OSDataset2.0 SAR-光学遥感影像匹配数据集使用说明

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数据集简介：OSDataset2.0 是一个面向 SAR—光学多模态影像匹配任务的大规模基准数据集，旨在为图像融合、协同解译、灾害监测和高精度定位等应用提供统一的训练资源与评估基准。数据集中 SAR 影像则来自国产高分三号（GF-3）卫星聚束模式影像，光学影像均来源于 Google Earth 的高分辨率光学图像。OSDataset2.0 由两个相互补充的子集构成：局部训练数据集（patch-level subset）和全幅场景测试集（scene-level subset）。局部训练数据集由 14 个国家多种典型地形地貌场景影像中制作得到的 6476 对 512×512 像素 SAR-光学图像块组成，统一重采样至 1 m 分辨率，并经过自动配准与人工质检，将残余配准误差控制在 1.5 像素内，主要用于深度学习模型训练以及局部配准性能评估。局部训练数据集也包含了作者团队前期发布的 OSDataset 数据集。全幅场景测试集提供一对覆盖密集城市、基础设施与大面积植被等多类型区域的整景 GeoTIFF 影像，并重采样至 0.43 m 分辨率；同时基于 SAR 和光学载荷的成像机理，针对人造金属杆状结构此类稳定强散射目标采集了 72 对亚像素级真值同名点，并配套了通用的精度评估代码，可对各种匹配算法在真实大场景中的精度、正确率和稳定性进行量化分析。数据集结构目录如图 1 所示：

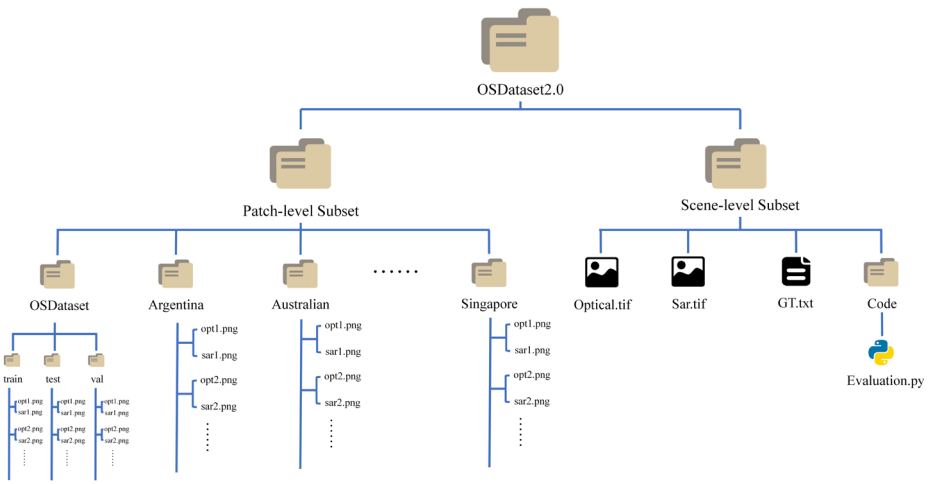

图 1. OSDataset2.0 数据集结构

各文件夹内具体内容如下：

一、局部训练数据集（patch-level subset）

局部训练数据集共包含 14 个文件夹，其中 OSDataset 文件夹为作者团队前期发布的 OSDataset 数据集，其余 13 个文件夹则存放由多个不同地形地貌场景影像制作得到的 512×512 像素 SAR-光学图像对。每个文件夹中，光学图像块命名为 *optn.png*，SAR 图像

块命名为 *sarn.png*，其中 *n* 为图像对编号，编号相同的光学图像与 SAR 图像构成一一对应的配准图像对如图 2 所示。

图 2. 光学-SAR 图像对

二、全幅场景测试集（scene-level subset）

全幅场景测试集用于在大尺度真实场景下评估 SAR—光学多模态匹配算法性能。共包含以下内容：a) Sar.tif: GeoTIFF 格式的 SAR 影像，空间采样间隔为 0.43 m，单通道幅度数据，大小为 35,507×27,298 像素；b) Optical.tif: GeoTIFF 格式的光学影像，空间采样间隔为 0.43 m，RGB 三通道数据，大小为 35,783×35,783 像素；c) GT.txt：存放基于人造金属杆状结构采集的 72 对亚像素级真值同名点，每行记录一对光学–SAR 同名点像素坐标。d) Code 文件夹：用于存放配准精度评估工具 Evaluation.py，该脚本可读取算法输出的匹配点与 GT.txt 中的真值控制点，构建仿射变换、多项式或薄板样条几何模型，对待校正影像进行重采样校正，并生成包含 RMSE、MEAN、MEDIAN、MAX 等指标的评估结果文件，用于在统一标准下比较不同匹配方法的性能。数据集分布如下图所示。

图 3. 全幅场景数据集及标识的 72 对真值同名点。

本期数据引用格式如下：

[1] 向俞明, 陈锦杨, 洪中华, 等. OSDataset2.0：SAR-光学影像匹配数据集及评估基准[J]. 雷达学报(中英文), 待出版. doi: 10.12000/JR25176

XIANG Yuming, CHEN Jinyang, HONG Zhonghua, et al. OSDataset2.0: SAR-Optical Image Matching Dataset and Evaluation Benchmark[J]. Journal of Radars, in press. doi: 10.12000/JR25176

[2] Y. Xiang, X. Wang, F. Wang, H. You, X. Qiu and K. Fu, "A Global-to-Local Algorithm for High-Resolution Optical and SAR Image Registration," in IEEE Transactions on Geoscience

and Remote Sensing, vol. 61, pp. 1-20, 2023, Art no. 5215320, doi: 10.1109/TGRS.2023.3309855.
[3] Y. Xiang, R. Tao, F. Wang, H. You and B. Han, "Automatic Registration of Optical and SAR Images Via Improved Phase Congruency Model," in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 13, pp. 5847-5861, 2020, doi: 10.1109/JSTARS.2020.3026162.

英文说明：

OSDataset2.0: User Manual for SAR-Optical Remote Sensing Image Matching Dataset

Data Editor：XIANG Yuming (Tongji University)

Download website： https://radars.ac.cn/web/data/getData?newsColumnId=992fa882-30f1-4bda-9553-36c56a8b457d

Dataset description：OSDataset2.0 is a large-scale benchmark dataset designed for SAR-optical multi-modal image matching tasks, aiming to provide unified training resources and evaluation benchmarks for applications such as image fusion, collaborative interpretation, disaster monitoring, and high-precision positioning. The optical images in the dataset are sourced from high-resolution optical images of Google Earth, while the SAR images are obtained from domestic Gaofen-3 (GF-3) satellite spotlight mode imagery. OSDataset2.0 consists of two complementary subsets: a patch-level training subset and a scene-level test subset. The patch-level training subset comprises 6,476 pairs of 512×512 pixel SAR-optical image patches, generated from imagery of various typical terrains and landscapes across 14 countries. All patches are uniformly resampled to 1 m resolution and have undergone automatic registration and manual quality inspection, ensuring residual registration errors are controlled to within 1.5 pixels. This subset is primarily used for deep learning model training and local registration performance evaluation. It also includes the previously released OSDataset by the author's team. The scene-level test subset provides a pair of full-scene GeoTIFF images covering multiple types of areas such as dense urban regions, infrastructure, and large vegetated areas, resampled to a unified 0.43 m resolution. Additionally, based on the imaging mechanisms of optical and SAR payloads, 72 pairs of sub-pixel ground truth corresponding points have been collected for stable strong scattering targets like artificial metal pole structures. The subset is accompanied by general-purpose accuracy evaluation code, enabling objective quantitative analysis of the registration accuracy, correctness, and stability of various matching algorithms in real large-scale scenarios. The directory structure of the dataset is shown in Figure 1.

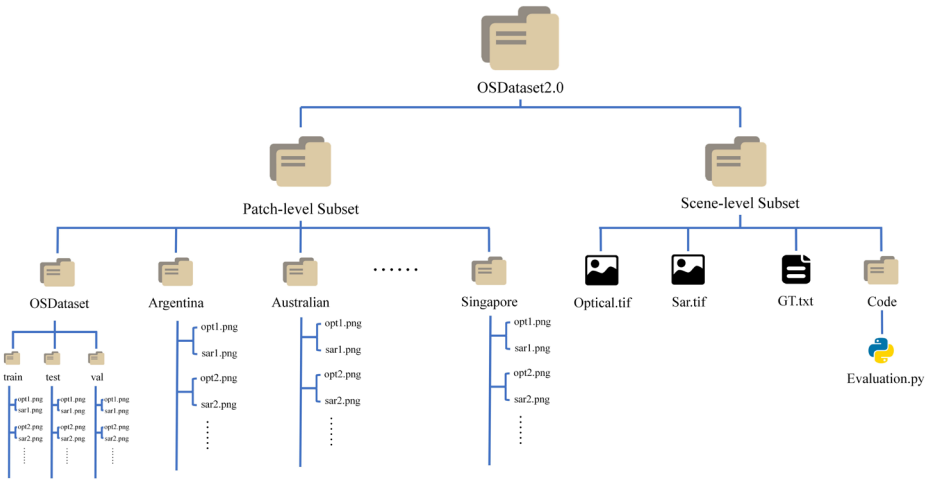

Figure 1. The directory structure of OSDataset2.0.

The specific contents of each folder are as follows:

I. The Patch-Level Subset

The patch-level training subset contains a total of 14 folders. Among these, the "OSDataset" folder contains the previously released OSDataset by the author's team, while the remaining 13 folders store 512×512 pixel optical-SAR image pairs generated from various terrain and landscape scenes. In each folder, the optical image patches are named "optn.png", and the SAR image patches are named "sarn.png", where "n" represents the image pair serial number. Optical and SAR images with the same serial number form a corresponding registered image pair, as illustrated in Figure 2.

Figure 2. A pair of optical-SAR images.

II. Scene-Level Subset

The scene-level test subset is used to evaluate the performance of SAR-optical matching algorithms in large-scale real-world scenarios. It includes the following contents: a) Sar.tif: SAR image in GeoTIFF format, with a spatial sampling interval of 0.43 m. It contains single-channel amplitude data and has dimensions of 35,507 × 27,298 pixels. b) Optical.tif: Optical image in GeoTIFF format. As shown in Figure 3, it has a spatial sampling interval of 0.43 m, consists of RGB three-channel data, and has dimensions of 35,783 × 35,783 pixels. c) GT.txt: Stores 72 pairs of sub-pixel ground truth corresponding points collected based on artificial metal pole structures, and each row records the pixel coordinates of a pair of optical-SAR

corresponding points. d) Code folder: Contains the registration accuracy evaluation tool Evaluation.py. This script can read the matching points output by algorithms and the ground truth control points from GT.txt, construct geometric models such as affine transformation, polynomial or thin-plate spline, perform resampling correction on the image to be aligned, and generate evaluation result files containing metrics such as RMSE, MEAN, MEDIAN, and MAX. This enables performance comparison of different matching methods under unified standards.

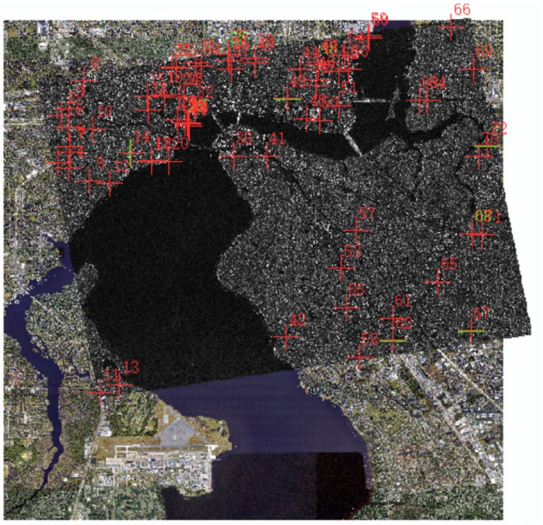

Figure 3. The scene-level dataset and 72 pairs of ground truths.

Reference:

[1] XIANG Yuming, CHEN Jinyang, HONG Zhonghua, et al. OSDataset2.0: SAR-Optical Image Matching Dataset and Evaluation Benchmark[J]. Journal of Radars, in press. doi: 10.12000/JR25176

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[3] Y. Xiang, R. Tao, F. Wang, H. You and B. Han, "Automatic Registration of Optical and SAR Images Via Improved Phase Congruency Model," in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 13, pp. 5847-5861, 2020, doi: 10.1109/JSTARS.2020.3026162.