-1 [1,221 kB]
Get:14 http://archive.ubuntu.com/ubuntu jammy/universe amd64 fonts-lmodern all
2.004.5-6.1 [4,532 kB]
Get:15 http://archive.ubuntu.com/ubuntu jammy/main amd64 fonts-noto-mono all
20201225-1build1 [397 kB]
Get:16 http://archive.ubuntu.com/ubuntu jammy/universe amd64 fonts-texgyre all
20180621-3.1 [10.2 MB]
Get:17 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libapache-pom-java
all 18-1 [4,720 B]
Get:18 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libcmark-
gfm0.29.0.gfm.3 amd64 0.29.0.gfm.3-3 [115 kB]
Get:19 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libcmark-gfm-
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java all 43-1 [10.8 kB]
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java all 1.2-2 [60.3 kB]
Get:22 http://archive.ubuntu.com/ubuntu jammy/main amd64 libfontenc1 amd64
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amd64 2021.20210626.59705-1ubuntu0.2 [39.1 kB]
Get:24 http://archive.ubuntu.com/ubuntu jammy/main amd64 rubygems-integration
all 1.18 [5,336 B]
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3.0.2-7ubuntu2.8 [50.1 kB]
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3.3.5-2 [228 kB]
Get:27 http://archive.ubuntu.com/ubuntu jammy/main amd64 ruby amd64 1:3.0~exp1
[5,100 B]
Get:28 http://archive.ubuntu.com/ubuntu jammy/main amd64 rake all 13.0.6-2 [61.7
kB]
Get:29 http://archive.ubuntu.com/ubuntu jammy/main amd64 ruby-net-telnet all
0.1.1-2 [12.6 kB]
Get:30 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 ruby-webrick
all 1.7.0-3ubuntu0.1 [52.1 kB]
Get:31 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 ruby-xmlrpc all
0.3.2-1ubuntu0.1 [24.9 kB]
Get:32 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libruby3.0
amd64 3.0.2-7ubuntu2.8 [5,113 kB]
Get:33 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libsynctex2
amd64 2021.20210626.59705-1ubuntu0.2 [55.6 kB]
Get:34 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libteckit0 amd64
2.5.11+ds1-1 [421 kB]
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Get:35 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 libtexlua53
amd64 2021.20210626.59705-1ubuntu0.2 [120 kB]
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amd64 2021.20210626.59705-1ubuntu0.2 [267 kB]
Get:37 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libzzip-0-13 amd64
0.13.72+dfsg.1-1.1 [27.0 kB]
Get:38 http://archive.ubuntu.com/ubuntu jammy/main amd64 xfonts-encodings all
1:1.0.5-0ubuntu2 [578 kB]
Get:39 http://archive.ubuntu.com/ubuntu jammy/main amd64 xfonts-utils amd64
1:7.7+6build2 [94.6 kB]
Get:40 http://archive.ubuntu.com/ubuntu jammy/universe amd64 lmodern all
2.004.5-6.1 [9,471 kB]
Get:41 http://archive.ubuntu.com/ubuntu jammy/universe amd64 pandoc-data all
2.9.2.1-3ubuntu2 [81.8 kB]
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2.9.2.1-3ubuntu2 [20.3 MB]
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all 12.2-1ubuntu1 [185 kB]
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2.5.11+ds1-1 [699 kB]
Get:46 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tex-gyre all
20180621-3.1 [6,209 kB]
Get:47 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 texlive-
binaries amd64 2021.20210626.59705-1ubuntu0.2 [9,860 kB]
Get:48 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-base all
2021.20220204-1 [21.0 MB]
Get:49 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-fonts-
recommended all 2021.20220204-1 [4,972 kB]
Get:50 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-base
all 2021.20220204-1 [1,128 kB]
Get:51 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libfontbox-java all
1:1.8.16-2 [207 kB]
Get:52 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libpdfbox-java all
1:1.8.16-2 [5,199 kB]
Get:53 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-
recommended all 2021.20220204-1 [14.4 MB]
Get:54 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-pictures
all 2021.20220204-1 [8,720 kB]
Get:55 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-extra
all 2021.20220204-1 [13.9 MB]
Get:56 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-plain-
generic all 2021.20220204-1 [27.5 MB]
Get:57 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tipa all 2:1.3-21
[2,967 kB]
Get:58 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-xetex all
2021.20220204-1 [12.4 MB]
```

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Fetched 202 MB in 5s (40.8 MB/s)
Extracting templates from packages: 100%
Preconfiguring packages …
Selecting previously unselected package fonts-droid-fallback.
(Reading database … 124926 files and directories currently installed.)
Preparing to unpack …/00-fonts-droid-fallback_1%3a6.0.1r16-1.1build1_all.deb
…
Unpacking fonts-droid-fallback (1:6.0.1r16-1.1build1) …
Selecting previously unselected package fonts-lato.
Preparing to unpack …/01-fonts-lato_2.0-2.1_all.deb …
Unpacking fonts-lato (2.0-2.1) …
Selecting previously unselected package poppler-data.
Preparing to unpack …/02-poppler-data_0.4.11-1_all.deb …
Unpacking poppler-data (0.4.11-1) …
Selecting previously unselected package tex-common.
Preparing to unpack …/03-tex-common_6.17_all.deb …
Unpacking tex-common (6.17) …
Selecting previously unselected package fonts-urw-base35.
Preparing to unpack …/04-fonts-urw-base35_20200910-1_all.deb …
Unpacking fonts-urw-base35 (20200910-1) …
Selecting previously unselected package libgs9-common.
Preparing to unpack …/05-libgs9-common_9.55.0~dfsg1-0ubuntu5.10_all.deb …
Unpacking libgs9-common (9.55.0~dfsg1-0ubuntu5.10) …
Selecting previously unselected package libidn12:amd64.
Preparing to unpack …/06-libidn12_1.38-4ubuntu1_amd64.deb …
Unpacking libidn12:amd64 (1.38-4ubuntu1) …
Selecting previously unselected package libijs-0.35:amd64.
Preparing to unpack …/07-libijs-0.35_0.35-15build2_amd64.deb …
Unpacking libijs-0.35:amd64 (0.35-15build2) …
Selecting previously unselected package libjbig2dec0:amd64.
Preparing to unpack …/08-libjbig2dec0_0.19-3build2_amd64.deb …
Unpacking libjbig2dec0:amd64 (0.19-3build2) …
Selecting previously unselected package libgs9:amd64.
Preparing to unpack …/09-libgs9_9.55.0~dfsg1-0ubuntu5.10_amd64.deb …
Unpacking libgs9:amd64 (9.55.0~dfsg1-0ubuntu5.10) …
Selecting previously unselected package libkpathsea6:amd64.
Preparing to unpack …/10-libkpathsea6_2021.20210626.59705-1ubuntu0.2_amd64.deb
…
Unpacking libkpathsea6:amd64 (2021.20210626.59705-1ubuntu0.2) …
Selecting previously unselected package libwoff1:amd64.
Preparing to unpack …/11-libwoff1_1.0.2-1build4_amd64.deb …
Unpacking libwoff1:amd64 (1.0.2-1build4) …
Selecting previously unselected package dvisvgm.
Preparing to unpack …/12-dvisvgm_2.13.1-1_amd64.deb …
Unpacking dvisvgm (2.13.1-1) …
Selecting previously unselected package fonts-lmodern.
Preparing to unpack …/13-fonts-lmodern_2.004.5-6.1_all.deb …
Unpacking fonts-lmodern (2.004.5-6.1) …
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Selecting previously unselected package fonts-noto-mono.
Preparing to unpack …/14-fonts-noto-mono_20201225-1build1_all.deb …
Unpacking fonts-noto-mono (20201225-1build1) …
Selecting previously unselected package fonts-texgyre.
Preparing to unpack …/15-fonts-texgyre_20180621-3.1_all.deb …
Unpacking fonts-texgyre (20180621-3.1) …
Selecting previously unselected package libapache-pom-java.
Preparing to unpack …/16-libapache-pom-java_18-1_all.deb …
Unpacking libapache-pom-java (18-1) …
Selecting previously unselected package libcmark-gfm0.29.0.gfm.3:amd64.
Preparing to unpack …/17-libcmark-gfm0.29.0.gfm.3_0.29.0.gfm.3-3_amd64.deb …
Unpacking libcmark-gfm0.29.0.gfm.3:amd64 (0.29.0.gfm.3-3) …
Selecting previously unselected package libcmark-gfm-
extensions0.29.0.gfm.3:amd64.
Preparing to unpack …/18-libcmark-gfm-
extensions0.29.0.gfm.3_0.29.0.gfm.3-3_amd64.deb …
Unpacking libcmark-gfm-extensions0.29.0.gfm.3:amd64 (0.29.0.gfm.3-3) …
Selecting previously unselected package libcommons-parent-java.
Preparing to unpack …/19-libcommons-parent-java_43-1_all.deb …
Unpacking libcommons-parent-java (43-1) …
Selecting previously unselected package libcommons-logging-java.
Preparing to unpack …/20-libcommons-logging-java_1.2-2_all.deb …
Unpacking libcommons-logging-java (1.2-2) …
Selecting previously unselected package libfontenc1:amd64.
Preparing to unpack …/21-libfontenc1_1%3a1.1.4-1build3_amd64.deb …
Unpacking libfontenc1:amd64 (1:1.1.4-1build3) …
Selecting previously unselected package libptexenc1:amd64.
Preparing to unpack …/22-libptexenc1_2021.20210626.59705-1ubuntu0.2_amd64.deb
…
Unpacking libptexenc1:amd64 (2021.20210626.59705-1ubuntu0.2) …
Selecting previously unselected package rubygems-integration.
Preparing to unpack …/23-rubygems-integration_1.18_all.deb …
Unpacking rubygems-integration (1.18) …
Selecting previously unselected package ruby3.0.
Preparing to unpack …/24-ruby3.0_3.0.2-7ubuntu2.8_amd64.deb …
Unpacking ruby3.0 (3.0.2-7ubuntu2.8) …
Selecting previously unselected package ruby-rubygems.
Preparing to unpack …/25-ruby-rubygems_3.3.5-2_all.deb …
Unpacking ruby-rubygems (3.3.5-2) …
Selecting previously unselected package ruby.
Preparing to unpack …/26-ruby_1%3a3.0~exp1_amd64.deb …
Unpacking ruby (1:3.0~exp1) …
Selecting previously unselected package rake.
Preparing to unpack …/27-rake_13.0.6-2_all.deb …
Unpacking rake (13.0.6-2) …
Selecting previously unselected package ruby-net-telnet.
Preparing to unpack …/28-ruby-net-telnet_0.1.1-2_all.deb …
Unpacking ruby-net-telnet (0.1.1-2) …
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Selecting previously unselected package ruby-webrick.
Preparing to unpack …/29-ruby-webrick_1.7.0-3ubuntu0.1_all.deb …
Unpacking ruby-webrick (1.7.0-3ubuntu0.1) …
Selecting previously unselected package ruby-xmlrpc.
Preparing to unpack …/30-ruby-xmlrpc_0.3.2-1ubuntu0.1_all.deb …
Unpacking ruby-xmlrpc (0.3.2-1ubuntu0.1) …
Selecting previously unselected package libruby3.0:amd64.
Preparing to unpack …/31-libruby3.0_3.0.2-7ubuntu2.8_amd64.deb …
Unpacking libruby3.0:amd64 (3.0.2-7ubuntu2.8) …
Selecting previously unselected package libsynctex2:amd64.
Preparing to unpack …/32-libsynctex2_2021.20210626.59705-1ubuntu0.2_amd64.deb
…
Unpacking libsynctex2:amd64 (2021.20210626.59705-1ubuntu0.2) …
Selecting previously unselected package libteckit0:amd64.
Preparing to unpack …/33-libteckit0_2.5.11+ds1-1_amd64.deb …
Unpacking libteckit0:amd64 (2.5.11+ds1-1) …
Selecting previously unselected package libtexlua53:amd64.
Preparing to unpack …/34-libtexlua53_2021.20210626.59705-1ubuntu0.2_amd64.deb
…
Unpacking libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.2) …
Selecting previously unselected package libtexluajit2:amd64.
Preparing to unpack
…/35-libtexluajit2_2021.20210626.59705-1ubuntu0.2_amd64.deb …
Unpacking libtexluajit2:amd64 (2021.20210626.59705-1ubuntu0.2) …
Selecting previously unselected package libzzip-0-13:amd64.
Preparing to unpack …/36-libzzip-0-13_0.13.72+dfsg.1-1.1_amd64.deb …
Unpacking libzzip-0-13:amd64 (0.13.72+dfsg.1-1.1) …
Selecting previously unselected package xfonts-encodings.
Preparing to unpack …/37-xfonts-encodings_1%3a1.0.5-0ubuntu2_all.deb …
Unpacking xfonts-encodings (1:1.0.5-0ubuntu2) …
Selecting previously unselected package xfonts-utils.
Preparing to unpack …/38-xfonts-utils_1%3a7.7+6build2_amd64.deb …
Unpacking xfonts-utils (1:7.7+6build2) …
Selecting previously unselected package lmodern.
Preparing to unpack …/39-lmodern_2.004.5-6.1_all.deb …
Unpacking lmodern (2.004.5-6.1) …
Selecting previously unselected package pandoc-data.
Preparing to unpack …/40-pandoc-data_2.9.2.1-3ubuntu2_all.deb …
Unpacking pandoc-data (2.9.2.1-3ubuntu2) …
Selecting previously unselected package pandoc.
Preparing to unpack …/41-pandoc_2.9.2.1-3ubuntu2_amd64.deb …
Unpacking pandoc (2.9.2.1-3ubuntu2) …
Selecting previously unselected package preview-latex-style.
Preparing to unpack …/42-preview-latex-style_12.2-1ubuntu1_all.deb …
Unpacking preview-latex-style (12.2-1ubuntu1) …
Selecting previously unselected package t1utils.
Preparing to unpack …/43-t1utils_1.41-4build2_amd64.deb …
Unpacking t1utils (1.41-4build2) …
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Selecting previously unselected package teckit.
Preparing to unpack …/44-teckit_2.5.11+ds1-1_amd64.deb …
Unpacking teckit (2.5.11+ds1-1) …
Selecting previously unselected package tex-gyre.
Preparing to unpack …/45-tex-gyre_20180621-3.1_all.deb …
Unpacking tex-gyre (20180621-3.1) …
Selecting previously unselected package texlive-binaries.
Preparing to unpack …/46-texlive-
binaries_2021.20210626.59705-1ubuntu0.2_amd64.deb …
Unpacking texlive-binaries (2021.20210626.59705-1ubuntu0.2) …
Selecting previously unselected package texlive-base.
Preparing to unpack …/47-texlive-base_2021.20220204-1_all.deb …
Unpacking texlive-base (2021.20220204-1) …
Selecting previously unselected package texlive-fonts-recommended.
Preparing to unpack …/48-texlive-fonts-recommended_2021.20220204-1_all.deb …
Unpacking texlive-fonts-recommended (2021.20220204-1) …
Selecting previously unselected package texlive-latex-base.
Preparing to unpack …/49-texlive-latex-base_2021.20220204-1_all.deb …
Unpacking texlive-latex-base (2021.20220204-1) …
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_2021.20220204-1_all.deb …
Unpacking texlive-latex-recommended (2021.20220204-1) …
Selecting previously unselected package texlive-pictures.
Preparing to unpack …/53-texlive-pictures_2021.20220204-1_all.deb …
Unpacking texlive-pictures (2021.20220204-1) …
Selecting previously unselected package texlive-latex-extra.
Preparing to unpack …/54-texlive-latex-extra_2021.20220204-1_all.deb …
Unpacking texlive-latex-extra (2021.20220204-1) …
Selecting previously unselected package texlive-plain-generic.
Preparing to unpack …/55-texlive-plain-generic_2021.20220204-1_all.deb …
Unpacking texlive-plain-generic (2021.20220204-1) …
Selecting previously unselected package tipa.
Preparing to unpack …/56-tipa_2%3a1.3-21_all.deb …
Unpacking tipa (2:1.3-21) …
Selecting previously unselected package texlive-xetex.
Preparing to unpack …/57-texlive-xetex_2021.20220204-1_all.deb …
Unpacking texlive-xetex (2021.20220204-1) …
Setting up fonts-lato (2.0-2.1) …
Setting up fonts-noto-mono (20201225-1build1) …
Setting up libwoff1:amd64 (1.0.2-1build4) …
Setting up libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.2) …
Setting up libijs-0.35:amd64 (0.35-15build2) …
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Setting up libtexluajit2:amd64 (2021.20210626.59705-1ubuntu0.2) …
Setting up libfontbox-java (1:1.8.16-2) …
```