```
# This Python 3 environment comes with many helpful analytics
libraries installed
# It is defined by the kaggle/python Docker image:
https://github.com/kaggle/docker-python
# For example, here's several helpful packages to load

import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

# Input data files are available in the read-only "../input/"
directory
# For example, running this (by clicking run or pressing Shift+Enter)
will list all files under the input directory

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# You can write up to 20GB to the current directory (/kaggle/working/)
that gets preserved as output when you create a version using "Save &
Run All"
# You can also write temporary files to /kaggle/temp/, but they won't
be saved outside of the current session

!pip install hvplot
```

```
Collecting hvplot
  Downloading hvplot-0.9.2-py2.py3-none-any.whl.metadata (20 kB)
Requirement already satisfied: bokeh>=1.0.0 in
/opt/conda/lib/python3.10/site-packages (from hvplot) (3.4.1)
Requirement already satisfied: colorcet>=2 in
/opt/conda/lib/python3.10/site-packages (from hvplot) (3.1.0)
Requirement already satisfied: holoviews>=1.11.0 in
/opt/conda/lib/python3.10/site-packages (from hvplot) (1.18.3)
Requirement already satisfied: pandas in
/opt/conda/lib/python3.10/site-packages (from hvplot) (2.1.4)
Requirement already satisfied: numpy>=1.15 in
/opt/conda/lib/python3.10/site-packages (from hvplot) (1.26.4)
Requirement already satisfied: packaging in
/opt/conda/lib/python3.10/site-packages (from hvplot) (21.3)
Requirement already satisfied: panel>=0.11.0 in
/opt/conda/lib/python3.10/site-packages (from hvplot) (1.4.1)
Requirement already satisfied: param<3.0,>=1.12.0 in
/opt/conda/lib/python3.10/site-packages (from hvplot) (2.1.0)
Requirement already satisfied: Jinja2>=2.9 in
/opt/conda/lib/python3.10/site-packages (from bokeh>=1.0.0->hvplot)
(3.1.2)
Requirement already satisfied: contourpy>=1.2 in
/opt/conda/lib/python3.10/site-packages (from bokeh>=1.0.0->hvplot)
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(1.2.0)
Requirement already satisfied: pillow>=7.1.0 in
/opt/conda/lib/python3.10/site-packages (from bokeh>=1.0.0->hvplot)
(9.5.0)
Requirement already satisfied: PyYAML>=3.10 in
/opt/conda/lib/python3.10/site-packages (from bokeh>=1.0.0->hvplot)
(6.0.1)
Requirement already satisfied: tornado>=6.2 in
/opt/conda/lib/python3.10/site-packages (from bokeh>=1.0.0->hvplot)
(6.3.3)
Requirement already satisfied: xyzservices>=2021.09.1 in
/opt/conda/lib/python3.10/site-packages (from bokeh>=1.0.0->hvplot)
(2024.4.0)
Requirement already satisfied: pyviz-comms>=0.7.4 in
/opt/conda/lib/python3.10/site-packages (from holoviews>=1.11.0-
>hvplot) (3.0.2)
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in
/opt/conda/lib/python3.10/site-packages (from packaging->hvplot)
(3.1.1)
Requirement already satisfied: python-dateutil>=2.8.2 in
/opt/conda/lib/python3.10/site-packages (from pandas->hvplot)
(2.9.0.post0)
Requirement already satisfied: pytz>=2020.1 in
/opt/conda/lib/python3.10/site-packages (from pandas->hvplot)
(2023.3.post1)
Requirement already satisfied: tzdata>=2022.1 in
/opt/conda/lib/python3.10/site-packages (from pandas->hvplot) (2023.4)
Requirement already satisfied: markdown in
/opt/conda/lib/python3.10/site-packages (from panel>=0.11.0->hvplot)
(3.5.2)
Requirement already satisfied: markdown-it-py in
/opt/conda/lib/python3.10/site-packages (from panel>=0.11.0->hvplot)
(3.0.0)
Requirement already satisfied: linkify-it-py in
/opt/conda/lib/python3.10/site-packages (from panel>=0.11.0->hvplot)
(2.0.3)
Requirement already satisfied: mdit-py-plugins in
/opt/conda/lib/python3.10/site-packages (from panel>=0.11.0->hvplot)
(0.4.0)
Requirement already satisfied: requests in
/opt/conda/lib/python3.10/site-packages (from panel>=0.11.0->hvplot)
(2.31.0)
Requirement already satisfied: tqdm>=4.48.0 in
/opt/conda/lib/python3.10/site-packages (from panel>=0.11.0->hvplot)
(4.66.1)
Requirement already satisfied: bleach in
/opt/conda/lib/python3.10/site-packages (from panel>=0.11.0->hvplot)
(6.1.0)
Requirement already satisfied: typing-extensions in
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/opt/conda/lib/python3.10/site-packages (from panel>=0.11.0->hvplot)
(4.9.0)
Requirement already satisfied: MarkupSafe>=2.0 in
/opt/conda/lib/python3.10/site-packages (from Jinja2>=2.9-
>bokeh>=1.0.0->hvplot) (2.1.3)
Requirement already satisfied: six>=1.5 in
/opt/conda/lib/python3.10/site-packages (from python-dateutil>=2.8.2-
>pandas->hvplot) (1.16.0)
Requirement already satisfied: webencodings in
/opt/conda/lib/python3.10/site-packages (from bleach->panel>=0.11.0-
>hvplot) (0.5.1)
Requirement already satisfied: uc-micro-py in
/opt/conda/lib/python3.10/site-packages (from linkify-it-py-
>panel>=0.11.0->hvplot) (1.0.3)
Requirement already satisfied: mdurl~=0.1 in
/opt/conda/lib/python3.10/site-packages (from markdown-it-py-
>panel>=0.11.0->hvplot) (0.1.2)
Requirement already satisfied: charset-normalizer<4,>=2 in
/opt/conda/lib/python3.10/site-packages (from requests->panel>=0.11.0-
>hvplot) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in
/opt/conda/lib/python3.10/site-packages (from requests->panel>=0.11.0-
>hvplot) (3.6)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/opt/conda/lib/python3.10/site-packages (from requests->panel>=0.11.0-
>hvplot) (1.26.18)
Requirement already satisfied: certifi>=2017.4.17 in
/opt/conda/lib/python3.10/site-packages (from requests->panel>=0.11.0-
>hvplot) (2024.2.2)
Downloading hvplot-0.9.2-py2.py3-none-any.whl (1.8 MB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.8/1.8 MB 29.6 MB/s eta
0:00:00a 0:00:01

!pip install git+https://github.com/paulgavrikov/visualkeras --upgrade

Collecting git+https://github.com/paulgavrikov/visualkeras
  Cloning https://github.com/paulgavrikov/visualkeras to /tmp/pip-req-
build-58v2sc5q
  Running command git clone --filter=blob:none --quiet
https://github.com/paulgavrikov/visualkeras /tmp/pip-req-build-
58v2sc5q
  Resolved https://github.com/paulgavrikov/visualkeras to commit
0ffcf1adc61c98068f8984a3646fcf3b46f01420
  Preparing metadata (setup.py) ... ent already satisfied:
pillow>=6.2.0 in /opt/conda/lib/python3.10/site-packages (from
visualkeras==0.0.2) (9.5.0)
Requirement already satisfied: numpy>=1.18.1 in
/opt/conda/lib/python3.10/site-packages (from visualkeras==0.0.2)
(1.26.4)
Collecting aggdraw>=1.3.11 (from visualkeras==0.0.2)
```

```
  Downloading aggdraw-1.3.18.post0-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (661 bytes)
Downloading aggdraw-1.3.18.post0-cp310-cp310-
manylinux_2_17_x86_64.manylinux2014_x86_64.whl (993 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 993.8/993.8 kB 16.1 MB/s eta
0:00:00a 0:00:01
e=visualkeras-0.0.2-py3-none-any.whl size=13782
sha256=a0ccc30757bf36de3be65a4fcfa335a38ab38eecda36982cbfe13ee6c015711
b
  Stored in directory:
/tmp/pip-ephem-wheel-cache-da_n34x6/wheels/89/d3/c2/937382b33c09192fc8
4331bbc02c4565d62aeae67e9684c37e
Successfully built visualkeras
Installing collected packages: aggdraw, visualkeras
Successfully installed aggdraw-1.3.18.post0 visualkeras-0.0.2
```

```
import numpy as np
import pandas as pd
import os

# Tensorflow, Keras
from tensorflow.keras.models import Sequential, load_model
from tensorflow.keras.layers import Conv2D, MaxPooling2D,
BatchNormalization, Flatten, Dense, Dropout, Bidirectional
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.preprocessing.image import ImageDataGenerator,
load_img, img_to_array
from tensorflow.keras.utils import load_img, img_to_array
from tensorflow.keras.callbacks import EarlyStopping
from tensorflow.keras.optimizers.schedules import ExponentialDecay
from tensorflow.keras.initializers import RandomNormal
from tensorflow.keras.applications import VGG16, ResNet101V2

# Sklearn
from sklearn.metrics import accuracy_score, confusion_matrix,
ConfusionMatrixDisplay
from sklearn.utils.class_weight import compute_class_weight

# Plot
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
from PIL import ImageFile, Image
import hvplot.pandas
from shapely.geometry import Point
import geopandas as gpd
from geopandas import GeoDataFrame
import visualkeras
# Set LOAD_TRUNCATED_IMAGES to true
ImageFile.LOAD_TRUNCATED_IMAGES = True
```

```
"(function(root) {\n  function now() {\n    return new Date();\n  }\n\
n  var force = true;\n  var py_version = '3.4.1'.replace('rc', '-
rc.').replace('.dev', '-dev.');\n  var reloading = false;\n  var Bokeh
= root.Bokeh;\n\n  if (typeof (root._bokeh_timeout) === \"undefined\"
|| force) {\n    root._bokeh_timeout = Date.now() + 5000;\n
root._bokeh_failed_load = false;\n  }\n\n  function run_callbacks() {\
n    try {\n
root._bokeh_onload_callbacks.forEach(function(callback) {\n        if
(callback != null)\n          callback();\n      });\n    } finally {\
n      delete root._bokeh_onload_callbacks;\n    }\n
console.debug(\"Bokeh: all callbacks have finished\");\n  }\n\n
function load_libs(css_urls, js_urls, js_modules, js_exports,
callback) {\n    if (css_urls == null) css_urls = [];\n    if (js_urls
== null) js_urls = [];\n    if (js_modules == null) js_modules = [];\n
if (js_exports == null) js_exports = {};\n\n
root._bokeh_onload_callbacks.push(callback);\n\n    if
(root._bokeh_is_loading > 0) {\n      console.debug(\"Bokeh: BokehJS
is being loaded, scheduling callback at\", now());\n      return
null;\n    }\n    if (js_urls.length === 0 && js_modules.length === 0
&& Object.keys(js_exports).length === 0) {\n      run_callbacks();\n
return null;\n    }\n    if (!reloading) {\n
console.debug(\"Bokeh: BokehJS not loaded, scheduling load and
callback at\", now());\n    }\n\n    function on_load() {\n
root._bokeh_is_loading--;\n      if (root._bokeh_is_loading === 0) {\n
console.debug(\"Bokeh: all BokehJS libraries/stylesheets loaded\");\n
run_callbacks()\n      }\n    }\n    window._bokeh_on_load = on_load\
n\n    function on_error() {\n      console.error(\"failed to load \"
+ url);\n    }\n\n    var skip = [];\n    if (window.requirejs) {\n
window.requirejs.config({'packages': {}, 'paths': {}, 'shim': {}});\n
root._bokeh_is_loading = css_urls.length + 0;\n    } else {\n
root._bokeh_is_loading = css_urls.length + js_urls.length +
js_modules.length + Object.keys(js_exports).length;\n    }\n\n    var
existing_stylesheets = []\n    var links =
document.getElementsByTagName('link')\n    for (var i = 0; i <
links.length; i++) {\n      var link = links[i]\n      if (link.href !
= null) {\n\texisting_stylesheets.push(link.href)\n      }\n    }\n
for (var i = 0; i < css_urls.length; i++) {\n      var url =
css_urls[i];\n      if (existing_stylesheets.indexOf(url) !== -1) {\n\
ton_load()\n\tcontinue;\n      }\n      const element =
document.createElement(\"link\");\n      element.onload = on_load;\n
element.onerror = on_error;\n      element.rel = \"stylesheet\";\n
element.type = \"text/css\";\n      element.href = url;\n
console.debug(\"Bokeh: injecting link tag for BokehJS stylesheet: \",
url);\n      document.body.appendChild(element);\n    }    var
existing_scripts = []\n    var scripts =
document.getElementsByTagName('script')\n    for (var i = 0; i <
scripts.length; i++) {\n      var script = scripts[i]\n      if
(script.src != null) {\n\texisting_scripts.push(script.src)\n      }\n
}\n    for (var i = 0; i < js_urls.length; i++) {\n      var url =
js_urls[i];\n      if (skip.indexOf(url) !== -1 ||
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existing_scripts.indexOf(url) !== -1) {\n\tif (!window.requirejs) {\n\
t  on_load();\n\t}\n\tcontinue;\n      }\n      var element =
document.createElement('script');\n      element.onload = on_load;\n
element.onerror = on_error;\n      element.async = false;\n
element.src = url;\n      console.debug(\"Bokeh: injecting script tag
for BokehJS library: \", url);\n
document.head.appendChild(element);\n    }\n    for (var i = 0; i <
js_modules.length; i++) {\n      var url = js_modules[i];\n      if
(skip.indexOf(url) !== -1 || existing_scripts.indexOf(url) !== -1) {\
n\tif (!window.requirejs) {\n\t  on_load();\n\t}\n\tcontinue;\
n      }\n      var element = document.createElement('script');\n
element.onload = on_load;\n      element.onerror = on_error;\n
element.async = false;\n      element.src = url;\n      element.type =
\"module\";\n      console.debug(\"Bokeh: injecting script tag for
BokehJS library: \", url);\n      document.head.appendChild(element);\
n    }\n    for (const name in js_exports) {\n      var url =
js_exports[name];\n      if (skip.indexOf(url) >= 0 || root[name] !=
null) {\n\tif (!window.requirejs) {\n\t  on_load();\n\t}\n\tcontinue;\
n      }\n      var element = document.createElement('script');\n
element.onerror = on_error;\n      element.async = false;\n
element.type = \"module\";\n      console.debug(\"Bokeh: injecting
script tag for BokehJS library: \", url);\n      element.textContent =
`\n      import ${name} from \"${url}\"\n      window.${name} = $
{name}\n      window._bokeh_on_load()\n      `\n
document.head.appendChild(element);\n    }\n    if (!js_urls.length &&
!js_modules.length) {\n      on_load()\n    }\n  };\n\n  function
inject_raw_css(css) {\n    const element =
document.createElement(\"style\");\n
element.appendChild(document.createTextNode(css));\n
document.body.appendChild(element);\n  }\n\n  var js_urls =
[\"https://cdn.bokeh.org/bokeh/release/bokeh-3.4.1.min.js\",
\"https://cdn.bokeh.org/bokeh/release/bokeh-gl-3.4.1.min.js\",
\"https://cdn.bokeh.org/bokeh/release/bokeh-widgets-3.4.1.min.js\",
\"https://cdn.bokeh.org/bokeh/release/bokeh-tables-3.4.1.min.js\",
\"https://cdn.holoviz.org/panel/1.4.1/dist/panel.min.js\"];\n  var
js_modules = [];\n  var js_exports = {};\n  var css_urls = [];\n  var
inline_js = [    function(Bokeh) {\n
Bokeh.set_log_level(\"info\");\n    },\nfunction(Bokeh) {} // ensure
no trailing comma for IE\n  ];\n\n  function run_inline_js() {\n    if
((root.Bokeh !== undefined) || (force === true)) {\n      for (var i =
0; i < inline_js.length; i++) {\n\ttry {\n
inline_js[i].call(root, root.Bokeh);\n\t} catch(e) {\n\t  if (!
reloading) {\n\t    throw e;\n\t  }\n\t}\n      }\n      // Cache old
bokeh versions\n      if (Bokeh != undefined && !reloading) {\n\tvar
NewBokeh = root.Bokeh;\n\tif (Bokeh.versions === undefined) {\n\t
Bokeh.versions = new Map();\n\t}\n\tif (NewBokeh.version !==
Bokeh.version) {\n\t  Bokeh.versions.set(NewBokeh.version, NewBokeh)\
n\t}\n\troot.Bokeh = Bokeh;\n      }} else if (Date.now() <
root._bokeh_timeout) {\n      setTimeout(run_inline_js, 100);\n    }
else if (!root._bokeh_failed_load) {\n      console.log(\"Bokeh:
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BokehJS failed to load within specified timeout.\");\n
root._bokeh_failed_load = true;\n    }\n
root._bokeh_is_initializing = false\n  }\n\n  function load_or_wait()
{\n    // Implement a backoff loop that tries to ensure we do not load
multiple\n    // versions of Bokeh and its dependencies at the same
time.\n    // In recent versions we use the
root._bokeh_is_initializing flag\n    // to determine whether there is
an ongoing attempt to initialize\n    // bokeh, however for backward
compatibility we also try to ensure\n    // that we do not start
loading a newer (Panel>=1.0 and Bokeh>3) version\n    // before older
versions are fully initialized.\n    if (root._bokeh_is_initializing
&& Date.now() > root._bokeh_timeout) {\n
root._bokeh_is_initializing = false;\n
root._bokeh_onload_callbacks = undefined;\n      console.log(\"Bokeh:
BokehJS was loaded multiple times but one version failed to
initialize.\");\n      load_or_wait();\n    } else if
(root._bokeh_is_initializing || (typeof root._bokeh_is_initializing
=== \"undefined\" && root._bokeh_onload_callbacks !== undefined)) {\n
setTimeout(load_or_wait, 100);\n    } else {\n
root._bokeh_is_initializing = true\n      root._bokeh_onload_callbacks
= []\n      var bokeh_loaded = Bokeh != null && (Bokeh.version ===
py_version || (Bokeh.versions !== undefined &&
Bokeh.versions.has(py_version)));\n      if (!reloading && !
bokeh_loaded) {\n\troot.Bokeh = undefined;\n      }\n
load_libs(css_urls, js_urls, js_modules, js_exports, function() {\n\
tconsole.debug(\"Bokeh: BokehJS plotting callback run at\", now());\n\
trun_inline_js();\n      });\n    }\n  }\n  // Give older versions of
the autoload script a head-start to ensure\n  // they initialize
before we start loading newer version.\n  setTimeout(load_or_wait,
100)\n}(window));"

"\nif ((window.PyViz === undefined) || (window.PyViz instanceof
HTMLElement)) {\n  window.PyViz = {comms: {}, comm_status:{}, kernels:
{}, receivers: {}, plot_index: []}\n}\n\n\n    function
JupyterCommManager() {\n    }\n\n
JupyterCommManager.prototype.register_target = function(plot_id,
comm_id, msg_handler) {\n      if (window.comm_manager ||
((window.Jupyter !== undefined) && (Jupyter.notebook.kernel != null)))
{\n        var comm_manager = window.comm_manager ||
Jupyter.notebook.kernel.comm_manager;\n
comm_manager.register_target(comm_id, function(comm) {\n
comm.on_msg(msg_handler);\n        });\n      } else if ((plot_id in
window.PyViz.kernels) && (window.PyViz.kernels[plot_id])) {\n
window.PyViz.kernels[plot_id].registerCommTarget(comm_id,
function(comm) {\n          comm.onMsg = msg_handler;\n        });\n
} else if (typeof google != 'undefined' && google.colab.kernel !=
null) {\n        google.colab.kernel.comms.registerTarget(comm_id,
(comm) => {\n          var messages =
comm.messages[Symbol.asyncIterator]();\n          function
processIteratorResult(result) {\n            var message =
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result.value;\n            console.log(message)\n            var
content = {data: message.data, comm_id};\n            var buffers =
[]\n            for (var buffer of message.buffers || []) {\n
buffers.push(new DataView(buffer))\n            }\n            var
metadata = message.metadata || {};\n            var msg = {content,
buffers, metadata}\n            msg_handler(msg);\n            return
messages.next().then(processIteratorResult);\n          }\n
return messages.next().then(processIteratorResult);\n        })\n
}\n    }\n\n    JupyterCommManager.prototype.get_client_comm =
function(plot_id, comm_id, msg_handler) {\n      if (comm_id in
window.PyViz.comms) {\n        return window.PyViz.comms[comm_id];\n
} else if (window.comm_manager || ((window.Jupyter !== undefined) &&
(Jupyter.notebook.kernel != null))) {\n        var comm_manager =
window.comm_manager || Jupyter.notebook.kernel.comm_manager;\n
var comm = comm_manager.new_comm(comm_id, {}, {}, {}, comm_id);\n
if (msg_handler) {\n          comm.on_msg(msg_handler);\n        }\n
} else if ((plot_id in window.PyViz.kernels) &&
(window.PyViz.kernels[plot_id])) {\n        var comm =
window.PyViz.kernels[plot_id].connectToComm(comm_id);\n
comm.open();\n        if (msg_handler) {\n          comm.onMsg =
msg_handler;\n        }\n      } else if (typeof google != 'undefined'
&& google.colab.kernel != null) {\n        var comm_promise =
google.colab.kernel.comms.open(comm_id)\n
comm_promise.then((comm) => {\n          window.PyViz.comms[comm_id] =
comm;\n          if (msg_handler) {\n            var messages =
comm.messages[Symbol.asyncIterator]();\n            function
processIteratorResult(result) {\n              var message =
result.value;\n              var content = {data: message.data};\n
var metadata = message.metadata || {comm_id};\n              var msg =
{content, metadata}\n              msg_handler(msg);\n
return messages.next().then(processIteratorResult);\n            }\n
return messages.next().then(processIteratorResult);\n          }\n
}) \n        var sendClosure = (data, metadata, buffers,
disposeOnDone) => {\n          return comm_promise.then((comm) => {\n
comm.send(data, metadata, buffers, disposeOnDone);\n          });\n
};\n        var comm = {\n          send: sendClosure\n        };\n
}\n      window.PyViz.comms[comm_id] = comm;\n      return comm;\n
}\n    window.PyViz.comm_manager = new JupyterCommManager();\n    \n\
n\nvar JS_MIME_TYPE = 'application/javascript';\nvar HTML_MIME_TYPE =
'text/html';\nvar EXEC_MIME_TYPE =
'application/vnd.holoviews_exec.v0+json';\nvar CLASS_NAME = 'output';\
n\n/**\n * Render data to the DOM node\n */\nfunction render(props,
node) {\n  var div = document.createElement(\"div\");\n  var script =
document.createElement(\"script\");\n  node.appendChild(div);\n
node.appendChild(script);\n}\n\n/**\n * Handle when a new output is
added\n */\nfunction handle_add_output(event, handle) {\n  var
output_area = handle.output_area;\n  var output = handle.output;\n  if
((output.data == undefined) || (!
output.data.hasOwnProperty(EXEC_MIME_TYPE))) {\n    return\n  }\n  var
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id = output.metadata[EXEC_MIME_TYPE][\"id\"];\n  var toinsert =
output_area.element.find(\".\" + CLASS_NAME.split(' ')[0]);\n  if
(id !== undefined) {\n    var nchildren = toinsert.length;\n    var
html_node = toinsert[nchildren-1].children[0];\n
html_node.innerHTML = output.data[HTML_MIME_TYPE];\n    var scripts =
[];\n    var nodelist = html_node.querySelectorAll(\"script\");\n
for (var i in nodelist) {\n      if (nodelist.hasOwnProperty(i)) {\n
scripts.push(nodelist[i])\n      }\n    }\n\n
scripts.forEach( function (oldScript) {\n      var newScript =
document.createElement(\"script\");\n      var attrs = [];\n      var
nodemap = oldScript.attributes;\n      for (var j in nodemap) {\n
if (nodemap.hasOwnProperty(j)) {\n          attrs.push(nodemap[j])\n
}\n      }\n      attrs.forEach(function(attr)
{ newScript.setAttribute(attr.name, attr.value) });\n
newScript.appendChild(document.createTextNode(oldScript.innerHTML));\n
oldScript.parentNode.replaceChild(newScript, oldScript);\n    });\n
if (JS_MIME_TYPE in output.data) {\n      toinsert[nchildren-
1].children[1].textContent = output.data[JS_MIME_TYPE];\n    }\n
output_area._hv_plot_id = id;\n    if ((window.Bokeh !== undefined) &&
(id in Bokeh.index)) {\n      window.PyViz.plot_index[id] =
Bokeh.index[id];\n    } else {\n      window.PyViz.plot_index[id] =
null;\n    }\n  } else if (output.metadata[EXEC_MIME_TYPE]
[\"server_id\"] !== undefined) {\n    var bk_div =
document.createElement(\"div\");\n    bk_div.innerHTML =
output.data[HTML_MIME_TYPE];\n    var script_attrs =
bk_div.children[0].attributes;\n    for (var i = 0; i <
script_attrs.length; i++) {\n      toinsert[toinsert.length -
1].childNodes[1].setAttribute(script_attrs[i].name,
script_attrs[i].value);\n    }\n    // store reference to server id on
output_area\n    output_area._bokeh_server_id =
output.metadata[EXEC_MIME_TYPE][\"server_id\"];\n  }\n}\n\n/**\n *
Handle when an output is cleared or removed\n */\nfunction
handle_clear_output(event, handle) {\n  var id =
handle.cell.output_area._hv_plot_id;\n  var server_id =
handle.cell.output_area._bokeh_server_id;\n  if (((id === undefined)
|| !(id in PyViz.plot_index)) && (server_id !== undefined))
{ return; }\n  var comm =
window.PyViz.comm_manager.get_client_comm(\"hv-extension-comm\", \"hv-
extension-comm\", function () {});\n  if (server_id !== null) {\n
comm.send({event_type: 'server_delete', 'id': server_id});\n
return;\n  } else if (comm !== null) {\n    comm.send({event_type:
'delete', 'id': id});\n  }\n  delete PyViz.plot_index[id];\n  if
((window.Bokeh !== undefined) & (id in window.Bokeh.index)) {\n    var
doc = window.Bokeh.index[id].model.document\n    doc.clear();\n
const i = window.Bokeh.documents.indexOf(doc);\n    if (i > -1) {\n
window.Bokeh.documents.splice(i, 1);\n    }\n  }\n}\n\n/**\n * Handle
kernel restart event\n */\nfunction handle_kernel_cleanup(event,
handle) {\n  delete PyViz.comms[\"hv-extension-comm\"];\n
window.PyViz.plot_index = {}\n}\n\n/**\n * Handle update_display_data
```

```
messages\n */\nfunction handle_update_output(event, handle) {\n
handle_clear_output(event, {cell: {output_area: handle.output_area}})\
n  handle_add_output(event, handle)\n}\n\nfunction
register_renderer(events, OutputArea) {\n  function append_mime(data,
metadata, element) {\n    // create a DOM node to render to\n    var
toinsert = this.create_output_subarea(\n    metadata,\n
CLASS_NAME,\n    EXEC_MIME_TYPE\n    );\n
this.keyboard_manager.register_events(toinsert);\n    // Render to
node\n    var props = {data: data, metadata:
metadata[EXEC_MIME_TYPE]};\n    render(props, toinsert[0]);\n
element.append(toinsert);\n    return toinsert\n  }\n\n
events.on('output_added.OutputArea', handle_add_output);\n
events.on('output_updated.OutputArea', handle_update_output);\n
events.on('clear_output.CodeCell', handle_clear_output);\n
events.on('delete.Cell', handle_clear_output);\n
events.on('kernel_ready.Kernel', handle_kernel_cleanup);\n\n
OutputArea.prototype.register_mime_type(EXEC_MIME_TYPE, append_mime,
{\n    safe: true,\n    index: 0\n  });\n}\n\nif (window.Jupyter !==
undefined) {\n  try {\n    var events = require('base/js/events');\n
var OutputArea = require('notebook/js/outputarea').OutputArea;\n    if
(OutputArea.prototype.mime_types().indexOf(EXEC_MIME_TYPE) == -1) {\n
register_renderer(events, OutputArea);\n    }\n  } catch(err) {\n  }\
n}\n"

""

train_path = "../input/wildfire-prediction-dataset/train"
valid_path = "../input/wildfire-prediction-dataset/valid"
test_path = "../input/wildfire-prediction-dataset/test"
```

GEOSPATIAL ANALYSIS

```
path=[]
filenames=[]
longitude=[]
latitude=[]
folder_path="../input/wildfire-prediction-dataset/"

# Iterate through subdirectories and files
for entry in os.scandir(folder_path):
    if entry.is_dir():
        subfolder_path = os.path.join(folder_path, entry.name)
        for sub_entry in os.scandir(subfolder_path):
            if sub_entry.is_dir():
                for file in enumerate(os.listdir(sub_entry.path)):
                    # Append the file name to the DataFrame$
                    path.append(sub_entry.path+'/'+file[1])
                    filenames.append(file[1])
                    parts = file[1].split(',')
```

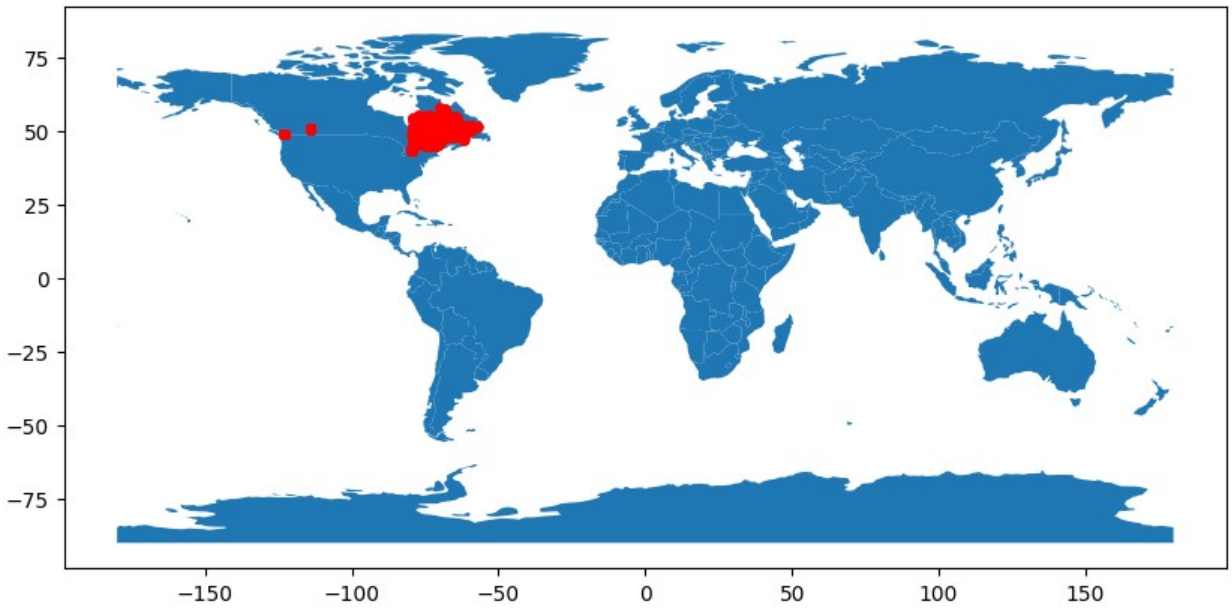
```
                    longitude.append(parts[0])
                    latitude.append(parts[1].split('.jp')[0])

df_pictures = pd.DataFrame({'Filename': filenames, 'Longitude':
longitude, 'Latitude': latitude, 'Path': path})
# Convert 'Longitude' and 'Latitude' columns to numerical values
df_pictures['Longitude'] = pd.to_numeric(df_pictures['Longitude'])
df_pictures['Latitude'] = pd.to_numeric(df_pictures['Latitude'])

df_pictures
```

```
                         Filename   Longitude   Latitude  \
0         -73.71631,46.04137.jpg  -73.716310  46.041370
1         -74.62281,45.80216.jpg  -74.622810  45.802160
2         -70.19693,53.61931.jpg  -70.196930  53.619310
3         -71.15229,46.51529.jpg  -71.152290  46.515290
4         -71.70749,45.72332.jpg  -71.707490  45.723320
...                          ...         ...        ...
42845   -79.504062,43.815677.jpg  -79.504062  43.815677
42846   -75.741689,45.367119.jpg  -75.741689  45.367119
42847  -123.078186,49.197516.jpg -123.078186  49.197516
42848  -122.736563,49.177259.jpg -122.736563  49.177259
42849   -114.11366,51.088034.jpg -114.113660  51.088034

                                                    Path
0      ../input/wildfire-prediction-dataset/valid/wil...
1      ../input/wildfire-prediction-dataset/valid/wil...
2      ../input/wildfire-prediction-dataset/valid/wil...
3      ../input/wildfire-prediction-dataset/valid/wil...
4      ../input/wildfire-prediction-dataset/valid/wil...
...                                                  ...
42845  ../input/wildfire-prediction-dataset/train/now...
42846  ../input/wildfire-prediction-dataset/train/now...
42847  ../input/wildfire-prediction-dataset/train/now...
42848  ../input/wildfire-prediction-dataset/train/now...
42849  ../input/wildfire-prediction-dataset/train/now...

[42850 rows x 4 columns]
```

```
geometry = [Point(xy) for xy in zip(df_pictures['Longitude'],
df_pictures['Latitude'])]
gdf = GeoDataFrame(df_pictures, geometry=geometry)

#this is a simple map that goes with geopandas
world = gpd.read_file(gpd.datasets.get_path('naturalearth_lowres'))
gdf.plot(ax=world.plot(figsize=(10, 6)), marker='o', color='red',
markersize=15);
```

```
/tmp/ipykernel_34/712328175.py:5: FutureWarning: The geopandas.dataset
module is deprecated and will be removed in GeoPandas 1.0. You can get
the original 'naturalearth_lowres' data from
```

```
https://www.naturalearthdata.com/downloads/110m-cultural-vectors/.
  world = gpd.read_file(gpd.datasets.get_path('naturalearth_lowres'))
```




```
rescale_datagen = ImageDataGenerator(
    dtype='float32',                # Data type for the output data
    rescale=1./255.,                # Rescale pixel values to the
range [0, 1]
    rotation_range=10,              # Randomly rotate images by up to
10 degrees
    zoom_range=0.05,                # Randomly zoom in/out on images
by 5%
    width_shift_range=0.1,          # Randomly shift the width of
images by 10%
    height_shift_range=0.1,         # Randomly shift the height of
images by 10%
    shear_range=0.15,               # Randomly apply shear
transformations
    horizontal_flip=True,           # Randomly flip images
horizontally
    fill_mode="nearest"             # Strategy for filling in newly
created pixels
)
train_generator = rescale_datagen.flow_from_directory(train_path,
                                                      batch_size = 50,

                                                      target_size =
(224,224),
                                                      color_mode =
"rgb",
```

```
                                                    class_mode =
"categorical",
                                                    shuffle = True,
                                                    seed = 42)
valid_generator = rescale_datagen.flow_from_directory(valid_path,
                                                    batch_size = 50,
                                                    target_size =
(224,224),
                                                    color_mode =
"rgb",
                                                    class_mode =
"categorical",
                                                    shuffle = True,
                                                    seed = 42)
test_generator = rescale_datagen.flow_from_directory(test_path,
                                                   batch_size = 50,
                                                   target_size =
(224,224),
                                                   color_mode =
"rgb",
                                                   class_mode =
"categorical",
                                                   shuffle = False,
                                                   seed = 42)
```

```
Found 30250 images belonging to 2 classes.
Found 6300 images belonging to 2 classes.
Found 6300 images belonging to 2 classes.
```

```
class_labels = list(train_generator.class_indices.keys())
class_labels
```

```
['nowildfire', 'wildfire']
```

```
# Calculate class weights
class_labels = np.unique(valid_generator.classes)
class_distribution = np.bincount(train_generator.classes) +
np.bincount(valid_generator.classes) +
np.bincount(test_generator.classes)
total_samples = np.sum(class_distribution)
class_weights = total_samples / (len(class_labels) *
class_distribution)

class_weights /= np.sum(class_weights)

# Create a dictionary of class weights
class_weight_dict = {class_index: weight for class_index, weight in
enumerate(np.round(class_weights,2))}
class_weight_dict
```

```
{0: 0.53, 1: 0.47}
```

```
import matplotlib.pyplot as plt
import random

# Set the number of random images to plot
num_images_to_plot = 5

# Create a 3x5 grid of subplots
fig, axes = plt.subplots(3, num_images_to_plot, figsize=(15, 9))  #
Adjust figsize as needed

# Iterate through the generator to get random images
for i in range(3):
    for j in range(num_images_to_plot):
        # Get a random batch based on the row (train, valid, or test)
        if i == 0:
            batch = next(train_generator)
        elif i == 1:
            batch = next(valid_generator)
        else:
            batch = next(test_generator)

        images, labels = batch

        # Select a random image from the batch
        random_index = random.randint(0, len(images) - 1)
        image_to_plot = images[random_index]
        label_to_plot = labels[random_index]

        # Plot the selected image on the corresponding subplot
        axes[i, j].imshow(image_to_plot)
        axes[i, j].set_title(f"Class: {label_to_plot.argmax()}")  #
Assuming one-hot encoded labels
        axes[i, j].axis('off')  # Turn off axis labels

# Adjust spacing between subplots for better layout
plt.tight_layout()
plt.show()
```


```
# building neural networks
random_normal_initializer = RandomNormal(mean=0.0, stddev=0.05)
cnn_model = Sequential([
    # Conv layer 1:
    Conv2D(32, (3, 3), input_shape=(250,250,3), activation='elu',
kernel_initializer =random_normal_initializer),
    BatchNormalization(),
    MaxPooling2D(pool_size = (2, 2)),

    # Conv layer 2:
    Conv2D(16, (3, 3), activation='elu', kernel_initializer
=random_normal_initializer),
    BatchNormalization(),
    MaxPooling2D(pool_size = (2, 2)),

    # Conv layer 3:
    Conv2D(16, (3, 3), activation='elu', kernel_initializer
=random_normal_initializer),
    BatchNormalization(),
    MaxPooling2D(pool_size = (2, 2)),

    Flatten(),

    # fully connected layers:
    Dense(units = 128, activation = 'elu'),
    Dense(units = 2, activation = 'softmax')
```

```
])


cnn_model.compile(optimizer=Adam(learning_rate = 0.001), loss =
'categorical_crossentropy', metrics = ['accuracy'])
cnn_model.summary()
```

```
/opt/conda/lib/python3.10/site-packages/keras/src/layers/
convolutional/base_conv.py:99: UserWarning: Do not pass an
`input_shape`/`input_dim` argument to a layer. When using Sequential
models, prefer using an `Input(shape)` object as the first layer in
the model instead.
  super().__init__(

Model: "sequential"
```

```
┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━
┓
┃ Layer (type)                    ┃ Output Shape           ┃
Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━
┩
│ conv2d (Conv2D)                 │ (None, 248, 248, 32)   │
896 │
├─────────────────────────────────┼────────────────────────┼──────────────
┤
│ batch_normalization             │ (None, 248, 248, 32)   │
128 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────────
┤
│ max_pooling2d (MaxPooling2D)    │ (None, 124, 124, 32)   │
0 │
├─────────────────────────────────┼────────────────────────┼──────────────
┤
│ conv2d_1 (Conv2D)               │ (None, 122, 122, 16)   │
4,624 │
├─────────────────────────────────┼────────────────────────┼──────────────
┤
│ batch_normalization_1           │ (None, 122, 122, 16)   │
64 │
│ (BatchNormalization)            │                        │
│
├─────────────────────────────────┼────────────────────────┼──────────────
┤
│ max_pooling2d_1 (MaxPooling2D)  │ (None, 61, 61, 16)     │
0 │
├─────────────────────────────────┼────────────────────────┼──────────────
┤
```

```
| conv2d_2 (Conv2D)                    | (None, 59, 59, 16)      |
2,320 |
├──────────────────────────────────────┼─────────────────────────┼──────
──────┤
| batch_normalization_2                | (None, 59, 59, 16)      |
64 |
| (BatchNormalization)                 |                         |
|
├──────────────────────────────────────┼─────────────────────────┼──────
──────┤
| max_pooling2d_2 (MaxPooling2D)       | (None, 29, 29, 16)      |
0 |
├──────────────────────────────────────┼─────────────────────────┼──────
──────┤
| flatten (Flatten)                    | (None, 13456)           |
0 |
├──────────────────────────────────────┼─────────────────────────┼──────
──────┤
| dense (Dense)                        | (None, 128)             |
1,722,496 |
├──────────────────────────────────────┼─────────────────────────┼──────
──────┤
| dense_1 (Dense)                      | (None, 2)               |
258 |
└──────────────────────────────────────┴─────────────────────────┴──────
──────┘

 Total params: 1,730,850 (6.60 MB)

 Trainable params: 1,730,722 (6.60 MB)

 Non-trainable params: 128 (512.00 B)
```

```
callback = EarlyStopping(monitor='val_accuracy', patience=5,
restore_best_weights=True)

logs1 = cnn_model.fit(train_generator,
                    epochs = 20,
                    steps_per_epoch=int(30250/50),
                    validation_data = valid_generator,
                    validation_steps=int(6300/50),
                    callbacks=[callback])

training_accuracy = logs1.history['accuracy']
validation_accuracy = logs1.history['val_accuracy']

# Get the training and validation loss
training_loss = logs1.history['loss']
validation_loss = logs1.history['val_loss']

# Plot the accuracy
```

```
plt.figure(figsize=(8, 4))
plt.plot(training_accuracy, label='Training accuracy')
plt.plot(validation_accuracy, label='Validation accuracy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.title('Training and Validation accuracy')
plt.legend()
plt.show()

# Plot the loss
plt.figure(figsize=(8, 4))
plt.plot(training_loss, label='Training Loss')
plt.plot(validation_loss, label='Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.title('Training and Validation Loss')
plt.legend()
plt.show()

result = cnn_model.evaluate(test_generator, steps=6300/50)

test_generator.reset()
prediction2 = cnn_model.predict(test_generator)
y_prediction2 = np.argmax(prediction2, axis=1)

conf_matrix = confusion_matrix(y_true=test_generator.classes,
y_pred=y_prediction2)
ConfusionMatrixDisplay(conf_matrix,
display_labels=class_labels).plot()

acc_cnn_model = accuracy_score(y_true=test_generator.classes,
y_pred=y_prediction2)
print(f"Accuracy of CNN model: {acc_cnn_model*100:.1f}%")

from keras.models import Model
from keras.layers import Dense, Flatten
from keras.applications import ResNet101
from keras.optimizers import Adam

# Load pre-trained ResNet101 model
base_model = ResNet101(weights='imagenet', include_top=False,
input_shape=(224, 224, 3))

# Freeze the pre-trained layers
for layer in base_model.layers:
    layer.trainable = False
    layer_output = layer.output
#     print(layer.name, layer_output.shape)

# Add your custom dense layers for binary classification
x = base_model.output
```

```
x = Flatten()(x)
x = Dense(512, activation='relu')(x)
x = Dense(128, activation='relu')(x)
predictions = Dense(2, activation='softmax')(x)

# Create the final model
model = Model(inputs=base_model.input, outputs=predictions)

# Compile the model
model.compile(optimizer=Adam(learning_rate=0.001),
loss='categorical_crossentropy', metrics=['AUC','accuracy'])

# Print model summary
model.summary()
```

```
Model: "functional_3"
```

Layer (type)	Output Shape	Param #	Connected to
input_layer_1 (InputLayer)	(None, 224, 224, 3)	0	-
conv1_pad (ZeroPadding2D)	(None, 230, 230, 3)	0	input_layer_1[0]…
conv1_conv (Conv2D)	(None, 112, 112, 64)	9,472	conv1_pad[0][0]
conv1_bn (BatchNormalizatio…	(None, 112, 112, 64)	256	conv1_conv[0][0]
conv1_relu (Activation)	(None, 112, 112, 64)	0	conv1_bn[0][0]

```
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ pool1_pad            │ (None, 114, 114,  │          0 │ conv1_relu[0]
[0]  │
│ (ZeroPadding2D)      │ 64)                  │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ pool1_pool           │ (None, 56, 56,    │          0 │ pool1_pad[0]
[0]   │
│ (MaxPooling2D)       │ 64)                  │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_1_conv  │ (None, 56, 56,    │      4,160 │ pool1_pool[0]
[0]  │
│ (Conv2D)             │ 64)                  │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_1_bn    │ (None, 56, 56,    │        256 │
conv2_block1_1_c… │
│ (BatchNormalizatio… │ 64)                  │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_1_relu  │ (None, 56, 56,    │          0 │
conv2_block1_1_b… │
│ (Activation)         │ 64)                  │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_2_conv  │ (None, 56, 56,    │     36,928 │
conv2_block1_1_r… │
│ (Conv2D)             │ 64)                  │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_2_bn    │ (None, 56, 56,    │        256 │
conv2_block1_2_c… │
│ (BatchNormalizatio… │ 64)                  │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_2_relu  │ (None, 56, 56,    │          0 │
conv2_block1_2_b… │
│ (Activation)         │ 64)                  │            │
│
```

```
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_0_conv  │ (None, 56, 56,       │     16,640 │ pool1_pool[0]
[0]   │
│ (Conv2D)             │ 256)                 │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_3_conv  │ (None, 56, 56,       │     16,640 │
conv2_block1_2_r… │
│ (Conv2D)             │ 256)                 │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_0_bn    │ (None, 56, 56,       │      1,024 │
conv2_block1_0_c… │
│ (BatchNormalizatio… │ 256)                 │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_3_bn    │ (None, 56, 56,       │      1,024 │
conv2_block1_3_c… │
│ (BatchNormalizatio… │ 256)                 │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_add     │ (None, 56, 56,       │          0 │
conv2_block1_0_b… │
│ (Add)                │ 256)                 │            │
conv2_block1_3_b… │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block1_out     │ (None, 56, 56,       │          0 │
conv2_block1_add… │
│ (Activation)         │ 256)                 │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block2_1_conv  │ (None, 56, 56,       │     16,448 │
conv2_block1_out… │
│ (Conv2D)             │ 64)                  │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv2_block2_1_bn    │ (None, 56, 56,       │        256 │
conv2_block2_1_c… │
│ (BatchNormalizatio… │ 64)                  │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
```

```
──────┤
│ conv2_block2_1_relu │ (None, 56, 56,     │           0 │
conv2_block2_1_b… │
│ (Activation)        │ 64)                │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv2_block2_2_conv │ (None, 56, 56,     │      36,928 │
conv2_block2_1_r… │
│ (Conv2D)            │ 64)                │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv2_block2_2_bn   │ (None, 56, 56,     │         256 │
conv2_block2_2_c… │
│ (BatchNormalizatio… │ 64)                │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv2_block2_2_relu │ (None, 56, 56,     │           0 │
conv2_block2_2_b… │
│ (Activation)        │ 64)                │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv2_block2_3_conv │ (None, 56, 56,     │      16,640 │
conv2_block2_2_r… │
│ (Conv2D)            │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv2_block2_3_bn   │ (None, 56, 56,     │       1,024 │
conv2_block2_3_c… │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv2_block2_add    │ (None, 56, 56,     │           0 │
conv2_block1_out… │
│ (Add)               │ 256)               │             │
conv2_block2_3_b… │
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv2_block2_out    │ (None, 56, 56,     │           0 │
conv2_block2_add… │
│ (Activation)        │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
```

```
| conv2_block3_1_conv | (None, 56, 56,     |     16,448 |
conv2_block2_out… |
| (Conv2D)            | 64)                |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
| conv2_block3_1_bn   | (None, 56, 56,     |        256 |
conv2_block3_1_c… |
| (BatchNormalizatio… | 64)                |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
| conv2_block3_1_relu | (None, 56, 56,     |          0 |
conv2_block3_1_b… |
| (Activation)        | 64)                |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
| conv2_block3_2_conv | (None, 56, 56,     |     36,928 |
conv2_block3_1_r… |
| (Conv2D)            | 64)                |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
| conv2_block3_2_bn   | (None, 56, 56,     |        256 |
conv2_block3_2_c… |
| (BatchNormalizatio… | 64)                |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
| conv2_block3_2_relu | (None, 56, 56,     |          0 |
conv2_block3_2_b… |
| (Activation)        | 64)                |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
| conv2_block3_3_conv | (None, 56, 56,     |     16,640 |
conv2_block3_2_r… |
| (Conv2D)            | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
| conv2_block3_3_bn   | (None, 56, 56,     |      1,024 |
conv2_block3_3_c… |
| (BatchNormalizatio… | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
| conv2_block3_add    | (None, 56, 56,     |          0 |
```

```
conv2_block2_out… │
│ (Add)               │ 256)               │             │
conv2_block3_3_b… │
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv2_block3_out    │ (None, 56, 56,     │           0 │
conv2_block3_add… │
│ (Activation)        │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block1_1_conv │ (None, 28, 28,     │      32,896 │
conv2_block3_out… │
│ (Conv2D)            │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block1_1_bn   │ (None, 28, 28,     │         512 │
conv3_block1_1_c… │
│ (BatchNormalizatio… │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block1_1_relu │ (None, 28, 28,     │           0 │
conv3_block1_1_b… │
│ (Activation)        │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block1_2_conv │ (None, 28, 28,     │     147,584 │
conv3_block1_1_r… │
│ (Conv2D)            │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block1_2_bn   │ (None, 28, 28,     │         512 │
conv3_block1_2_c… │
│ (BatchNormalizatio… │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block1_2_relu │ (None, 28, 28,     │           0 │
conv3_block1_2_b… │
│ (Activation)        │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block1_0_conv │ (None, 28, 28,     │     131,584 │
conv2_block3_out… │
```

```
| (Conv2D)              | 512)                 |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| conv3_block1_3_conv | (None, 28, 28,     |     66,048 |
conv3_block1_2_r… |
| (Conv2D)              | 512)                 |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| conv3_block1_0_bn   | (None, 28, 28,     |      2,048 |
conv3_block1_0_c… |
| (BatchNormalizatio… | 512)                 |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| conv3_block1_3_bn   | (None, 28, 28,     |      2,048 |
conv3_block1_3_c… |
| (BatchNormalizatio… | 512)                 |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| conv3_block1_add    | (None, 28, 28,     |           0 |
conv3_block1_0_b… |
| (Add)                 | 512)                 |             |
conv3_block1_3_b… |
├───────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| conv3_block1_out    | (None, 28, 28,     |           0 |
conv3_block1_add… |
| (Activation)          | 512)                 |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| conv3_block2_1_conv | (None, 28, 28,     |     65,664 |
conv3_block1_out… |
| (Conv2D)              | 128)                 |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| conv3_block2_1_bn   | (None, 28, 28,     |         512 |
conv3_block2_1_c… |
| (BatchNormalizatio… | 128)                 |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────────
──────┤
| conv3_block2_1_relu | (None, 28, 28,     |           0 |
conv3_block2_1_b… |
| (Activation)          | 128)                 |             |
```

```
│
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
│ conv3_block2_2_conv │ (None, 28, 28,      │     147,584 │
conv3_block2_1_r… │
│ (Conv2D)            │ 128)                │             │
│
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
│ conv3_block2_2_bn   │ (None, 28, 28,      │         512 │
conv3_block2_2_c… │
│ (BatchNormalizatio… │ 128)                │             │
│
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
│ conv3_block2_2_relu │ (None, 28, 28,      │           0 │
conv3_block2_2_b… │
│ (Activation)        │ 128)                │             │
│
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
│ conv3_block2_3_conv │ (None, 28, 28,      │      66,048 │
conv3_block2_2_r… │
│ (Conv2D)            │ 512)                │             │
│
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
│ conv3_block2_3_bn   │ (None, 28, 28,      │       2,048 │
conv3_block2_3_c… │
│ (BatchNormalizatio… │ 512)                │             │
│
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
│ conv3_block2_add    │ (None, 28, 28,      │           0 │
conv3_block1_out… │
│ (Add)               │ 512)                │             │
conv3_block2_3_b… │
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
│ conv3_block2_out    │ (None, 28, 28,      │           0 │
conv3_block2_add… │
│ (Activation)        │ 512)                │             │
│
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
│ conv3_block3_1_conv │ (None, 28, 28,      │      65,664 │
conv3_block2_out… │
│ (Conv2D)            │ 128)                │             │
│
```

```
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv3_block3_1_bn    │ (None, 28, 28,       │          512 │
conv3_block3_1_c… │
│ (BatchNormalizatio… │ 128)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv3_block3_1_relu  │ (None, 28, 28,       │            0 │
conv3_block3_1_b… │
│ (Activation)         │ 128)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv3_block3_2_conv  │ (None, 28, 28,       │      147,584 │
conv3_block3_1_r… │
│ (Conv2D)             │ 128)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv3_block3_2_bn    │ (None, 28, 28,       │          512 │
conv3_block3_2_c… │
│ (BatchNormalizatio… │ 128)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv3_block3_2_relu  │ (None, 28, 28,       │            0 │
conv3_block3_2_b… │
│ (Activation)         │ 128)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv3_block3_3_conv  │ (None, 28, 28,       │       66,048 │
conv3_block3_2_r… │
│ (Conv2D)             │ 512)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv3_block3_3_bn    │ (None, 28, 28,       │        2,048 │
conv3_block3_3_c… │
│ (BatchNormalizatio… │ 512)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
──────┤
│ conv3_block3_add     │ (None, 28, 28,       │            0 │
conv3_block2_out… │
│ (Add)                │ 512)                 │              │
conv3_block3_3_b… │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────
```

```
──────┤
│ conv3_block3_out    │ (None, 28, 28,     │           0 │
conv3_block3_add… │
│ (Activation)        │ 512)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block4_1_conv │ (None, 28, 28,     │      65,664 │
conv3_block3_out… │
│ (Conv2D)            │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block4_1_bn   │ (None, 28, 28,     │         512 │
conv3_block4_1_c… │
│ (BatchNormalizatio… │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block4_1_relu │ (None, 28, 28,     │           0 │
conv3_block4_1_b… │
│ (Activation)        │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block4_2_conv │ (None, 28, 28,     │     147,584 │
conv3_block4_1_r… │
│ (Conv2D)            │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block4_2_bn   │ (None, 28, 28,     │         512 │
conv3_block4_2_c… │
│ (BatchNormalizatio… │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block4_2_relu │ (None, 28, 28,     │           0 │
conv3_block4_2_b… │
│ (Activation)        │ 128)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv3_block4_3_conv │ (None, 28, 28,     │      66,048 │
conv3_block4_2_r… │
│ (Conv2D)            │ 512)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
```

```
| conv3_block4_3_bn   | (None, 28, 28,     |       2,048 |
conv3_block4_3_c… |
| (BatchNormalizatio… | 512)               |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv3_block4_add    | (None, 28, 28,     |           0 |
conv3_block3_out… |
| (Add)               | 512)               |             |
conv3_block4_3_b… |
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv3_block4_out    | (None, 28, 28,     |           0 |
conv3_block4_add… |
| (Activation)        | 512)               |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block1_1_conv | (None, 14, 14,     |     131,328 |
conv3_block4_out… |
| (Conv2D)            | 256)               |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block1_1_bn   | (None, 14, 14,     |       1,024 |
conv4_block1_1_c… |
| (BatchNormalizatio… | 256)               |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block1_1_relu | (None, 14, 14,     |           0 |
conv4_block1_1_b… |
| (Activation)        | 256)               |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block1_2_conv | (None, 14, 14,     |     590,080 |
conv4_block1_1_r… |
| (Conv2D)            | 256)               |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block1_2_bn   | (None, 14, 14,     |       1,024 |
conv4_block1_2_c… |
| (BatchNormalizatio… | 256)               |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block1_2_relu | (None, 14, 14,     |           0 |
conv4_block1_2_b… |
```

```
| (Activation)         | 256)                |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block1_0_conv | (None, 14, 14,     |    525,312 |
conv3_block4_out… |
| (Conv2D)             | 1024)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block1_3_conv | (None, 14, 14,     |    263,168 |
conv4_block1_2_r… |
| (Conv2D)             | 1024)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block1_0_bn    | (None, 14, 14,     |      4,096 |
conv4_block1_0_c… |
| (BatchNormalizatio… | 1024)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block1_3_bn    | (None, 14, 14,     |      4,096 |
conv4_block1_3_c… |
| (BatchNormalizatio… | 1024)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block1_add     | (None, 14, 14,     |          0 |
conv4_block1_0_b… |
| (Add)                | 1024)               |             |
conv4_block1_3_b… |
├──────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block1_out     | (None, 14, 14,     |          0 |
conv4_block1_add… |
| (Activation)         | 1024)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block2_1_conv | (None, 14, 14,     |    262,400 |
conv4_block1_out… |
| (Conv2D)             | 256)                |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block2_1_bn    | (None, 14, 14,     |      1,024 |
conv4_block2_1_c… |
| (BatchNormalizatio… | 256)                |             |
```

```
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv4_block2_1_relu │ (None, 14, 14,     │           0 │
conv4_block2_1_b… │
│ (Activation)        │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv4_block2_2_conv │ (None, 14, 14,     │     590,080 │
conv4_block2_1_r… │
│ (Conv2D)            │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv4_block2_2_bn   │ (None, 14, 14,     │       1,024 │
conv4_block2_2_c… │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv4_block2_2_relu │ (None, 14, 14,     │           0 │
conv4_block2_2_b… │
│ (Activation)        │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv4_block2_3_conv │ (None, 14, 14,     │     263,168 │
conv4_block2_2_r… │
│ (Conv2D)            │ 1024)              │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv4_block2_3_bn   │ (None, 14, 14,     │       4,096 │
conv4_block2_3_c… │
│ (BatchNormalizatio… │ 1024)              │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv4_block2_add    │ (None, 14, 14,     │           0 │
conv4_block1_out… │
│ (Add)               │ 1024)              │             │
conv4_block2_3_b… │
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
│ conv4_block2_out    │ (None, 14, 14,     │           0 │
conv4_block2_add… │
│ (Activation)        │ 1024)              │             │
│
```

```
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block3_1_conv  │ (None, 14, 14,       │      262,400 │
conv4_block2_out… │
│ (Conv2D)             │ 256)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block3_1_bn    │ (None, 14, 14,       │        1,024 │
conv4_block3_1_c… │
│ (BatchNormalizatio… │ 256)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block3_1_relu  │ (None, 14, 14,       │            0 │
conv4_block3_1_b… │
│ (Activation)         │ 256)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block3_2_conv  │ (None, 14, 14,       │      590,080 │
conv4_block3_1_r… │
│ (Conv2D)             │ 256)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block3_2_bn    │ (None, 14, 14,       │        1,024 │
conv4_block3_2_c… │
│ (BatchNormalizatio… │ 256)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block3_2_relu  │ (None, 14, 14,       │            0 │
conv4_block3_2_b… │
│ (Activation)         │ 256)                 │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block3_3_conv  │ (None, 14, 14,       │      263,168 │
conv4_block3_2_r… │
│ (Conv2D)             │ 1024)                │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block3_3_bn    │ (None, 14, 14,       │        4,096 │
conv4_block3_3_c… │
│ (BatchNormalizatio… │ 1024)                │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
```

```
──────┤
| conv4_block3_add    | (None, 14, 14,    |           0 |
conv4_block2_out… |
| (Add)               | 1024)             |             |
conv4_block3_3_b… |
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| conv4_block3_out    | (None, 14, 14,    |           0 |
conv4_block3_add… |
| (Activation)        | 1024)             |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| conv4_block4_1_conv | (None, 14, 14,    |     262,400 |
conv4_block3_out… |
| (Conv2D)            | 256)              |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| conv4_block4_1_bn   | (None, 14, 14,    |       1,024 |
conv4_block4_1_c… |
| (BatchNormalizatio… | 256)              |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| conv4_block4_1_relu | (None, 14, 14,    |           0 |
conv4_block4_1_b… |
| (Activation)        | 256)              |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| conv4_block4_2_conv | (None, 14, 14,    |     590,080 |
conv4_block4_1_r… |
| (Conv2D)            | 256)              |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| conv4_block4_2_bn   | (None, 14, 14,    |       1,024 |
conv4_block4_2_c… |
| (BatchNormalizatio… | 256)              |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
| conv4_block4_2_relu | (None, 14, 14,    |           0 |
conv4_block4_2_b… |
| (Activation)        | 256)              |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────────
──────┤
```

```
| conv4_block4_3_conv | (None, 14, 14,     |    263,168 |
conv4_block4_2_r… |
| (Conv2D)            | 1024)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block4_3_bn   | (None, 14, 14,     |      4,096 |
conv4_block4_3_c… |
| (BatchNormalizatio… | 1024)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block4_add    | (None, 14, 14,     |          0 |
conv4_block3_out… |
| (Add)               | 1024)              |            |
conv4_block4_3_b… |
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block4_out    | (None, 14, 14,     |          0 |
conv4_block4_add… |
| (Activation)        | 1024)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block5_1_conv | (None, 14, 14,     |    262,400 |
conv4_block4_out… |
| (Conv2D)            | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block5_1_bn   | (None, 14, 14,     |      1,024 |
conv4_block5_1_c… |
| (BatchNormalizatio… | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block5_1_relu | (None, 14, 14,     |          0 |
conv4_block5_1_b… |
| (Activation)        | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block5_2_conv | (None, 14, 14,     |    590,080 |
conv4_block5_1_r… |
| (Conv2D)            | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block5_2_bn   | (None, 14, 14,     |      1,024 |
```

```
conv4_block5_2_c… │
│ (BatchNormalizatio… │ 256)               │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block5_2_relu │ (None, 14, 14,     │          0 │
conv4_block5_2_b… │
│ (Activation)        │ 256)               │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block5_3_conv │ (None, 14, 14,     │    263,168 │
conv4_block5_2_r… │
│ (Conv2D)            │ 1024)              │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block5_3_bn   │ (None, 14, 14,     │      4,096 │
conv4_block5_3_c… │
│ (BatchNormalizatio… │ 1024)              │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block5_add    │ (None, 14, 14,     │          0 │
conv4_block4_out… │
│ (Add)               │ 1024)              │            │
conv4_block5_3_b… │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block5_out    │ (None, 14, 14,     │          0 │
conv4_block5_add… │
│ (Activation)        │ 1024)              │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block6_1_conv │ (None, 14, 14,     │    262,400 │
conv4_block5_out… │
│ (Conv2D)            │ 256)               │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block6_1_bn   │ (None, 14, 14,     │      1,024 │
conv4_block6_1_c… │
│ (BatchNormalizatio… │ 256)               │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block6_1_relu │ (None, 14, 14,     │          0 │
conv4_block6_1_b… │
```

```
| (Activation)         | 256)                |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block6_2_conv | (None, 14, 14,     |    590,080 |
conv4_block6_1_r… |
| (Conv2D)             | 256)                |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block6_2_bn    | (None, 14, 14,     |      1,024 |
conv4_block6_2_c… |
| (BatchNormalizatio… | 256)                |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block6_2_relu | (None, 14, 14,     |          0 |
conv4_block6_2_b… |
| (Activation)         | 256)                |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block6_3_conv | (None, 14, 14,     |    263,168 |
conv4_block6_2_r… |
| (Conv2D)             | 1024)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block6_3_bn    | (None, 14, 14,     |      4,096 |
conv4_block6_3_c… |
| (BatchNormalizatio… | 1024)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block6_add     | (None, 14, 14,     |          0 |
conv4_block5_out… |
| (Add)                | 1024)               |             |
conv4_block6_3_b… |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block6_out     | (None, 14, 14,     |          0 |
conv4_block6_add… |
| (Activation)         | 1024)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block7_1_conv | (None, 14, 14,     |    262,400 |
conv4_block6_out… |
| (Conv2D)             | 256)                |             |
```

```
│
├─────────────────────┼──────────────────┼──────────────┼──────────────
───────┤
│ conv4_block7_1_bn   │ (None, 14, 14,   │        1,024 │
conv4_block7_1_c… │
│ (BatchNormalizatio… │ 256)             │              │
│
├─────────────────────┼──────────────────┼──────────────┼──────────────
───────┤
│ conv4_block7_1_relu │ (None, 14, 14,   │            0 │
conv4_block7_1_b… │
│ (Activation)        │ 256)             │              │
│
├─────────────────────┼──────────────────┼──────────────┼──────────────
───────┤
│ conv4_block7_2_conv │ (None, 14, 14,   │      590,080 │
conv4_block7_1_r… │
│ (Conv2D)            │ 256)             │              │
│
├─────────────────────┼──────────────────┼──────────────┼──────────────
───────┤
│ conv4_block7_2_bn   │ (None, 14, 14,   │        1,024 │
conv4_block7_2_c… │
│ (BatchNormalizatio… │ 256)             │              │
│
├─────────────────────┼──────────────────┼──────────────┼──────────────
───────┤
│ conv4_block7_2_relu │ (None, 14, 14,   │            0 │
conv4_block7_2_b… │
│ (Activation)        │ 256)             │              │
│
├─────────────────────┼──────────────────┼──────────────┼──────────────
───────┤
│ conv4_block7_3_conv │ (None, 14, 14,   │      263,168 │
conv4_block7_2_r… │
│ (Conv2D)            │ 1024)            │              │
│
├─────────────────────┼──────────────────┼──────────────┼──────────────
───────┤
│ conv4_block7_3_bn   │ (None, 14, 14,   │        4,096 │
conv4_block7_3_c… │
│ (BatchNormalizatio… │ 1024)            │              │
│
├─────────────────────┼──────────────────┼──────────────┼──────────────
───────┤
│ conv4_block7_add    │ (None, 14, 14,   │            0 │
conv4_block6_out… │
│ (Add)               │ 1024)            │              │
conv4_block7_3_b… │
```

```
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block7_out    │ (None, 14, 14,      │           0 │
conv4_block7_add… │
│ (Activation)        │ 1024)               │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block8_1_conv │ (None, 14, 14,      │     262,400 │
conv4_block7_out… │
│ (Conv2D)            │ 256)                │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block8_1_bn   │ (None, 14, 14,      │       1,024 │
conv4_block8_1_c… │
│ (BatchNormalizatio… │ 256)                │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block8_1_relu │ (None, 14, 14,      │           0 │
conv4_block8_1_b… │
│ (Activation)        │ 256)                │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block8_2_conv │ (None, 14, 14,      │     590,080 │
conv4_block8_1_r… │
│ (Conv2D)            │ 256)                │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block8_2_bn   │ (None, 14, 14,      │       1,024 │
conv4_block8_2_c… │
│ (BatchNormalizatio… │ 256)                │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block8_2_relu │ (None, 14, 14,      │           0 │
conv4_block8_2_b… │
│ (Activation)        │ 256)                │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block8_3_conv │ (None, 14, 14,      │     263,168 │
conv4_block8_2_r… │
│ (Conv2D)            │ 1024)               │             │
│
├─────────────────────┼─────────────────────┼─────────────┼──────────────────
```

```
──────┤
│ conv4_block8_3_bn   │ (None, 14, 14,     │       4,096 │
conv4_block8_3_c… │
│ (BatchNormalizatio… │ 1024)              │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block8_add    │ (None, 14, 14,     │           0 │
conv4_block7_out… │
│ (Add)               │ 1024)              │             │
conv4_block8_3_b… │
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block8_out    │ (None, 14, 14,     │           0 │
conv4_block8_add… │
│ (Activation)        │ 1024)              │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block9_1_conv │ (None, 14, 14,     │     262,400 │
conv4_block8_out… │
│ (Conv2D)            │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block9_1_bn   │ (None, 14, 14,     │       1,024 │
conv4_block9_1_c… │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block9_1_relu │ (None, 14, 14,     │           0 │
conv4_block9_1_b… │
│ (Activation)        │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block9_2_conv │ (None, 14, 14,     │     590,080 │
conv4_block9_1_r… │
│ (Conv2D)            │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block9_2_bn   │ (None, 14, 14,     │       1,024 │
conv4_block9_2_c… │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
```

```
| conv4_block9_2_relu | (None, 14, 14,    |           0 |
conv4_block9_2_b… |
| (Activation)        | 256)              |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────
──────┤
| conv4_block9_3_conv | (None, 14, 14,    |     263,168 |
conv4_block9_2_r… |
| (Conv2D)            | 1024)             |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────
──────┤
| conv4_block9_3_bn   | (None, 14, 14,    |       4,096 |
conv4_block9_3_c… |
| (BatchNormalizatio… | 1024)             |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────
──────┤
| conv4_block9_add    | (None, 14, 14,    |           0 |
conv4_block8_out… |
| (Add)               | 1024)             |             |
conv4_block9_3_b… |
├─────────────────────┼───────────────────┼─────────────┼──────────────
──────┤
| conv4_block9_out    | (None, 14, 14,    |           0 |
conv4_block9_add… |
| (Activation)        | 1024)             |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────
──────┤
| conv4_block10_1_co… | (None, 14, 14,    |     262,400 |
conv4_block9_out… |
| (Conv2D)            | 256)              |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────
──────┤
| conv4_block10_1_bn  | (None, 14, 14,    |       1,024 |
conv4_block10_1_… |
| (BatchNormalizatio… | 256)              |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────
──────┤
| conv4_block10_1_re… | (None, 14, 14,    |           0 |
conv4_block10_1_… |
| (Activation)        | 256)              |             |
|
├─────────────────────┼───────────────────┼─────────────┼──────────────
──────┤
| conv4_block10_2_co… | (None, 14, 14,    |     590,080 |
conv4_block10_1_… |
```

```
| (Conv2D)              | 256)                 |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────
──────┤
| conv4_block10_2_bn    | (None, 14, 14,       |       1,024 |
conv4_block10_2_… |
| (BatchNormalizatio… | 256)                 |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────
──────┤
| conv4_block10_2_re… | (None, 14, 14,       |           0 |
conv4_block10_2_… |
| (Activation)          | 256)                 |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────
──────┤
| conv4_block10_3_co… | (None, 14, 14,       |     263,168 |
conv4_block10_2_… |
| (Conv2D)              | 1024)                |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────
──────┤
| conv4_block10_3_bn    | (None, 14, 14,       |       4,096 |
conv4_block10_3_… |
| (BatchNormalizatio… | 1024)                |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────
──────┤
| conv4_block10_add     | (None, 14, 14,       |           0 |
conv4_block9_out… |
| (Add)                 | 1024)                |             |
conv4_block10_3_… |
├───────────────────────┼──────────────────────┼─────────────┼──────────
──────┤
| conv4_block10_out     | (None, 14, 14,       |           0 |
conv4_block10_ad… |
| (Activation)          | 1024)                |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────
──────┤
| conv4_block11_1_co… | (None, 14, 14,       |     262,400 |
conv4_block10_ou… |
| (Conv2D)              | 256)                 |             |
|                       |                      |             |
├───────────────────────┼──────────────────────┼─────────────┼──────────
──────┤
| conv4_block11_1_bn    | (None, 14, 14,       |       1,024 |
conv4_block11_1_… |
| (BatchNormalizatio… | 256)                 |             |
```

```
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block11_1_re… │ (None, 14, 14,     │           0 │
conv4_block11_1_… │
│ (Activation)         │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block11_2_co… │ (None, 14, 14,     │     590,080 │
conv4_block11_1_… │
│ (Conv2D)             │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block11_2_bn   │ (None, 14, 14,     │       1,024 │
conv4_block11_2_… │
│ (BatchNormalizatio… │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block11_2_re… │ (None, 14, 14,     │           0 │
conv4_block11_2_… │
│ (Activation)         │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block11_3_co… │ (None, 14, 14,     │     263,168 │
conv4_block11_2_… │
│ (Conv2D)             │ 1024)                │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block11_3_bn   │ (None, 14, 14,     │       4,096 │
conv4_block11_3_… │
│ (BatchNormalizatio… │ 1024)                │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block11_add    │ (None, 14, 14,     │           0 │
conv4_block10_ou… │
│ (Add)                │ 1024)                │             │
conv4_block11_3_… │
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block11_out    │ (None, 14, 14,     │           0 │
conv4_block11_ad… │
│ (Activation)         │ 1024)                │             │
│
```

```
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block12_1_co… │ (None, 14, 14,     │    262,400 │
conv4_block11_ou… │
│ (Conv2D)             │ 256)                 │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block12_1_bn   │ (None, 14, 14,     │      1,024 │
conv4_block12_1_… │
│ (BatchNormalizatio… │ 256)                 │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block12_1_re… │ (None, 14, 14,     │          0 │
conv4_block12_1_… │
│ (Activation)         │ 256)                 │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block12_2_co… │ (None, 14, 14,     │    590,080 │
conv4_block12_1_… │
│ (Conv2D)             │ 256)                 │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block12_2_bn   │ (None, 14, 14,     │      1,024 │
conv4_block12_2_… │
│ (BatchNormalizatio… │ 256)                 │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block12_2_re… │ (None, 14, 14,     │          0 │
conv4_block12_2_… │
│ (Activation)         │ 256)                 │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block12_3_co… │ (None, 14, 14,     │    263,168 │
conv4_block12_2_… │
│ (Conv2D)             │ 1024)                │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
──────┤
│ conv4_block12_3_bn   │ (None, 14, 14,     │      4,096 │
conv4_block12_3_… │
│ (BatchNormalizatio… │ 1024)                │            │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────
```

```
──────┤
│ conv4_block12_add   │ (None, 14, 14,     │           0 │
conv4_block11_ou… │
│ (Add)               │ 1024)              │             │
conv4_block12_3_… │
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block12_out   │ (None, 14, 14,     │           0 │
conv4_block12_ad… │
│ (Activation)        │ 1024)              │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block13_1_co… │ (None, 14, 14,     │     262,400 │
conv4_block12_ou… │
│ (Conv2D)            │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block13_1_bn  │ (None, 14, 14,     │       1,024 │
conv4_block13_1_… │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block13_1_re… │ (None, 14, 14,     │           0 │
conv4_block13_1_… │
│ (Activation)        │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block13_2_co… │ (None, 14, 14,     │     590,080 │
conv4_block13_1_… │
│ (Conv2D)            │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block13_2_bn  │ (None, 14, 14,     │       1,024 │
conv4_block13_2_… │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block13_2_re… │ (None, 14, 14,     │           0 │
conv4_block13_2_… │
│ (Activation)        │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
```

```
| conv4_block13_3_co… | (None, 14, 14,     |    263,168 |
conv4_block13_2_… |
| (Conv2D)            | 1024)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block13_3_bn  | (None, 14, 14,     |      4,096 |
conv4_block13_3_… |
| (BatchNormalizatio… | 1024)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block13_add   | (None, 14, 14,     |          0 |
conv4_block12_ou… |
| (Add)               | 1024)              |            |
conv4_block13_3_… |
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block13_out   | (None, 14, 14,     |          0 |
conv4_block13_ad… |
| (Activation)        | 1024)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block14_1_co… | (None, 14, 14,     |    262,400 |
conv4_block13_ou… |
| (Conv2D)            | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block14_1_bn  | (None, 14, 14,     |      1,024 |
conv4_block14_1_… |
| (BatchNormalizatio… | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block14_1_re… | (None, 14, 14,     |          0 |
conv4_block14_1_… |
| (Activation)        | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block14_2_co… | (None, 14, 14,     |    590,080 |
conv4_block14_1_… |
| (Conv2D)            | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block14_2_bn  | (None, 14, 14,     |      1,024 |
```

```
conv4_block14_2_… │
│ (BatchNormalizatio… │ 256)               │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block14_2_re… │ (None, 14, 14,     │          0 │
conv4_block14_2_… │
│ (Activation)        │ 256)               │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block14_3_co… │ (None, 14, 14,     │    263,168 │
conv4_block14_2_… │
│ (Conv2D)            │ 1024)              │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block14_3_bn  │ (None, 14, 14,     │      4,096 │
conv4_block14_3_… │
│ (BatchNormalizatio… │ 1024)              │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block14_add   │ (None, 14, 14,     │          0 │
conv4_block13_ou… │
│ (Add)               │ 1024)              │            │
conv4_block14_3_… │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block14_out   │ (None, 14, 14,     │          0 │
conv4_block14_ad… │
│ (Activation)        │ 1024)              │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block15_1_co… │ (None, 14, 14,     │    262,400 │
conv4_block14_ou… │
│ (Conv2D)            │ 256)               │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block15_1_bn  │ (None, 14, 14,     │      1,024 │
conv4_block15_1_… │
│ (BatchNormalizatio… │ 256)               │            │
├──────────────────────┼────────────────────┼────────────┼──────────────────
──────┤
│ conv4_block15_1_re… │ (None, 14, 14,     │          0 │
conv4_block15_1_… │
```

```
| (Activation)         | 256)                |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block15_2_co… | (None, 14, 14,      |     590,080 |
conv4_block15_1_… |
| (Conv2D)             | 256)                |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block15_2_bn   | (None, 14, 14,      |       1,024 |
conv4_block15_2_… |
| (BatchNormalizatio… | 256)                |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block15_2_re… | (None, 14, 14,      |           0 |
conv4_block15_2_… |
| (Activation)         | 256)                |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block15_3_co… | (None, 14, 14,      |     263,168 |
conv4_block15_2_… |
| (Conv2D)             | 1024)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block15_3_bn   | (None, 14, 14,      |       4,096 |
conv4_block15_3_… |
| (BatchNormalizatio… | 1024)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block15_add    | (None, 14, 14,      |           0 |
conv4_block14_ou… |
| (Add)                | 1024)               |             |
conv4_block15_3_… |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block15_out    | (None, 14, 14,      |           0 |
conv4_block15_ad… |
| (Activation)         | 1024)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv4_block16_1_co… | (None, 14, 14,      |     262,400 |
conv4_block15_ou… |
| (Conv2D)             | 256)                |             |
```

```
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block16_1_bn   │ (None, 14, 14,       │       1,024 │
conv4_block16_1_… │
│ (BatchNormalizatio… │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block16_1_re… │ (None, 14, 14,       │           0 │
conv4_block16_1_… │
│ (Activation)         │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block16_2_co… │ (None, 14, 14,       │     590,080 │
conv4_block16_1_… │
│ (Conv2D)             │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block16_2_bn   │ (None, 14, 14,       │       1,024 │
conv4_block16_2_… │
│ (BatchNormalizatio… │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block16_2_re… │ (None, 14, 14,       │           0 │
conv4_block16_2_… │
│ (Activation)         │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block16_3_co… │ (None, 14, 14,       │     263,168 │
conv4_block16_2_… │
│ (Conv2D)             │ 1024)                │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block16_3_bn   │ (None, 14, 14,       │       4,096 │
conv4_block16_3_… │
│ (BatchNormalizatio… │ 1024)                │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block16_add    │ (None, 14, 14,       │           0 │
conv4_block15_ou… │
│ (Add)                │ 1024)                │             │
conv4_block16_3_… │
```

```
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block16_out    │ (None, 14, 14,       │            0 │ conv4_block16_ad… │
│ (Activation)         │ 1024)                │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block17_1_co… │ (None, 14, 14,       │      262,400 │ conv4_block16_ou… │
│ (Conv2D)             │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block17_1_bn   │ (None, 14, 14,       │        1,024 │ conv4_block17_1_… │
│ (BatchNormalizatio… │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block17_1_re… │ (None, 14, 14,       │            0 │ conv4_block17_1_… │
│ (Activation)         │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block17_2_co… │ (None, 14, 14,       │      590,080 │ conv4_block17_1_… │
│ (Conv2D)             │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block17_2_bn   │ (None, 14, 14,       │        1,024 │ conv4_block17_2_… │
│ (BatchNormalizatio… │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block17_2_re… │ (None, 14, 14,       │            0 │ conv4_block17_2_… │
│ (Activation)         │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block17_3_co… │ (None, 14, 14,       │      263,168 │ conv4_block17_2_… │
│ (Conv2D)             │ 1024)                │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
```

```
──────┤
│ conv4_block17_3_bn  │ (None, 14, 14,     │       4,096 │
conv4_block17_3_… │
│ (BatchNormalizatio… │ 1024)              │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block17_add   │ (None, 14, 14,     │           0 │
conv4_block16_ou… │
│ (Add)               │ 1024)              │             │
conv4_block17_3_… │
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block17_out   │ (None, 14, 14,     │           0 │
conv4_block17_ad… │
│ (Activation)        │ 1024)              │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block18_1_co… │ (None, 14, 14,     │     262,400 │
conv4_block17_ou… │
│ (Conv2D)            │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block18_1_bn  │ (None, 14, 14,     │       1,024 │
conv4_block18_1_… │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block18_1_re… │ (None, 14, 14,     │           0 │
conv4_block18_1_… │
│ (Activation)        │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block18_2_co… │ (None, 14, 14,     │     590,080 │
conv4_block18_1_… │
│ (Conv2D)            │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block18_2_bn  │ (None, 14, 14,     │       1,024 │
conv4_block18_2_… │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
```

```
| conv4_block18_2_re… | (None, 14, 14,     |           0 |
conv4_block18_2_… |
| (Activation)        | 256)               |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block18_3_co… | (None, 14, 14,     |     263,168 |
conv4_block18_2_… |
| (Conv2D)            | 1024)              |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block18_3_bn  | (None, 14, 14,     |       4,096 |
conv4_block18_3_… |
| (BatchNormalizatio… | 1024)              |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block18_add   | (None, 14, 14,     |           0 |
conv4_block17_ou… |
| (Add)               | 1024)              |             |
conv4_block18_3_… |
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block18_out   | (None, 14, 14,     |           0 |
conv4_block18_ad… |
| (Activation)        | 1024)              |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block19_1_co… | (None, 14, 14,     |     262,400 |
conv4_block18_ou… |
| (Conv2D)            | 256)               |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block19_1_bn  | (None, 14, 14,     |       1,024 |
conv4_block19_1_… |
| (BatchNormalizatio… | 256)               |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block19_1_re… | (None, 14, 14,     |           0 |
conv4_block19_1_… |
| (Activation)        | 256)               |             |
|
├─────────────────────┼────────────────────┼─────────────┼──────────────
──────┤
| conv4_block19_2_co… | (None, 14, 14,     |     590,080 |
conv4_block19_1_… |
```

```
| (Conv2D)              | 256)                |             |
|                       |                     |             |
├───────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block19_2_bn    | (None, 14, 14,      |       1,024 |
conv4_block19_2_… |
| (BatchNormalizatio… | 256)                |             |
|                       |                     |             |
├───────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block19_2_re… | (None, 14, 14,      |           0 |
conv4_block19_2_… |
| (Activation)          | 256)                |             |
|                       |                     |             |
├───────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block19_3_co… | (None, 14, 14,      |     263,168 |
conv4_block19_2_… |
| (Conv2D)              | 1024)               |             |
|                       |                     |             |
├───────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block19_3_bn    | (None, 14, 14,      |       4,096 |
conv4_block19_3_… |
| (BatchNormalizatio… | 1024)               |             |
|                       |                     |             |
├───────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block19_add     | (None, 14, 14,      |           0 |
conv4_block18_ou… |
| (Add)                 | 1024)               |             |
conv4_block19_3_… |
├───────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block19_out     | (None, 14, 14,      |           0 |
conv4_block19_ad… |
| (Activation)          | 1024)               |             |
|                       |                     |             |
├───────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block20_1_co… | (None, 14, 14,      |     262,400 |
conv4_block19_ou… |
| (Conv2D)              | 256)                |             |
|                       |                     |             |
├───────────────────────┼─────────────────────┼─────────────┼──────────
──────┤
| conv4_block20_1_bn    | (None, 14, 14,      |       1,024 |
conv4_block20_1_… |
| (BatchNormalizatio… | 256)                |             |
```

```
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block20_1_re… │ (None, 14, 14,     │           0 │
conv4_block20_1_… │
│ (Activation)         │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block20_2_co… │ (None, 14, 14,     │     590,080 │
conv4_block20_1_… │
│ (Conv2D)             │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block20_2_bn   │ (None, 14, 14,     │       1,024 │
conv4_block20_2_… │
│ (BatchNormalizatio… │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block20_2_re… │ (None, 14, 14,     │           0 │
conv4_block20_2_… │
│ (Activation)         │ 256)                 │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block20_3_co… │ (None, 14, 14,     │     263,168 │
conv4_block20_2_… │
│ (Conv2D)             │ 1024)                │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block20_3_bn   │ (None, 14, 14,     │       4,096 │
conv4_block20_3_… │
│ (BatchNormalizatio… │ 1024)                │             │
│
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block20_add    │ (None, 14, 14,     │           0 │
conv4_block19_ou… │
│ (Add)                │ 1024)                │             │
conv4_block20_3_… │
├──────────────────────┼──────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block20_out    │ (None, 14, 14,     │           0 │
conv4_block20_ad… │
│ (Activation)         │ 1024)                │             │
│
```

```
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block21_1_co… │ (None, 14, 14,       │      262,400 │ conv4_block20_ou… │
│ (Conv2D)             │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block21_1_bn   │ (None, 14, 14,       │        1,024 │ conv4_block21_1_… │
│ (BatchNormalizatio… │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block21_1_re… │ (None, 14, 14,       │            0 │ conv4_block21_1_… │
│ (Activation)         │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block21_2_co… │ (None, 14, 14,       │      590,080 │ conv4_block21_1_… │
│ (Conv2D)             │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block21_2_bn   │ (None, 14, 14,       │        1,024 │ conv4_block21_2_… │
│ (BatchNormalizatio… │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block21_2_re… │ (None, 14, 14,       │            0 │ conv4_block21_2_… │
│ (Activation)         │ 256)                 │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block21_3_co… │ (None, 14, 14,       │      263,168 │ conv4_block21_2_… │
│ (Conv2D)             │ 1024)                │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv4_block21_3_bn   │ (None, 14, 14,       │        4,096 │ conv4_block21_3_… │
│ (BatchNormalizatio… │ 1024)                │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
```

```
──────┤
│ conv4_block21_add   │ (None, 14, 14,     │           0 │
conv4_block20_ou… │
│ (Add)               │ 1024)              │             │
conv4_block21_3_… │
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block21_out   │ (None, 14, 14,     │           0 │
conv4_block21_ad… │
│ (Activation)        │ 1024)              │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block22_1_co… │ (None, 14, 14,     │     262,400 │
conv4_block21_ou… │
│ (Conv2D)            │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block22_1_bn  │ (None, 14, 14,     │       1,024 │
conv4_block22_1_… │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block22_1_re… │ (None, 14, 14,     │           0 │
conv4_block22_1_… │
│ (Activation)        │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block22_2_co… │ (None, 14, 14,     │     590,080 │
conv4_block22_1_… │
│ (Conv2D)            │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block22_2_bn  │ (None, 14, 14,     │       1,024 │
conv4_block22_2_… │
│ (BatchNormalizatio… │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
│ conv4_block22_2_re… │ (None, 14, 14,     │           0 │
conv4_block22_2_… │
│ (Activation)        │ 256)               │             │
│
├─────────────────────┼────────────────────┼─────────────┼──────────
──────┤
```

```
| conv4_block22_3_co… | (None, 14, 14,     |    263,168 |
conv4_block22_2_… |
| (Conv2D)            | 1024)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block22_3_bn  | (None, 14, 14,     |      4,096 |
conv4_block22_3_… |
| (BatchNormalizatio… | 1024)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block22_add   | (None, 14, 14,     |          0 |
conv4_block21_ou… |
| (Add)               | 1024)              |            |
conv4_block22_3_… |
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block22_out   | (None, 14, 14,     |          0 |
conv4_block22_ad… |
| (Activation)        | 1024)              |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block23_1_co… | (None, 14, 14,     |    262,400 |
conv4_block22_ou… |
| (Conv2D)            | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block23_1_bn  | (None, 14, 14,     |      1,024 |
conv4_block23_1_… |
| (BatchNormalizatio… | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block23_1_re… | (None, 14, 14,     |          0 |
conv4_block23_1_… |
| (Activation)        | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block23_2_co… | (None, 14, 14,     |    590,080 |
conv4_block23_1_… |
| (Conv2D)            | 256)               |            |
|
├─────────────────────┼────────────────────┼────────────┼──────────────
──────┤
| conv4_block23_2_bn  | (None, 14, 14,     |      1,024 |
```

```
conv4_block23_2_… │
│ (BatchNormalizatio… │ 256)               │             │
│                     │                    │             │
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block23_2_re… │ (None, 14, 14,     │           0 │
conv4_block23_2_… │
│ (Activation)        │ 256)               │             │
│                     │                    │             │
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block23_3_co… │ (None, 14, 14,     │     263,168 │
conv4_block23_2_… │
│ (Conv2D)            │ 1024)              │             │
│                     │                    │             │
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block23_3_bn  │ (None, 14, 14,     │       4,096 │
conv4_block23_3_… │
│ (BatchNormalizatio… │ 1024)              │             │
│                     │                    │             │
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block23_add   │ (None, 14, 14,     │           0 │
conv4_block22_ou… │
│ (Add)               │ 1024)              │             │
conv4_block23_3_… │
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv4_block23_out   │ (None, 14, 14,     │           0 │
conv4_block23_ad… │
│ (Activation)        │ 1024)              │             │
│                     │                    │             │
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv5_block1_1_conv │ (None, 7, 7, 512)  │     524,800 │
conv4_block23_ou… │
│ (Conv2D)            │                    │             │
│                     │                    │             │
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv5_block1_1_bn   │ (None, 7, 7, 512)  │       2,048 │
conv5_block1_1_c… │
│ (BatchNormalizatio… │                    │             │
│                     │                    │             │
├─────────────────────┼────────────────────┼─────────────┼──────────────────
──────┤
│ conv5_block1_1_relu │ (None, 7, 7, 512)  │           0 │
conv5_block1_1_b… │
```

```
| (Activation)         |                     |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv5_block1_2_conv | (None, 7, 7, 512) |  2,359,808 |
conv5_block1_1_r… |
| (Conv2D)             |                     |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv5_block1_2_bn   | (None, 7, 7, 512) |      2,048 |
conv5_block1_2_c… |
| (BatchNormalizatio… |                     |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv5_block1_2_relu | (None, 7, 7, 512) |          0 |
conv5_block1_2_b… |
| (Activation)         |                     |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv5_block1_0_conv | (None, 7, 7,       |  2,099,200 |
conv4_block23_ou… |
| (Conv2D)             | 2048)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv5_block1_3_conv | (None, 7, 7,       |  1,050,624 |
conv5_block1_2_r… |
| (Conv2D)             | 2048)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv5_block1_0_bn   | (None, 7, 7,       |      8,192 |
conv5_block1_0_c… |
| (BatchNormalizatio… | 2048)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv5_block1_3_bn   | (None, 7, 7,       |      8,192 |
conv5_block1_3_c… |
| (BatchNormalizatio… | 2048)               |             |
|                      |                     |             |
├──────────────────────┼─────────────────────┼─────────────┼──────────────
──────┤
| conv5_block1_add    | (None, 7, 7,       |          0 |
conv5_block1_0_b… |
| (Add)                | 2048)               |             |
```

```
conv5_block1_3_b… │
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ conv5_block1_out     │ (None, 7, 7,         │            0 │
conv5_block1_add… │
│ (Activation)         │ 2048)                │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ conv5_block2_1_conv  │ (None, 7, 7, 512)    │    1,049,088 │
conv5_block1_out… │
│ (Conv2D)             │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ conv5_block2_1_bn    │ (None, 7, 7, 512)    │        2,048 │
conv5_block2_1_c… │
│ (BatchNormalizatio… │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ conv5_block2_1_relu  │ (None, 7, 7, 512)    │            0 │
conv5_block2_1_b… │
│ (Activation)         │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ conv5_block2_2_conv  │ (None, 7, 7, 512)    │    2,359,808 │
conv5_block2_1_r… │
│ (Conv2D)             │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ conv5_block2_2_bn    │ (None, 7, 7, 512)    │        2,048 │
conv5_block2_2_c… │
│ (BatchNormalizatio… │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ conv5_block2_2_relu  │ (None, 7, 7, 512)    │            0 │
conv5_block2_2_b… │
│ (Activation)         │                      │              │
│
├──────────────────────┼──────────────────────┼──────────────┼──────────────
──────┤
│ conv5_block2_3_conv  │ (None, 7, 7,         │    1,050,624 │
conv5_block2_2_r… │
│ (Conv2D)             │ 2048)                │              │
│
```

```
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv5_block2_3_bn    │ (None, 7, 7,         │        8,192 │ conv5_block2_3_c… │
│ (BatchNormalizatio… │ 2048)                │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv5_block2_add     │ (None, 7, 7,         │            0 │ conv5_block1_out… │
│ (Add)                │ 2048)                │              │ conv5_block2_3_b… │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv5_block2_out     │ (None, 7, 7,         │            0 │ conv5_block2_add… │
│ (Activation)         │ 2048)                │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv5_block3_1_conv  │ (None, 7, 7, 512)    │    1,049,088 │ conv5_block2_out… │
│ (Conv2D)             │                      │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv5_block3_1_bn    │ (None, 7, 7, 512)    │        2,048 │ conv5_block3_1_c… │
│ (BatchNormalizatio… │                      │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv5_block3_1_relu  │ (None, 7, 7, 512)    │            0 │ conv5_block3_1_b… │
│ (Activation)         │                      │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv5_block3_2_conv  │ (None, 7, 7, 512)    │    2,359,808 │ conv5_block3_1_r… │
│ (Conv2D)             │                      │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
│ conv5_block3_2_bn    │ (None, 7, 7, 512)    │        2,048 │ conv5_block3_2_c… │
│ (BatchNormalizatio… │                      │              │                      │
├──────────────────────┼──────────────────────┼──────────────┼──────────────────────┤
```

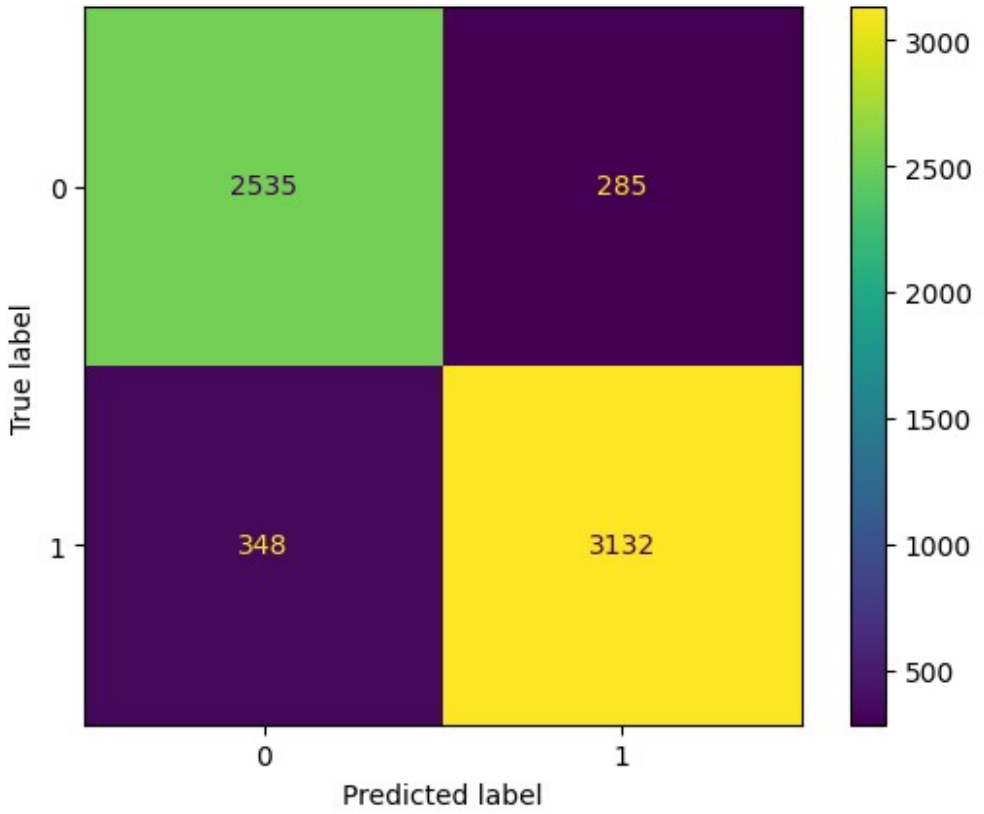
```
──────┤
│ conv5_block3_2_relu │ (None, 7, 7, 512) │          0 │
conv5_block3_2_b… │
│ (Activation)        │                   │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ conv5_block3_3_conv │ (None, 7, 7,      │  1,050,624 │
conv5_block3_2_r… │
│ (Conv2D)            │ 2048)             │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ conv5_block3_3_bn   │ (None, 7, 7,      │      8,192 │
conv5_block3_3_c… │
│ (BatchNormalizatio… │ 2048)             │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ conv5_block3_add    │ (None, 7, 7,      │          0 │
conv5_block2_out… │
│ (Add)               │ 2048)             │            │
conv5_block3_3_b… │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ conv5_block3_out    │ (None, 7, 7,      │          0 │
conv5_block3_add… │
│ (Activation)        │ 2048)             │            │
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ flatten_1 (Flatten) │ (None, 100352)    │          0 │
conv5_block3_out… │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ dense_3 (Dense)     │ (None, 512)       │ 51,380,736 │ flatten_1[0]
[0]   │
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ dense_4 (Dense)     │ (None, 128)       │     65,664 │ dense_3[0][0]
│
├─────────────────────┼───────────────────┼────────────┼──────────────────
──────┤
│ dense_5 (Dense)     │ (None, 2)         │        258 │ dense_4[0][0]
│
└─────────────────────┴───────────────────┴────────────┴──────────────────
──────┘

 Total params: 94,104,834 (358.98 MB)
```

```
 Trainable params: 51,446,658 (196.25 MB)

 Non-trainable params: 42,658,176 (162.73 MB)
```

```
callback = EarlyStopping(monitor='val_accuracy', patience=5,
restore_best_weights=True)

logs2 = model.fit(train_generator,
                  epochs = 10,
                  steps_per_epoch=int(30250/50),
                  validation_data = valid_generator,
                  validation_steps=int(6300/50),
                  callbacks=[callback])
```

```
Epoch 1/10

/opt/conda/lib/python3.10/site-packages/keras/src/trainers/
data_adapters/py_dataset_adapter.py:120: UserWarning: Your `PyDataset`
class should call `super().__init__(**kwargs)` in its constructor.
`**kwargs` can include `workers`, `use_multiprocessing`,
`max_queue_size`. Do not pass these arguments to `fit()`, as they will
be ignored.
  self._warn_if_super_not_called()

  1/605 ━━━━━━━━━━━━━━━━━━━━ 5:09:33 31s/step - AUC: 0.6416 -
accuracy: 0.5400 - loss: 0.7790

WARNING: All log messages before absl::InitializeLog() is called are
written to STDERR
I0000 00:00:1713969455.483947      99 device_compiler.h:186] Compiled
cluster using XLA!  This line is logged at most once for the lifetime
of the process.
W0000 00:00:1713969455.571727      99 graph_launch.cc:671] Fallback to
op-by-op mode because memset node breaks graph update

605/605 ━━━━━━━━━━━━━━━━━━━━ 0s 837ms/step - AUC: 0.8489 - accuracy:
0.8075 - loss: 1.3595

W0000 00:00:1713969970.033867     100 graph_launch.cc:671] Fallback to
op-by-op mode because memset node breaks graph update

605/605 ━━━━━━━━━━━━━━━━━━━━ 661s 1s/step - AUC: 0.8490 - accuracy:
0.8076 - loss: 1.3583 - val_AUC: 0.9444 - val_accuracy: 0.8817 -
val_loss: 0.3046
Epoch 2/10
605/605 ━━━━━━━━━━━━━━━━━━━━ 0s 129us/step - AUC: 0.0000e+00 -
accuracy: 0.0000e+00 - loss: 0.0000e+00 - val_AUC: 0.0000e+00 -
val_accuracy: 0.0000e+00 - val_loss: 0.0000e+00
Epoch 3/10

/opt/conda/lib/python3.10/contextlib.py:153: UserWarning: Your input
ran out of data; interrupting training. Make sure that your dataset or
```

```
generator can generate at least `steps_per_epoch * epochs` batches.
You may need to use the `.repeat()` function when building your
dataset.
  self.gen.throw(typ, value, traceback)

605/605 ━━━━━━━━━━━━━━━━━━━━ 445s 729ms/step - AUC: 0.9280 - accuracy:
0.8667 - loss: 0.3398 - val_AUC: 0.9478 - val_accuracy: 0.8722 -
val_loss: 0.3313
Epoch 4/10
605/605 ━━━━━━━━━━━━━━━━━━━━ 0s 53us/step - AUC: 0.0000e+00 -
accuracy: 0.0000e+00 - loss: 0.0000e+00 - val_AUC: 0.0000e+00 -
val_accuracy: 0.0000e+00 - val_loss: 0.0000e+00
Epoch 5/10
605/605 ━━━━━━━━━━━━━━━━━━━━ 430s 705ms/step - AUC: 0.9371 - accuracy:
0.8722 - loss: 0.3188 - val_AUC: 0.9565 - val_accuracy: 0.8873 -
val_loss: 0.2696
Epoch 6/10
605/605 ━━━━━━━━━━━━━━━━━━━━ 0s 58us/step - AUC: 0.0000e+00 -
accuracy: 0.0000e+00 - loss: 0.0000e+00 - val_AUC: 0.0000e+00 -
val_accuracy: 0.0000e+00 - val_loss: 0.0000e+00
Epoch 7/10
605/605 ━━━━━━━━━━━━━━━━━━━━ 430s 705ms/step - AUC: 0.9423 - accuracy:
0.8785 - loss: 0.3049 - val_AUC: 0.9505 - val_accuracy: 0.8897 -
val_loss: 0.2817
Epoch 8/10

# resnet101_model= load_model("Model_resnet.h5")
test_generator.reset()
prediction4 = model.predict(test_generator)
y_prediction4 = np.argmax(prediction4, axis=1)

conf_matrix = confusion_matrix(y_true=test_generator.classes,
y_pred=y_prediction4)
ConfusionMatrixDisplay(conf_matrix,
display_labels=class_labels).plot()

126/126 ━━━━━━━━━━━━━━━━━━━━ 71s 561ms/step

<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at
0x7f7c5c349ab0>
```




```
model.save("imported_model.keras")

acc_resnet = accuracy_score(y_true=test_generator.classes,
y_pred=y_prediction4)
print(f"Accuracy of Resnet model: {acc_resnet*100:.1f}%")

Accuracy of Resnet model: 90.0%

visualkeras.layered_view(model,legend=True, to_file='ResNet101.png')
```

```
resnet101.save("imported_model.keras")

from keras.models import load_model

# Load the HDF5 model
loaded_model = load_model('/kaggle/working/imported_model.keras')

test_generator.reset()
prediction_3 = loaded_model.predict(test_generator)

acc_loaded_resnet = accuracy_score(y_true=test_generator.classes,
```

```
y_pred=prediction_3)
print(f"Accuracy of Resnet model: {acc_loaded_resnet*100:.1f}%")

  2/126 ━━━━━━━━━━━━━━━━━━━━ 9s 73ms/step

W0000 00:00:1713972234.893598     101 graph_launch.cc:671] Fallback to
op-by-op mode because memset node breaks graph update

126/126 ━━━━━━━━━━━━━━━━━━━━ 78s 564ms/step

---------------------------------------------------------------------------
-----
ValueError                                Traceback (most recent call
last)
Cell In[23], line 9
      6 test_generator.reset()
      7 prediction_3 = loaded_model.predict(test_generator)
----> 9 acc_loaded_resnet =
accuracy_score(y_true=test_generator.classes, y_pred=prediction_3)
     10 print(f"Accuracy of Resnet model: {acc_loaded_resnet*100:.1f}
%")

File
/opt/conda/lib/python3.10/site-packages/sklearn/utils/_param_validatio
n.py:192, in
validate_params.<locals>.decorator.<locals>.wrapper(*args, **kwargs)
    187 validate_parameter_constraints(
    188     parameter_constraints, params,
caller_name=func.__qualname__
    189 )
    191 try:
--> 192     return func(*args, **kwargs)
    193 except InvalidParameterError as e:
    194     # When the function is just a wrapper around an estimator,
we allow
    195     # the function to delegate validation to the estimator,
but we replace
    196     # the name of the estimator by the name of the function in
the error
    197     # message to avoid confusion.
    198     msg = re.sub(
    199         r"parameter of \w+ must be",
    200         f"parameter of {func.__qualname__} must be",
    201         str(e),
    202     )

File
/opt/conda/lib/python3.10/site-packages/sklearn/metrics/_classificatio
n.py:221, in accuracy_score(y_true, y_pred, normalize, sample_weight)
    155 """Accuracy classification score.
```

```
    156
    157 In multilabel classification, this function computes subset
accuracy:
   (...)
    217 0.5
    218 """
    220 # Compute accuracy for each possible representation
--> 221 y_type, y_true, y_pred = _check_targets(y_true, y_pred)
    222 check_consistent_length(y_true, y_pred, sample_weight)
    223 if y_type.startswith("multilabel"):

File
/opt/conda/lib/python3.10/site-packages/sklearn/metrics/_classificatio
n.py:95, in _check_targets(y_true, y_pred)
     92     y_type = {"multiclass"}
     94 if len(y_type) > 1:
---> 95     raise ValueError(
     96         "Classification metrics can't handle a mix of {0} and
{1} targets".format(
     97             type_true, type_pred
     98         )
     99     )
    101 # We can't have more than one value on y_type => The set is no
more needed
    102 y_type = y_type.pop()

ValueError: Classification metrics can't handle a mix of binary and
continuous-multioutput targets
```