Instruction of FAIR-CSAR-V1.0 Dataset

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Reference and Citation Format for FAIR-CSAR-V1.0 dataset:

[1] Y. Wu, Y. Suo, Q. Meng, W. Dai, T. Miao, W. Zhao, Z. Yan, W. Diao, G. Xie, Q. Ke, Y. Zhao, K. Fu, X. Sun, "FAIR-CSAR: A Benchmark Dataset for Fine-Grained Object Detection and Recognition Based on Single-Look Complex SAR Images," in *IEEE Transactions on Geoscience and Remote Sensing*, vol. 63, pp. 1-22, 2025, Art no. 5201022, doi: 10.1109/TGRS.2024.3519891.

[2] 吴有明, 刁文辉, 索玉玺, 孙显. FAIR-CSAR 复图像目标数据集 V1.0（FAIR-CSAR-V1.0）[OL]. 雷达学报, 2025. https://radars.ac.cn/web/data/getData?dataType=FAIR_CSAR..

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https://radars.ac.cn/web/data/getData?dataType=FAIR_CSAR_en&pageType=en.

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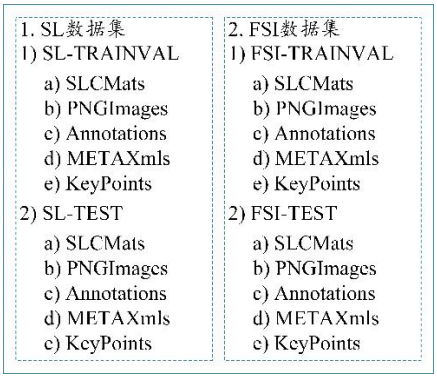
Dataset Overview: FAIR-CSAR-V1.0 dataset aims to advance research in fine-grained SAR object detection and recognition by providing the SAR complex-valued samples and corresponding scattering characteristic annotations of various sub-categories. Derived from 175 full-scene Gaofen-3 Level-1 Single-Look Complex (SLC) products, this dataset covers 32 global regions covering airports, refineries, ports, and riverways. With a total volume of 250GB and over 340K instances across 5 major categories and 22 subcategories, it stands as the largest SAR target dataset to date, featuring the most refined annotation granularity and highest bit-depth storage

precision. In addition, to facilitate SAR target characteristic-guided algorithm optimization, FAIR-CSAR-V1.0 provides detailed annotations of satellite-ground azimuth angles and strong scattering point distributions, offering foundational support for exploiting SAR target scattering properties.

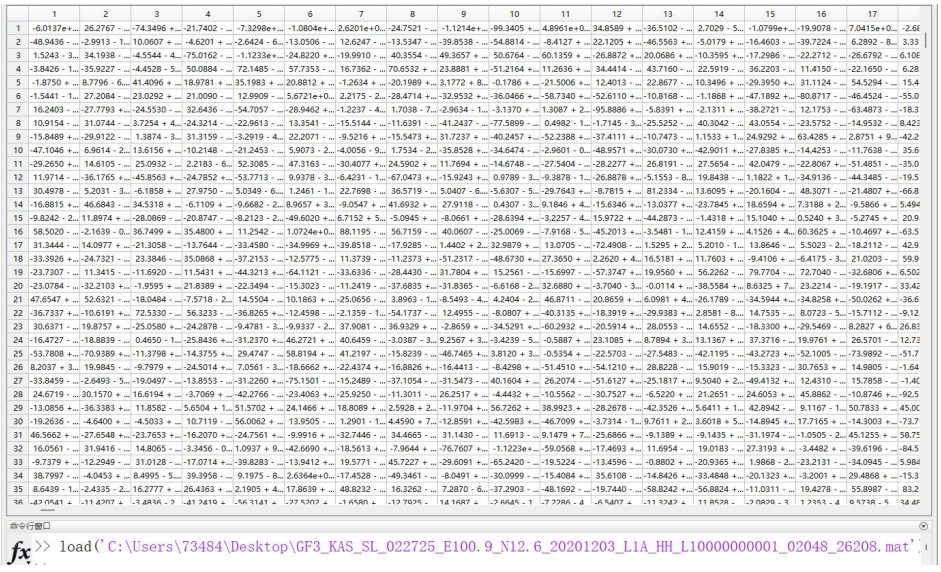
The FAIR-CSAR-V1.0 dataset contains two sub-datasets, the SL dataset and the FSI dataset. The SL dataset is in Spotlight mode with a nominal resolution of 1m, which contains 170K instances covering a total of 22 classes. The specific label is Airbus_A220， Airbus_A320，Airbus_A330，Airfreighter，Boeing737，Boeing747，Boeing767，Boeing777，Fokker-50，Gulfstream，Helicopter，Other_Aircraft，Bulk_Carrier，Container_Ship，General_Cargo_Ship，Motion_Defocusing_Ship，Oil_Tanker，Warship，Other_Ship，Bridge，Tank，Tower_Crane；The FSI dataset is in Fine Stripmap Mode with a nominal resolution of 5m, which contains 170K instances across 3 classes, namely Bridge, Ship, and Tank.

Both SL and FSI datasets are divided into training-validation sets (SL-TRAINVAL and FSI-TRAINVAL) and test sets (SL-TEST and FSI-TEST) with the following directory structure:



Directory Structure and File Descriptions:

1) **SLCMats-**Float32 single-look complex images stored as complex matrices in .mat files.



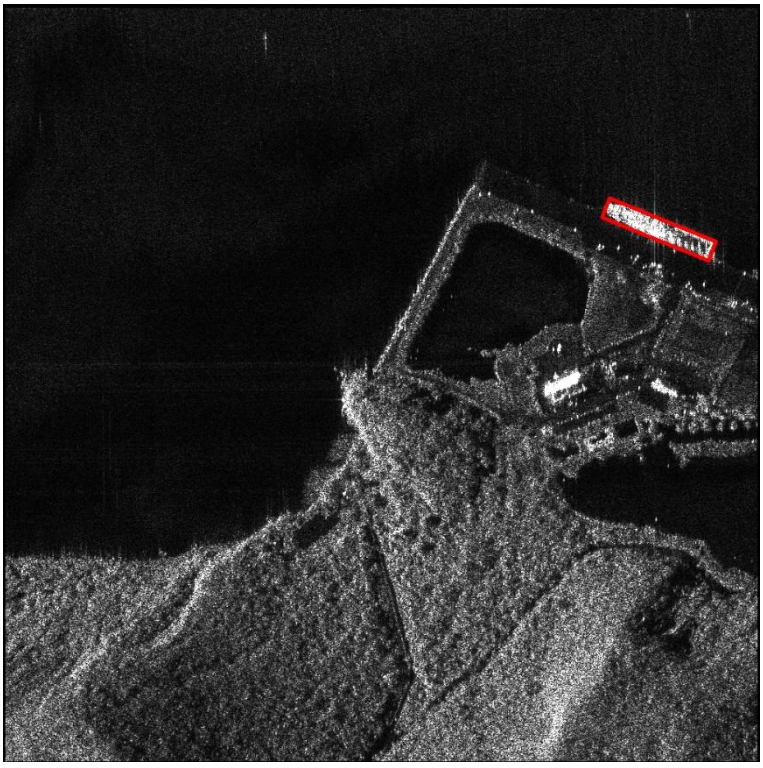
(GF3_KAS_SL_022725_E100.9_N12.6_20201203_L1A_HH_L10000000001_02048_26208.mat)

2) **PNGImages-**Uint8 intensity images in .png format.

(GF3_KAS_SL_022725_E100.9_N12.6_20201203_L1A_HH_L10000000001_02048_26208.png)

3) **Annotations-**oriented bounding box (OBB) annotations in DOTA format.

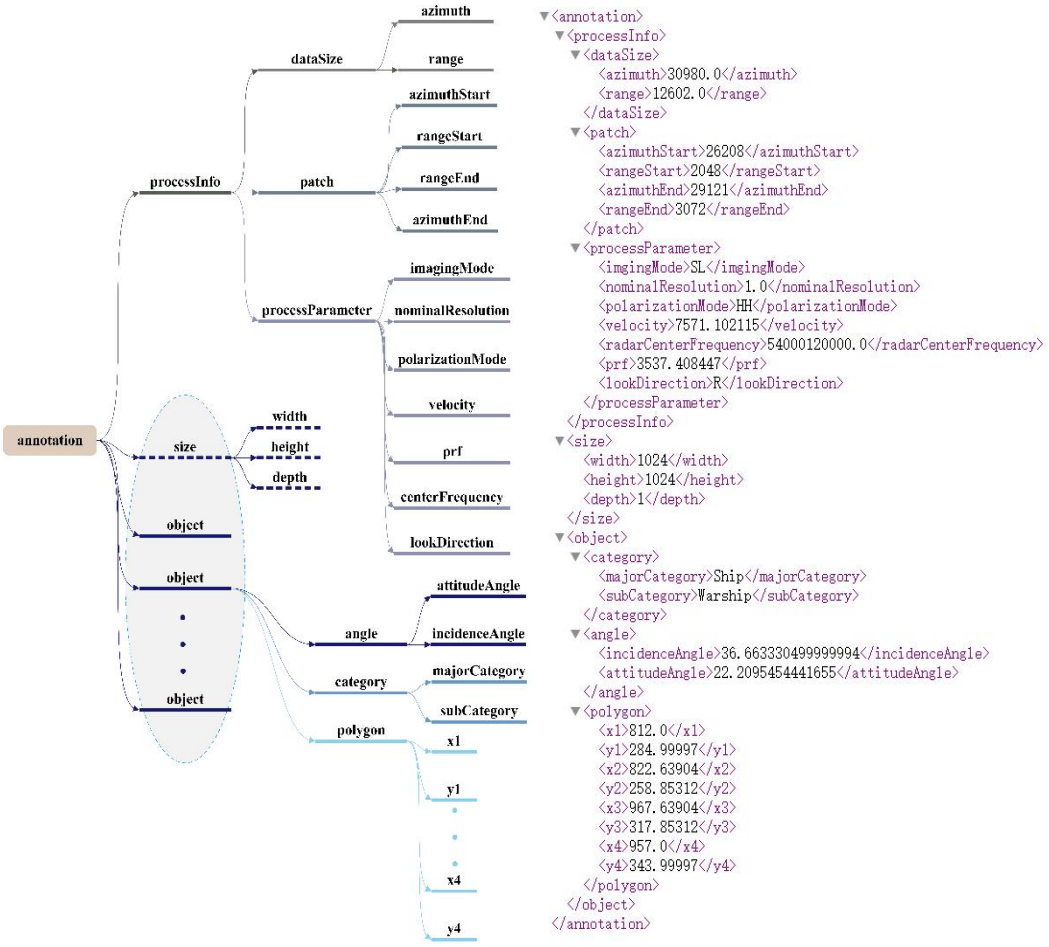
```
812.0 284.9999694824219 822.6390380859375 258.8531188964844 967.6390380859375 317.8531188964844 957.0 343.9999694824219 Warship 0
```



(GF3_KAS_SL_022725_E100.9_N12.6_20201203_L1A_HH_L10000000001_02048_26208.txt)

4) **METAXmls-**Extensible markup language (XML) files containing imaging parameters (e.g.,

pulse repetition interval) alongside bounding boxes and class labels.



(GF3_KAS_SL_022725_E100.9_N12.6_20201203_L1A_HH_L10000000001_02048_26208.xml)

5) **KeyPoints-**XML based annotations of strong scattering point distribution. Each target instance is labeled with 9 key scattering points to characterize its topological structure.

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<object>
<name>Tank</name>
<polygon>
<x1>818</x1>
<y1>590</y1>
<x2>844</x2>
<y2>590</y2>
<x3>844</x3>
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<x4>818</x4>
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<keypoints>
<x1>823</x1>
<y1>610</y1>
<x2>841</x2>
<y2>600</y2>
<x3>829</x3>
<y3>601</y3>
<x4>831</x4>
<y4>610</y4>
<x5>828</x5>
<y5>591</y5>
<x6>820</x6>
<y6>602</y6>
<x7>838</x7>
<y7>608</y7>
<x8>821</x8>
<y8>594</y8>
<x9>838</x9>
<y9>593</y9>
</keypoints>
</object>
<object>


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▼<annotation>
  <filename>示例A220.png</filename>
  ▼<object>
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    ▼<polygon>
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      <y1>175</y1>
      <x2>130</x2>
      <y2>154</y2>
      <x3>145</x3>
      <y3>227</y3>
      <x4>46</x4>
      <y4>248</y4>
    </polygon>
    ▼<keypoints>
      <x1>78</x1>
      <y1>209</y1>
      <x2>113</x2>
      <y2>192</y2>
      <x3>77</x3>
      <y3>171</y3>
      <x4>91</x4>
      <y4>204</y4>
      <x5>48</x5>
      <y5>221</y5>
      <x6>86</x6>
      <y6>187</y6>
      <x7>95</x7>
      <y7>229</y7>
      <x8>132</x8>
      <y8>186</y8>
      <x9>73</x9>
      <y9>197</y9>
    </keypoints>
  </object>
  ▼<object>
```