FAIR-CSAR 复图像目标数据集 V1.0
使用说明

数据主编：吴有明、刁文辉、索玉玺、孙显（目标认知与应用技术重点实验室（中国科学院空天信息创新研究院，北京 100190））

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本数据集参考文献与引用格式：

[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 and X. Sun, FAIR-CSAR: A Benchmark Dataset for Fine-Grained Object Detection and Recognition Based on Single-Look Complex SAR Images[J]. *IEEE Transactions on Geoscience and Remote Sensing*, vol. 63, pp. 1-22, 2025, 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.

Youming Wu, Wenhui Diao, Yuxi Suo, Xian Sun. A Benchmark Dataset for Fine-Grained Object Detection and Recognition Based on Single-Look Complex SAR Images (FAIR-CSAR-V1.0) [OL]. Journal of Radars, 2025. https://radars.ac.cn/web/data/getData?dataType=FAIR_CSAR_en&pageType=en.

致谢：感谢**中国科学院空天信息创新研究院目标认知与应用技术重点实验室**付琨、孙显*、吴有明、刁文辉、索玉玺、孟庆彪、戴威、苗添、赵文超、闫志远、谢国村、柯清洋、赵一铭等人对 FAIR-CSAR-V1.0 数据集构建与发布做出的贡献。

数据集简介：FAIR-CSAR-V1.0 数据集旨在构建一套基于 SAR 复值图像且糅合散射特性标注的目标检测识别数据集，推动 SAR 图像细粒度目标检测识别算法的研究与发展。该数据集由 175 景完整的高分 3 号 1 级单视复值影像产品处理得到，覆盖全球 32 个地区的机场、炼油厂、港口以及河道等，数据总量达 250Gb，实例数目超过 340K，共分为 5 大类 22 子类，是目前**规模最大、标注粒度最精细、存储位深最细腻**的 SAR 图像目标检测识别数据集。此外，为了推动 SAR 目标特性引导监督算法优化的技术发展，FAIR-CSAR-V1.0 数据集对**星地相对方位角、强散射点分布**等特性信息进行了细致标注，对于敏感于方位角度的 SAR 目标散射特性信息的引导利用提供了数据支撑和研究基础。

FAIR-CSAR-V1.0 数据集含 SL 数据集和 FSI 数据集两个子数据集。其中 SL 数据集数据采用聚束模式，标称分辨率为 1m，包含 170K 实例，SL 数据集共包含 22 类，具体名称为 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；FSI 数据集采用精细条带模式 1，标称分辨率为 5m，包含 170K 实例，FSI 数据集共包含 3 类，分别为 Bridge，Ship，Tank。

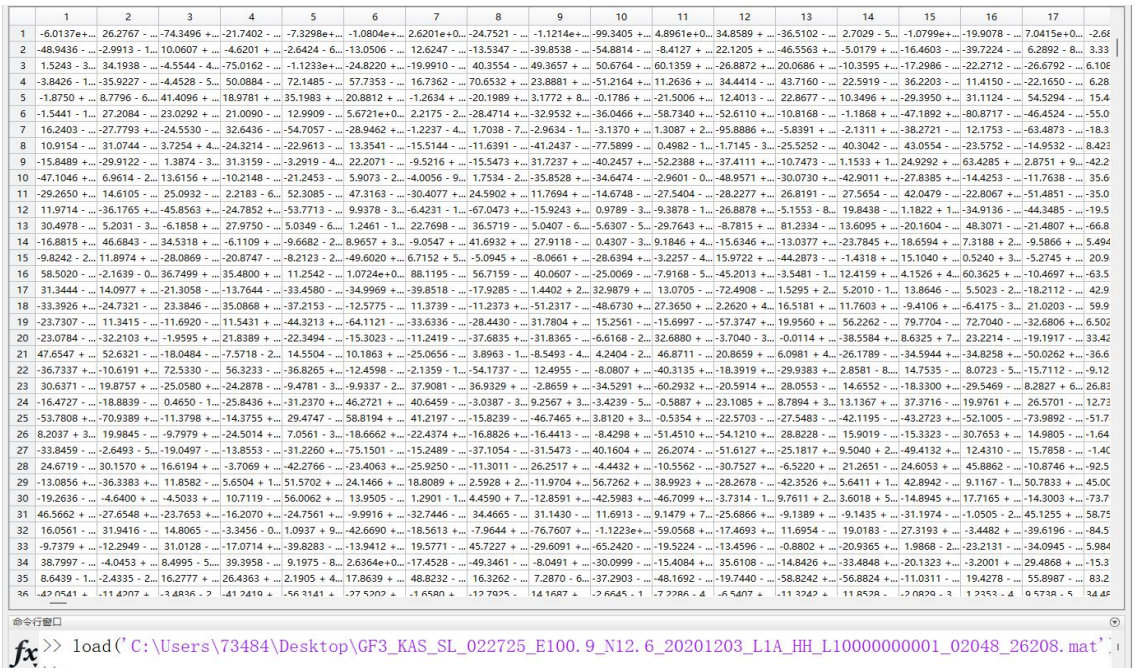
SL 数据集和 FSI 数据集均被分为训练验证集（SL-TRAINVAL 和 FSI-TRAINVAL）和测试集（SL-TEST 和 FSI-TEST），其目录结构如下：

1. SL数据集
1) SL-TRAINVAL
   a) SLCMats
   b) PNGImages
   c) Annotations
   d) METAXmls
   e) KeyPoints
2) SL-TEST
   a) SLCMats
   b) PNGImages
   c) Annotations
   d) METAXmls
   e) KeyPoints

2. FSI数据集
1) FSI-TRAINVAL
   a) SLCMats
   b) PNGImages
   c) Annotations
   d) METAXmls
   e) KeyPoints
2) FSI-TEST
   a) SLCMats
   b) PNGImages
   c) Annotations
   d) METAXmls
   e) KeyPoints

各文件夹内文件具体内容与样本示例如下：

1) **SLCMats** 浮点型（float32）单视复数图像，以浮点型复数矩阵形式保存于.mat 文件，示例如下：



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
1	-6.0137e+...	26.2767 - ...	-74.3496 +...	-21.7402 - ...	-7.3298e+...	-1.0804e+...	2.6201e+0...	-24.7521 - ...	-1.1214e+...	-99.3405 +...	4.8961e+0...	34.8589 + ...	-36.5102 - ...	2.7029 - 5...	-1.0799e+...	-19.9078 - ...	7.0415e+0...	-2.6E
2	-48.9436 - ...	-2.9913 - 1...	10.0607 + ...	-4.6201 + ...	-2.6424 - 6...	-13.0506 - ...	12.6247 - ...	-13.5347 - ...	-39.8538 - ...	-54.8814 - ...	-8.4127 + ...	22.1205 + ...	-46.5563 +...	-5.0179 + ...	-16.4603 - ...	-39.7224 - ...	6.2892 - 8...	3.33
3	1.5243 - 3...	34.1938 - ...	-4.5544 - 4...	-75.0162 - ...	-1.1233e+...	-24.8220 +...	-19.9910 - ...	40.3554 - ...	49.3657 + ...	50.6764 - ...	60.1359 + ...	-26.8872 +...	20.0686 + ...	-10.3595 +...	-17.2986 - ...	-22.2712 - ...	-26.6792 - ...	6.10E
4	-3.8426 - 1...	-35.9227 - ...	-4.4528 - 5...	50.0884 - ...	72.1485 - ...	57.7353 - ...	16.7362 - ...	70.6532 + ...	23.8881 + ...	-51.2164 +...	11.2636 + ...	34.4414 - ...	43.7160 - ...	22.5919 - ...	36.2203 - ...	11.4150 - ...	-22.1650 - ...	6.28
5	-1.8750 + ...	8.7796 - 6...	41.4096 + ...	18.9781 + ...	35.1983 + ...	20.8812 + ...	-1.2634 + ...	-20.1989 +...	3.1772 + 8...	-0.1786 + ...	-21.5006 +...	12.4013 - ...	22.8677 - ...	10.3496 + ...	-29.3950 +...	31.1124 - ...	54.5294 - ...	15.4
6	-1.5441 - 1...	27.2084 - ...	23.0292 + ...	21.0090 - ...	12.9909 - ...	5.6721e+0...	2.2175 - 2...	-28.4714 +...	-32.9532 +...	-36.0466 +...	-58.7340 +...	-52.6110 +...	-10.8168 - ...	-1.1868 + ...	-47.1892 +...	-80.8717 - ...	-46.4524 - ...	-55.0
7	16.2403 - ...	-27.7793 +...	-24.5530 - ...	32.6436 - ...	-54.7057 - ...	-28.9462 +...	-1.2237 - 4...	1.7038 - 7...	-2.9634 - 1...	-3.1370 + ...	1.3087 + 2...	-95.8886 +...	-5.8391 + ...	-2.1311 + ...	-38.2721 - ...	12.1753 - ...	-63.4873 - ...	-18.3
8	10.9154 - ...	31.0744 - ...	3.7254 + 4...	-24.3214 - ...	-22.9613 - ...	13.3541 - ...	-15.5144 - ...	-11.6391 - ...	-41.2437 - ...	-77.5899 - ...	0.4982 - 1...	-1.7145 - 3...	-25.5252 - ...	40.3042 - ...	43.0554 - ...	-23.5752 - ...	-14.9532 - ...	8.423
9	-15.8489 +...	-29.9122 - ...	1.3874 - 3...	31.3159 - ...	-3.2919 - 4...	22.2071 - ...	-9.5216 + ...	-15.5473 +...	31.7237 + ...	-40.2457 +...	-52.2388 +...	-37.4111 +...	-10.7473 - ...	1.1533 + 1...	24.9292 + ...	63.4285 + ...	2.8751 + 9...	-42.2
10	-47.1046 +...	6.9614 - 2...	13.6156 + ...	-10.2148 - ...	-21.2453 - ...	5.9073 - 2...	-4.0056 - 9...	1.7534 - 2...	-35.8528 +...	-34.6474 - ...	-2.9601 - 0...	-48.9571 +...	-30.0730 +...	-42.9011 +...	-27.8385 +...	-14.4253 - ...	-11.7638 - ...	35.6
11	-29.2650 +...	14.6105 - ...	25.0932 - ...	2.2183 - 6...	52.3085 - ...	47.3163 - ...	-30.4077 +...	24.5902 + ...	11.7694 + ...	-14.6748 - ...	-27.5404 - ...	-28.2277 +...	26.8191 - ...	27.5654 - ...	42.0479 - ...	-22.8067 +...	-51.4851 - ...	-35.0
12	11.9714 - ...	-36.1765 +...	-45.8563 +...	-24.7852 +...	-53.7713 - ...	9.9378 - 3...	-6.4231 - 1...	-67.0473 +...	-15.9243 +...	0.9789 - 3...	-9.3878 - 1...	-26.8878 +...	-5.1553 - 8...	19.8438 - ...	1.1822 + 1...	-34.9136 - ...	-44.3485 - ...	-19.5
13	30.4978 - ...	5.2031 - 3...	-6.1858 + ...	27.9750 - ...	5.0349 - 6...	1.2461 - 1...	22.7698 - ...	36.5719 - ...	5.0407 - 6...	-5.6307 - 5...	-29.7643 +...	-8.7815 + ...	81.2334 - ...	13.6095 + ...	-20.1604 - ...	48.3071 - ...	-21.4807 +...	-66.8
14	-16.8815 +...	46.6843 - ...	34.5318 + ...	-6.1109 + ...	-9.6682 - 2...	8.9657 + 3...	-9.0547 + ...	41.6932 + ...	27.9118 - ...	0.4307 - 3...	9.1846 + 4...	-15.6346 +...	-13.0377 +...	-23.7845 +...	18.6594 + ...	7.3188 + 2...	-9.5866 + ...	5.494
15	-9.8242 - 2...	11.8974 + ...	-28.0869 - ...	-20.8747 - ...	-8.2123 - 2...	-49.6020 +...	6.7152 + 5...	-5.0945 + ...	-8.0661 + ...	-28.6394 +...	-3.2257 - 4...	15.9722 + ...	-44.2873 - ...	-1.4318 + ...	15.1040 + ...	0.5240 + 3...	-5.2745 + ...	20.9
16	58.5020 - ...	-2.1639 - 0...	36.7499 + ...	35.4800 + ...	11.2542 - ...	1.0724e+0...	88.1195 - ...	56.7159 - ...	40.0607 - ...	-25.0069 - ...	-7.9168 - 5...	-45.2013 +...	-3.5481 - 1...	12.4159 + ...	4.1526 + 4...	60.3625 + ...	-10.4697 +...	-63.5
17	31.3444 - ...	14.0977 + ...	-21.3058 - ...	-13.7644 - ...	-33.4580 - ...	-34.9969 +...	-39.8518 - ...	-17.9285 - ...	1.4402 + 2...	32.9879 + ...	13.0705 - ...	-72.4908 - ...	1.5295 + 2...	5.2010 - 1...	13.8646 - ...	5.5023 - 2...	-18.2112 - ...	42.9
18	-33.3926 +...	-24.7321 - ...	23.3846 - ...	35.0868 + ...	-37.2153 - ...	-12.5775 - ...	11.3739 - ...	-11.2373 +...	-51.2317 - ...	-48.6730 +...	27.3650 + ...	2.2620 + 4...	16.5181 + ...	11.7603 + ...	-9.4106 + ...	-6.4175 - 3...	21.0203 - ...	59.9
19	-23.7307 - ...	11.3415 - ...	-11.6920 - ...	11.5431 + ...	-44.3213 +...	-64.1121 - ...	-33.6336 - ...	-28.4430 - ...	31.7804 + ...	15.2561 - ...	-15.6997 - ...	-57.3747 +...	19.9560 + ...	56.2262 - ...	79.7704 - ...	72.7040 - ...	-32.6806 +...	6.502
20	-23.0784 - ...	-32.2103 +...	-1.9595 + ...	21.8389 + ...	-22.3494 - ...	-15.3023 - ...	-11.2419 - ...	-37.6835 +...	-31.8365 - ...	-6.6168 - 2...	32.6880 + ...	-3.7040 - 3...	-0.0114 + ...	-38.5584 +...	8.6325 + 7...	23.2214 - ...	-19.1917 - ...	33.42
21	47.6547 + ...	52.6321 - ...	-18.0484 - ...	-7.5718 - 2...	14.5504 - ...	10.1863 + ...	-25.0656 - ...	3.8963 - 1...	-8.5493 - 4...	4.2404 - 2...	46.8711 - ...	20.8659 + ...	6.0981 + 4...	-26.1789 - ...	-34.5944 +...	-34.8258 +...	-50.0262 +...	-36.6
22	-36.7337 +...	-10.6191 +...	72.5330 - ...	56.3233 - ...	-36.8265 +...	-12.4598 - ...	-2.1359 - 1...	-54.1737 - ...	12.4955 - ...	-8.0807 + ...	-40.3135 +...	-18.3919 +...	-29.9383 +...	2.8581 - 8...	14.7535 - ...	8.0723 - 5...	-15.7112 - ...	-9.12
23	30.6371 - ...	19.8757 + ...	-25.0580 +...	-24.2878 - ...	-9.4781 - 3...	-9.9337 - 2...	37.9081 - ...	36.9329 + ...	-2.8659 + ...	-34.5291 +...	-60.2932 +...	-20.5914 +...	28.0553 - ...	14.6552 - ...	-18.3300 +...	-29.5469 - ...	8.2827 + 6...	26.8
24	-16.4727 - ...	-18.8839 - ...	0.4650 - 1...	-25.8436 +...	-31.2370 +...	46.2721 + ...	40.6459 - ...	-3.0387 - 3...	9.2567 + 3...	-3.4239 - 5...	-0.5887 + ...	23.1085 + ...	8.7894 + 3...	13.1367 + ...	37.3716 - ...	19.9761 + ...	26.5701 - ...	12.73
25	-53.7808 +...	-70.9389 +...	-11.3798 +...	-14.3755 +...	29.4747 - ...	58.8194 + ...	41.2197 - ...	-15.8239 - ...	-46.7465 +...	3.8120 + 3...	-0.5354 + ...	-22.5703 - ...	-27.5483 - ...	-42.1195 - ...	-43.2723 +...	-52.1005 - ...	-73.9892 - ...	-51.7
26	8.2037 + 3...	19.9845 - ...	-9.7979 + ...	-24.5014 +...	7.0561 - 3...	-18.6662 +...	-22.4374 +...	-16.8826 +...	-16.4413 - ...	-8.4298 + ...	-51.4510 +...	-54.1210 +...	28.8228 - ...	15.9019 - ...	-15.3323 - ...	30.7653 + ...	14.9805 - ...	-1.64
27	-33.8459 - ...	-2.6493 - 5...	-19.0497 - ...	-13.8553 - ...	-31.2260 +...	-75.1501 - ...	-15.2489 - ...	-37.1054 - ...	-31.5473 - ...	40.1604 + ...	26.2074 - ...	-51.6127 +...	-25.1817 +...	9.5040 + 2...	-49.4132 +...	12.4310 - ...	15.7858 - ...	-1.40
28	24.6719 - ...	30.1570 + ...	16.6194 + ...	-3.7069 + ...	-42.2766 - ...	-23.4063 +...	-25.9250 - ...	-11.3011 - ...	26.2517 + ...	-4.4432 + ...	-10.5562 - ...	-30.7527 +...	-6.5220 + ...	21.2651 - ...	24.6053 + ...	45.8862 - ...	-10.8746 +...	-92.5
29	-13.0856 +...	-36.3383 +...	11.8582 - ...	5.6504 + 1...	51.5702 + ...	24.1466 + ...	18.8089 + ...	2.5928 + 2...	-11.9704 +...	56.7262 + ...	38.9923 + ...	-28.2678 - ...	-42.3526 +...	5.6411 + 1...	42.8942 - ...	9.1167 - 1...	50.7833 + ...	45.0C
30	-19.2636 - ...	-4.6400 + ...	-4.5033 + ...	10.7119 - ...	56.0062 + ...	13.9505 - ...	1.2901 - 1...	4.4590 + 7...	-12.8591 +...	-42.5983 +...	-46.7099 +...	-3.7314 - 1...	9.7611 + 2...	3.6018 + 5...	-14.8945 +...	17.7165 + ...	-14.3003 +...	-73.7
31	46.5662 + ...	-27.6548 +...	-23.7653 +...	-16.2070 +...	-24.7561 +...	-9.9916 + ...	-32.7446 - ...	34.4665 - ...	31.1430 - ...	11.6913 - ...	9.1479 + 7...	-25.6866 +...	-9.1389 + ...	-9.1435 + ...	-31.1974 - ...	-1.0505 - 2...	45.1255 + ...	58.75
32	16.0561 - ...	31.9416 - ...	14.8065 - ...	-3.3456 - 0...	1.0937 + 9...	-42.6690 +...	-18.5613 +...	-7.9644 + ...	-76.7607 +...	-1.1223e+...	-59.0568 +...	-17.4693 +...	11.6954 - ...	19.0183 - ...	27.3193 + ...	-3.4482 + ...	-39.6196 - ...	-84.5
33	-9.7379 + ...	-12.2949 - ...	31.0128 - ...	-17.0714 +...	-39.8283 - ...	-13.9412 +...	19.5771 - ...	45.7227 + ...	-29.6091 +...	-65.2420 - ...	-19.5224 - ...	-13.4596 - ...	-0.8802 + ...	-20.9365 +...	1.9868 - 2...	-23.2131 - ...	-34.0945 - ...	5.984
34	38.7997 - ...	-4.0453 + ...	8.4995 - 5...	39.3958 - ...	9.1975 - 8...	2.6364e+0...	-17.4528 - ...	-49.3461 - ...	-8.0491 + ...	-30.0999 - ...	-15.4084 +...	35.6108 - ...	-14.8426 +...	-33.4848 +...	-20.1323 +...	-3.2001 + ...	29.4868 + ...	-15.3
35	8.6439 - 1...	-2.4335 - 2...	16.2777 + ...	26.4363 + ...	2.1905 + 4...	17.8639 + ...	48.8232 - ...	16.3262 - ...	7.2870 - 6...	-37.2903 - ...	-48.1692 - ...	-19.7440 - ...	-58.8242 +...	-56.8824 +...	-11.0311 - ...	19.4278 - ...	55.8987 - ...	83.2
36	-42.0541 +	-11.4207 +	-3.4836 - 2	-41.2419 +	-56.3141 +	-27.5202 +	-1.6580 +	-12.7825 -	14.1687 +	-2.6645 - 1	-7.2286 - 4	-6.5407 +	-11.3242 +	11.8528 -	-2.0829 - 3	1.2353 - 4	9.5738 - 5	34.4E

命令行窗口

```
>> load('C:\Users\73484\Desktop\GF3_KAS_SL_022725_E100.9_N12.6_20201203_L1A_HH_L10000000001_02048_26208.mat')
```

(GF3_KAS_SL_022725_E100.9_N12.6_20201203_L1A_HH_L10000000001_02048_26208.mat)

2) **PNGImages** 无符号整数型（uint8）图像数据，以.png 文件形式保存，示例如下：

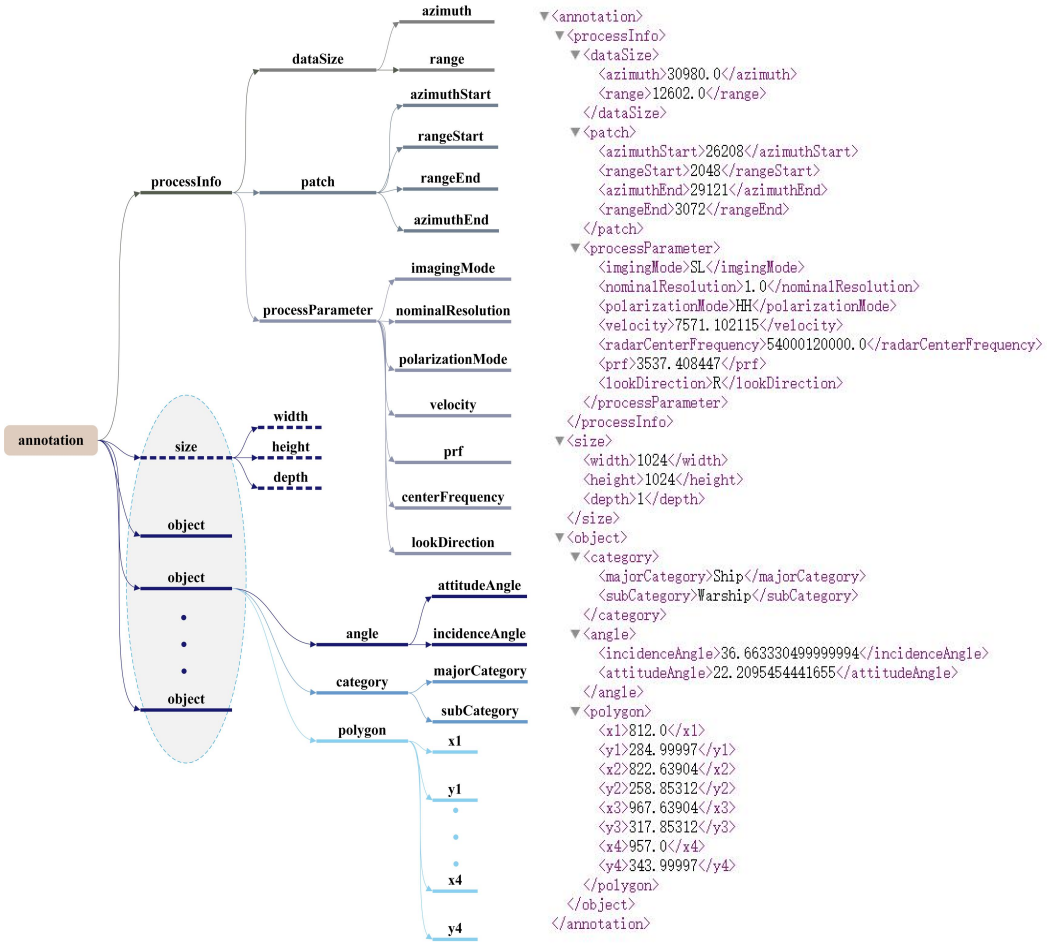
(GF3_KAS_SL_022725_E100.9_N12.6_20201203_L1A_HH_L10000000001_02048_26208.png
)

3) Annotations 旋转框数据标注，采用 DOTA 格式标注，示例如下：

```
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** 为可扩展标记语言，除检测识别所需要的检测框与类别标注外，额外给出了脉冲重复周期等成像参数，其具体结构与相关示例如下



(GF3_KAS_SL_022725_E100.9_N12.6_20201203_L1A_HH_L10000000001_02048_26208.xml)

5) **KeyPoints** 为可扩展标记语言,以目标实例为基本单位提取并标注强散射点分布，每个目标实例共提取 9 个关键散射点以表征其拓扑结构，其具体形式如下所示：

除上述基础的复数据、图像、标注、成像参数外，

```
▼<annotation>
  <filename>示例Tank.png</filename>
  ▼<object>
    <name>Tank</name>
    ▼<polygon>
      <x1>818</x1>
      <y1>590</y1>
      <x2>844</x2>
      <y2>590</y2>
      <x3>844</x3>
      <y3>614</y3>
      <x4>818</x4>
      <y4>614</y4>
    </polygon>
    ▼<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>
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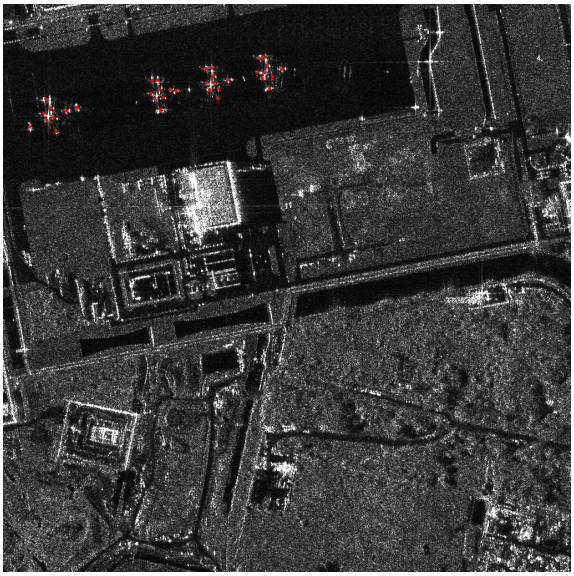


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