J. de Curtò i DíAz Digitally signed by J. de Curtò i DíAz Date: 2022.01.02 21:31:34 +08'00'

Pràctica 2. Neteja i anàlisi de dades. Universitat Oberta de Catalunya.
DrCyZ: Techniques for analyzing and extracting useful information from CyZ.

J. de Curtò i DíAz.

I. de Zarzà i Cubero.

04-01-2022.

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DrCyZ: Techniques for analyzing and extracting useful information from CyZ.

De Curtò i DíAz.
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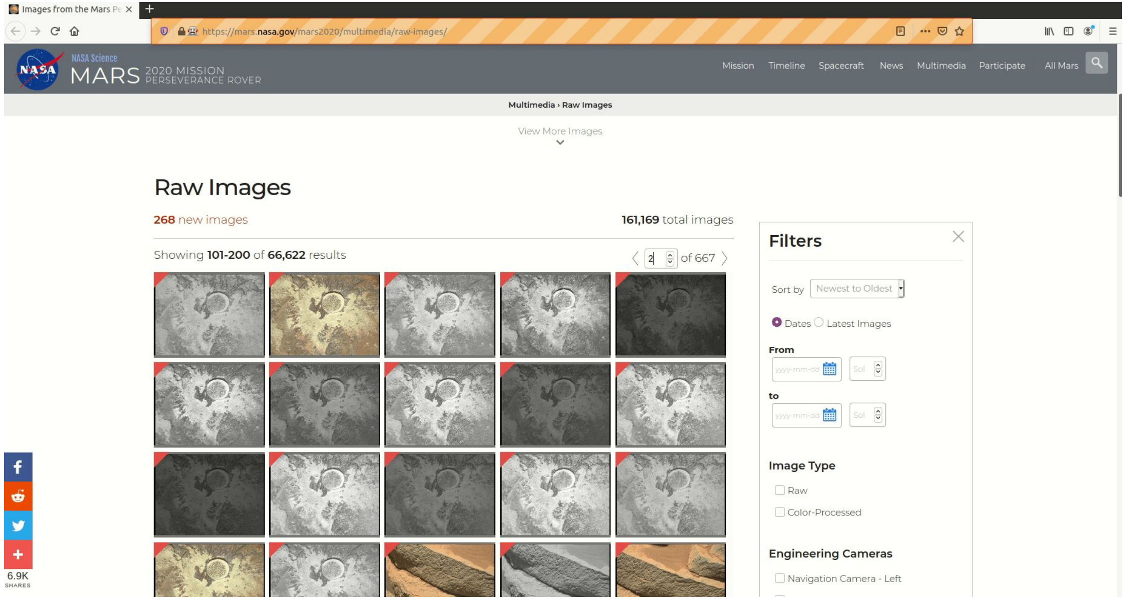
https://github.com/decurtoidiaz/cyz

https://github.com/decurtoidiaz/drcyz


Images from the Mars Pe

https://mars.nasa.gov/mars2020/multimedia/raw-images/

Raw Images

268 new images

161,169 total images

Showing 101-200 of 66,622 results

2 of 667

Filters

Sort by Newest to Oldest

● Dates ○ Latest Images

From yyyy-mm-dd Sol

to yyyy-mm-dd Sol

Image Type

□ Raw

□ Color-Processed

Engineering Cameras

□ Navigation Camera - Left

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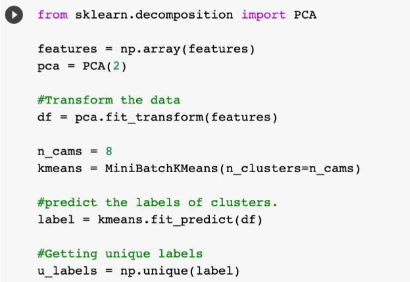
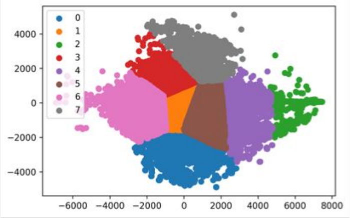
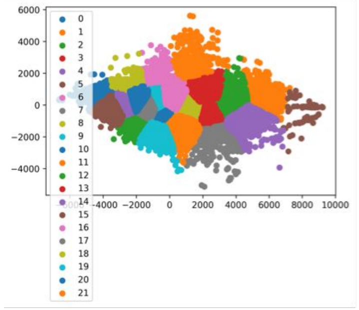
K-means Clustering with PCA(2)



```
from sklearn.decomposition import PCA

features = np.array(features)
pca = PCA(2)

#Transform the data
df = pca.fit_transform(features)

n_cams = 8
kmeans = MiniBatchKMeans(n_clusters=n_cams)

#predict the labels of clusters.
label = kmeans.fit_predict(df)

#Getting unique labels
u_labels = np.unique(label)
```



Curiosity



Perseverance

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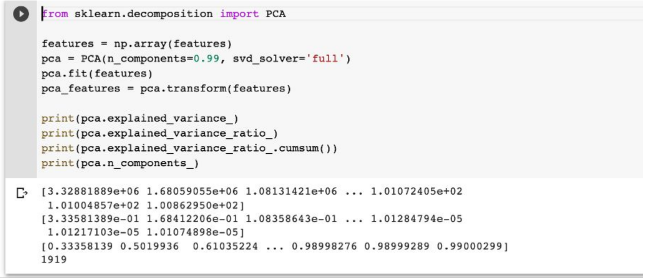
**t-SNE with
PCA (explaining 99%
of variance)**



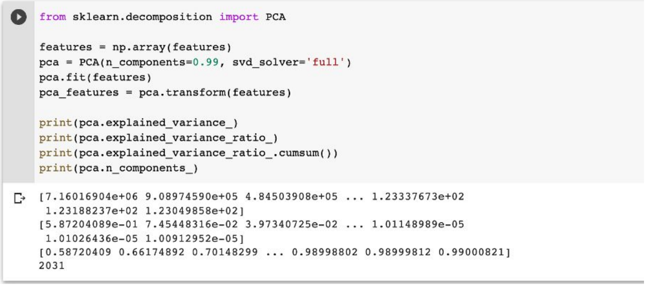
```
from sklearn.decomposition import PCA

features = np.array(features)
pca = PCA(n_components=0.99, svd_solver='full')
pca.fit(features)
pca_features = pca.transform(features)

print(pca.explained_variance_)
print(pca.explained_variance_ratio_)
print(pca.explained_variance_ratio_.cumsum())
print(pca.n_components_)
```

```
[3.32881889e+06 1.68059055e+06 1.08131421e+06 ... 1.01072405e+02
 1.01004857e+02 1.00862950e+02]
[3.33581389e-01 1.68412206e-01 1.08358643e-01 ... 1.01284794e-05
 1.01217103e-05 1.01074898e-05]
[0.33358139 0.5019936  0.61035224 ... 0.98998276 0.98999289 0.99000299]
1919
```

Curiosity



```
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pca.fit(features)
pca_features = pca.transform(features)

print(pca.explained_variance_)
print(pca.explained_variance_ratio_)
print(pca.explained_variance_ratio_.cumsum())
print(pca.n_components_)
```

```
[7.16016904e+06 9.08974590e+05 4.84503908e+05 ... 1.23337673e+02
 1.23188237e+02 1.23049858e+02]
[5.87204089e-01 7.45448316e-02 3.97340725e-02 ... 1.01148989e-05
 1.01026436e-05 1.00912952e-05]
[0.58720409 0.66174892 0.70148299 ... 0.98998802 0.98999812 0.99000821]
2031
```

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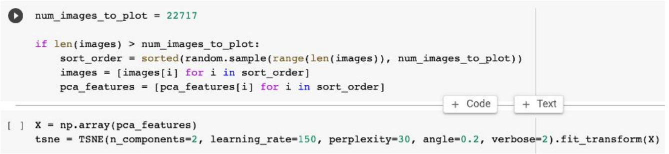
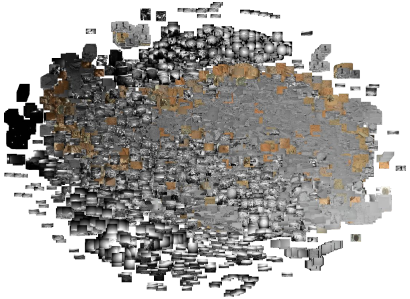
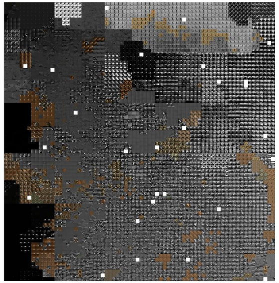
t-SNE with PCA (explaining 99% of variance)



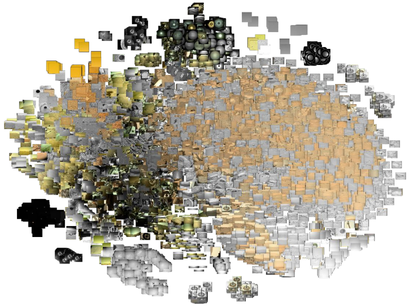
```
num_images_to_plot = 22717

if len(images) > num_images_to_plot:
    sort_order = sorted(random.sample(range(len(images)), num_images_to_plot))
    images = [images[i] for i in sort_order]
    pca_features = [pca_features[i] for i in sort_order]
```

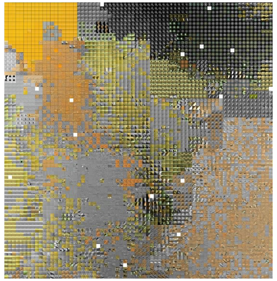
```
X = np.array(pca_features)
tsne = TSNE(n_components=2, learning_rate=150, perplexity=30, angle=0.2, verbose=2).fit_transform(X)
```





Curiosity





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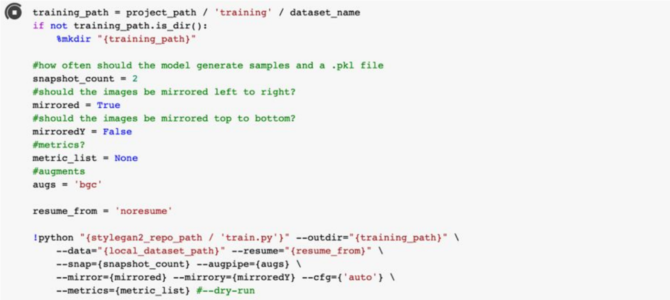
Stylegan2-ada training with subset of samples (drcyz - 5025 corresponding terrain pictures to ease convergence) from Perseverance.



```
training_path = project_path / 'training' / dataset_name
if not training_path.is_dir():
    %mkdir "{training_path}"

#how often should the model generate samples and a .pkl file
snapshot_count = 2
#should the images be mirrored left to right?
mirrored = True
#should the images be mirrored top to bottom?
mirroredY = False
#metrics?
metric_list = None
#augments
augs = 'bgc'

resume_from = 'noresume'

!python "{stylegan2_repo_path / 'train.py'}" --outdir="{training_path}" \
    --data="{local_dataset_path}" --resume="{resume_from}" \
    --snap={snapshot_count} --augpipe={augs} \
    --mirror={mirrored} --mirrory={mirroredY} --cfg={'auto'} \
    --metrics={metric_list} #--dry-run
```

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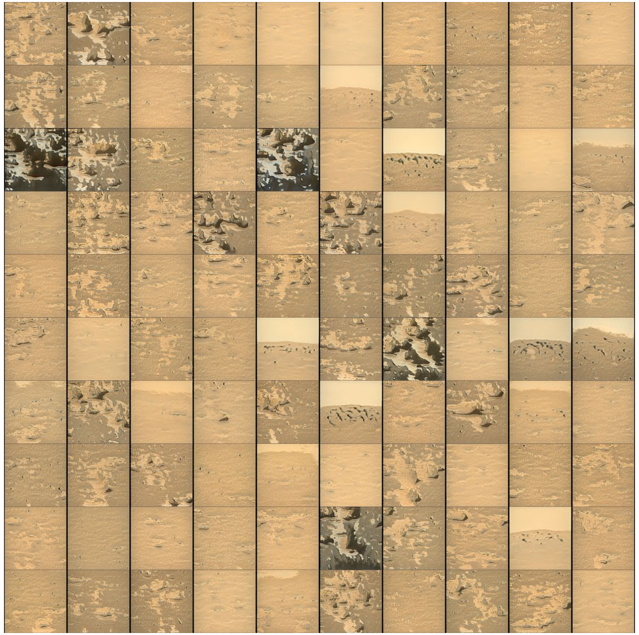
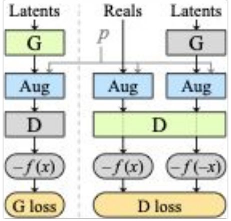


Grid of 100 synthetic samples.



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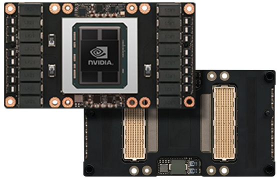
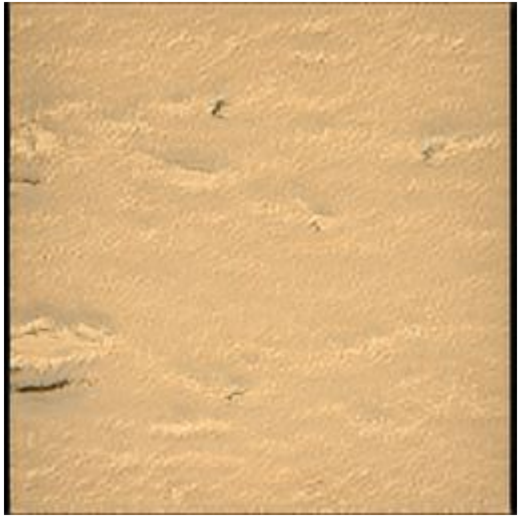
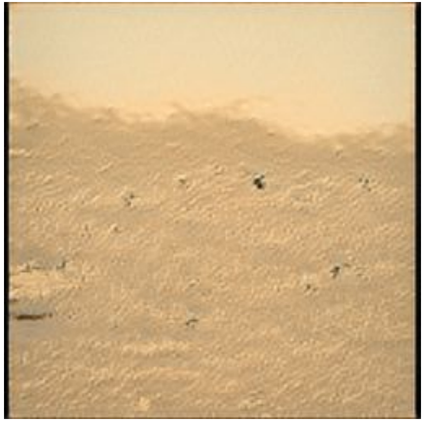
Stylegan2-ada training with subset of samples from Perseverance.

1 x NVIDIA Tesla P-100 around 48h.





Two frames exploring Z-sphere latent space.



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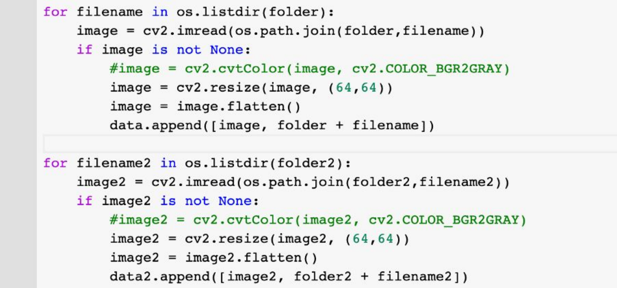
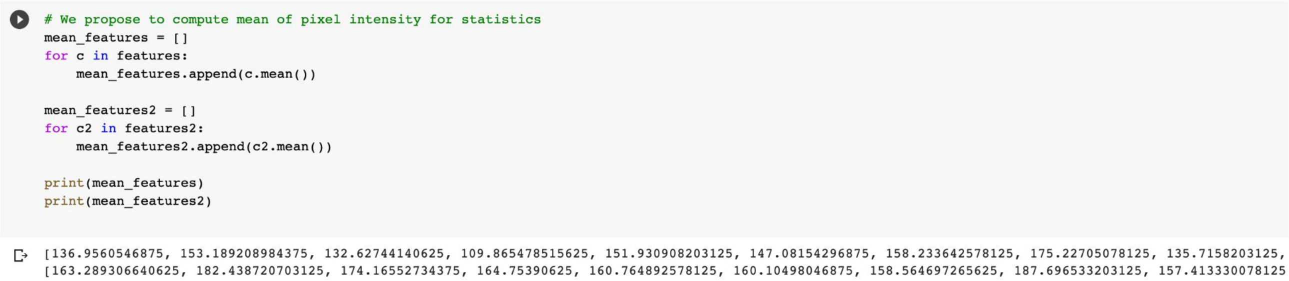
Statistical comparison of the samples by mean intensity (rgb and gray scale).



```
for filename in os.listdir(folder):
    image = cv2.imread(os.path.join(folder,filename))
    if image is not None:
        #image = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
        image = cv2.resize(image, (64,64))
        image = image.flatten()
        data.append([image, folder + filename])

for filename2 in os.listdir(folder2):
    image2 = cv2.imread(os.path.join(folder2,filename2))
    if image2 is not None:
        #image2 = cv2.cvtColor(image2, cv2.COLOR_BGR2GRAY)
        image2 = cv2.resize(image2, (64,64))
        image2 = image2.flatten()
        data2.append([image2, folder2 + filename2])
```

Comparison at size 64x64.



```
# We propose to compute mean of pixel intensity for statistics
mean_features = []
for c in features:
    mean_features.append(c.mean())

mean_features2 = []
for c2 in features2:
    mean_features2.append(c2.mean())

print(mean_features)
print(mean_features2)
```

```
[136.9560546875, 153.189208984375, 132.62744140625, 109.865478515625, 151.930908203125, 147.08154296875, 158.233642578125, 175.22705078125, 135.7158203125,
[163.289306640625, 182.438720703125, 174.16552734375, 164.75390625, 160.764892578125, 160.10498046875, 158.564697265625, 187.696533203125, 157.413330078125
```

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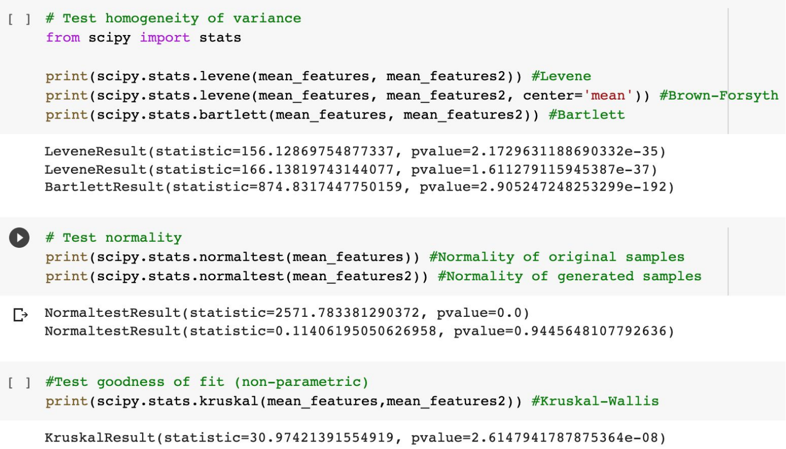
Statistical comparison of the samples by mean intensity (rgb and gray scale).



```
[ ] # Test homogeneity of variance
    from scipy import stats

    print(scipy.stats.levene(mean_features, mean_features2)) #Levene
    print(scipy.stats.levene(mean_features, mean_features2, center='mean')) #Brown-Forsyth
    print(scipy.stats.bartlett(mean_features, mean_features2)) #Bartlett

    LeveneResult(statistic=156.12869754877337, pvalue=2.1729631188690332e-35)
    LeveneResult(statistic=166.13819743144077, pvalue=1.611279115945387e-37)
    BartlettResult(statistic=874.8317447750159, pvalue=2.905247248253299e-192)
```

Homogeneity of variance

```
    # Test normality
    print(scipy.stats.normaltest(mean_features)) #Normality of original samples
    print(scipy.stats.normaltest(mean_features2)) #Normality of generated samples

    NormaltestResult(statistic=2571.783381290372, pvalue=0.0)
    NormaltestResult(statistic=0.11406195050626958, pvalue=0.9445648107792636)
```

Normality

```
[ ] #Test goodness of fit (non-parametric)
    print(scipy.stats.kruskal(mean_features,mean_features2)) #Kruskal-Wallis

    KruskalResult(statistic=30.97421391554919, pvalue=2.6147941787875364e-08)
```

Goodness of fit (non-parametric)

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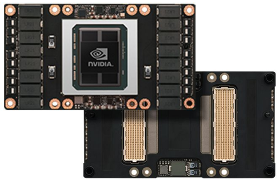
Stylegan2-ada training with subset of samples from Perseverance.

1 x NVIDIA Tesla P-100 around 48h.



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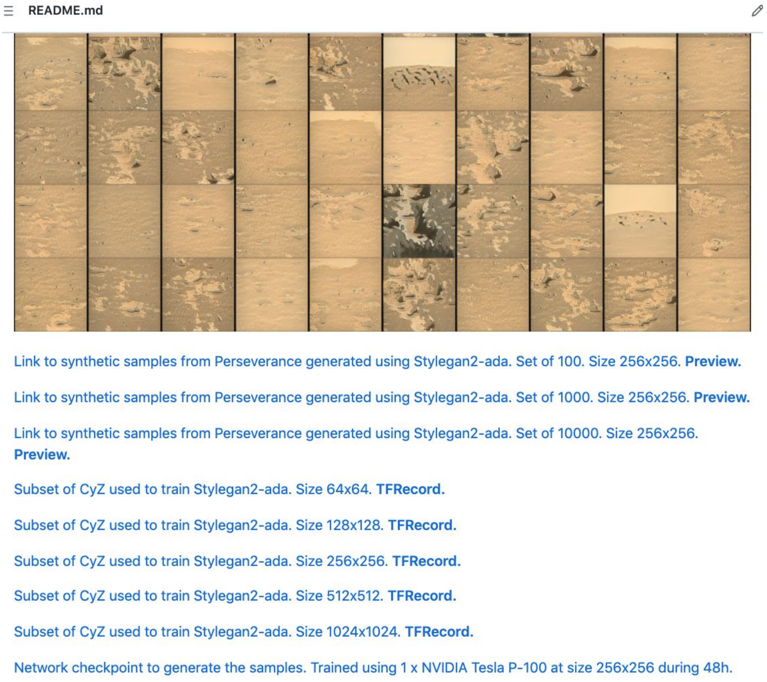

Link to synthetic samples from Perseverance generated using Stylegan2-ada. Set of 100. Size 256x256. **Preview.**

Link to synthetic samples from Perseverance generated using Stylegan2-ada. Set of 1000. Size 256x256. **Preview.**

Link to synthetic samples from Perseverance generated using Stylegan2-ada. Set of 10000. Size 256x256. **Preview.**

Subset of CyZ used to train Stylegan2-ada. Size 64x64. **TFRecord.**

Subset of CyZ used to train Stylegan2-ada. Size 128x128. **TFRecord.**

Subset of CyZ used to train Stylegan2-ada. Size 256x256. **TFRecord.**

Subset of CyZ used to train Stylegan2-ada. Size 512x512. **TFRecord.**

Subset of CyZ used to train Stylegan2-ada. Size 1024x1024. **TFRecord.**

Network checkpoint to generate the samples. Trained using 1 x NVIDIA Tesla P-100 at size 256x256 during 48h.

We release: subset of data used to train the networks, in png and TFRecords.

Sets of 100, 1000 and 10000 synthetic samples.

Network checkpoint to sample from.

And notebooks in python to reproduce the experiments.

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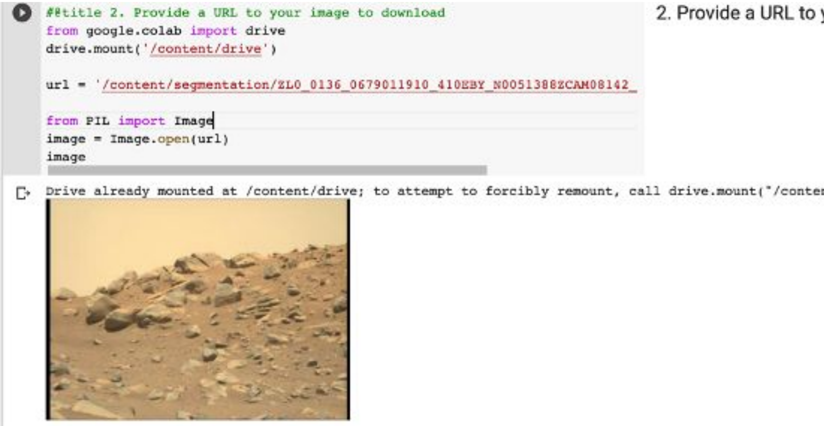
Example of instance segmentation using Deeplab on a sample from Perseverance.



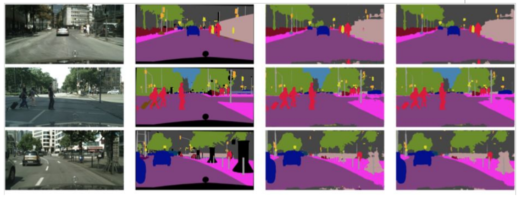
```
#@title 2. Provide a URL to your image to download
from google.colab import drive
drive.mount('/content/drive')

url = '/content/segmentation/ZL0_0136_0679011910_410EBY_N0051388ZCAM08142_

from PIL import Image
image = Image.open(url)
image
```

2. Provide a URL to your image to download

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```



Example of Instance Segmentation using Deeplab on CityScapes.

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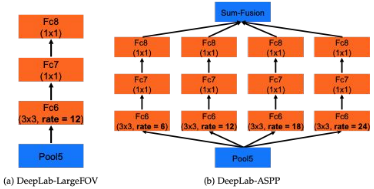
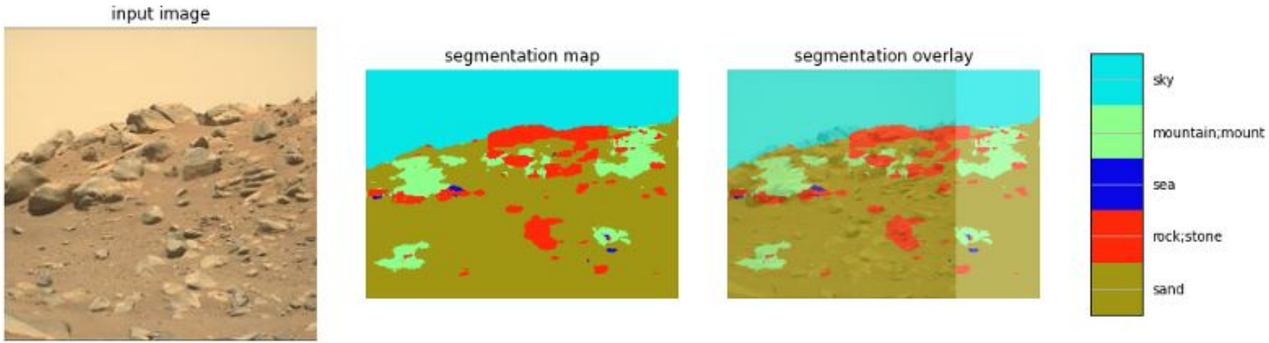


(a) DeepLab-LargeFOV

(b) DeepLab-ASPP



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https://doi.org/10.5281/zenodo.5655473

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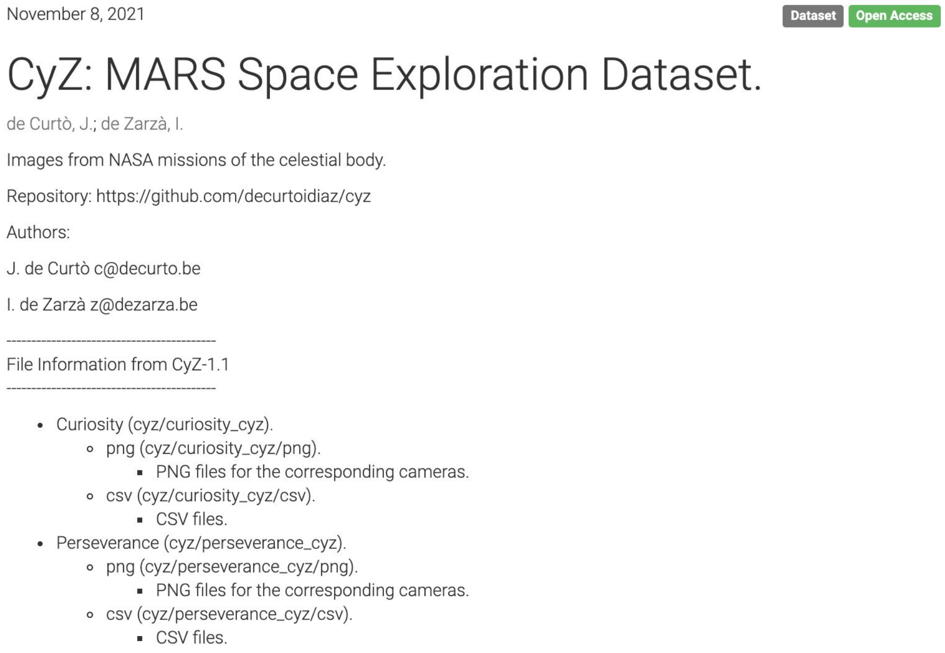

November 8, 2021

Dataset Open Access

CyZ: MARS Space Exploration Dataset.

de Curtò, J.; de Zarzà, I.

Images from NASA missions of the celestial body.

Repository: https://github.com/decurtoidiaz/cyz

Authors:

J. de Curtò c@decurto.be

I. de Zarzà z@dezarza.be

File Information from CyZ-1.1

- Curiosity (cyz/curiosity_cyz).
  - png (cyz/curiosity_cyz/png).
    - PNG files for the corresponding cameras.
  - csv (cyz/curiosity_cyz/csv).
    - CSV files.
- Perseverance (cyz/perseverance_cyz).
  - png (cyz/perseverance_cyz/png).
    - PNG files for the corresponding cameras.
  - csv (cyz/perseverance_cyz/csv).
    - CSV files.

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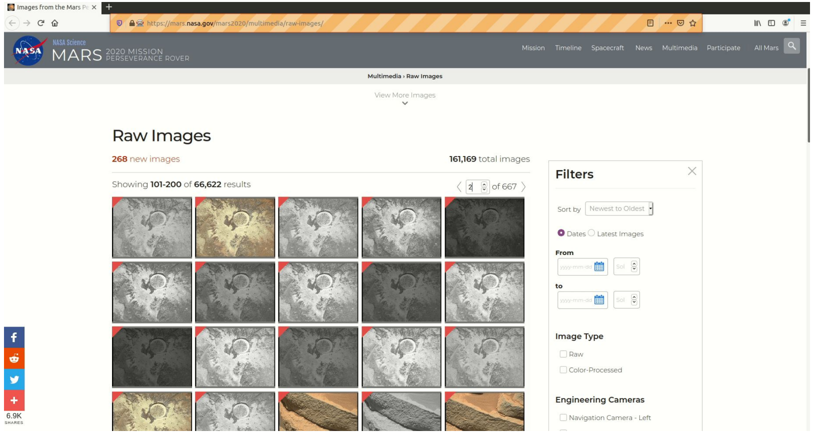
https://github.com/decurtoidiaz/drcyz



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268 new images

161,169 total images

Showing 101-200 of 66,622 results

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● Dates ○ Latest Images

From yyyy-mm-dd Sol

to yyyy-mm-dd Sol

Image Type

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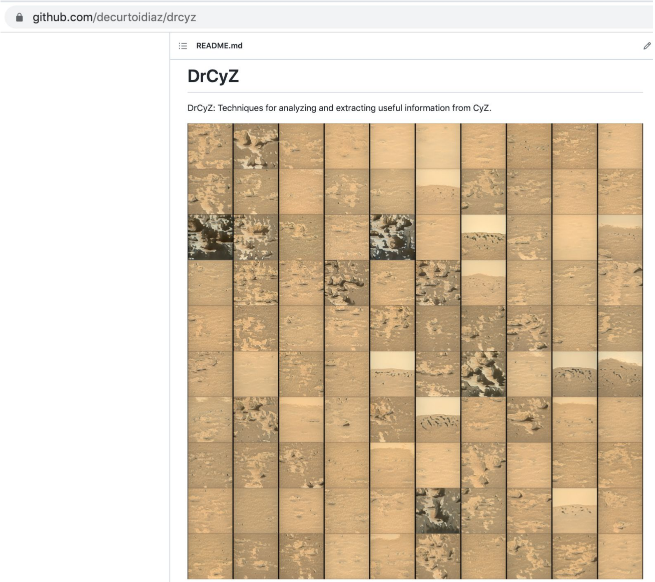
Engineering Cameras

□ Navigation Camera - Left



github.com/decurtoidiaz/drcyz

README.md

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