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PolSF: PolSAR image datasets on San Francisco ^{*}

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Abstract. Polarimetric SAR data has the characteristics of all-weather, all-time and so on, which is widely used in many fields. However, the data of annotation is relatively small, which is not conducive to our research. In this paper, we have collected five open polarimetric SAR images, which are images of the San Francisco area. These five images come from different satellites at different times, and has great scientific research value. We annotate the collected images at the pixel level for image classification and segmentation. For the convenience of researchers, the annotated data is open source <https://github.com/liuxuvip/PolSF>.

Keywords: PolSAR image· classification· segmentation.

1 Introduction

With the development of sensors, studying their differences and characteristics are significant research topics [1]. Different sensors produce different characteristics of data and images. That is to say, each kind of data has its own characteristics and advantages. Making full use of these data is significant and challenging.

In the literature, polarimetric SAR image classification is a hot topic [2], [3], [4], [5], [6], [7], [8]. polarimetric SAR image classification is also a pixel level remote sensing image interpretation task, which has the characteristics of fine recognition and need to determine the category of each pixel.

Polarimetric SAR image classification tasks can be divided into unsupervised classification, semi-supervised classification and supervised classification according to the label of training data. According to the quality of the label, it can be

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divided into strong supervised learning and weak supervised learning, the latter includes incomplete supervised learning, inexact supervised learning and inaccurate supervised learning [9]. Therefore, it can adopt different learning methods and ideas to deal with polarimetric SAR image classification problems. However, there are very few labeled data that can be used in practical research.

In this paper, we introduced the data and gave our labeled ground truth. To meet the needs of researchers. First, we download the original data from the website [10]. Second, we use the ESA PolSARpro v6.0 (Biomass Edition) software [11], [12] read the original data files and get the PauliRGB images. Third, we get the high-resolution Google map of the same period, mark the image with its information by the labelme software [13]. Finally, the marked color map is remapped and encoded to get the mark file. In the following chapters, dataset details will be introduced.

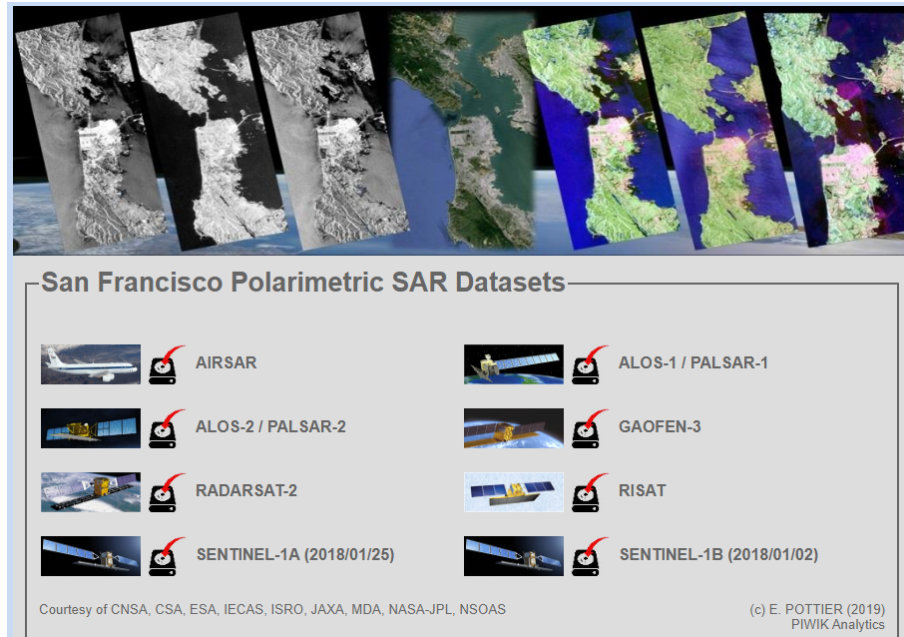


Fig. 1. The PolSAR data in the web.

2 PolSF

In this section, the PolSAR dataset *PolSF* is presented [See Fig 4]. The original PolSAR data is downloaded the IETR website[See Fig 4] [10]. We select five the PolSAR data of five satellites for the San Francisco area, cut and mark the adjacent area. Fig 2 show different raw data packages, these data are uploaded

in August 9th, 2019. In addition, we can see from Fig 3 that the data formats of different satellite imaging are different. Table 1 also give the details of the satellites.









 SAN_FRANCISCO_AIRSAR.zip	修改日期: 2019/8/9 1:21 大小: 8.34 MB
 SAN_FRANCISCO_ALOS1.zip	修改日期: 2019/8/9 2:28 大小: 703 MB
 SAN_FRANCISCO_ALOS2.zip	修改日期: 2019/8/9 1:08 大小: 5.08 GB
 SAN_FRANCISCO_GF3.zip	修改日期: 2019/8/9 2:25 大小: 434 MB
 SAN_FRANCISCO_RISAT.zip	修改日期: 2019/8/9 2:28 大小: 768 MB
 SAN_FRANCISCO_RS2.zip	修改日期: 2019/8/9 2:14 大小: 552 MB
 SAN_FRANCISCO_S1A_20180125.zip	修改日期: 2019/8/9 1:31 大小: 3.83 GB
 SAN_FRANCISCO_S1B_20180102.zip	修改日期: 2019/8/9 1:31 大小: 3.90 GB

Fig. 2. PolSF dataset files.

2.1 PolSF-AIRSAR

The AIRSAR data is shown in Fig4(a) and Fig4(f). The imaging time is 1989.08. The spatial resolution is 10m. Fig4(a) is a pseudo color image formed by PauliRGB decomposition. The size of original image is 1024×900 . Fig4(b) is the ground truth marked by our team IPIU, there are five categories of objectives. i.e. 1, Mountain, 2, Water, 3, Urban, 4, Vegetation, 5, Bare soil.

2.2 PolSF-ALOS2

The ALOS2 data is shown in Fig. 4(b) and Fig. 4(g). The imaging time is 2015.03. The spatial resolution is 18m. The size of original image is 8080×22608 , the coordinates of cut region is (x1:736, y1:2832, x2:3520, y2:7888), which is

the coordinates of the upper left corner and the lower right corner. Fig. 4(a) is a pseudo color image formed by PauliRGB decomposition. Fig. 4(b) is the ground truth marked by our team IPIU, there are six categories of objectives. i.e. 1, Montain, 2, Water, 3, Vegetation, 4, High-Density Urban, 5, Low-Density Urban, 6, Developd.

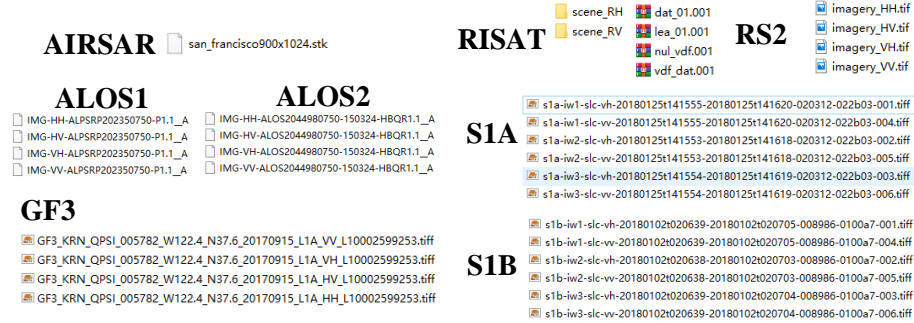


Fig. 3. The data format in each satellite.

2.3 PolSF-GF3

The GF3 data is shown in Fig. 4(c) and Fig. 4(h). The imaging time is 2018.08. The spatial resolution is 8m. The size of original image is 5829×7173 , the coordinates of cut region is (1144, 3464, 3448, 6376). Fig. 4(a) is a pseudo color image formed by PauliRGB decomposition. Fig. 4. (b) is the ground truth marked by our team IPIU, there are six categories of objectives. i.e. 1, Montain, 2, Water, 3, Vegetation, 4, High-Density Urban, 5, Low-Density Urban, 6, Developd.

2.4 PolSF-RISAT

For this image, the size of original image is 8719×13843 , the coordinates of cut region is (2486, 4257, 7414, 10648). The RISAT data is shown in Fig. 4(d) and Fig. 4(i). The imaging time is 2016.08. The spatial resolution is 2.33m. Fig. 4(a) is a pseudo color image formed by PauliRGB decomposition. Fig. 4(b) is the ground truth marked by our team IPIU, there are six categories of objectives. i.e. 1, Montain, 2, Water, 3, Vegetation, 4, High-Density Urban, 5, Low-Density Urban, 6, Developd.

2.5 PolSF-RS2

The RS2 data is shown in Fig. 4(e) and Fig. 4(j). The size of original image is 2823×14416 , the coordinates of cut region is (7326,661,9125,2040). The imaging time is 2008.04. The spatial resolution is 8m. Fig. 4(a) is a pseudo color image

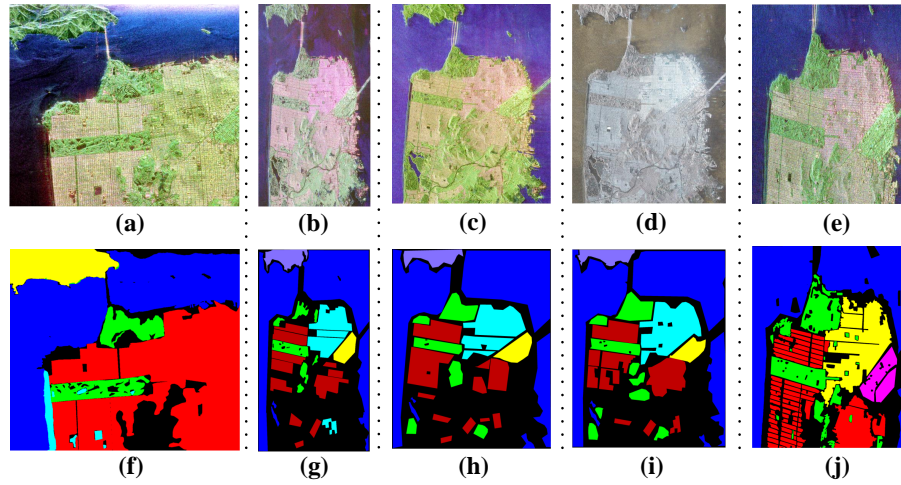


Fig. 4. PolSF Dataset visualization and annotation. (a)-(e), PauliRGB image of SF-AIRSAR, SF-ALOS2, SF-GF3, SF-RISAT and SF-RS2. (f)-(j), Color ground truth of SF-AIRSAR, SF-ALOS2, SF-GF3, SF-RISAT and SF-RS2.

formed by PauliRGB decomposition. Fig. 4(b) is the ground truth, there are five categories of objectives. i.e. 1, Water, 2, Vegetation, 3, High-Density Urban, 4, Low-Density Urban, 5, Developd.

Table 1. The details of each image.

Sensors	Time	Resolution	Dimensions	Class	PolarType
SF-AIRSAR	1989.08	10m	1024*900	5	full
SF-ALOS2	2015.03	18m	2784*5056	6	full
SF-GF3	2018.08	8m	2304*2912	6	full
SF-RISAT	2016.08	2.33m	4928*6391	6	ppl
SF-RS2	2008.04	8m	1380*1800	5	full

3 CONCLUSIONS

In this paper, we have published five image marker maps. These five images come from different satellites and have different data characteristics. There are similarities in the changes. They are suitable for further scientific research, such

as single source image pixel level classification, multi-source image pixel level fusion classification, etc.

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References

1. Bin Chen, Bo Huang, and Bing Xu, "Multi-source remotely sensed data fusion for improving land cover classification," *ISPRS Journal of Photogrammetry and Remote Sensing*, vol. 124, pp. 27–39, 2017.
2. Xu Liu, Licheng Jiao, Xu Tang, Qigong Sun, and Dan Zhang, "Polarimetric convolutional network for polsar image classification," *IEEE Trans. Geosci. Remote Sens.*, vol. 57, no. 5, pp. 3040–3054, May 2019.
3. Zhimian Zhang, Haipeng Wang, Feng Xu, and Ya-Qiu Jin, "Complex-valued convolutional neural network and its application in polarimetric sar image classification," *IEEE Trans. Geosci. Remote Sens.*, vol. 55, no. 12, pp. 7177–7188, 2017.
4. Y. Guo, L. Jiao, S. Wang, S. Wang, F. Liu, and W. Hua, "Fuzzy superpixels for polarimetric sar images classification," *IEEE Transactions on Fuzzy Systems*, vol. 26, no. 5, pp. 2846–2860, Oct 2018.
5. H. Bi, J. Sun, and Z. Xu, "Unsupervised polsar image classification using discriminative clustering," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 55, no. 6, pp. 3531–3544, June 2017.
6. S. Chen and C. Tao, "Polar image classification using polarimetric-feature-driven deep convolutional neural network," *IEEE Geoscience and Remote Sensing Letters*, vol. 15, no. 4, pp. 627–631, April 2018.
7. F. Liu, L. Jiao, B. Hou, and S. Yang, "Pol-sar image classification based on wishart dbn and local spatial information," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 54, no. 6, pp. 3292–3308, June 2016.
8. Q. Yin, W. Hong, F. Zhang, and E. Pottier, "Optimal combination of polarimetric features for vegetation classification in polsar image," *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, vol. 12, no. 10, pp. 3919–3931, Oct 2019.
9. Zhi-Hua Zhou, "A brief introduction to weakly supervised learning," *National Science Review*, vol. 5, no. 1, pp. 44–53, 2017.
10. "San Francisco Polarimetric SAR Datasets," *Online: <https://www.ietr.fr/polsarpro-bio/san-francisco/>*.
11. E Pottier, F Sarti, M Fitrzyk, and Jolanda Patruno, "Polsarpro-biomass edition: The new esa polarimetric sar data processing and educational toolbox for the future esa & third party fully polarimetric sar missions," 2019.
12. "The ESA PolSARpro v6.0 (Biomass Edition) Software," *Online: <https://www.ietr.fr/polsarpro-bio/>*.
13. "LabelMe: the open annotation tool," *Online: <http://labelme.csail.mit.edu/Release3.0/>*.