Supplementary description of MarsScapes

1. Definitions of various terrains in MarsScapes

In order to relieve the influence of perspective effect on ground-view images, i.e., the remote terrains look smaller while the nearby terrains look larger, we divide a map into three regions from near to far and set various terrain standards for different regions as presented in Tab. 1. Taking "big rock" for example, as shown in Fig. 1, it should have a weight larger than 90 pixels or a height larger than 70 pixels when occurring in region III.

Table1: Terrain standards for different regions

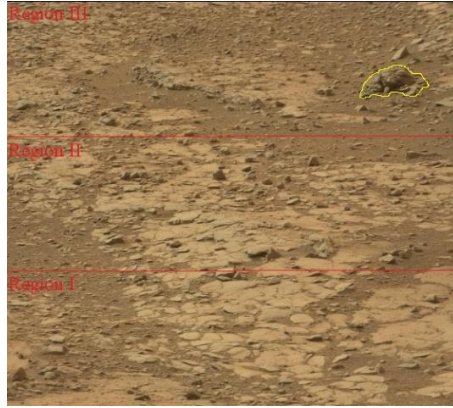| Terrain	Region I	Region II	Region III
Big Rock	w > 90 or h > 70	w > 70 or h > 50	w > 50 or h > 30
Bedrock	w > 110 or h > 70	w > 90 or h > 70	w > 70 or h > 50
Steep Slope	w > 90 or h > 70	w > 70 or h > 50	w > 50 or h > 30
Sand	w > 110 or h > 70	w > 90 or h > 70	w > 70 or h > 50
Soil	w > 110 or h > 70	w > 90 or h > 70	w > 70 or h > 50
Gravel	w > 110 or h > 70	w > 90 or h > 70	w > 70 or h > 50
Sky	-	-	-
Unknown	-	-	-

Figure 1: A sample for big rock.

Specific definition and examples for each category are given in the following subsections.

1.1. Big Rock

The yellow polygons are examples of big rocks, which are so big that it is hard for rovers to go over them. When labeling this category, we need to pay attention to the following matters.

1) Several rocks that are close to each other are considered as one big rock, as shown in Fig. 2.

Figure 2: Several rocks that are close to each other are labeled as one big rock.

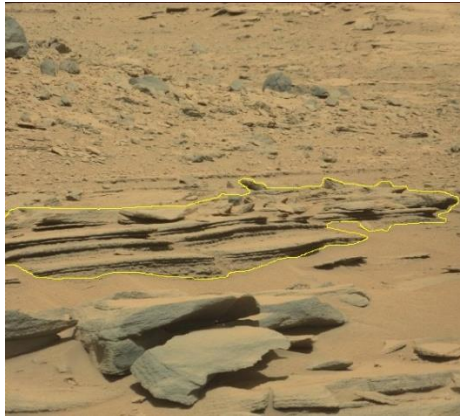2) A large area of stratified rocks is labeled as a big rock, as shown in Fig. 3.

Figure 3: A large area of stratified rocks is labeled as a big rock.

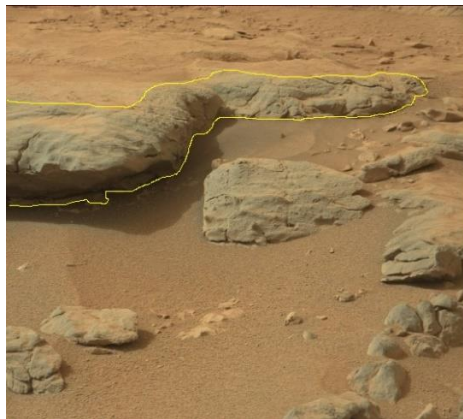3) The curved edge of a bedrock is labeled as a big rock, as shown in Fig. 4.

Figure 4: The curved edge of a bedrock is labeled as a big rock.

1.2. Bedrock

Bedrock terrains are typically hard surfaces of flat and embedded rocks, which are drivable for rovers. Sometimes they are as smooth as bathroom tiles, but sometimes they are rougher. As shown in Fig. 5 and Fig. 6, they are annotated with green polygons.
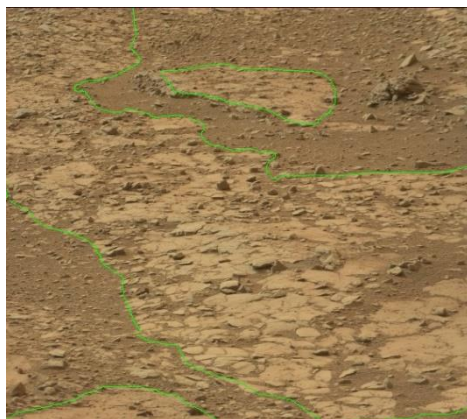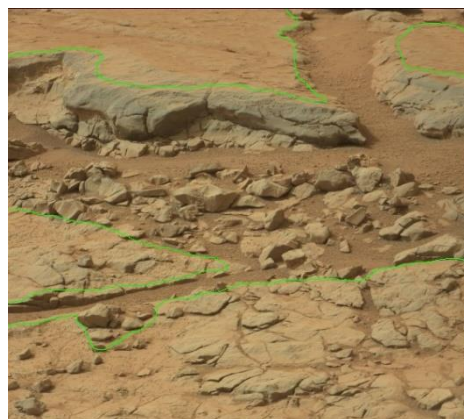

Figure 5: Samples for rough bedrocks.   Figure 6: Samples for smooth bedrocks.

1.3. Sand

Typical sand terrain on Mars is similar with a beach on Earth. It is covered with powdery and slippery dust, which makes it challenging for rovers to drive through. This terrain type is usually characterized by ripples, as shown in Fig. 7.
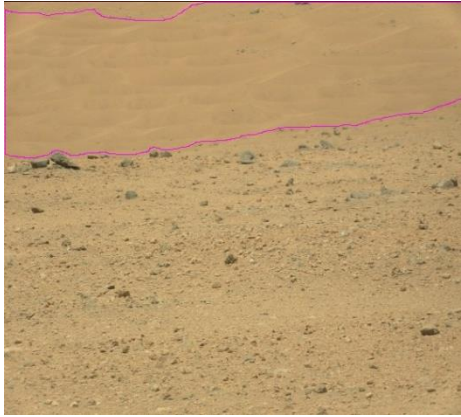
Figure 7: A sample for sand terrain.

1.4. Soil

The surface of soil has sufficient cohesion so that the rovers do not experience significant slip. A few small gravels can be found on soil but they would not be obstacles for driving. As shown in Fig. 8, the full image is labeled as soil.

Figure 8: A sample for soil terrain.

1.5. Gravel

Different from sporadic small stones on soil, the gravel terrain are filled with rocks whose size is smaller than big rock, which makes it difficult for rovers to go across. The red polygon is an example of gravel in Fig. 9.
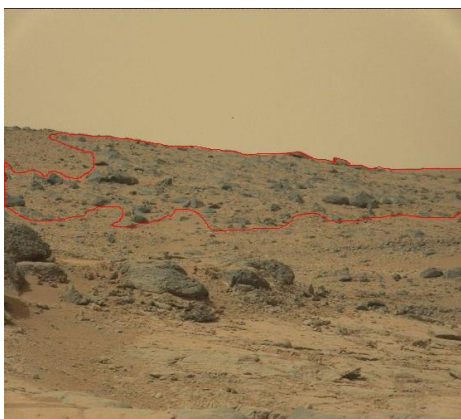

Figure 9: A sample for gravel terrain.

1.6. Steep Slope

As shown in Tab. 1, the standards of steep slope are the same as those of big rock in different regions. Steep slope is a type of impassable terrain, which is very rate in our dataset. It is labeled with an azure polygon in Fig. 10.
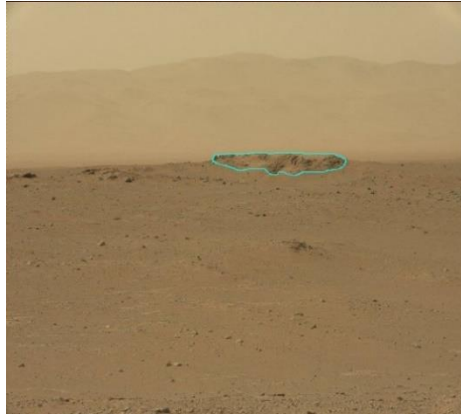

Figure 10: A sample for steep slope.

1.7. Sky

An example of sky is displayed in Fig. 11.

Figure 11: A sample for sky.

1.8. Unknown

We define other areas as "unknown", including undetermined terrain shown in Fig. 12 and the rover itself shown in Fig. 13.
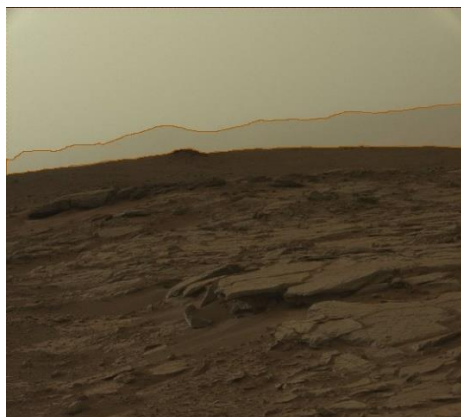

Figure 12: A sample for undetermined terrain.

Figure 13: The part of a rover is labeled as "unknown".

2. Samples of MarsScapes

Limited by file size, we only provide panorama images, semantic segmentation annotations and instance segmentation annotations of three samples in MarsScapes. The full dataset and codes of the data processing are available at http://www.inrobotslab.com/datasets/.
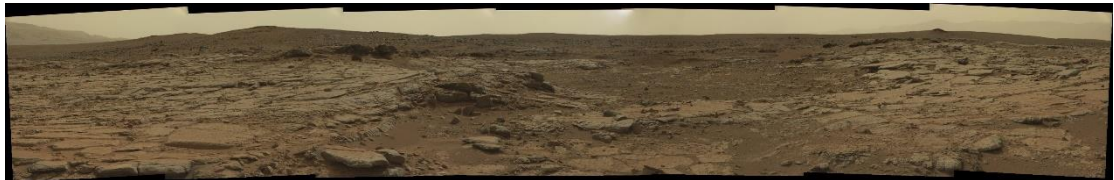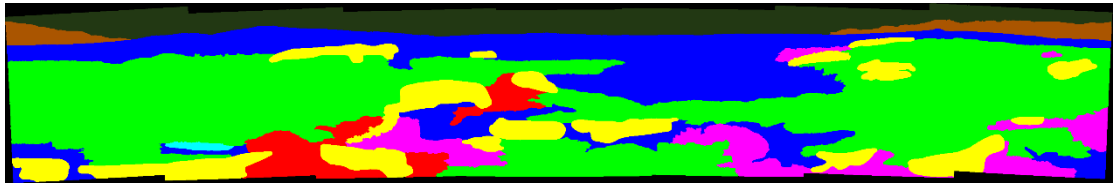

Figure 20: Panorama image of sample 137_1.

Figure 21: Semantic segmentation annotations of sample 137_1.

Figure 22: Instance segmentation annotations of sample 137_1.

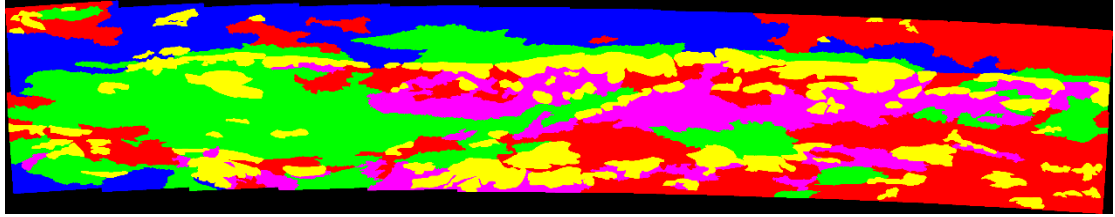Figure 14: Panorama image of sample 439_2.

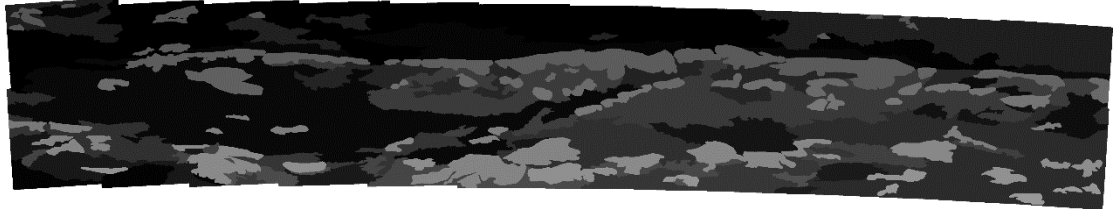Figure 15: Ground truth for semantic segmentation of sample 439_2.

Figure 16: Ground truth for instance segmentation of sample 439_2.

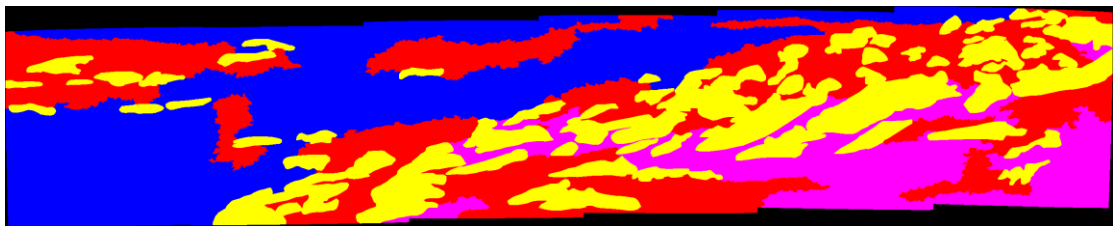Figure 17: Panorama image of sample 551_1.

Figure 18: Ground truth for semantic segmentation of sample 551_1.

Figure 19: Ground truth for instance segmentation of sample 551_1.