sample_compute_cohesive_sand_coarse_fraction

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The Coastal Grain Size Portal (C-GRASP) dataset Will Speiser, Daniel Buscombe, and Evan Goldstein > Categorize Samples by percent sand, percent mud, and percent coarse

The purpose of this notebook
This notebook serves as a guide of how to calculate percent cohesive, percent sand, and percent coarse sediment for each sample within a chosen sample dataset. This notebook calls selected data from the CGRASP zenodo repository and runs an iterative function that interpolates the cumulative distribution of each sample, and finds the percentage of samples that are below and above the minimum and wentworth classification of sand sediment grain size in millimeters respectively. The code will compute and add three new fields to the input sample data dataframe for each sample that specifies the percent cohesives,sands, and coarse of the sample composition. To calculate interpolation error or to translate sample data from phi to mm units, see the other notebooks within this repository.
The output of the notebook is a csv with the selected CGRASP dataset and the above three new fields

[1]:
```
import pandas as pd
import numpy as np
import scipy
# from scipy.interpolate import interp1d
import ipywidgets
import matplotlib.pyplot as plt
from tqdm import tqdm
```

Choose a dataset

[2]:
```
#Dataset collection widget
zen=ipywidgets.Select(
    options=['Entire Dataset', 'Estimated Onshore Data', 'Verified Onshore␣
↪Data', 'Verified Onshore Post 2012 Data'],
    value='Entire Dataset',
    # rows=10,
    description='Dataset:',
    disabled=False
)

display(zen)
```

```
Select(description='Dataset:', options=('Entire Dataset', 'Estimated Onshore␣
 ↪Data', 'Verified Onshore Data', '…
```

Download chosen dataset

```
[3]: url = 'https://zenodo.org/record/6099266/files/'
     if zen.value=='Entire Dataset':
         filename='dataset_10kmcoast.csv'
     if zen.value=='Estimated Onshore Data':
         filename='Data_EstimatedOnshore.csv'
     if zen.value=='Verified Onshore Data':
         filename='Data_VerifiedOnshore.csv'
     if zen.value=='Verified Onshore Post 2012 Data':
         filename='Data_Post2012_VerifiedOnshore.csv'

     print("Downloading {}".format(url+filename))
```

```
Downloading
https://zenodo.org/record/6099266/files/Data_Post2012_VerifiedOnshore.csv
```

```
[4]: url=(url+filename)
     print('Retrieving Data, Please Wait')
     #retrieve data
     df=pd.read_csv(url)
     print('Sediment Data Retrieved!')
```

```
Retrieving Data, Please Wait
Sediment Data Retrieved!
```

Specify percentiles In this cell specify the names of the given distributions within the sample data (i.e. d10, d50, d90) within the `percentiles` variable.

```
[5]: percentiles=str('d10,d16,d25,d50,d65,d75,d84,d90')

     #extract percentile values and percentile names that were provided with the␣
      ↪source dataset (e.g, 'd50' and .5)
     given_dist_vals=[]
     given_dist_names=[]

     for i in range(0,len((percentiles).split(',',))):
         a=(percentiles).split(',',)[i]
         b=a.split('d')[1]
         val=int(b)/100
         given_dist_names.append(a)
         given_dist_vals.append(val)
```

Calculate percent sand and percent cohesive Run this cell to calculate percent sand and percent cohesive.

It will first iterate through each sample and calculate the percent sand via cumulative interpolation. Then it will take the found cumulative percentile for the minimum and maximum wentworth sand grain size (mm) then turn it into a percent fraction and assign the appropriate percent fractions for cohesive, coarse, and sand.

This may take a long time on the full dataset - please consult the waitbar at the bottom of the cell to view progress

```
[6]: for i in tqdm(range(0,(len(df)))):#repeats for each row, aka sample
         #create an array of distribution grain sizes for each sample
         grain_size_bins=[]
         #This collects the values from the distributions
         for ia in range(0,len((percentiles).split(',',))):
             bin_size=df[given_dist_names[ia]].iloc[i]
             grain_size_bins.append(bin_size)
             grain_size_frequencies=given_dist_vals

         grain_size_frequencies = np.array(grain_size_frequencies)
         grain_size_bins = np.array(grain_size_bins)

         # find grain size bins in the sand range
         sand_bin_freqs = grain_size_frequencies[(grain_size_bins<=2.0) &␣
      ↪(grain_size_bins>.063)]

         # if not nan
         if len(sand_bin_freqs)>0:

             # get the range of frequencies covered by sand fraction
             prop_sand = sand_bin_freqs.max() - sand_bin_freqs.min()

             # if that range is the same as the full range, assume 100% sand
             if prop_sand==(np.max(grain_size_frequencies) - np.
      ↪min(grain_size_frequencies)):
                 prop_sand = 1.0
         else:
             prop_sand = np.nan

         df.loc[i,["%Sand"]] = 100*prop_sand

         # find grain size bins in the cohesive range
         cohesive_bin_freqs = grain_size_frequencies[(grain_size_bins<=.063) &␣
      ↪(grain_size_bins>0)]

         # if not nan
         if len(cohesive_bin_freqs)>0:

             # get the range of frequencies covered by sand fraction
             prop_cohesive = cohesive_bin_freqs.max() - cohesive_bin_freqs.min()
```

```
        # if that range is the same as the full range, assume 100% sand
        if prop_cohesive==(np.max(grain_size_frequencies) - np.
↪min(grain_size_frequencies)):
            prop_cohesive = 1.0
    else:
        prop_cohesive = np.nan

    df.loc[i,["%Cohesive"]] = 100*prop_cohesive
```

```
100%|

       | 2113/2113 [00:02<00:00, 1041.54it/s]
```

Compute percentage mud and silt (“cohesive”)

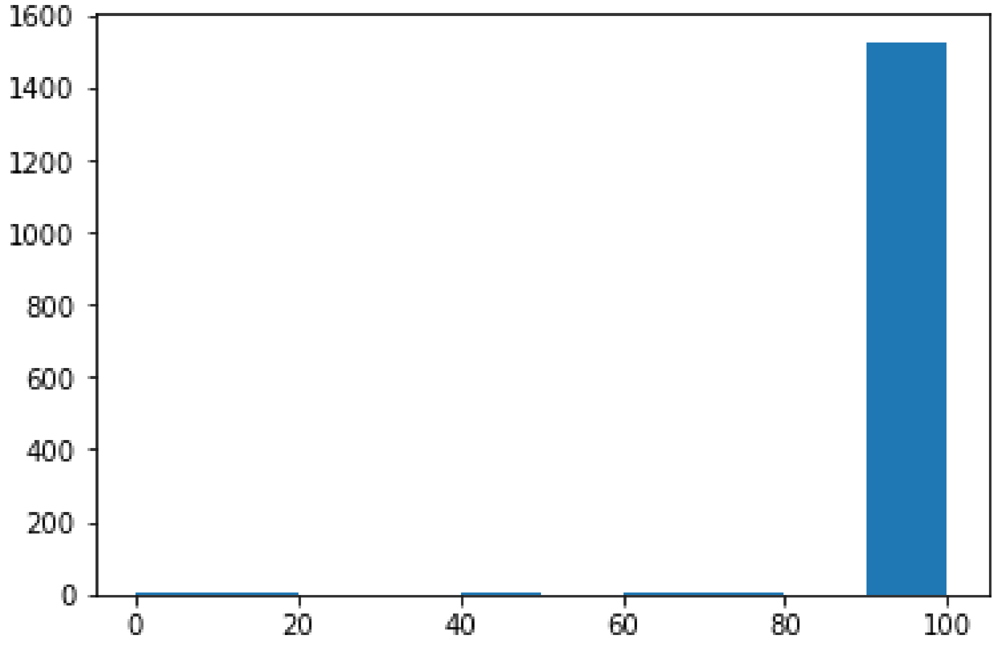
Compute percentage gravel (“coarse”)

```
[7]: #Remaining percentile is gravel
     df['%Coarse']=100-(df["%Sand"]+df['%Cohesive'])
```

Make a quick plot to view distribution of ‘percent sand’

```
[8]: plt.hist(df['%Sand'][np.isfinite(df['%Sand'])])
```

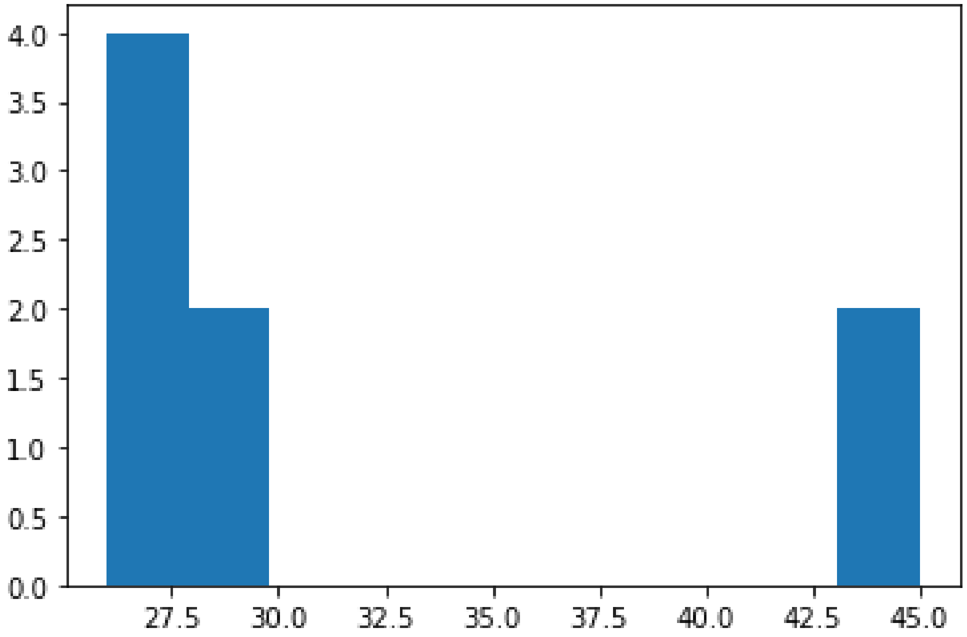
```
[8]: (array([   3.,    3.,    0.,    0.,    3.,    0.,    4.,    6.,    0.,
        1525.]),
      array([  0.,  10.,  20.,  30.,  40.,  50.,  60.,  70.,  80.,  90., 100.]),
      <BarContainer object of 10 artists>)
```



Make a quick plot to view distribution of 'percent coarse'

```
[9]: plt.hist(df['%Coarse'][np.isfinite(df['%Coarse'])])
```

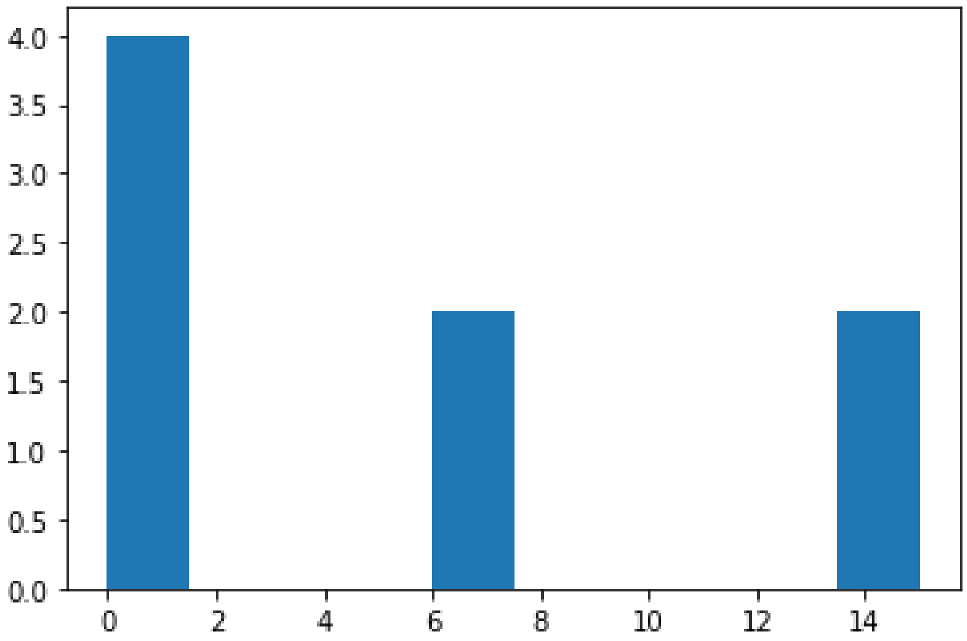
```
[9]: (array([4., 2., 0., 0., 0., 0., 0., 0., 0., 2.]),
      array([26. , 27.9, 29.8, 31.7, 33.6, 35.5, 37.4, 39.3, 41.2, 43.1, 45. ]),
      <BarContainer object of 10 artists>)
```



Make a quick plot to view distribution of 'percent cohesive'

```
[10]: plt.hist(df['%Cohesive'][np.isfinite(df['%Cohesive'])])
```

```
[10]: (array([4., 0., 0., 0., 2., 0., 0., 0., 0., 2.]),
       array([ 0. ,  1.5,  3. ,  4.5,  6. ,  7.5,  9. , 10.5, 12. , 13.5, 15. ]),
       <BarContainer object of 10 artists>)
```



0.0.1 Output to file

Finally, define a csv file name for the output dataframe

```
[11]: output_csvfile='../data_plus_fractions.csv'
```

write the data to that csv file

```
[12]: df.to_csv(output_csvfile) #convert data to CSV
```

```
[ ]:
```