



POLSARPRO & Land retrievals using SAR Polarimetry

(Practical Session)

Eric POTTIER

Erxue Chen

University of Rennes 1

Chinese Academy of forestry



Pol-InSAR Practical Land cover Classification

Supervised Classification Based on GF-3 PolSAR data





ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

"龙计划4"高级陆地遥感国际培训班 2017年11月20日——11月25日 云南师范大学,中国,昆明

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China





ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

SNASCC

Step-1: Environment Set



ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

NRSCC

Step-2: Speckle Filter



[S2] >> [T3]

Number of Looks 1

Run

ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

NRSEC

[S2] >> [C4]

Window Size Col

Exit

BOXCAR Speckle Filter

Window Size Row

System Noise Filtering (HV / VH)

(S2) >> [T4]

3

(S2)>> [C3]

Step-2: Speckle Filter



Quit







ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

SATIM Map Algebra

Exit



PauliRGB Before Filter



PauliRGB after Filter

"龙计划4"高级陆地遥感国际培训班 2017年11月20日——11月25日 云南师范大学,中国,昆明

Step-3: Features Extraction



ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

Step-3: Features Extraction

| Polarimetric SAR Data Processing and Educational Tool v5.1 - I | Venu | | | | | |
|--|--|---|--|--|--|--|
| PolSARpro The Polarimetric SAR Data Processing and Educational Tool | | | | | | |
| T3 S Environment V Import Convert V Pr | ocess v bisplay v Calibration v Utilities v Tools v Cor | nfiguration v Help v V | | | | |
| Matrix Elements | KRO : Krogager Decomposition | Data Processing: Polarimetric Decomposition | | | | |
| Correlation Coefficients | CAM : Cameron Decomposition | Input Directory | | | | |
| Elliptical Basis Change 🔸 | HAA : H / A / Alpha Decomposition JRH : Huynen Decomposition | - Output Directory | | | | |
| Polarimetric Speckle Filter 🔹 🕨 | RMB1 : Barnes 1 Decomposition RMB2 : Barnes 2 Decomposition | J:/GF3_Data_Directory_B0X | | | | |
| H / A / Alpha Decomposition Polarimetric Decompositions | SRC : Cloude Decomposition VHDx : Unified Huynen Decomposition WAH1 : Holm 1 Decomposition | Init Row 1 End Row 1892 Init Col 1 End Col 1373 Freeman 3 Components Decomposition T3 Window Size Row 3 Window Size Col 3 | | | | |
| Polarimetric Functionalities - 1 ▸ Polarimetric Functionalities - 2 ▸ | WAH2 : Holm 2 Decomposition AN3 : An & Yang 3 Component Decomposition | TgtG TgtG TgtG Via BMP Target Generators (TgtG) | | | | |
| Polarimetric Segmentation 🔹 🕨 | AN4 : An & Yang 4 Component Decomposition BF4 : Bhattacharya & Frery 4 Component Decomposition | | | | | |
| Polarimetric Data Analysis 🔸 Polarimetric Data Clustering 🕨 | FRE2 : Freeman 3 Component Decomposition FRE3 : Freeman 3 Component Decomposition NEU : Neuman 9 Composition | Decomposition / Reconstruction Output Format © T3 © C3 | | | | |
| Batch Process | NNED : Arii 3 Component NNED Decomposition ANNED : Arii 3 Component ANNED Decomposition | | | | | |
| | VZ3 : Van Zyl (1992) 3 Component Decomposition SIN4 : Singh 4 Component Decomposition YAM3 : Yamaguchi 3 Component Decomposition YAM4 : Yamaguchi 4 Component Decomposition | | | | | |
| Polarization features: | MCSM5 : L. Zhang 5 Component Decomposition TSVM : Touzi Decomposition | | | | | |
| ≻Freeman_Odd.bin ≻Freeman Dbl.bin | Aghababasee Decomposition 2KR : Raney Decomposition CPD : Compact-Pol Decomposition | Run 2 Exit | | | | |
| ≻Freeman_Vol.bin | | | | | | |

ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

esa

Step-4: SVM classifier



Confusion Matrix

Polarimetric SAR Data Processing and Educational Tool v5.1 - Menu

Polarimetric Functionalities - 2

Polarimetric Segmentation

Polarimetric Data Analysis

Batch Process

Polarimetric Data Clustering

PolSARpro The Polarimetric SAR Data Processing and Educational Tool T3 S Environment Convert Process Calibration
Utilities ▼ Configuration ▼ Education ▼ Help Quit Import)isplay Tools E X Data Processing: SVM Supervised Classification Matrix Elements Input Directory Correlation Coefficients J:/GF3 Data Directory BOX/T3 H / A / Alpha Classification Elliptical Basis Change Output Directory-H / u / v Classification (Xu & Jin) :/GF3_Data_Directory_BOX / 🛯 🚞 Polarimetric Speckle Filter H / A / Alpha - Wishart Classification 1892 End Row 1373 Scattering Model Based - Wishart Classification Init Row 1 Init Col End Col H / A / Alpha Decomposition Step 1 - Training Areas Unified Huynen Classification Polarimetric Decompositions 🗃 🚰 Graphic Editor Areas File J:/GF3_Data_Directory_B0X/T3/svm_training_areas.txt Fuzzy - H / Alpha Classification Polarimetric Functionalities - 1 Step 2 - Classification Configuration

🔽 BMP

Step 3 - Color Maps

1. Select the training sample data.

Wishart Supervised Classification

G.P.F. Supervised Classification

SVM Supervised Classification

Rule-Based Hierarchical Classification

Basic Scattering Mechanism Identification

- 2. Select the classification features
- 3. Select the Kernel function
- 4. Run Classification

ColorMap 16 C:/Users/Administrator/AppData/Roaming/PolSARpro 5.1.1/ColorMap/Supervised ColorMap11 🛱 Edit E Pauli |S11+S22| |S12+S21| |S11-S22| Coded Colormap Sinclair |S11| |(S12+S21)/2| |S22| Step 4 - SVM Parameter Setting Input Polarimetric Indicators Sampling option Output SVM parameters Τ3 Class Probability E BMP Training sampling 500 Mean Hyperplane Distance E BMP Other Select If important unbalanced training point Useful but time consuming ******** Step 5 - Kernel Parameter BBF C Linear RECOMMANDED Polynomial Cost 100 Optimisation parameters Degree 2 Gamma = 1/sigma Setup, and Bun Exit Step 6 - Run Classification

ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

CM Editor

Step-4.1: SVM classifier



| I Data Processing: SVM Supervised Classification | 1. Select the training sample data. |
|--|---|
| Input Directory | |
| J:/GF3_Data_Directory_BOX/T3 | WARNING |
| - Output Directory - | |
| J:/GF3_Data_Directory_B0X / T3 🔪 | |
| Init Bow 1 End Bow 1892 Init Col 1 End Col 1373 | |
| Step 1 - Training Areas | |
| Areas File J:/GF3_Data_Directory_B0X/T3/svm_training_areas.txt CGraphic Editor | Yes No Cancel |
| - Step 2 - Classification Configuration | |
| 🔽 BMP 🔽 Confusion Matrix CM Editor | |
| Step 3 - Color Maps | |
| ColorMap 16 C:/Users/Administrator/AppData/Roaming/PolSARpro_5.1.1/ColorMap/Supervised_ColorMap11 😅 Edit | |
| Pauli IS11+S22 IS12+S21 IS11-S22 | GG3_Data_Directory_BOX → T3 v 4 搜索 T3 P |
| Coded Colormap | 组织 ▼ 新建文件夹 副註 ▼ □ 20 |
| Step 4 - SVM Parameter Setting | ▲ 名称 日野 |
| In Input Polarimetric Indicators In Sampling option | 🔞 🖉 alaba hara 30 |
| C T3 | anjpatomp 20. |
| Other Select | 🖳 🔜 entropy.bmp 20: |
| Useful but time consuming | Ereeman_Dbl_dB.bmp 20: |
| Step 5 · Kernel Parameter | E Freeman_Odd_dB.bmp 20: |
| C RBF ECOMMANDED O Polynomial C Linear | E Freeman_Vol_dB.bmp 200 |
| Cost 100 Gamma = 1/sigma Uptimisation parameters Degree 2 | Pauli Pixels.bmp 20. |
| | |
| Step 6 - Bun Classification | |
| | |
| | |
| | 打开(O) 取消 |

ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

"龙计划4"高级陆地遥感国际培训班 2017年11月20日——11月25日 云南师范大学,中国,昆明

sa

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

SNRSEE





1. Select the training sample data.

Basic operation:



ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

"龙计划4"高级陆地遥感国际培训班 2017年11月20日—11月25日 云南师范大学,中国,昆明

| ENRSCE 作素纤能大掌 | Step-4.1: SVM classifier | esa |
|--|--|-------|
| ${\it I}$ Polarimetric SAR Data Processing and Educational Tool v5.1 | - Menu | |
| PolSARpro The Polarimetric SAR Data Proce | essing and Educational Tool | |
| T3 S Environment V Import Convert V | Process v Display v Calibration v Utilities v Tools v Configuration v Education v Help v | .Quit |



1. Select the training sample data.

Basic operation:

- 1. Add a new class 1.
- Select first area for class1;Select second area for class1;....
 - 3. Add a new class 2.
 - 4. Select first area for class2;Select second area for class2;....
 - **10. Save configuration**

. . . .





1. Select the training sample data.

Do it yourself. Prepare the training sample data



ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

"龙计划4"高级陆地遥感国际培训班 2017年11月20日—11月25日 云南师范大学,中国,昆明

Step-4.2: SVM classifier



| Data Processing: SVM Supervised Classification | C X | 2. Select the classification features |
|--|-----------------------|---|
| - Input Directory- | | |
| J:/GF3_Data_Directory_B0X/T3 | | Calact Polarimatric Indicators |
| - Output Directory- | | |
| J:/GF3_Data_Directory_BOX | / 13 | Add or remove polarimetric indicator (No complex file !) |
| Step 1 - Training Areas | 1373 | alpha.bin |
| | | anisotropy.bin |
| Areas File [J:/dF3_Data_Directory_BUX/13/svm_training_areas.txt | Graphic Editor | entropy.bin |
| - Step 2 - Classification Configuration | | Freeman_Dbl.bin = >> Freeman_Dbl.bin |
| 🔽 BMP 🔽 Confusion Matrix CM E | ditor | Freeman_Udd.bin Freeman_Udd.bin |
| — Step 3 - Color Maps | | mask valid pixels bin |
| ColorMap 16 C:/Users/Administrator/AppData/Roaming/PoISARpro_5.1.1/ColorMap/Supervised_ColorMap | 11 🗃 Edit | T11.bin |
| Coded Colormap Pauli S11+S22 S12+S21 S11-S22 Sinclair S11 (S12+S21)/2 S22 Sinclair S11 (S12+S21)/2 S22 | 1 | T12_imag.bin T12_real.bin |
| - Step 4 - SVM Parameter Setting | | |
| Input Polarimetric Indicators Sampling option Output SVM parameters | | |
| C T3 | 🗖 ВМР | |
| 🕥 Other Select 🛛 🔽 Kingsstant unbelanced training spint 🗌 Mean Hyperplane Distance | ce 📻 _{BMP} 📕 | |
| | ig | |
| Step 5 - Kernel Parameter | | |
| C RBF RECOMMANDED (• Polynomial Degree Setup and Run | C Linear | Select the features that need to be added to the classifier |
| Step 6 - Run Classification Exit | | |

ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

SNASEC

sa



| 🧣 Data Processing: SVM Supervised Classification | | 3. Select the Kernel function |
|--|----------------|--|
| - Input Directory- | | |
| J:/GF3_Data_Directory_B0X/T3 | | |
| - Output Directory | | We choose polynomial |
| J:/GF3_Data_Directory_B0X | / []] | kernel function |
| Init Bow 1 End Bow 1892 Init Col 1 End C | `d1373 | Kernel function |
| Step 1 - Training Areas | .01 1010 | |
| Areas File J:/GF3 Data Directory B0X/T3/svm training areas.txt | Graphic Editor | P Degree:2 |
| - Step 2 - Classification Configuration | | |
| EMP Confusion Matrix | CM Editor | |
| | | |
| ColorMap 16 C:/Users/Administrator/AppData/Roaming/PolSARpro_5.1.1/ColorMap/Supervised_Color | rMap11 🗃 🛃 | |
| □ Coded Colormap □ Sinclair S11+S22 S12+S21 S11 □ Sinclair S11 (S12+S21)/2 S2 | -5221 | 4. Run Classification |
| Step 4 - SVM Parameter Setting | | C:\Windows\system32\cmd.exe |
| Input Polarimetric Indicators Sampling option Output SVM parameter | | File : sym-predict.c |
| C T3 | 🗖 ВМР | Project : ESA_POLSARPRO Authors : Cedric LARDEUX |
| Other Select If important unbalanced training point Mean Hyperplane D | stance 🔲 BMP | Uersion : 1.0 Creation : 01/2011 |
| Sten 5 - Kernel Parameter | uming | * |
| | C Linear | UMR CNRS 6164 Remote Sensing Group - SHINE Team |
| Cost 100 Gamma = 1/sigma Optimisation parameters Degree 2 | | UNIVERSITY OF RENNES I Rat. 11D - Campus de Regulieu |
| Setup and Run | / 3 | 263 Avenue General Leclerc 35042 RENNES Cedex |
| | | × |
| Step 6 - Run Classification 4. Exit | | Description : This function is based on the LIBSUM V2.29 and adapted |
| | | CO PPOCESS FOISHAPPO BINAFY FILE |
| | | ************************************** |

ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE

20-25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China

Classification Result



svm_classification_file.bmp

NRSEE





Do it yourself:

Select different kernel functions to classify and compare the classification results.

ADVANCED LAND REMOTE SENSING INTERNATIONAL TRAINING COURSE 20–25 November 2017 | Yunnan Normal University Kunming, Yunnan Province, P.R. China "龙计划4"高级陆地遥感国际培训班 2017年11月20日—11月25日 云南师范大学,中国,昆明

