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# **USG3**

***Release 1.0***

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**CONTENTS:**

<b>1</b>	<b>How to Interact with the API</b>	<b>3</b>
1.1	USG3 Module Tutorials . . . . .	3
1.2	Environmental requirements for the package . . . . .	6
<b>2</b>	<b>Setup Snippets</b>	<b>13</b>
<b>3</b>	<b>Get Data API</b>	<b>15</b>
<b>4</b>	<b>Visualization Script</b>	<b>17</b>
<b>5</b>	<b>Indices and tables</b>	<b>19</b>
	<b>Index</b>	<b>21</b>



The USGS 3DEP project (United States Geological Survey 3D Elevation Program) aims at responding to growing needs for high-quality topographic data and a wide range of 3D data representation of the county's features.

The data is stored in a repository on an amazon server. The server contains geospatial data on over 1000 geographical regions. The data stored is in a .ept JSON file format. Entwine Point Tile format (ept) is a simple way to store data. It achieves this by a simple tree-based format. To enable processing ept has crucial keys that enable smooth processing. The dataset is however very complicated to understand

Hence this project aims to create a package to interact with the data and process it into a less complex file, example of code interaction can be found in the notebook labeled scriptdemonstration.ipynb

All package dependencies can be found in the requirements.txt file

New in version 1.0:

1. Fetching of data from USGS 3DEP amazon data source
2. Visualization of boundaries
3. Calculation of Topographic Wetness Index
4. Transformation of boundary points

<b>Warning: * This is an API in very early stages of development that may include some bugs or not support some systems *</b>
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## HOW TO INTERACT WITH THE API

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**Note:**

1. Run:

```
pip install USG3
```

to install the API and all dependencies

2. To import the API and all dependencies:

```
import USG3
```

to your IDE/script

3. If you require specific functions from the package you can access them via:

```
from USG3 import <function name>
```

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### 1.1 USG3 Module Tutorials

The package consists of a number of scripts that carry out different functions

#### 1.1.1 Modules In The package

Supported functions include the following:

1. classification
2. elevation\_data
3. elevation
4. visualize
5. generate
6. reprojection

## Generate

### **gather\_input()**

This is a script function meant to be run on the command line console. It is interactive and enables the user to input various parameters that the function will use to produce a raster file, shape and geojson file.

**Return type** bound, full\_path, output\_file\_laz, output\_file\_tif, output\_file\_csv

### **get\_raster\_terrain(bounds, full\_path, output\_file\_laz, output\_file\_tif, output\_file\_csv, pipeline)**

This function generates necessary geospatial data files such as raster files and las files.

**Param: bounds** input the bounds of the region

**Param: full\_path** input the full path of the region's ept file. This can be found by running the gather\_input function.

**Param: output\_file\_laz** input the location to store the laz file.

**Param: output\_file\_tif** input the location to store the raster image file. This.

**Param: output\_file\_csv** input the location to store the geopandas dataframe stored in csv format.

**Return type** None

## Elevation\_data

### **get\_elevation(laz\_file, las\_file, output\_path, crs)**

This function extracts elevation of given geometrical points given the latitude and the longitude of the given point.

**Param: laz\_file** The given laz file that contains the detailed geographical data of the location.

**Param: las\_file** The location to store the converted las file equivalent of the laz file.

**Param: output\_path** The output path for the geopandas dataframe generated.

**Param: crs** The projection crs you desire to use.

**Return type** geoPandasData frame, lasfile dataframe



## classification

ASPRS Standard LiDAR Point Classes	
Classification	Meaning
0	Created, never classified
1	Unclassified
2	Ground
3	Low Vegetation
4	Medium Vegetation
5	High Vegetation
6	Building
7	Low Point (noise)
8	Model Key-point (mass point)
9	Water
10	Reserved for ASPRS Definition
11	Reserved for ASPRS Definition
12	Overlap Points
13-31	Reserved for ASPRS Definition

## Reprojection

This is a class script and hence must be initialized before using it The class requires a geopandas dataframe for initialization.

```
<instance name>=REPRO(geopandasfile)
```

```
<instance name>.reprojet():
```

**Return type** a set reprojection crs for the given geopandas dataframe

## visualize

This class comprises functions to visualize the data

```
visualize_3D(las_file,output_name, **kwargs):
```

**Param:las\_file** the las file from which we get the information

**Output:output\_name** the output name for the 3d renderer

**Return type** a 3D plot stored in html format

```
standardize_plot(geo_frame, setcrs, tiff_file, shp_output)
```

**Param:geo\_frame** Geodata frame

**Param:setc** set the reprojection of the geopandas dataframe

**Param:tiff\_file** path to the raster image file

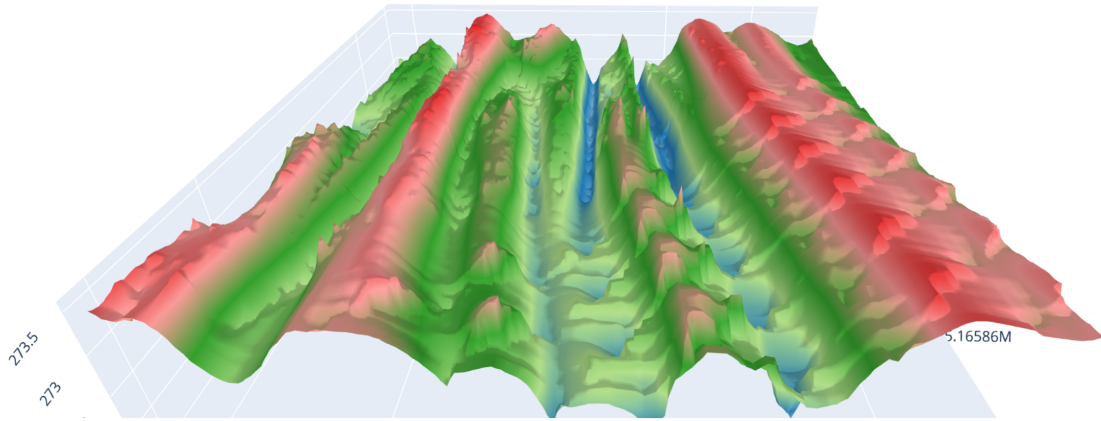


Fig. 1: 3D visualization of IO\_FULLSTATE

**Param:shp\_output** path to store the corresponding shape file

## 1.2 Environmental requirements for the package

The package was build under the following environmental dependencies

absl-py==0.11.0

aiohttp==3.7.4.post0

alabaster==0.7.12

alembic==1.4.1

altair==4.1.0

anaconda-client==1.7.2

anaconda-navigator==2.0.1

anaconda-project @ file:///tmp/build/80754af9/anaconda-project\_1610472525955/work

anyio @ file:///C:/ci/anyio\_1620153167783/work/dist appdirs==1.4.4

argh==0.26.2

argon2-cffi @ file:///C:/ci/argon2-cffi\_1613038019788/work

arrow==0.15.5

asn1crypto @ file:///tmp/build/80754af9/asn1crypto\_1596577642040/work

astor==0.8.1

astroid @ file:///C:/ci/astroid\_1613500971479/work

astropy @ file:///C:/ci/astropy\_1617745665646/work

astunparse==1.6.3  
async-generator==1.10  
async-timeout==3.0.1  
atomicwrites==1.4.0  
atpublic==2.3  
attrs @ file:///tmp/build/80754af9/attrs\_1604765588209/work  
audioread==2.1.9  
autopep8 @ file:///tmp/build/80754af9/autopep8\_1615918855173/work Babel @ file:///tmp/build/80754af9/babel\_1607110387436/work  
backcall @ file:///home/ktietz/src/ci/backcall\_1611930011877/work  
backports.functools-lru-cache @ file:///tmp/build/80754af9/backports.functools\_lru\_cache\_1618170165463/work  
backports.shutil-get-terminal-size @ file:///tmp/build/80754af9/backports.shutil\_get\_terminal\_size\_1608222128777/work  
backports.tempfile @ file:///home/linux1/recipes/ci/backports.tempfile\_1610991236607/work  
backports weakref==1.0.post1  
base58==2.0.1  
bcrypt @ file:///C:/ci/bcrypt\_1597918112552/work  
beautifulsoup4 @ file:///home/linux1/recipes/ci/beautifulsoup4\_1610988766420/work  
binaryornot @ file:///tmp/build/80754af9/binaryornot\_1617751525010/work  
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bkcharts==0.2  
black==19.10b0  
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blinker==1.4 bokeh @ file:///C:/ci/bokeh\_1617827520528/work  
boto==2.49.0  
boto3==1.13.24  
botocore==1.16.24  
Bottleneck==1.3.2  
bravado==11.0.3  
bravado-core==5.17.0  
brotlipy==0.7.0  
cached-property==1.5.2  
cachelib==0.1  
cachetools==4.1.0  
catboost==0.24.3  
certifi==2020.12.5  
cffi @ file:///C:/ci/cffi\_1613247308275/work

chardet==3.0.4  
clang==5.0 click==7.1.2  
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clyent==1.2.2  
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conda==4.10.1  
conda-build==3.21.4  
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confuse==1.3.0  
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cycler==0.10.0  
Cython @ file:///C:/ci/cython\_1618435342622/work  
cytoolz==0.11.0  
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databricks-cli==0.14.3  
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docker==5.0.0  
docutils==0.15.2  
dpath==2.0.1

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dvc==2.5.4  
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et-xmlfile==1.0.1  
fastcache==1.1.0  
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Flask==1.1.2  
Flask-Session==0.3.2  
Flask-Sessions==0.1.5  
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ftfy==6.0.3  
funcy==1.16  
future==0.18.2  
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google-api-python-client==2.15.0  
google-auth==1.23.0  
google-auth-http2==0.1.0  
google-auth-oauthlib==0.4.2  
google-pasta==0.2.0  
google-trans-new==1.1.9  
googleapis-common-protos==1.53.0  
googletrans==3.1.0a0  
grandalf==0.6  
graphviz==0.15

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HeapDict==1.0.1
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httpx==0.13.3
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jsonref==0.2 jsonschema @ file:///tmp/build/80754af9/jsonschema_1602607155483/work jupyter==1.0.0 jupyter-
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MarkupSafe==1.1.1 matplotlib==3.2.2 mccabe==0.6.1 menuinst==1.4.16 missingno==0.4.2 mistune @ file:///C:/
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```

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@ file:///tmp/build/80754af9/ptyprocess\_1609355006118/work/dist/ptyprocess-0.7.0-py2.py3-none-any.whl py @ file:///tmp/build/80754af9/py\_1607971587848/work pyarrow==4.0.1 pyasn1==0.4.8 pyasn1-modules==0.2.8 pycodestyle @ file:///home/ktietz/src/ci\_mi/pycodestyle\_1612807597675/work py-cosat==0.6.3 pycparser @ file:///tmp/build/80754af9/pycparser\_1594388511720/work pycrypto==2.6.1 py-curl==7.43.0.6 pydeck==0.4.0b1 pydocstyle @ file:///tmp/build/80754af9/pydocstyle\_1616182067796/work py-dot==1.4.2 pydotplus==2.0.2 PyDrive2==1.8.3 pydub==0.25.1 pyerfa @ file:///C:/ci/pyerfa\_1619391058121/work pyflakes @ file:///home/ktietz/src/ci\_ipy2/pyflakes\_1612551159640/work pygit2==1.6.1 Pygments @ file:///tmp/build/80754af9/pygments\_1615143339740/work pygtrie==2.4.2 PyJWT==2.1.0 pylint @ file:///C:/ci/pylint\_1617135975189/work pyls-black @ file:///tmp/build/80754af9/pyls-black\_1607553132291/work pyls-spyder @ file:///tmp/build/80754af9/pyls-spyder\_1613849700860/work PyMySQL==0.9.3 PyNaCl @ file:///C:/ci/pynacl\_1595009241355/work pyodbc==4.0.0-unsupported pyOpenSSL @ file:///tmp/build/80754af9/pyopenssl\_1608057966937/work pyparsing @ file:///home/linux1/recipes/ci/pyparsing\_1610983426697/work PyQt5==5.12.3 PyQt5-sip==12.9.0 PyQtWebEngine==5.12.1 pyreadline==2.1 pyrsistent @ file:///C:/ci/pyrsistent\_1600123688363/work PySocks @ file:///C:/ci/pysocks\_1594394709107/work pytest==6.2.3 python-benedict==0.24.0 python-dateutil @ file:///home/ktietz/src/ci/python-dateutil\_1611928101742/work python-dotenv==0.12.0 python-editor==1.0.4 python-fsutil==0.5.0 python-jsonrpc-server @ file:///tmp/build/80754af9/python-jsonrpc-server\_1600278539111/work python-language-server @ file:///tmp/build/80754af9/python-language-server\_1607972495879/work python-slugify==4.0.0 python-speech-features==0.6 pytz @ file:///tmp/build/80754af9/pytz\_1612215392582/work PyWavelets @ file:///C:/ci/pywavelets\_1601658407053/work pywin32==227 pywin32-ctypes @ 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## SETUP SNIPPETS



**GET DATA API**



## VISUALIZATION SCRIPT



## INDICES AND TABLES

- `genindex`
- `modindex`
- `search`





## INDEX

### B

built-in function

gather\_input(), 4

get\_elevation(), 4

get\_raster\_terrain(), 4

standardize\_plot(), 5

### G

gather\_input()

built-in function, 4

get\_elevation()

built-in function, 4

get\_raster\_terrain()

built-in function, 4

### S

standardize\_plot()

built-in function, 5