Clustering - Adult Dataset

Prepared by

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Objective of the porject

The goal of this machine learning project is **to predict whether a person makes over 50K a year** or not given their demographic variation. To achieve this, several classification techniques

In [3]:
```
!pip install pycaret
```

```
WARNING: Keyring is skipped due to an exception: Failed to unlock the colle
ction!
Collecting pycaret
  Using cached pycaret-2.3.10-py3-none-any.whl (320 kB)
Collecting wordcloud
  Downloading wordcloud-1.8.2.2-cp38-cp38-manylinux_2_17_x86_64.manylinux20
14_x86_64.whl (458 kB)
     |████████████████████████████████| 458 kB 1.3 MB/s eta 0:00:01
Requirement already satisfied: numba<0.55 in /home/damar.pramuditya/.pyenv/
versions/anaconda3-2020.11/lib/python3.8/site-packages (from pycaret) (0.5
1.2)
Requirement already satisfied: scikit-learn==0.23.2 in /home/damar.pramudit
ya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from pyca
ret) (0.23.2)
Collecting spacy<2.4.0
  Downloading spacy-2.3.8-cp38-cp38-manylinux_2_17_x86_64.manylinux2014_x86
_64.whl (5.0 MB)
     |████████████████████████████████| 5.0 MB 1.2 MB/s eta 0:00:01
Collecting pandas-profiling>=2.8.0
  Using cached pandas_profiling-3.4.0-py2.py3-none-any.whl (315 kB)
Requirement already satisfied: pyyaml<6.0.0 in /home/damar.pramuditya/.pyen
v/versions/anaconda3-2020.11/lib/python3.8/site-packages (from pycaret) (5.
3.1)
Collecting textblob
  Using cached textblob-0.17.1-py2.py3-none-any.whl (636 kB)
Requirement already satisfied: matplotlib in /home/damar.pramuditya/.pyenv/
versions/anaconda3-2020.11/lib/python3.8/site-packages (from pycaret) (3.3.
2)
Collecting pyLDAvis
  Using cached pyLDAvis-3.3.1.tar.gz (1.7 MB)
  Installing build dependencies ... done
  Getting requirements to build wheel ... done
  Installing backend dependencies ... done
    Preparing wheel metadata ... done
Requirement already satisfied: pandas in /home/damar.pramuditya/.pyenv/vers
ions/anaconda3-2020.11/lib/python3.8/site-packages (from pycaret) (1.1.3)
Collecting umap-learn
  Using cached umap-learn-0.5.3.tar.gz (88 kB)
Collecting yellowbrick>=1.0.1
  Using cached yellowbrick-1.5-py3-none-any.whl (282 kB)
Requirement already satisfied: seaborn in /home/damar.pramuditya/.pyenv/ver
sions/anaconda3-2020.11/lib/python3.8/site-packages (from pycaret) (0.11.0)
Collecting gensim<4.0.0
  Downloading gensim-3.8.3-cp38-cp38-manylinux1_x86_64.whl (24.2 MB)
```

```
     |████████████████████████████████| 24.2 MB 1.2 MB/s eta 0:00:01
Collecting cufflinks>=0.17.0
  Using cached cufflinks-0.17.3.tar.gz (81 kB)
Collecting mlxtend>=0.17.0
  Using cached mlxtend-0.21.0-py2.py3-none-any.whl (1.3 MB)
Collecting mlflow
  Using cached mlflow-1.30.0-py3-none-any.whl (17.0 MB)
Requirement already satisfied: joblib in /home/damar.pramuditya/.pyenv/vers
ions/anaconda3-2020.11/lib/python3.8/site-packages (from pycaret) (0.17.0)
Collecting plotly>=4.4.1
  Downloading plotly-5.11.0-py2.py3-none-any.whl (15.3 MB)
     |████████████████████████████████| 15.3 MB 1.1 MB/s eta 0:00:01    |██
███████████████                  | 8.2 MB 935 kB/s eta 0:00:08
Requirement already satisfied: scipy<=1.5.4 in /home/damar.pramuditya/.pyen
v/versions/anaconda3-2020.11/lib/python3.8/site-packages (from pycaret) (1.
5.2)
Requirement already satisfied: ipywidgets in /home/damar.pramuditya/.pyenv/
versions/anaconda3-2020.11/lib/python3.8/site-packages (from pycaret) (7.5.
1)
Collecting pyod
  Using cached pyod-1.0.6.tar.gz (141 kB)
Requirement already satisfied: IPython in /home/damar.pramuditya/.pyenv/ver
sions/anaconda3-2020.11/lib/python3.8/site-packages (from pycaret) (7.19.0)
Requirement already satisfied: nltk in /home/damar.pramuditya/.pyenv/versio
ns/anaconda3-2020.11/lib/python3.8/site-packages (from pycaret) (3.5)
Collecting imbalanced-learn==0.7.0
  Using cached imbalanced_learn-0.7.0-py3-none-any.whl (167 kB)
Collecting Boruta
  Using cached Boruta-0.3-py3-none-any.whl (56 kB)
Collecting kmodes>=0.10.1
  Using cached kmodes-0.12.2-py2.py3-none-any.whl (20 kB)
Collecting scikit-plot
  Using cached scikit_plot-0.3.7-py3-none-any.whl (33 kB)
Collecting lightgbm>=2.3.1
  Using cached lightgbm-3.3.3-py3-none-manylinux1_x86_64.whl (2.0 MB)
Requirement already satisfied: pillow in /home/damar.pramuditya/.pyenv/vers
ions/anaconda3-2020.11/lib/python3.8/site-packages (from wordcloud->pycare
t) (8.0.1)
Requirement already satisfied: numpy>=1.6.1 in /home/damar.pramuditya/.pyen
v/versions/anaconda3-2020.11/lib/python3.8/site-packages (from wordcloud->p
ycaret) (1.19.2)
Requirement already satisfied: llvmlite<0.35,>=0.34.0.dev0 in /home/damar.p
ramuditya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (fr
om numba<0.55->pycaret) (0.34.0)
Requirement already satisfied: setuptools in /home/damar.pramuditya/.pyenv/
versions/anaconda3-2020.11/lib/python3.8/site-packages (from numba<0.55->py
caret) (50.3.1.post20201107)
Requirement already satisfied: threadpoolctl>=2.0.0 in /home/damar.pramudit
ya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from scik
it-learn==0.23.2->pycaret) (2.1.0)
Collecting blis<0.8.0,>=0.4.0
  Downloading blis-0.7.9-cp38-cp38-manylinux_2_17_x86_64.manylinux2014_x86_
64.whl (10.2 MB)
     |████████████████████████████████| 10.2 MB 1.3 MB/s eta 0:00:01
Requirement already satisfied: tqdm<5.0.0,>=4.38.0 in /home/damar.pramudity
a/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from spacy
<2.4.0->pycaret) (4.50.2)
Requirement already satisfied: requests<3.0.0,>=2.13.0 in /home/damar.pramu
ditya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from s
pacy<2.4.0->pycaret) (2.24.0)
Collecting thinc<7.5.0,>=7.4.1
  Downloading thinc-7.4.6-cp38-cp38-manylinux_2_17_x86_64.manylinux2014_x86
_64.whl (1.1 MB)
     |████████████████████████████████| 1.1 MB 775 kB/s eta 0:00:01
```

```
Collecting cymem<2.1.0,>=2.0.2
  Downloading cymem-2.0.7-cp38-cp38-manylinux_2_17_x86_64.manylinux2014_x86
_64.whl (36 kB)
Collecting catalogue<1.1.0,>=0.0.7
  Using cached catalogue-1.0.2-py2.py3-none-any.whl (16 kB)
Collecting preshed<3.1.0,>=3.0.2
  Downloading preshed-3.0.8-cp38-cp38-manylinux_2_5_x86_64.manylinux1_x86_6
4.manylinux_2_17_x86_64.manylinux2014_x86_64.whl (130 kB)
     |████████████████████████████████| 130 kB 1.2 MB/s eta 0:00:01
Collecting srsly<1.1.0,>=1.0.2
  Downloading srsly-1.0.6-cp38-cp38-manylinux_2_17_x86_64.manylinux2014_x86
_64.whl (211 kB)
     |████████████████████████████████| 211 kB 1.4 MB/s eta 0:00:01
Collecting plac<1.2.0,>=0.9.6
  Using cached plac-1.1.3-py2.py3-none-any.whl (20 kB)
Collecting wasabi<1.1.0,>=0.4.0
  Using cached wasabi-0.10.1-py3-none-any.whl (26 kB)
Collecting murmurhash<1.1.0,>=0.28.0
  Downloading murmurhash-1.0.9-cp38-cp38-manylinux_2_5_x86_64.manylinux1_x8
6_64.manylinux_2_17_x86_64.manylinux2014_x86_64.whl (21 kB)
Collecting visions[type_image_path]==0.7.5
  Using cached visions-0.7.5-py3-none-any.whl (102 kB)
Collecting htmlmin==0.1.12
  Using cached htmlmin-0.1.12.tar.gz (19 kB)
Collecting phik<0.13,>=0.11.1
  Downloading phik-0.12.2-cp38-cp38-manylinux_2_17_x86_64.manylinux2014_x86
_64.whl (696 kB)
     |████████████████████████████████| 696 kB 1.4 MB/s eta 0:00:01
Collecting multimethod<1.10,>=1.4
  Using cached multimethod-1.9-py3-none-any.whl (10 kB)
Collecting pydantic<1.11,>=1.8.1
  Downloading pydantic-1.10.2-cp38-cp38-manylinux_2_17_x86_64.manylinux2014
_x86_64.whl (13.6 MB)
     |████████████████████████████████| 13.6 MB 291 kB/s eta 0:00:01
Collecting missingno<0.6,>=0.4.2
  Using cached missingno-0.5.1-py3-none-any.whl (8.7 kB)
Collecting statsmodels<0.14,>=0.13.2
  Downloading statsmodels-0.13.2-cp38-cp38-manylinux_2_17_x86_64.manylinux2
014_x86_64.whl (9.9 MB)
     |████████████████████████████████| 9.9 MB 406 kB/s eta 0:00:01
Requirement already satisfied: jinja2<3.2,>=2.11.1 in /home/damar.pramudity
a/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from panda
s-profiling>=2.8.0->pycaret) (2.11.2)
Requirement already satisfied: kiwisolver>=1.0.1 in /home/damar.pramuditya
/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from matplo
tlib->pycaret) (1.3.0)
Requirement already satisfied: certifi>=2020.06.20 in /home/damar.pramudity
a/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from matpl
otlib->pycaret) (2020.6.20)
Requirement already satisfied: cycler>=0.10 in /home/damar.pramuditya/.pyen
v/versions/anaconda3-2020.11/lib/python3.8/site-packages (from matplotlib->
pycaret) (0.10.0)
Requirement already satisfied: python-dateutil>=2.1 in /home/damar.pramudit
ya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from matp
lotlib->pycaret) (2.8.1)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.3 in
/home/damar.pramuditya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site
-packages (from matplotlib->pycaret) (2.4.7)
Requirement already satisfied: numexpr in /home/damar.pramuditya/.pyenv/ver
sions/anaconda3-2020.11/lib/python3.8/site-packages (from pyLDAvis->pycare
t) (2.7.1)
Requirement already satisfied: future in /home/damar.pramuditya/.pyenv/vers
ions/anaconda3-2020.11/lib/python3.8/site-packages (from pyLDAvis->pycaret)
(0.18.2)
```

```
Collecting sklearn
  Downloading sklearn-0.0.tar.gz (1.1 kB)
Collecting funcy
  Using cached funcy-1.17-py2.py3-none-any.whl (33 kB)
Requirement already satisfied: pytz>=2017.2 in /home/damar.pramuditya/.pyen
v/versions/anaconda3-2020.11/lib/python3.8/site-packages (from pandas->pyca
ret) (2020.1)
Collecting pynndescent>=0.5
  Using cached pynndescent-0.5.7.tar.gz (1.1 MB)
Collecting smart-open>=1.8.1
  Downloading smart_open-6.2.0-py3-none-any.whl (58 kB)
     |████████████████████████████████| 58 kB 99 kB/s eta 0:00:01
Requirement already satisfied: six>=1.5.0 in /home/damar.pramuditya/.pyenv/
versions/anaconda3-2020.11/lib/python3.8/site-packages (from gensim<4.0.0->
pycaret) (1.15.0)
Collecting colorlover>=0.2.1
  Using cached colorlover-0.3.0-py3-none-any.whl (8.9 kB)
Collecting alembic<2
  Using cached alembic-1.8.1-py3-none-any.whl (209 kB)
Collecting sqlalchemy<2,>=1.4.0
  Downloading SQLAlchemy-1.4.42-cp38-cp38-manylinux_2_5_x86_64.manylinux1_x
86_64.manylinux_2_17_x86_64.manylinux2014_x86_64.whl (1.6 MB)
     |████████████████████████████████| 1.6 MB 579 kB/s eta 0:00:01
Requirement already satisfied: cloudpickle<3 in /home/damar.pramuditya/.pye
nv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from mlflow->pyc
aret) (1.6.0)
Collecting protobuf<5,>=3.12.0
  Downloading protobuf-4.21.9-cp37-abi3-manylinux2014_x86_64.whl (408 kB)
     |████████████████████████████████| 408 kB 1.3 MB/s eta 0:00:01
Collecting databricks-cli<1,>=0.8.7
  Using cached databricks-cli-0.17.3.tar.gz (77 kB)
Requirement already satisfied: click<9,>=7.0 in /home/damar.pramuditya/.pye
nv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from mlflow->pyc
aret) (7.1.2)
Collecting sqlparse<1,>=0.4.0
  Using cached sqlparse-0.4.3-py3-none-any.whl (42 kB)
Collecting prometheus-flask-exporter<1
  Using cached prometheus_flask_exporter-0.20.3-py3-none-any.whl (18 kB)
Requirement already satisfied: packaging<22 in /home/damar.pramuditya/.pyen
v/versions/anaconda3-2020.11/lib/python3.8/site-packages (from mlflow->pyca
ret) (20.4)
Requirement already satisfied: entrypoints<1 in /home/damar.pramuditya/.pye
nv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from mlflow->pyc
aret) (0.3)
Collecting querystring-parser<2
  Using cached querystring_parser-1.2.4-py2.py3-none-any.whl (7.9 kB)
Collecting gitpython<4,>=2.1.0
  Using cached GitPython-3.1.29-py3-none-any.whl (182 kB)
Collecting docker<7,>=4.0.0
  Using cached docker-6.0.0-py3-none-any.whl (147 kB)
Collecting gunicorn<21; platform_system != "Windows"
  Using cached gunicorn-20.1.0-py3-none-any.whl (79 kB)
Collecting importlib-metadata!=4.7.0,<6,>=3.7.0
  Downloading importlib_metadata-5.0.0-py3-none-any.whl (21 kB)
Requirement already satisfied: Flask<3 in /home/damar.pramuditya/.pyenv/ver
sions/anaconda3-2020.11/lib/python3.8/site-packages (from mlflow->pycaret)
(1.1.2)
Collecting tenacity>=6.2.0
  Downloading tenacity-8.1.0-py3-none-any.whl (23 kB)
Requirement already satisfied: nbformat>=4.2.0 in /home/damar.pramuditya/.p
yenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from ipywidget
s->pycaret) (5.0.8)
Requirement already satisfied: ipykernel>=4.5.1 in /home/damar.pramuditya/.
pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from ipywidge
ts->pycaret) (5.3.4)
Requirement already satisfied: traitlets>=4.3.1 in /home/damar.pramuditya/.
pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from ipywidge
ts->pycaret) (5.0.5)
Requirement already satisfied: widgetsnbextension~=3.5.0 in /home/damar.pra
muditya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from
ipywidgets->pycaret) (3.5.1)
Requirement already satisfied: decorator in /home/damar.pramuditya/.pyenv/v
ersions/anaconda3-2020.11/lib/python3.8/site-packages (from IPython->pycare
t) (4.4.2)
Requirement already satisfied: pexpect>4.3; sys_platform != "win32" in /hom
e/damar.pramuditya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-pac
kages (from IPython->pycaret) (4.8.0)
Requirement already satisfied: jedi>=0.10 in /home/damar.pramuditya/.pyenv/
versions/anaconda3-2020.11/lib/python3.8/site-packages (from IPython->pycar
et) (0.17.1)
Requirement already satisfied: pygments in /home/damar.pramuditya/.pyenv/ve
rsions/anaconda3-2020.11/lib/python3.8/site-packages (from IPython->pycare
t) (2.7.2)
Requirement already satisfied: prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0
in /home/damar.pramuditya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/s
ite-packages (from IPython->pycaret) (3.0.8)
Requirement already satisfied: pickleshare in /home/damar.pramuditya/.pyenv
/versions/anaconda3-2020.11/lib/python3.8/site-packages (from IPython->pyca
ret) (0.7.5)
Requirement already satisfied: backcall in /home/damar.pramuditya/.pyenv/ve
rsions/anaconda3-2020.11/lib/python3.8/site-packages (from IPython->pycare
t) (0.2.0)
Requirement already satisfied: regex in /home/damar.pramuditya/.pyenv/versi
ons/anaconda3-2020.11/lib/python3.8/site-packages (from nltk->pycaret) (202
0.10.15)
Requirement already satisfied: wheel in /home/damar.pramuditya/.pyenv/versi
ons/anaconda3-2020.11/lib/python3.8/site-packages (from lightgbm>=2.3.1->py
caret) (0.35.1)
Requirement already satisfied: idna<3,>=2.5 in /home/damar.pramuditya/.pyen
v/versions/anaconda3-2020.11/lib/python3.8/site-packages (from requests<3.
0.0,>=2.13.0->spacy<2.4.0->pycaret) (2.10)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in /
home/damar.pramuditya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-
packages (from requests<3.0.0,>=2.13.0->spacy<2.4.0->pycaret) (1.25.11)
Requirement already satisfied: chardet<4,>=3.0.2 in /home/damar.pramuditya
/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from reques
ts<3.0.0,>=2.13.0->spacy<2.4.0->pycaret) (3.0.4)
Requirement already satisfied: networkx>=2.4 in /home/damar.pramuditya/.pye
nv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from visions[typ
e_image_path]==0.7.5->pandas-profiling>=2.8.0->pycaret) (2.5)
Collecting tangled-up-in-unicode>=0.0.4
  Using cached tangled_up_in_unicode-0.2.0-py3-none-any.whl (4.7 MB)
Requirement already satisfied: attrs>=19.3.0 in /home/damar.pramuditya/.pye
nv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from visions[typ
e_image_path]==0.7.5->pandas-profiling>=2.8.0->pycaret) (20.3.0)
Collecting imagehash; extra == "type_image_path"
  Using cached ImageHash-4.3.1-py2.py3-none-any.whl (296 kB)
Collecting typing-extensions>=4.1.0
  Downloading typing_extensions-4.4.0-py3-none-any.whl (26 kB)
Collecting patsy>=0.5.2
  Downloading patsy-0.5.3-py2.py3-none-any.whl (233 kB)
     |████████████████████████████████| 233 kB 1.1 MB/s eta 0:00:01
Requirement already satisfied: MarkupSafe>=0.23 in /home/damar.pramuditya/.
pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from jinja2
<3.2,>=2.11.1->pandas-profiling>=2.8.0->pycaret) (1.1.1)
Collecting Mako
  Using cached Mako-1.2.3-py3-none-any.whl (78 kB)
Collecting importlib-resources; python_version < "3.9"
```

```
  Downloading importlib_resources-5.10.0-py3-none-any.whl (34 kB)
Collecting greenlet!=0.4.17; python_version >= "3" and (platform_machine ==
"aarch64" or (platform_machine == "ppc64le" or (platform_machine == "x86_6
4" or (platform_machine == "amd64" or (platform_machine == "AMD64" or (plat
form_machine == "win32" or platform_machine == "WIN32"))))))
  Downloading greenlet-1.1.3.post0-cp38-cp38-manylinux_2_17_x86_64.manylinu
x2014_x86_64.whl (157 kB)
     |████████████████████████████████| 157 kB 1.5 MB/s eta 0:00:01
Collecting pyjwt>=1.7.0
  Downloading PyJWT-2.6.0-py3-none-any.whl (20 kB)
Collecting oauthlib>=3.1.0
  Downloading oauthlib-3.2.2-py3-none-any.whl (151 kB)
     |████████████████████████████████| 151 kB 1.4 MB/s eta 0:00:01
Collecting tabulate>=0.7.7
  Downloading tabulate-0.9.0-py3-none-any.whl (35 kB)
Requirement already satisfied: prometheus-client in /home/damar.pramuditya
/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from promet
heus-flask-exporter<1->mlflow->pycaret) (0.8.0)
Collecting gitdb<5,>=4.0.1
  Using cached gitdb-4.0.9-py3-none-any.whl (63 kB)
Collecting websocket-client>=0.32.0
  Downloading websocket_client-1.4.1-py3-none-any.whl (55 kB)
     |████████████████████████████████| 55 kB 1.3 MB/s eta 0:00:01
Requirement already satisfied: zipp>=0.5 in /home/damar.pramuditya/.pyenv/v
ersions/anaconda3-2020.11/lib/python3.8/site-packages (from importlib-metad
ata!=4.7.0,<6,>=3.7.0->mlflow->pycaret) (3.4.0)
Requirement already satisfied: itsdangerous>=0.24 in /home/damar.pramuditya
/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from Flask
<3->mlflow->pycaret) (1.1.0)
Requirement already satisfied: Werkzeug>=0.15 in /home/damar.pramuditya/.py
env/versions/anaconda3-2020.11/lib/python3.8/site-packages (from Flask<3->m
lflow->pycaret) (1.0.1)
Requirement already satisfied: jupyter-core in /home/damar.pramuditya/.pyen
v/versions/anaconda3-2020.11/lib/python3.8/site-packages (from nbformat>=4.
2.0->ipywidgets->pycaret) (4.6.3)
Requirement already satisfied: jsonschema!=2.5.0,>=2.4 in /home/damar.pramu
ditya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from n
bformat>=4.2.0->ipywidgets->pycaret) (3.2.0)
Requirement already satisfied: ipython-genutils in /home/damar.pramuditya/.
pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from nbformat
>=4.2.0->ipywidgets->pycaret) (0.2.0)
Requirement already satisfied: jupyter-client in /home/damar.pramuditya/.py
env/versions/anaconda3-2020.11/lib/python3.8/site-packages (from ipykernel>
=4.5.1->ipywidgets->pycaret) (6.1.7)
Requirement already satisfied: tornado>=4.2 in /home/damar.pramuditya/.pyen
v/versions/anaconda3-2020.11/lib/python3.8/site-packages (from ipykernel>=
4.5.1->ipywidgets->pycaret) (6.0.4)
Requirement already satisfied: notebook>=4.4.1 in /home/damar.pramuditya/.p
yenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from widgetsnb
extension~=3.5.0->ipywidgets->pycaret) (6.1.4)
Requirement already satisfied: ptyprocess>=0.5 in /home/damar.pramuditya/.p
yenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from pexpect>
4.3; sys_platform != "win32"->IPython->pycaret) (0.6.0)
Requirement already satisfied: parso<0.8.0,>=0.7.0 in /home/damar.pramudity
a/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from jedi>
=0.10->IPython->pycaret) (0.7.0)
Requirement already satisfied: wcwidth in /home/damar.pramuditya/.pyenv/ver
sions/anaconda3-2020.11/lib/python3.8/site-packages (from prompt-toolkit!=
3.0.0,!=3.0.1,<3.1.0,>=2.0.0->IPython->pycaret) (0.2.5)
Requirement already satisfied: PyWavelets in /home/damar.pramuditya/.pyenv/
versions/anaconda3-2020.11/lib/python3.8/site-packages (from imagehash; ext
ra == "type_image_path"->visions[type_image_path]==0.7.5->pandas-profiling>
=2.8.0->pycaret) (1.1.1)
Collecting smmap<6,>=3.0.1
```

```
  Using cached smmap-5.0.0-py3-none-any.whl (24 kB)
Requirement already satisfied: pyrsistent>=0.14.0 in /home/damar.pramuditya
/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from jsonsc
hema!=2.5.0,>=2.4->nbformat>=4.2.0->ipywidgets->pycaret) (0.17.3)
Requirement already satisfied: pyzmq>=13 in /home/damar.pramuditya/.pyenv/v
ersions/anaconda3-2020.11/lib/python3.8/site-packages (from jupyter-client-
>ipykernel>=4.5.1->ipywidgets->pycaret) (19.0.2)
Requirement already satisfied: Send2Trash in /home/damar.pramuditya/.pyenv/
versions/anaconda3-2020.11/lib/python3.8/site-packages (from notebook>=4.4.
1->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (1.5.0)
Requirement already satisfied: nbconvert in /home/damar.pramuditya/.pyenv/v
ersions/anaconda3-2020.11/lib/python3.8/site-packages (from notebook>=4.4.1
->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (6.0.7)
Requirement already satisfied: terminado>=0.8.3 in /home/damar.pramuditya/.
pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from notebook
>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (0.9.1)
Requirement already satisfied: argon2-cffi in /home/damar.pramuditya/.pyenv
/versions/anaconda3-2020.11/lib/python3.8/site-packages (from notebook>=4.
4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (20.1.0)
Requirement already satisfied: bleach in /home/damar.pramuditya/.pyenv/vers
ions/anaconda3-2020.11/lib/python3.8/site-packages (from nbconvert->noteboo
k>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (3.2.1)
Requirement already satisfied: nbclient<0.6.0,>=0.5.0 in /home/damar.pramud
itya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from nb
convert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret)
(0.5.1)
Requirement already satisfied: jupyterlab-pygments in /home/damar.pramudity
a/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from nbcon
vert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (0.
1.2)
Requirement already satisfied: testpath in /home/damar.pramuditya/.pyenv/ve
rsions/anaconda3-2020.11/lib/python3.8/site-packages (from nbconvert->noteb
ook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (0.4.4)
Requirement already satisfied: pandocfilters>=1.4.1 in /home/damar.pramudit
ya/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from nbco
nvert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (1.
4.3)
Requirement already satisfied: defusedxml in /home/damar.pramuditya/.pyenv/
versions/anaconda3-2020.11/lib/python3.8/site-packages (from nbconvert->not
ebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (0.6.0)
Requirement already satisfied: mistune<2,>=0.8.1 in /home/damar.pramuditya
/.pyenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from nbconv
ert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (0.8.
4)
Requirement already satisfied: cffi>=1.0.0 in /home/damar.pramuditya/.pyenv
/versions/anaconda3-2020.11/lib/python3.8/site-packages (from argon2-cffi->
notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (1.14.3)
Requirement already satisfied: webencodings in /home/damar.pramuditya/.pyen
v/versions/anaconda3-2020.11/lib/python3.8/site-packages (from bleach->nbco
nvert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret) (0.
5.1)
Requirement already satisfied: nest-asyncio in /home/damar.pramuditya/.pyen
v/versions/anaconda3-2020.11/lib/python3.8/site-packages (from nbclient<0.
6.0,>=0.5.0->nbconvert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidg
ets->pycaret) (1.4.2)
Requirement already satisfied: async-generator in /home/damar.pramuditya/.p
yenv/versions/anaconda3-2020.11/lib/python3.8/site-packages (from nbclient
<0.6.0,>=0.5.0->nbconvert->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipyw
idgets->pycaret) (1.10)
Requirement already satisfied: pycparser in /home/damar.pramuditya/.pyenv/v
ersions/anaconda3-2020.11/lib/python3.8/site-packages (from cffi>=1.0.0->ar
gon2-cffi->notebook>=4.4.1->widgetsnbextension~=3.5.0->ipywidgets->pycaret)
(2.20)
Building wheels for collected packages: pyLDAvis, umap-learn, cufflinks, py
```

```
od, htmlmin, sklearn, pynndescent, databricks-cli
  Building wheel for pyLDAvis (PEP 517) ... done
  Created wheel for pyLDAvis: filename=pyLDAvis-3.3.1-py2.py3-none-any.whl
size=136882 sha256=791eb67696817ffc038ab65497991285882e52bc39d0df6c42db73cb
342475cf
  Stored in directory: /home/damar.pramuditya/.cache/pip/wheels/90/61/ec/9d
be9efc3acf9c4e37ba70fbbcc3f3a0ebd121060aa593181a
  Building wheel for umap-learn (setup.py) ... done
  Created wheel for umap-learn: filename=umap_learn-0.5.3-py3-none-any.whl
size=82820 sha256=01deed179b6ed428d53f92f23c9a8b7c18eb423cff6d83ce94fcec652
06ef112
  Stored in directory: /home/damar.pramuditya/.cache/pip/wheels/a9/3a/67/06
a8950e053725912e6a8c42c4a3a241410f6487b8402542ea
  Building wheel for cufflinks (setup.py) ... done
  Created wheel for cufflinks: filename=cufflinks-0.17.3-py3-none-any.whl s
ize=67921 sha256=8faf42f116d09d1e1d00652d77e0b583ee5792a9f2b67c3544ad57ac88
a9d7f5
  Stored in directory: /home/damar.pramuditya/.cache/pip/wheels/6b/76/62/6d
a97734911ffcbdd559fd1a3f28526321f0ae699182a23866
  Building wheel for pyod (setup.py) ... done
  Created wheel for pyod: filename=pyod-1.0.6-py3-none-any.whl size=175085
sha256=b488326e8151171c6817069a52a2d55b950263a5a7754fd76e3c078385312c97
  Stored in directory: /home/damar.pramuditya/.cache/pip/wheels/98/93/e6/6d
40410d9635ecde42d06041a1ba7f2ee7396e036fcf702e73
  Building wheel for htmlmin (setup.py) ... done
  Created wheel for htmlmin: filename=htmlmin-0.1.12-py3-none-any.whl size=
27084 sha256=4ea923e97c5c2d04b374585bc05f83f425078062eb94b67712daa200937551
01
  Stored in directory: /home/damar.pramuditya/.cache/pip/wheels/23/14/6e/4b
e5bfeeb027f4939a01764b48edd5996acf574b0913fe5243
  Building wheel for sklearn (setup.py) ... done
  Created wheel for sklearn: filename=sklearn-0.0-py2.py3-none-any.whl size
=1316 sha256=86ac01eed3671d8163de32d68b26b5167d7e236de5374b3d1c74b4b2966065
a1
  Stored in directory: /home/damar.pramuditya/.cache/pip/wheels/22/0b/40/fd
3f795caaa1fb4c6cb738bc1f56100be1e57da95849bfc897
  Building wheel for pynndescent (setup.py) ... done
  Created wheel for pynndescent: filename=pynndescent-0.5.7-py3-none-any.wh
l size=54272 sha256=18fed5f6cf357c94b1d3d17909ab36df56ce0f4aa8750f1f1e3f1b5
28db01421
  Stored in directory: /home/damar.pramuditya/.cache/pip/wheels/1b/38/fe/99
e22fbae88abd1c5e8d99253cba6d1c590cc7a94408bff3bf
  Building wheel for databricks-cli (setup.py) ... done
  Created wheel for databricks-cli: filename=databricks_cli-0.17.3-py3-none
-any.whl size=139100 sha256=cd5a9a6c9077669720647cb3d2693b5d3de106c9924ed5c
e091b073c0335f023
  Stored in directory: /home/damar.pramuditya/.cache/pip/wheels/58/40/7c/d0
21d51dac18bfd095fb6837572ad2e6f1a34d221f4b1d976b
Successfully built pyLDAvis umap-learn cufflinks pyod htmlmin sklearn pynnd
escent databricks-cli
Installing collected packages: wordcloud, blis, cymem, catalogue, wasabi, s
rsly, plac, murmurhash, preshed, thinc, spacy, multimethod, tangled-up-in-u
nicode, imagehash, visions, htmlmin, phik, typing-extensions, pydantic, mis
singno, patsy, statsmodels, pandas-profiling, textblob, smart-open, gensim,
sklearn, funcy, pyLDAvis, pynndescent, umap-learn, yellowbrick, tenacity, p
lotly, colorlover, cufflinks, mlxtend, importlib-metadata, greenlet, sqlalc
hemy, Mako, importlib-resources, alembic, protobuf, pyjwt, oauthlib, tabula
te, databricks-cli, sqlparse, prometheus-flask-exporter, querystring-parse
r, smmap, gitdb, gitpython, websocket-client, docker, gunicorn, mlflow, pyo
d, imbalanced-learn, Boruta, kmodes, scikit-plot, lightgbm, pycaret
  Attempting uninstall: typing-extensions
    Found existing installation: typing-extensions 3.7.4.3
    Uninstalling typing-extensions-3.7.4.3:
      Successfully uninstalled typing-extensions-3.7.4.3
  Attempting uninstall: patsy
    Found existing installation: patsy 0.5.1
    Uninstalling patsy-0.5.1:
      Successfully uninstalled patsy-0.5.1
  Attempting uninstall: statsmodels
    Found existing installation: statsmodels 0.12.0
    Uninstalling statsmodels-0.12.0:
      Successfully uninstalled statsmodels-0.12.0
  Attempting uninstall: importlib-metadata
    Found existing installation: importlib-metadata 2.0.0
    Uninstalling importlib-metadata-2.0.0:
      Successfully uninstalled importlib-metadata-2.0.0
  Attempting uninstall: greenlet
    Found existing installation: greenlet 0.4.17
    Uninstalling greenlet-0.4.17:
      Successfully uninstalled greenlet-0.4.17
  Attempting uninstall: sqlalchemy
    Found existing installation: SQLAlchemy 1.3.20
    Uninstalling SQLAlchemy-1.3.20:
      Successfully uninstalled SQLAlchemy-1.3.20
ERROR: After October 2020 you may experience errors when installing or upda
ting packages. This is because pip will change the way that it resolves dep
endency conflicts.

We recommend you use --use-feature=2020-resolver to test your packages with
the new resolver before it becomes the default.

statsmodels 0.13.2 requires packaging>=21.3, but you'll have packaging 20.4
which is incompatible.
pyldavis 3.3.1 requires numpy>=1.20.0, but you'll have numpy 1.19.2 which i
s incompatible.
pyldavis 3.3.1 requires pandas>=1.2.0, but you'll have pandas 1.1.3 which i
s incompatible.
yellowbrick 1.5 requires scikit-learn>=1.0.0, but you'll have scikit-learn
0.23.2 which is incompatible.
mlxtend 0.21.0 requires scikit-learn>=1.0.2, but you'll have scikit-learn
0.23.2 which is incompatible.
docker 6.0.0 requires requests>=2.26.0, but you'll have requests 2.24.0 whi
ch is incompatible.
docker 6.0.0 requires urllib3>=1.26.0, but you'll have urllib3 1.25.11 whic
h is incompatible.
Successfully installed Boruta-0.3 Mako-1.2.3 alembic-1.8.1 blis-0.7.9 catal
ogue-1.0.2 colorlover-0.3.0 cufflinks-0.17.3 cymem-2.0.7 databricks-cli-0.1
7.3 docker-6.0.0 funcy-1.17 gensim-3.8.3 gitdb-4.0.9 gitpython-3.1.29 green
let-1.1.3.post0 gunicorn-20.1.0 htmlmin-0.1.12 imagehash-4.3.1 imbalanced-l
earn-0.7.0 importlib-metadata-5.0.0 importlib-resources-5.10.0 kmodes-0.12.
2 lightgbm-3.3.3 missingno-0.5.1 mlflow-1.30.0 mlxtend-0.21.0 multimethod-
1.9 murmurhash-1.0.9 oauthlib-3.2.2 pandas-profiling-3.4.0 patsy-0.5.3 phik
-0.12.2 plac-1.1.3 plotly-5.11.0 preshed-3.0.8 prometheus-flask-exporter-0.
20.3 protobuf-4.21.9 pyLDAvis-3.3.1 pycaret-2.3.10 pydantic-1.10.2 pyjwt-2.
6.0 pynndescent-0.5.7 pyod-1.0.6 querystring-parser-1.2.4 scikit-plot-0.3.7
sklearn-0.0 smart-open-6.2.0 smmap-5.0.0 spacy-2.3.8 sqlalchemy-1.4.42 sqlp
arse-0.4.3 srsly-1.0.6 statsmodels-0.13.2 tabulate-0.9.0 tangled-up-in-unic
ode-0.2.0 tenacity-8.1.0 textblob-0.17.1 thinc-7.4.6 typing-extensions-4.4.
```

In [1]:

```
import nltk
import sklearn
import pycaret
import pandas as pd

print('The nltk version is {}.'.format(nltk.__version__))
print('The scikit-learn version is {}.'.format(sklearn.__version__))
print('The pycaret version is {}.'.format(pycaret.__version__))
print('The pandas version is {}.'.format(pd.__version__))
```

```
The nltk version is 3.5.
The scikit-learn version is 0.23.2.
The pycaret version is 2.3.10.
The pandas version is 1.1.3.
```

Dataset

The income dataset was extracted from 1994 U.S. Census database.

The importance of census statistics

The census is a special, wide-range activity, which takes place once a decade in the entire country. The purpose is to gather information about the general population, in order to present a full and reliable picture of the population in the country - its housing conditions and demographic, social and economic characteristics. The information collected includes data on age, gender, country of origin, marital status, housing conditions, marriage, education, employment, etc.

This information makes it possible to plan better services, improve the quality of life and solve existing problems. Statistical information, which serves as the basis for constructing planning forecasts, is essential for the democratic process since it enables the citizens to examine the decisions made by the government and local authorities, and decide whether they serve the public they are meant to help.

Read more: Use of Census Data

In [2]:

```
dataset = pd.read_csv('adult.csv')
#check the shape of data
dataset.shape
```

Out[2]:

```
(32563, 15)
```

In [3]:

```
dataset.head(5)
```

Out[3]:

	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship
0	continuous	Private Self-emp-not-inc Self-emp-inc Federal-...	continuous	Bachelors Some-college 11th HS-grad Prof-schoo...	continuous	Married-civ-spouse Divorced Never-married Sepa...	Tech-support Craft-repair Other-service Sales ...	Wife Own-child Husband Not-in-family Other-rel...
1	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN

	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship
2	39.0	State-gov	77516.0	Bachelors	13.0	Never-married	Adm-clerical	Not-in-family
3	50.0	Self-emp-not-inc	83311.0	Bachelors	13.0	Married-civ-spouse	Exec-managerial	Husband

Data Dictionary

1. Categorical Attributes

- workclass: (categorical) Private, Self-emp-not-inc, Self-emp-inc, Federal-gov, Local-gov, State-gov, Without-pay, Never-worked.
    - Individual work category
- education: (categorical) Bachelors, Some-college, 11th, HS-grad, Prof-school, Assoc-acdm, Assoc-voc, 9th, 7th-8th, 12th, Masters, 1st-4th, 10th, Doctorate, 5th-6th, Preschool.
    - Individual's highest education degree
- marital-status: (categorical) Married-civ-spouse, Divorced, Never-married, Separated, Widowed, Married-spouse-absent, Married-AF-spouse.
    - Individual marital status
- occupation: (categorical) Tech-support, Craft-repair, Other-service, Sales, Exec-managerial, Prof-specialty, Handlers-cleaners, Machine-op-inspct, Adm-clerical, Farming-fishing, Transport-moving, Priv-house-serv, Protective-serv, Armed-Forces.
    - Individual's occupation
- relationship: (categorical) Wife, Own-child, Husband, Not-in-family, Other-relative, Unmarried.
    - Individual's relation in a family
- race: (categorical) White, Asian-Pac-Islander, Amer-Indian-Eskimo, Other, Black.
    - Race of Individual
- sex: (categorical) Female, Male.
- native-country: (categorical) United-States, Cambodia, England, Puerto-Rico, Canada, Germany, Outlying-US(Guam-USVI-etc), India, Japan, Greece, South, China, Cuba, Iran, Honduras, Philippines, Italy, Poland, Jamaica, Vietnam, Mexico, Portugal, Ireland, France, Dominican-Republic, Laos, Ecuador, Taiwan, Haiti, Columbia, Hungary, Guatemala, Nicaragua, Scotland, Thailand, Yugoslavia, El-Salvador, Trinadad&Tobago, Peru, Hong, Holand-Netherlands.
    - Individual's native country

2. Continuous Attributes

- age: continuous.
    - Age of an individual
- education-num: number of education year, continuous.
    - Individual's year of receiving education

- fnlwgt: final weight, continuous.
- The weights on the CPS files are controlled to independent estimates of the civilian noninstitutional population of the US. These are prepared monthly for us by Population Division here at the Census Bureau.
- capital-gain: continuous.
- capital-loss: continuous.
- hours-per-week: continuous.
  - Individual's working hour per week

What is Clustering?

Clustering is the task of grouping a set of objects in such a way that those in the same group (called a cluster) are more similar to each other than to those in other groups. It is an exploratory data mining activity, and a common technique for statistical data analysis used in many fields including machine learning, pattern recognition, image analysis, information retrieval, bioinformatics, data compression and computer graphics. Some common real life use cases of clustering are:

```
Customer segmentation based on purchase history or interests
to design targetted marketing compaigns.
Cluster documents into multiple categories based on tags,
topics, and the content of the document.
Analysis of outcome in social / life science experiments to
find natural groupings and patterns in the data.
```

Learn More about Clustering

In [5]:

```
data = dataset.sample(frac=0.95, random_state=786)
data_unseen = dataset.drop(data.index)

data.reset_index(drop=True, inplace=True)
data_unseen.reset_index(drop=True, inplace=True)

print('Data for Modeling: ' + str(data.shape))
print('Unseen Data For Predictions: ' + str(data_unseen.shape))
```

```
Data for Modeling: (30935, 15)
Unseen Data For Predictions: (1628, 15)
```

Setting up Environment in PyCaret

In [6]:

```
from pycaret.clustering import *

exp_clu101 = setup(data, normalize = True,
                   session_id = 123)
```

	Description	Value
0	session_id	123
1	Original Data	(30935, 15)
2	Missing Values	True
3	Numeric Features	0

	Description	Value
4	Categorical Features	15
5	Ordinal Features	False
6	High Cardinality Features	False
7	High Cardinality Method	None
8	Transformed Data	(30935, 21355)
9	CPU Jobs	-1
10	Use GPU	False
11	Log Experiment	False
12	Experiment Name	cluster-default-name
13	USI	8249
14	Imputation Type	simple
15	Iterative Imputation Iteration	None
16	Numeric Imputer	mean
17	Iterative Imputation Numeric Model	None
18	Categorical Imputer	mode
19	Iterative Imputation Categorical Model	None
20	Unknown Categoricals Handling	least_frequent
21	Normalize	True
22	Normalize Method	zscore
23	Transformation	False
24	Transformation Method	None
25	PCA	False
26	PCA Method	None
27	PCA Components	None
28	Ignore Low Variance	False
29	Combine Rare Levels	False
30	Rare Level Threshold	None
31	Numeric Binning	False
32	Remove Outliers	False
33	Outliers Threshold	None
34	Remove Multicollinearity	False
35	Multicollinearity Threshold	None
36	Remove Perfect Collinearity	False
37	Clustering	False
38	Clustering Iteration	None
39	Polynomial Features	False
40	Polynomial Degree	None

	Description	Value
41	Trignometry Features	False
42	Polynomial Threshold	None
43	Group Features	False
44	Feature Selection	False
45	Feature Selection Method	classic
46	Features Selection Threshold	None

Create a Model

In [7]:
```
models()
```

Out[7]:

	Name	Reference
ID		
kmeans	K-Means Clustering	sklearn.cluster._kmeans.KMeans
ap	Affinity Propagation	sklearn.cluster._affinity_propagation.Affinity...
meanshift	Mean Shift Clustering	sklearn.cluster._mean_shift.MeanShift
sc	Spectral Clustering	sklearn.cluster._spectral.SpectralClustering
hclust	Agglomerative Clustering	sklearn.cluster._agglomerative.AgglomerativeCl...
dbscan	Density-Based Spatial Clustering	sklearn.cluster._dbscan.DBSCAN
optics	OPTICS Clustering	sklearn.cluster._optics.OPTICS
birch	Birch Clustering	sklearn.cluster._birch.Birch
kmodes	K-Modes Clustering	kmodes.kmodes.KModes

In [8]:
```
kmeans = create_model('kmeans')
```

	Silhouette	Calinski-Harabasz	Davies-Bouldin	Homogeneity	Rand Index	Completeness
0	0.0652	2035.138	3.4917	0	0	0

In [11]:
```
print(kmeans)
```

```
KMeans(algorithm='auto', copy_x=True, init='k-means++', max_iter=300,
       n_clusters=4, n_init=10, n_jobs=-1, precompute_distances='deprecated
',
       random_state=123, tol=0.0001, verbose=0)
```

Assign a Model

In [15]:
```
kmean_results = assign_model(kmeans)
kmean_results.head(5)
```

Out[15]:

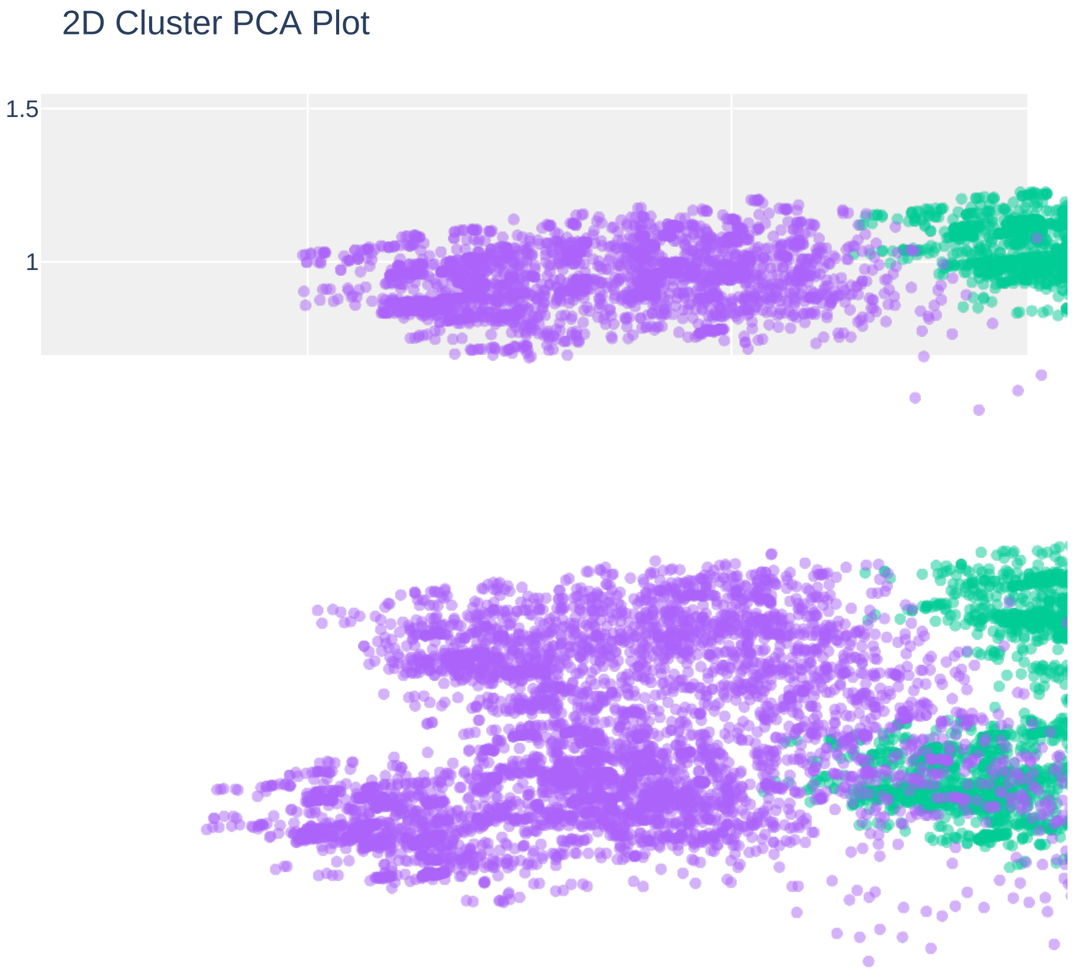
	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship	race
0	31.0	Private	352465.0	Some-college	10.0	Married-civ-spouse	Exec-managerial	Husband	White

	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship	race	
1	46.0	Self-emp-inc	120902.0	Bachelors	13.0	Married-civ-spouse	Exec-managerial	Husband	White	M
2	28.0	Private	94880.0	Some-college	10.0	Never-married	Craft-repair	Not-in-family	White	M
3	33.0	Private	409172.0	Bachelors	13.0	Married-civ-spouse	Exec-managerial	Own-child	White	M

Plot a Model

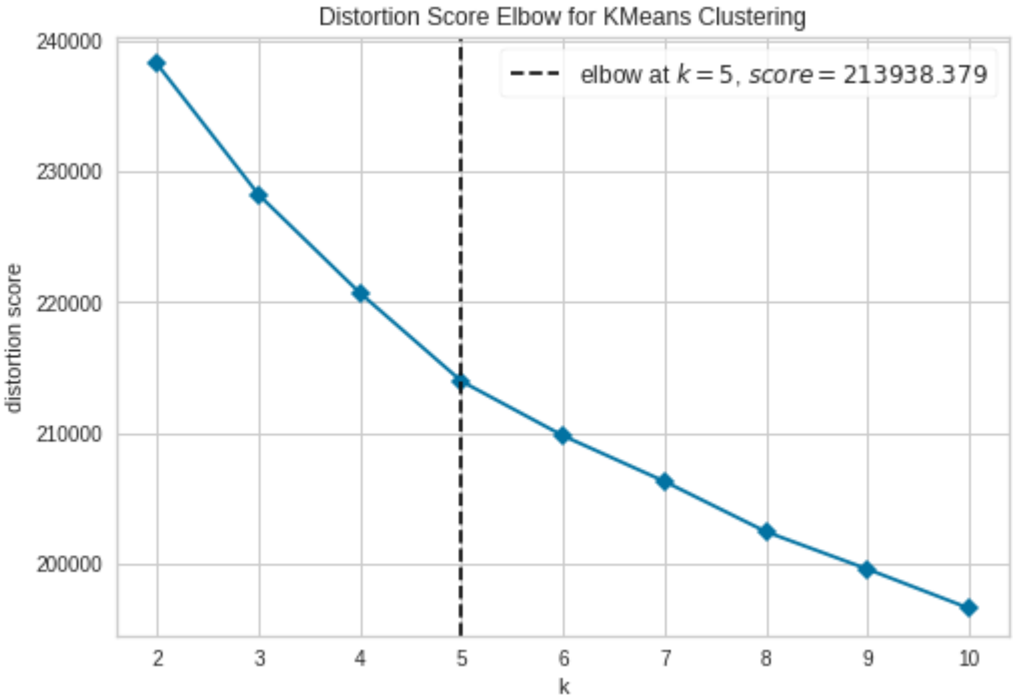
In [16]:

```
plot_model(kmeans)
```

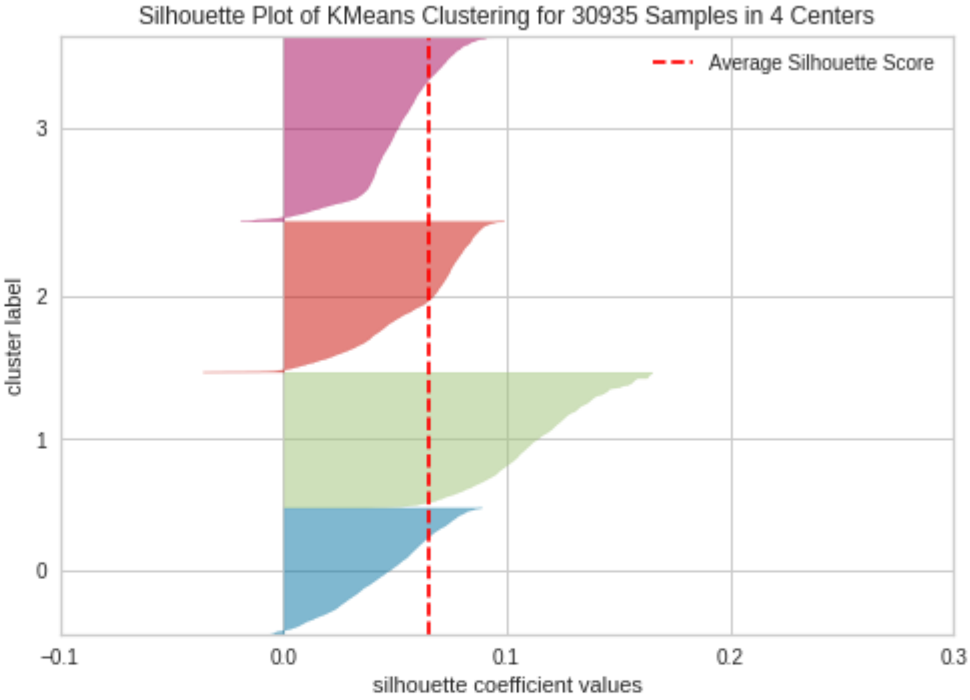


In [17]:

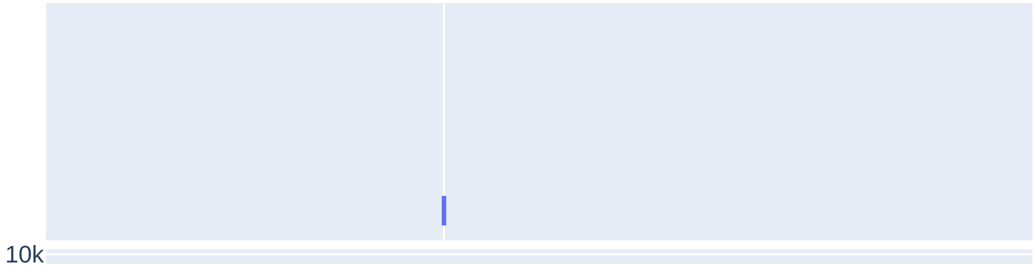
```
plot_model(kmeans, plot = 'elbow')
```



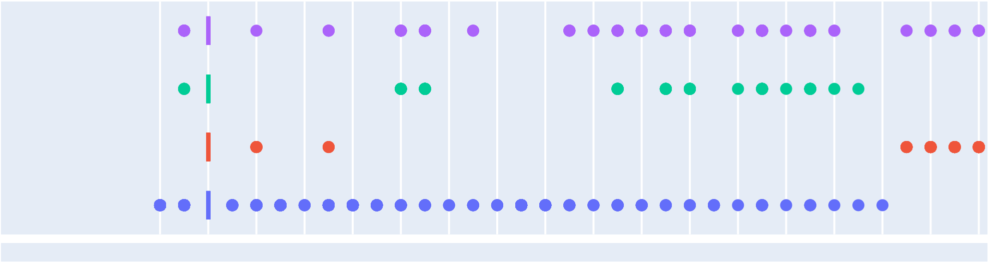
In [18]:
```
plot_model(kmeans, plot = 'silhouette')
```



In [19]:
```
plot_model(kmeans, plot = 'distribution') #to see size of clusters
```

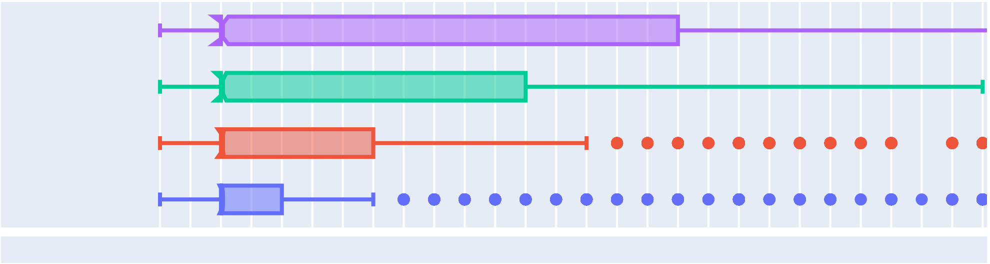


In [21]:
```
plot_model(kmeans, plot = 'distribution', feature = 'capital-gain')
```



In [22]:

```
plot_model(kmeans, plot = 'distribution', feature = 'hours-per-week')
```



Predict on unseen data

In [24]:

```
unseen_predictions = predict_model(kmeans, data=data_unseen)
unseen_predictions.head(5)
```

Out[24]:

	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship	race	
0	53.0	Private	234721.0	11th	7.0	Married-civ-spouse	Handlers-cleaners	Husband	Black	
1	19.0	Private	544091.0	HS-grad	9.0	Married-AF-spouse	Adm-clerical	Wife	White	F
2	43.0	Private	237993.0	Some-college	10.0	Married-civ-spouse	Tech-support	Husband	White	

	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship	race
3	19.0	Private	101509.0	Some-	10.0	Never-	Prof-	Own-child	White

In [ ]:
```
#The Cluster column indicating the cluster label predicted from the trainec
```

Saving the model

In [25]:
```
save_model(kmeans,'Final KMeans Model 30-10-2022')
```

```
Transformation Pipeline and Model Successfully Saved
```

Out[25]:
```
(Pipeline(memory=None,
          steps=[('dtypes',
                  DataTypes_Auto_infer(categorical_features=[],
                                       display_types=True, features_todrop=
[],
                                       id_columns=[], ml_usecase='regressio
n',
                                       numerical_features=[],
                                       target='UNSUPERVISED_DUMMY_TARGET',
                                       time_features=[])),
                 ('imputer',
                  Simple_Imputer(categorical_strategy='most frequent',
                                 fill_value_categorical=None,
                                 fill_value_numerical=None...
                 ('fix_perfect', 'passthrough'),
                 ('clean_names', Clean_Colum_Names()),
                 ('feature_select', 'passthrough'), ('fix_multi', 'passthro
ugh'),
                 ('dfs', 'passthrough'), ('pca', 'passthrough'),
                 ['trained_model',
                  KMeans(algorithm='auto', copy_x=True, init='k-means++',
                         max_iter=300, n_clusters=4, n_init=10, n_jobs=-1,
                         precompute_distances='deprecated', random_state=12
3,
                         tol=0.0001, verbose=0)]],
          verbose=False),
 'Final KMeans Model 30-10-2022.pkl')
```

Loading the saved model

In [26]:
```
saved_kmeans = load_model('Final KMeans Model 30-10-2022')
```

```
Transformation Pipeline and Model Successfully Loaded
```

In [28]:
```
new_prediction = predict_model(saved_kmeans, data=data_unseen)
new_prediction.head(5)
```

Out[28]:

	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship	race	
0	53.0	Private	234721.0	11th	7.0	Married-civ-spouse	Handlers-cleaners	Husband	Black	
1	19.0	Private	544091.0	HS-grad	9.0	Married-AF-spouse	Adm-clerical	Wife	White	F

	age	workclass	fnlwgt	education	education-num	marital-status	occupation	relationship	race
2	43.0	Private	237993.0	Some-college	10.0	Married-civ-spouse	Tech-support	Husband	White

```
In [3]: # Notice that the results of unseen_predictions and new_prediction are ide
```