

I. Installing the Unified Medical Language System (UMLS)

```
In [6]: %load_ext autoreload
%autoreload 2

import sys
import hashlib
sys.path.insert(0, '../..../trove')
```

The autoreload extension is already loaded. To reload it, use:
%reload_ext autoreload

A. Download the UMLS Release Files

Trove requires access to the [Unified Medical Language System \(UMLS\)](#) which is freely available after signing up for an account with the National Library of Medicine (NLM).

Visit the link below and download the latest "UMLS Metathesaurus Files" release [2020AB](#). This file is quite large (5.3 GB compressed), so it may take some time to download. **Please note, "full" release zip files are currently not supported.**

Alternatively, if you have an existing API KEY you can use the following script to download the zip file from the command line. See <https://documentation.uts.nlm.nih.gov/automating-downloads.html> for technical details on NLM authentication.

```
python download_umls.py \  
  --apikey XXXXXXXX-XXXX-XXXX-XXXX-XXXXXXXXXXXX \  
  --url https://download.nlm.nih.gov/umls/kss/2020AB/umls-2020AB-  
  metathesaurus.zip
```

B. Installation

Currently there are 2 ways to initialize the UMLS:

- From the source zip file (e.g., `umls-2020AB-metathesaurus.zip`)
- From the Rich Release Format (RRF) files generated by [MetamorphoSys](#)
- **TBD** An existing database instance

Depending on your machine, this should take 2-5 minutes.

Option 1: Install from NLM Zip File

```
In [4]: %time
from trove.labelers.umls import UMLS
```

```
# setup defaults
UMLS.config(
    cache_root = "~/trove/umls2022AB",
    backend = 'pandas'
)

NLM_ZIPFILE_PATH = "umls-2020AB-metathesaurus.zip"#edited this line from full ish
if not UMLS.is_initialized():
    print("Initializing the UMLS from zip file...")
    UMLS.init_from_nlm_zip(NLM_ZIPFILE_PATH, use_checksum=True)
```

Initializing the UMLS from zip file...

```
-----
UnboundLocalError                                Traceback (most recent call last)
File <timed exec>:12

File ~\Hubs\trove\tutorials\..\trove\trove\labelers\umls.py:303, in UMLS.init_from_nlm_zip(fpath, outdir, backend, use_checksum, keep_original_rrfs)
    300     release = 'full' if "full" in fpath.split('/')[1] else 'meta'
    302 # TODO: Implement 'full' installation for archived UMLS zip files
--> 303 if release == 'full':
    304     msg = "Please use UMLS `metathesaurus` zip files, not `full`"
    305     raise Exception(msg)

UnboundLocalError: local variable 'release' referenced before assignment
```

```
In [7]: md5 = hashlib.md5(b'umls-2020AB-metathesaurus.zip')
print(md5, '\n',md5.digest())
```

```
<md5 _hashlib.HASH object @ 0x0000224DFB51270>
b"\x1b\xb1\xa9'\xdb:\xe4\x82\x9e\xa3m\xde%\`Dn"
```

```
In [5]: from platform import python_version
python_version()
```

```
Out[5]: '3.9.7'
```

```
In [6]: #see Libraries below
!pip3 list
```

Package	Version
absl-py	0.13.0
aiobotocore	2.2.0
aiohttp	3.8.1
aioitertools	0.10.0
aiosignal	1.2.0
argon2-cffi	21.3.0
argon2-cffi-bindings	21.2.0
asttokens	2.0.5
astunparse	1.6.3
async-timeout	4.0.2
attrs	21.4.0
backcall	0.2.0
bleach	4.1.0
botocore	1.24.21
cachetools	4.2.4
certifi	2021.10.8
cffi	1.15.0
charset-normalizer	2.0.12
colorama	0.4.4
cramjam	2.5.0
cvxpy	1.2.0
cycler	0.11.0
DateTime	4.4
debugpy	1.5.1
decorator	5.1.1
defusedxml	0.7.1
ecos	2.0.10
entrypoints	0.4
executing	0.8.3
fastparquet	0.8.0
flatbuffers	1.12
fonttools	4.29.1
frozenlist	1.3.0
fsspec	2022.3.0
gast	0.4.0
google-auth	1.35.0
google-auth-oauthlib	0.4.4
google-pasta	0.2.0
grpcio	1.34.1
h5py	3.1.0
idna	3.3
ipykernel	6.9.1
ipython	8.1.1
ipython-genutils	0.2.0
ipywidgets	7.6.5
jedi	0.18.1
Jinja2	3.0.3
jmespath	1.0.0
joblib	1.1.0
jsonschema	4.4.0
jupyter	1.0.0
jupyter-client	7.1.2
jupyter-console	6.4.0
jupyter-core	4.9.2
jupyterlab-pygments	0.1.2
jupyterlab-widgets	1.0.2
keras-nightly	2.5.0.dev2021032900
Keras-Preprocessing	1.1.2

kiwisolver	1.3.2
Markdown	3.3.4
MarkupSafe	2.1.0
matplotlib	3.5.1
matplotlib-inline	0.1.3
mistune	0.8.4
msgpack	1.0.4
multidict	6.0.2
nbclient	0.5.11
nbconvert	6.4.2
nbformat	5.1.3
nest-asyncio	1.5.4
notebook	6.4.8
numpy	1.19.5
oauthlib	3.2.0
opt-einsum	3.3.0
osqp	0.6.2.post5
packaging	21.3
pandas	1.4.1
pandocfilters	1.5.0
parso	0.8.3
patsy	0.5.2
pickleshare	0.7.5
Pillow	9.0.1
pip	21.2.4
plotly	5.6.0
prometheus-client	0.13.1
prompt-toolkit	3.0.28
protobuf	3.19.4
pure-eval	0.2.2
pyasn1	0.4.8
pyasn1-modules	0.2.8
pycparser	2.21
Pygments	2.11.2
yparsing	3.0.7
pyreadstat	1.1.4
pyrsistent	0.18.1
python-dateutil	2.8.2
pytz	2021.3
pywin32	303
pywinpty	2.0.5
pyzmq	22.3.0
qdlldl	0.1.5.post0
qtconsole	5.2.2
QtPy	2.0.1
requests	2.27.1
requests-oauthlib	1.3.1
rsa	4.8
s3fs	2022.3.0
scikit-learn	1.0.2
scipy	1.8.0
scs	3.2.0
seaborn	0.11.2
Send2Trash	1.8.0
setuptools	58.0.4
six	1.15.0
sklearn	0.0
stack-data	0.2.0
statsmodels	0.13.2
tenacity	8.0.1

```

tensorboard                2.5.0
tensorboard-data-server    0.6.1
tensorboard-plugin-wit     1.8.1
tensorflow                  2.5.0
tensorflow-estimator       2.5.0
termcolor                   1.1.0
terminado                   0.13.2
testpath                    0.6.0
threadpoolctl              3.1.0
torch                       1.11.0
torchvision                 0.12.0
tornado                     6.1
traitlets                   5.1.1
typing_extensions          4.1.1
urllib3                     1.26.8
wcwidth                     0.2.5
webencodings                0.5.1
Werkzeug                    2.0.3
wheel                       0.37.1
widgetsnbextension         3.5.2
wincertstore                0.2
wrapit                       1.12.1
yarl                         1.7.2
zope.interface              5.4.0

```

Option 2: Install from RRF Files

If you have installed the UMLS before using [MetamorphoSys](#) to create custom vocabulary subsets you can directly use the generated RRF files.

In [16]:

```

%%time

RRF_FILE_PATH = ""
if not UMLS.is_initialized():
    print("Initializing the UMLS from RRFs...")
    UMLS.init_from_rrfs(RRF_FILE_PATH)

```

Initializing the UMLS from RRFs...

```

-----
FileNotFoundError                                Traceback (most recent call last)
File <timed exec>:4, in <module>

File ~\Hubs\trove\tutorials\..\..\trove\trove\labelers\umls.py:349, in UMLS.init_from
_rrfs(indir, outdir, backend)
   347 for fname in ['MRCONSO.RRF', 'MRSTY.RRF', 'MRSAB.RRF']:
   348     if not os.path.exists(f"{indir}/{fname}"):
--> 349         raise FileNotFoundError(
   350             errno.ENOENT,
   351             os.strerror(errno.ENOENT),
   352             fname
   353         )
   355 # Source terminologies - MRSAB.RRF
   356 sabs = {}

FileNotFoundError: [Errno 2] No such file or directory: 'MRCONSO.RRF'

```

Option 3: Install from an Existing Database Instance

TBD: If you have a live UMLS database instance running, you can initialize Trove as follows.

```
In [1]: # if not UMLS.is_initalized():
#       UMLS.init_from_dbconn(engine='mysql', dbname='UMLS2020AB')
```

3. Test the Installation

Here we apply some common term transformations. This should run in 2-4 minutes.

```
In [5]: %%time
from trove.labelers.umls import UMLS
from trove.transforms import SmartLowercase

# english stopwords
stopwords = set(open('data/stopwords.txt', 'r').read().splitlines())
stopwords = stopwords.union(set([t[0].upper() + t[1:] for t in stopwords]))

# options for filtering terms
config = {
    "type_mapping" : "TUI", # TUI = semantic types, CUI = concept ids
    'min_char_len' : 2,
    'max_tok_len' : 8,
    'min_dict_size' : 500,
    'stopwords' : stopwords,
    'transforms' : [SmartLowercase()],
    'languages' : {"ENG"},
    'filter_sabs' : {"SNOMEDCT_VET"},
    'filter_rgx' : r'''^[-+]*[0-9]+([\.[0-9]+)*$'' # filter numbers
}

umls = UMLS(**config)
```

```
-----
FileNotFoundError                               Traceback (most recent call last)
File <timed exec>:5, in <module>

FileNotFoundError: [Errno 2] No such file or directory: 'data/stopwords.txt'
```

Look at semantic type assignments for an example term `acetaminophen` from the Medical Subject Headings (MeSH®) terminology.

```
In [6]: from trove.labelers.umls import SemanticGroups

semgroups = SemanticGroups()
stys = umls.terminologies['MSH']['acetaminophen']
print(stys)
print([semgroups.types[sty] for sty in stys])

{'T109', 'T121'}
['Organic Chemical', 'Pharmacologic Substance']
```

In []: