

# A Temporal Polarimetric SAR Classification Method Based On Polarimetric-Temporal Feature Selection

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## Introduction

- Considering the similarity between feature maps in many aspects, a statistical similarity measure is introduced.
- we combine the feature graph similarity measure and temporal model matching to perform feature selection from two dimensions.
- The Transformer structure is introduced to PolSAR time series data

## Methods

Polarimetric dimensional feature extraction method IESSM:

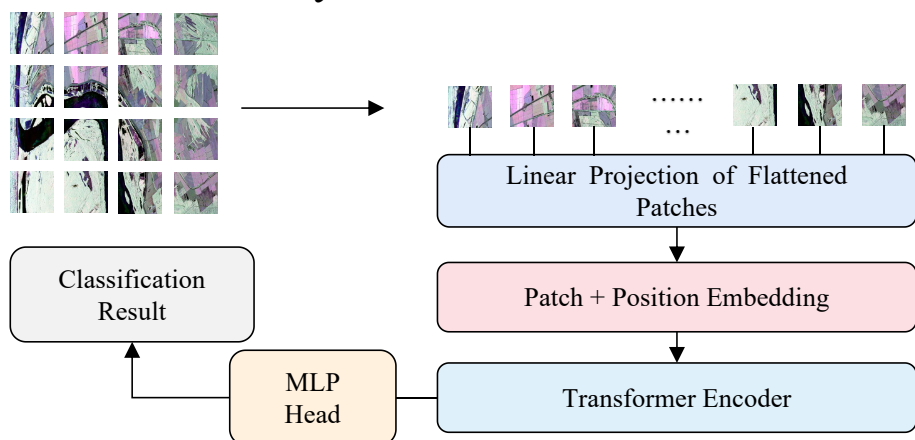
$$IESSM = (1 + \beta^2) \cdot \frac{NEHS(x, y) \cdot S(x, y)}{NEHS(x, y) + \beta^2 \cdot S(x, y)}$$

where NEHS is the standard entropy histogram similarity.  $S$  represents the structural similarity measure (SSIM).

Temporal dimensional feature extraction method SSV:

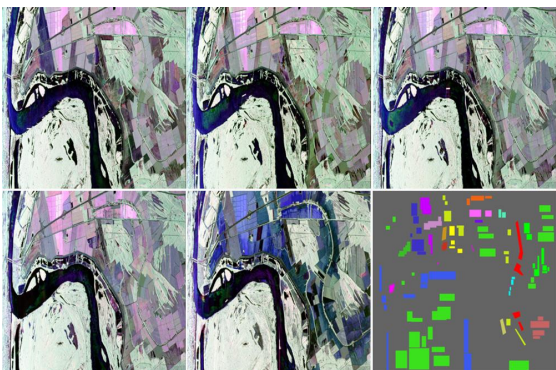
$$SSV = \sqrt{ED^2 + (1 - SCS)^2}$$

ED is the Euclidean distance, SCS is the spectral correlation similarity.



The structure of Vision Transformer

## Datasets

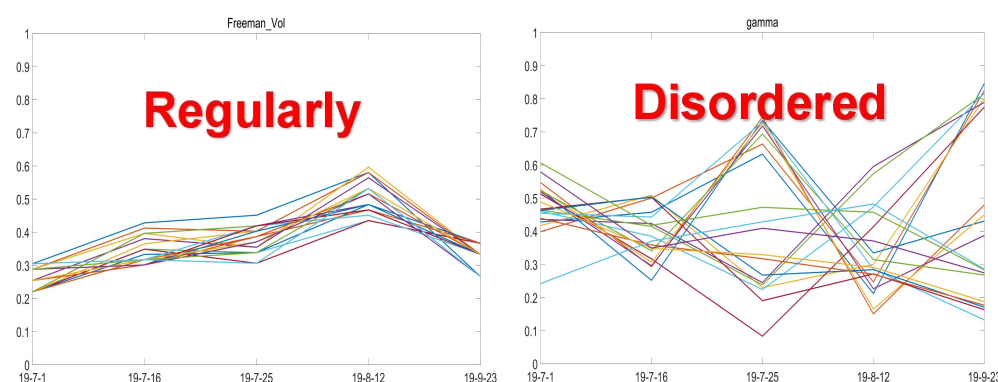


- UAVSAR
- 2019/07/01 to 2019/08/12
- 15000 × 9900
- L band

## Experiment

Table 1

Features	IESSM	SSV	IESSM+SSV
Alpha	0.8995	0.2661	<b>1.1656</b>
Anisotropy	0.9171	0.5520	1.4691
Beta	0.9077	0.4850	<b>1.3927</b>
(1-H)(1-A)	0.8563	0.3491	<b>1.2054</b>
(1-H)A	0.7893	0.4473	<b>1.2312</b>
H(1-A)	0.8961	0.4971	<b>1.3932</b>
HA	0.9223	0.4925	1.4148
Delta	0.9137	0.5090	1.4227
Entropy	0.8532	0.3510	<b>1.2042</b>
Gamma	0.9176	0.7269	1.6445
Lambda	0.9084	0.2603	<b>1.1687</b>
Freeman_Dbl	0.8730	0.3831	<b>1.2561</b>
Freeman_Odd	0.8642	0.5951	1.4593
Freeman_Vol	0.8922	0.2275	<b>1.1197</b>



We selected 20 samples of the same crop and observed the change in feature magnitude values over time on each of the two features

Table 2 Classification accuracy comparison

Method	Accuracy
ResNet-14+all 14 features	86.68%
Vision Transformer +all 14 features	<b>88.02%</b>
ResNet-14+9 features	85.99%
Vision Transformer +9 features	<b>87.38%</b>

## Conclusions

- Vision Transformer shows better performance when using the same number of features.
- The decrease in accuracy of the 9 features we selected is less than 1% compared to all features, achieving roughly comparable accuracy.