```
!pip install rasterio
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting rasterio
  Downloading rasterio-1.2.10-cp37-cp37m-manylinux1_x86_64.whl (19.3 MB)
     |████████████████████████████████| 19.3 MB 7.5 MB/s
Collecting click-plugins
  Downloading click_plugins-1.1.1-py2.py3-none-any.whl (7.5 kB)
Collecting cligj>=0.5
  Downloading cligj-0.7.2-py3-none-any.whl (7.1 kB)
Requirement already satisfied: setuptools in /usr/local/lib/python3.7/dist-packages (from rasterio) (57.4.0)
Requirement already satisfied: certifi in /usr/local/lib/python3.7/dist-packages (from rasterio) (2022.9.24)
Requirement already satisfied: numpy in /usr/local/lib/python3.7/dist-packages (from rasterio) (1.21.6)
Collecting affine
  Downloading affine-2.3.1-py2.py3-none-any.whl (16 kB)
Requirement already satisfied: attrs in /usr/local/lib/python3.7/dist-packages (from rasterio) (22.1.0)
Requirement already satisfied: click>=4.0 in /usr/local/lib/python3.7/dist-packages (from rasterio) (7.1.2)
Collecting snuggs>=1.4.1
  Downloading snuggs-1.4.7-py3-none-any.whl (5.4 kB)
Requirement already satisfied: pyparsing>=2.1.6 in /usr/local/lib/python3.7/dist-packages (from snuggs>=1.4.1->rasteric
Installing collected packages: snuggs, cligj, click-plugins, affine, rasterio
Successfully installed affine-2.3.1 click-plugins-1.1.1 cligj-0.7.2 rasterio-1.2.10 snuggs-1.4.7
```

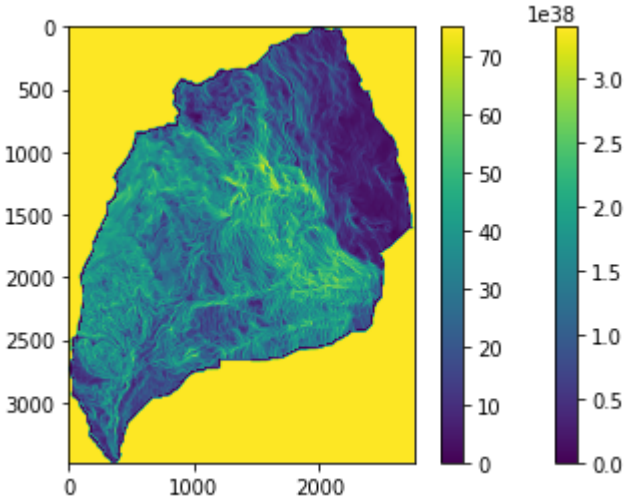
```
import rasterio as rio
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
from pandas import DataFrame
import statsmodels.graphics.api as smg
```

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
raster = rio.open('/content/drive/MyDrive/4. UNIVERSIDAD NACIONAL/Cartografia geotecnica/CartografiaGeotecnica/Taller5/Raste
pendiente=raster.read(1)
plt.imshow(pendiente)
plt.colorbar();

raster_mask = rio.open('/content/drive/MyDrive/4. UNIVERSIDAD NACIONAL/Cartografia geotecnica/CartografiaGeotecnica/Taller5/
msk=raster_mask.read_masks(1)
msk=np.where(msk==255,1,np.nan)
pendiente=msk*pendiente

pendiente=np.where(pendiente<0,np.nan,pendiente)
plt.imshow(pendiente)
plt.colorbar();
pendiente_vector=pendiente.ravel()  # para pasarlo a un vector
pendiente_vector_MenM=pendiente_vector[~np.isnan(pendiente_vector)] # para eliminar  del vector los datos NaN
pendiente_vector_MenM.shape # otra forma de saber las dimensiones
```

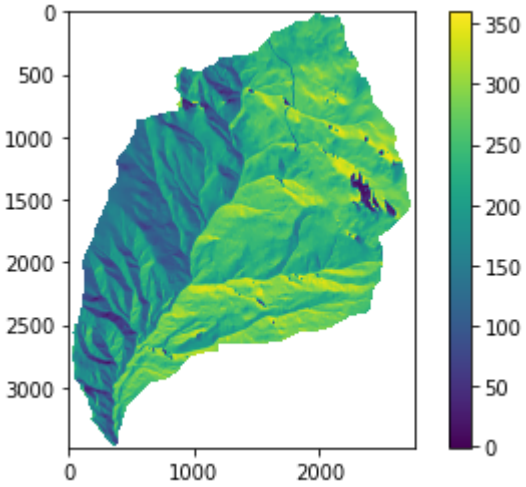
```
(5554845,)
```




```
raster = rio.open('/content/drive/MyDrive/4. UNIVERSIDAD NACIONAL/Cartografia geotecnica/CartografiaGeotecnica/Taller5/Raste
aspecto=raster.read(1)

raster_mask = rio.open('/content/drive/MyDrive/4. UNIVERSIDAD NACIONAL/Cartografia geotecnica/CartografiaGeotecnica/Taller5/
msk=raster_mask.read_masks(1)
```

```
msk=np.where(msk==255,1,np.nan)
aspecto=msk*aspecto

aspecto=np.where(aspecto<-100,np.nan,aspecto)
aspecto_vector=aspecto.ravel()
aspecto_vector_MenM=aspecto_vector[~np.isnan(aspecto_vector)]
plt.imshow(aspecto)
plt.colorbar()
aspecto_vector_MenM.shape
```

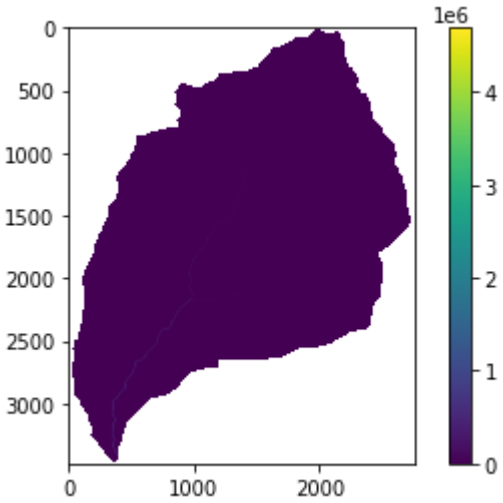
```
(5554845,)
```




```
raster = rio.open('/content/drive/MyDrive/4. UNIVERSIDAD NACIONAL/Cartografia geotecnica/CartografiaGeotecnica/Taller5/Raste
flujo=raster.read(1)

raster_mask = rio.open('/content/drive/MyDrive/4. UNIVERSIDAD NACIONAL/Cartografia geotecnica/CartografiaGeotecnica/Taller5/
msk=raster_mask.read_masks(1)
msk=np.where(msk==255,1,np.nan)
flujo=msk*flujo

flujo=np.where(flujo<0,np.nan,flujo)
flujo_vector=flujo.ravel()
flujo_vector_MenM=flujo_vector[~np.isnan(flujo_vector)]
plt.imshow(flujo)
plt.colorbar()
flujo.shape
```

```
flujo.shape
flujo_vector_MenM.shape
```

```
(5554845,)
```




```
raster = rio.open('/content/drive/MyDrive/4. UNIVERSIDAD NACIONAL/Cartografia geotecnica/CartografiaGeotecnica/Taller5/Raste
geologia=raster.read(1)

raster_mask = rio.open('/content/drive/MyDrive/4. UNIVERSIDAD NACIONAL/Cartografia geotecnica/CartografiaGeotecnica/Taller5/
msk=raster_mask.read_masks(1)
msk=np.where(msk==255,1,np.nan)
geologia=msk*geologia

geologia=np.where(geologia<0,np.nan,geologia)
geologia_vector=geologia.ravel()
geologia_vector_MenM=geologia_vector[~np.isnan(geologia_vector)]
plt.imshow(geologia)
plt.colorbar()
geologia_vector_MenM.shape
```

```
(5554845,)
```


```
np.shape(pendiente)
```

```
(3482, 2763)
```

```
np.shape(aspecto)
```

```
(3482, 2763)
```

```
np.shape(flujo)
```

```
(3482, 2763)
```

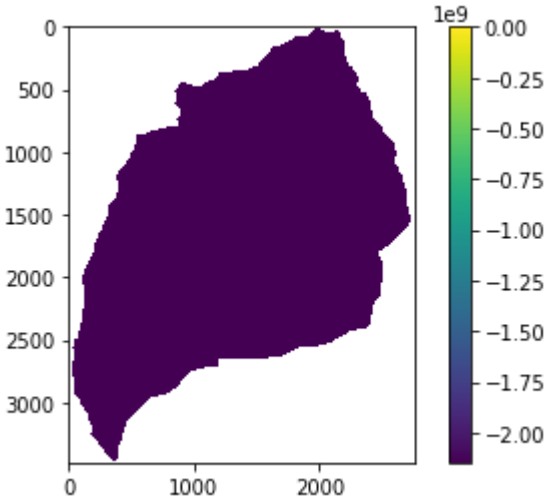
```
np.shape(geologia)
```

```
(3482, 2763)
```

```
raster = rio.open('/content/drive/MyDrive/4. UNIVERSIDAD NACIONAL/Cartografia geotecnica/CartografiaGeotecnica/Taller5/Raste
inventario=raster.read(1)
raster_mask = rio.open('/content/drive/MyDrive/4. UNIVERSIDAD NACIONAL/Cartografia geotecnica/CartografiaGeotecnica/Taller5/
msk=raster_mask.read_masks(1)
msk=np.where(msk==255,1,np.nan)
inventario=msk*inventario
inventario_vector=inventario.ravel()
inventario_vector_MenM=inventario_vector[~np.isnan(inventario_vector)]
plt.imshow(inventario)
```

```
plt.colorbar()
inventario_vector_MenM.shape
```

```
(5554845,)
```




```
np.shape(inventario)
```

```
(3482, 2763)
```

```
d={'inventario':inventario_vector_MenM,'pendiente':pendiente_vector_MenM,'flujo_acum':flujo_vector_MenM,'aspecto':aspecto_ve
df = pd.DataFrame(d)
print(list(df.columns))
```

```
['inventario', 'pendiente', 'flujo_acum', 'aspecto', 'geologia']
```

```
df.head()
```

	inventario	pendiente	flujo_acum	aspecto	geologia
0	-2.147484e+09	10.148775	1.0	218.836258	15.0

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5554845 entries, 0 to 5554844
Data columns (total 5 columns):
 #   Column      Dtype  
---  ------      -----  
 0   inventario  float64
 1   pendiente   float64
 2   flujo_acum  float64
 3   aspecto     float64
 4   geologia    float64
dtypes: float64(5)
memory usage: 211.9 MB
```

```
df1=df[(df["inventario"]==1) | (df["inventario"]==0).sample(frac=.1)]
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 32 entries, 799648 to 5343495
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   inventario  32 non-null     float64
 1   pendiente   32 non-null     float64
 2   flujo_acum  32 non-null     float64
 3   aspecto     32 non-null     float64
 4   geologia    32 non-null     float64
dtypes: float64(5)
memory usage: 1.5 KB
```

```
resumen=df1.describe().T
print(resumen)
```

```
             count        mean        std        min         25%         50%  \
inventario   32.0    1.000000   0.000000   1.000000    1.000000    1.000000
```

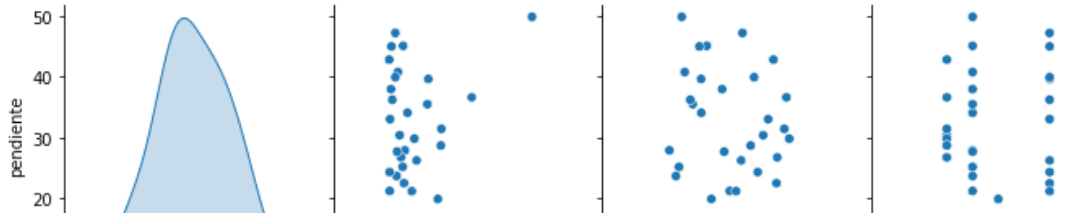
```
pendiente    32.0   30.881745   9.989842  10.981749   24.061012   30.022455
flujo_acum   32.0   49.937500  68.161070   0.000000    7.500000   26.500000
aspecto      32.0  177.716631  57.809234  85.605873  129.389715  174.594040
geologia     32.0    3.968750   1.674946   2.000000    3.000000    3.000000

                    75%         max
inventario     1.000000    1.000000
pendiente     38.332056   49.843197
flujo_acum    60.250000  330.000000
aspecto      224.301723  270.946014
geologia       6.000000    6.000000
```

```
matriz=df.drop(['inventario'],axis=1) # función para eliminar una columna (axis=1)
matriz.head()
```

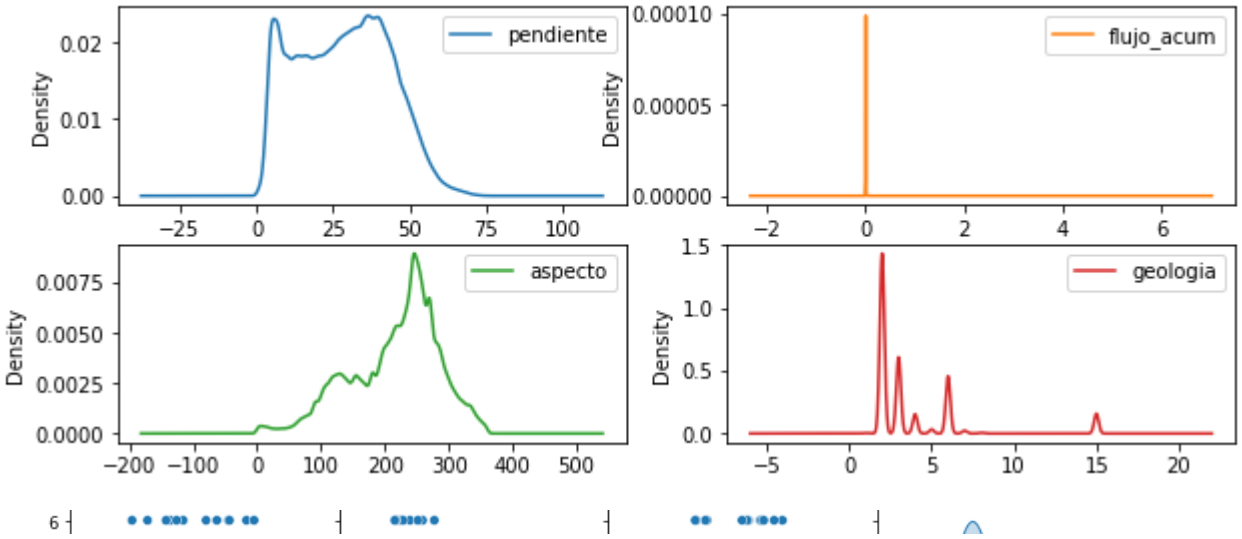
	pendiente	flujo_acum	aspecto	geologia
0	10.148775	1.0	218.836258	15.0
1	9.004342	1.0	218.494370	15.0
2	9.214328	1.0	220.666763	15.0
3	9.395398	1.0	222.757767	15.0
4	9.551983	1.0	224.808960	15.0

```
matriz_cont=matriz.drop(['geologia'],axis=1)
matriz_cont.head()
```

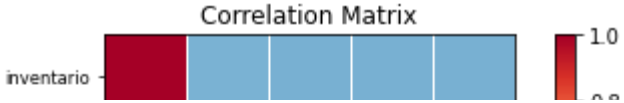
```
          pendiente  fluio acum    aspecto
pd.plotting.scatter_matrix(matriz_cont, alpha = 0.3, figsize = (14,10), diagonal='kde');


sns.pairplot(df1, hue='inventario');
```




```
matriz.plot(kind='density', subplots=True, layout=(2, 2), sharex=False, figsize=(10, 4));
```

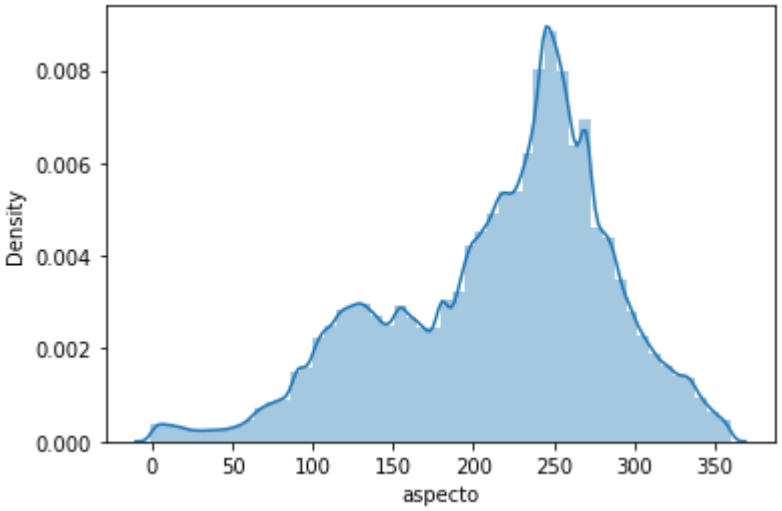



```
MatCorre=DataFrame(df.corr())
smg.plot_corr(MatCorre, xnames=list(MatCorre.columns)) ;
```

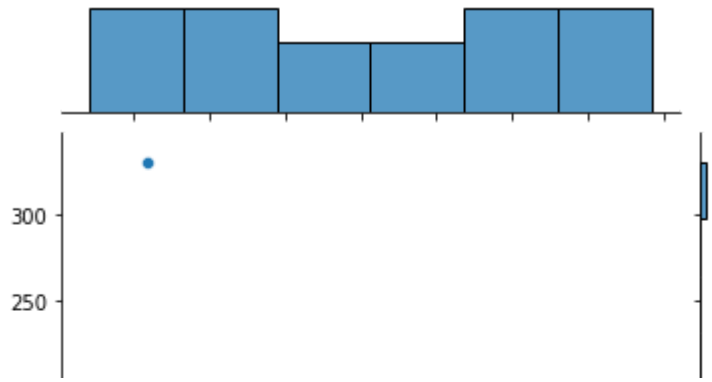



```
sns.distplot(df['aspecto']);
```

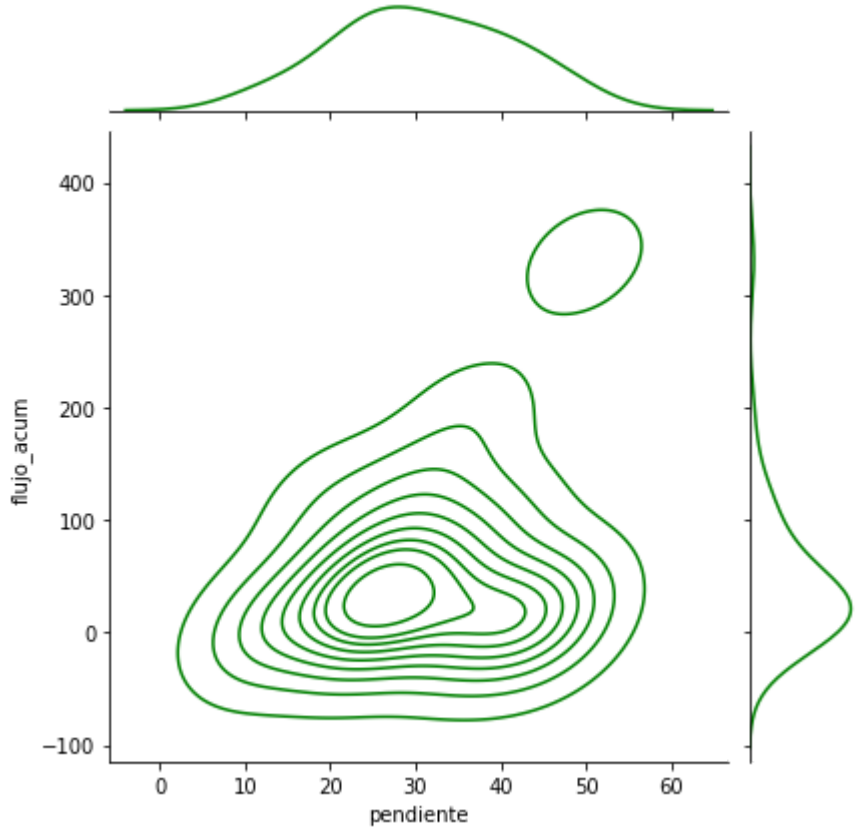
```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarnin
  warnings.warn(msg, FutureWarning)
```



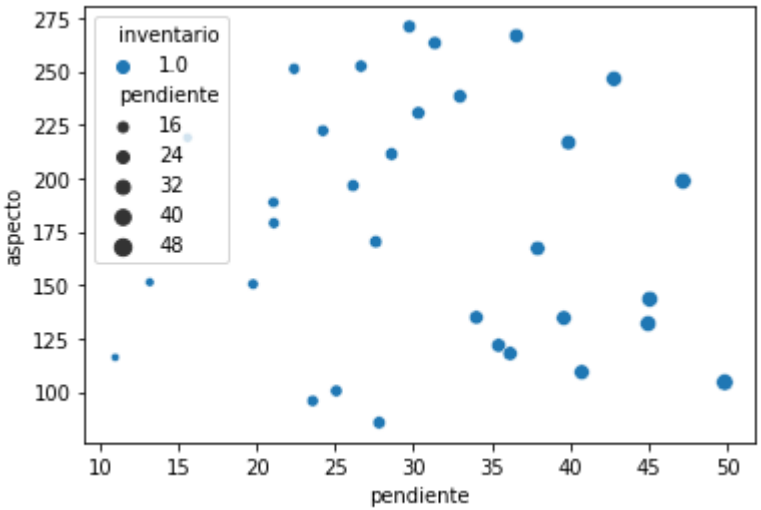

```
sns.jointplot(x='aspecto', y='flujo_acum', data=df1, kind='scatter');
```




```
sns.jointplot(x='pendiente', y='flujo_acum', data=df1, kind='kde', color='g');
```




```
sns.scatterplot(x="pendiente", y="aspecto", hue="inventario", size='pendiente',data=df1);
```




```
sns.lmplot('flujo_acum', 'pendiente', data=df1, hue='inventario', fit_reg=False);
```

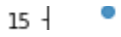
```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variables as keywor
```

```
media=df.groupby('inventario').mean()
print(media)
```

```
                pendiente   flujo_acum     aspecto  geologia
inventario
-2.147484e+09  28.300629  1844.058365  216.588516  3.749118
 1.000000e+00  30.881745    49.937500  177.716631  3.968750
```


```
#Para contar el numero de celdas con y sin MenM
df['inventario'].value_counts()
```

```
-2.147484e+09    5554813
 1.000000e+00         32
Name: inventario, dtype: int64
```




```
landslides=df.inventario.astype(bool)
si_lands=df[landslides]
no_lands=df[~landslides]
```

```
si_lands.count()
```

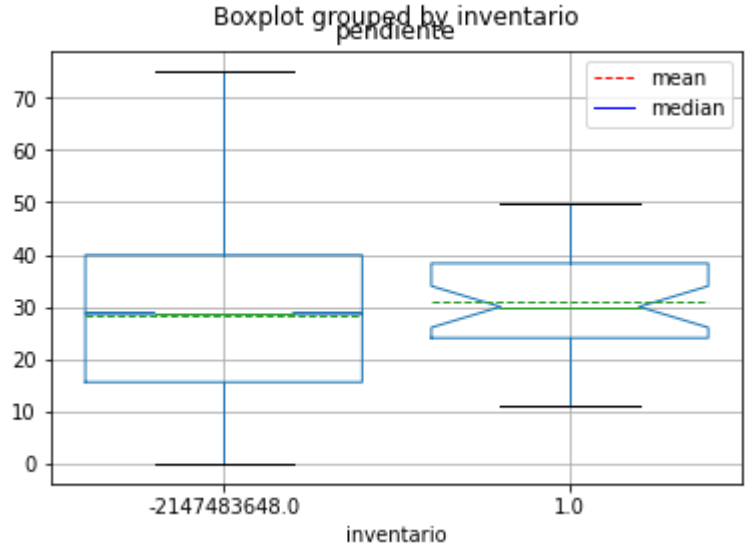
```
inventario    5554845
pendiente     5554845
flujo_acum    5554845
aspecto       5554845
geologia      5554845
dtype: int64
```

```
no_lands.count()
```

```
inventario    0
pendiente     0
flujo_acum    0
aspecto       0
geologia      0
dtype: int64
```

```
df.boxplot('pendiente', by='inventario', notch=True, widths=0.8, showmeans=True, meanline=True)
plt.plot([], [], '--', linewidth=1, color='red', label='mean')
plt.plot([], [], '-', linewidth=1, color='blue', label='median')
plt.legend();
```

```
/usr/local/lib/python3.7/dist-packages/matplotlib/cbook/__init__.py:1376: VisibleDeprecationWarning: Creating an ndarra
  X = np.atleast_1d(X.T if isinstance(X, np.ndarray) else np.asarray(X))
```




```
from scipy import stats
stats.ttest_ind(no_lands["pendiente"], si_lands["pendiente"])
```

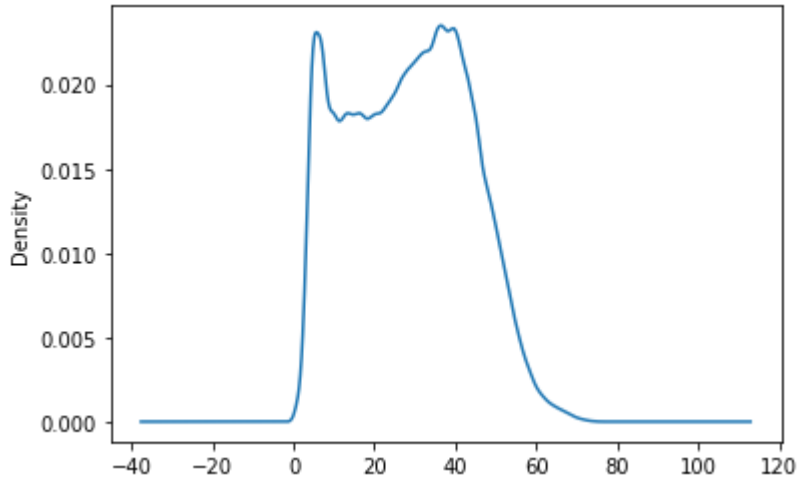
```
Ttest_indResult(statistic=nan, pvalue=nan)
```

```
fig, ax = plt.subplots()
si_lands['pendiente'].plot.kde(ax=ax, label='Sin MenM')
no_lands['pendiente'].plot.kde(ax=ax, label='Con MenM')
ax.set_xlim(0,90)
ax.set_xlabel('Pendiente (°)', color='k', size=12)
ax.set_ylabel('Densidad', color='k', size=12)
```

```
ax.legend(loc=1, fontsize=10)
ax.tick_params('y', colors='k', labelsize= 10)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-52-d9737c74ea64> in <module>
      1 fig, ax = plt.subplots()
      2 si_lands['pendiente'].plot.kde(ax=ax, label='Sin MenM')
----> 3 no_lands['pendiente'].plot.kde(ax=ax, label='Con MenM')
      4 ax.set_xlim(0,90)
      5 ax.set_xlabel('Pendiente (°)', color='k', size=12)

 7 frames 

<__array_function__ internals> in nanmax(*args, **kwargs)

/usr/local/lib/python3.7/dist-packages/numpy/lib/nanfunctions.py in nanmax(a, axis, out, keepdims)
    432         # Fast, but not safe for subclasses of ndarray, or object arrays,
    433         # which do not implement isnan (gh-9009), or fmax correctly (gh-8975)
--> 434         res = np.fmax.reduce(a, axis=axis, out=out, **kwargs)
    435         if np.isnan(res).any():
    436             warnings.warn("All-NaN slice encountered", RuntimeWarning,

ValueError: zero-size array to reduction operation fmax which has no identity
```

SEARCH STACK OVERFLOW




```
#se importan todas las librerias a utilizar
from sklearn.decomposition import PCA
```

```
from sklearn.preprocessing import scale

#Se importan los archivos
data= pd.read_excel("https://github.com/edieraristizabal/Libro_cartoGeotecnia/blob/master/data/PUNTOS.xlsx?raw=true", sheet_
puntos=data['INVENTARIO']
data.drop('INVENTARIO', axis=1, inplace=True)

# Se debe escalar los datos antes de aplicar PCA
data = pd.DataFrame(scale(data), columns=['DV', 'A', 'CP', 'CT', 'DF', 'GEOLOGIA','RR','R','S','TPI','WI','COBERTURA','DDS',

## Se implementa el análisi PCA con la libreria sklearn de python
n = len(data.columns)
pca = PCA(n_components=n)
pca = pca.fit(data)
pca_samples = pca.transform(data)

#Se puede graficar cuanto aporta a la varianza cada componente generado
plt.plot(pca.explained_variance_ratio_)
plt.xlabel('Number of components')
plt.ylabel('Explained variance')
plt.show()

#graficamos el acumulado de varianza explicada en las nuevas dimensiones
plt.plot(np.cumsum(pca.explained_variance_ratio_))
plt.xlabel('number of components')
plt.ylabel('cumulative explained variance')
plt.show()

#Para identificar cada variable como se relaciona con las componentes utilizamos las figuras byplot de python
# 0,1 denota el componente principl 1 y 2 (PC1 and PC2); para otros componentes se modifica el número
xvector = pca.components_[0]
yvector = pca.components_[1]

xs = pca.transform(data)[:,0] # Componente principal 1
ys = pca.transform(data)[:,1] # Componente principal 2

mask1=np.ma.masked_where(puntos < 1,xs )
mask2=np.ma.masked_where(puntos < 1,ys )
```

```
## Para visualizar las proyecciones de cada variable en los componentes se utiliza la siguiente función
for i in range(len(xvector)):
# arrows project features (ie columns from csv) as vectors onto PC axes
    plt.arrow(0, 0, xvector[i]*max(xs), yvector[i]*max(ys),
              color='r', width=0.0005, head_width=0.0025)
    plt.text(xvector[i]*max(xs)*1.2, yvector[i]*max(ys)*1.2,
             list(data.columns.values)[i], color='r')

plt.scatter(xs, ys, s=70,marker='x',c='blue', label='MenM')
plt.scatter(mask1,mask2,facecolors='black', edgecolors='black', s=70, alpha=0.5, label='No MenM')
plt.tick_params('y', colors='k', labelsize=12, length=2)
plt.tick_params('x', colors='k', labelsize= 12, length=2)
plt.xlabel("Componente Principal 1", fontsize=16)
plt.ylabel("Componente Principal 2", fontsize=16)
plt.legend(fontsize=14)
plt.show()
```

```
---------------------------------------------------------------------------
HTTPError                                 Traceback (most recent call last)
<ipython-input-54-f4aa5d4546f4> in <module>
      4
      5 #Se importan los archivos
----> 6 data= pd.read_excel("https://github.com/edieraristizabal/Libro_cartoGeotecnia/blob/master/data/PUNTOS.xlsx?raw=true", sheet_name='PUNTOS')
      7 puntos=data['INVENTARIO']
      8 data.drop('INVENTARIO', axis=1, inplace=True)

                                  12 frames
/usr/lib/python3.7/urllib/request.py in http_error_default(self, req, fp, code, msg, hdrs)
    647 class HTTPDefaultErrorHandler(BaseHandler):
    648     def http_error_default(self, req, fp, code, msg, hdrs):
--> 649         raise HTTPError(req.full_url, code, msg, hdrs, fp)
    650
    651 class HTTPRedirectHandler(BaseHandler):

HTTPError: HTTP Error 404: Not Found
```

SEARCH STACK OVERFLOW

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0s completed at 4:47 PM