



西安理工大学
XI'AN UNIVERSITY OF TECHNOLOGY



KNN、SVM、3D-CAE对高光谱 图像进行分类

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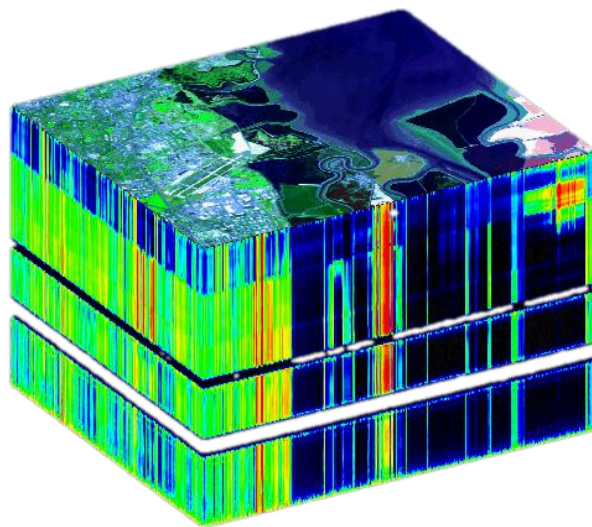
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Roadmap



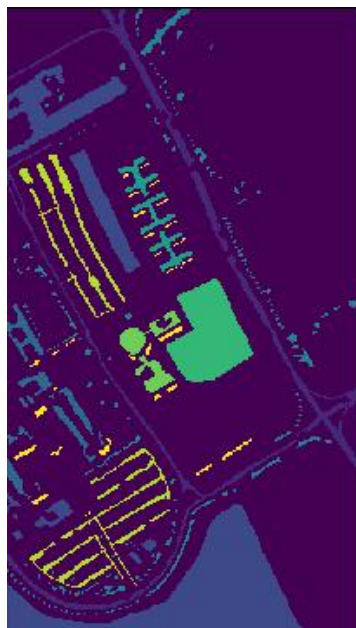
- **Background**
- Related work
- Our method
- Experiment
- Conclusion

高光谱图像： 光谱分辨率在10¹数量级范围内的光谱图像。一般通过搭载在不同空间平台上的高光谱传感器，即成像光谱仪，在电磁波谱的紫外、可见光、近红外和中红外区域，以数十至数百个连续且细分的光谱波段对目标区域同时成像。在获得地表图像信息的同时，也获得其光谱信息，第一次真正做到了光谱与图像的结合。



Background

PaviaU data set: 帕维亚数据集是由Reflective Optics System Imaging Spectrometer sensor在意大利帕维亚大学获得的。它的空间分辨率是1.3米，有 610×340 像素，包含115个光谱带，其波长范围为0.43至0.86 μm 。



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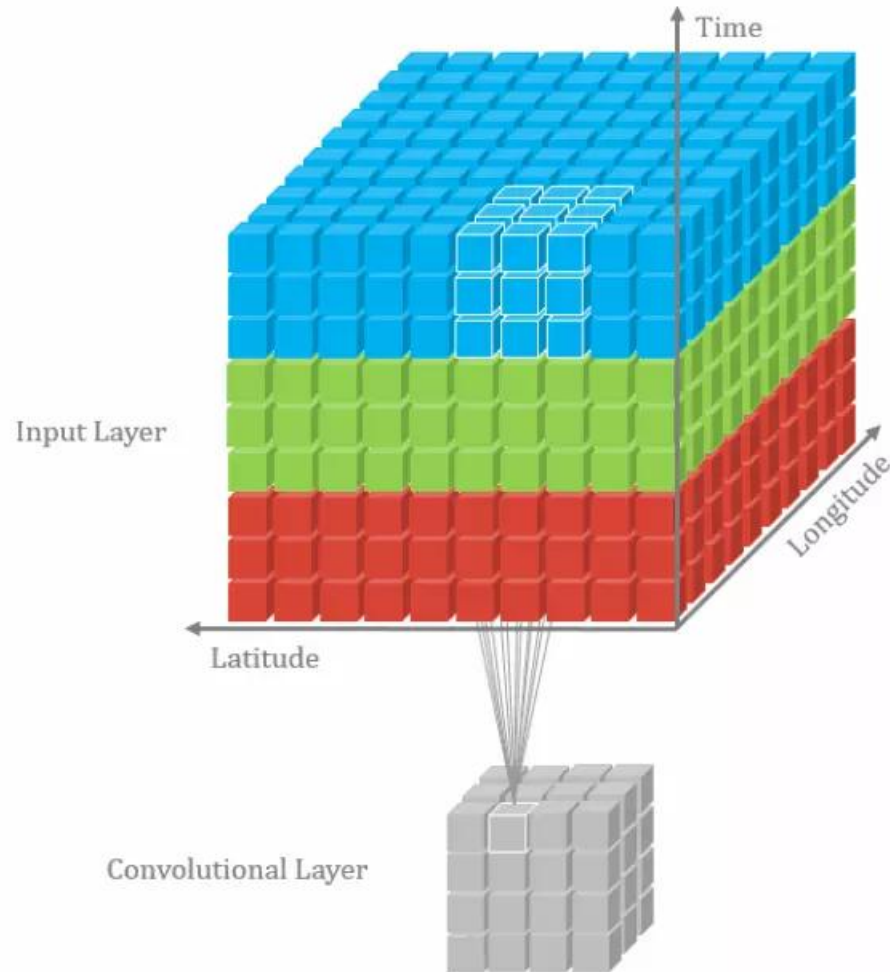


1. SVM

2. KNN

3. 3DCAE

3D卷积

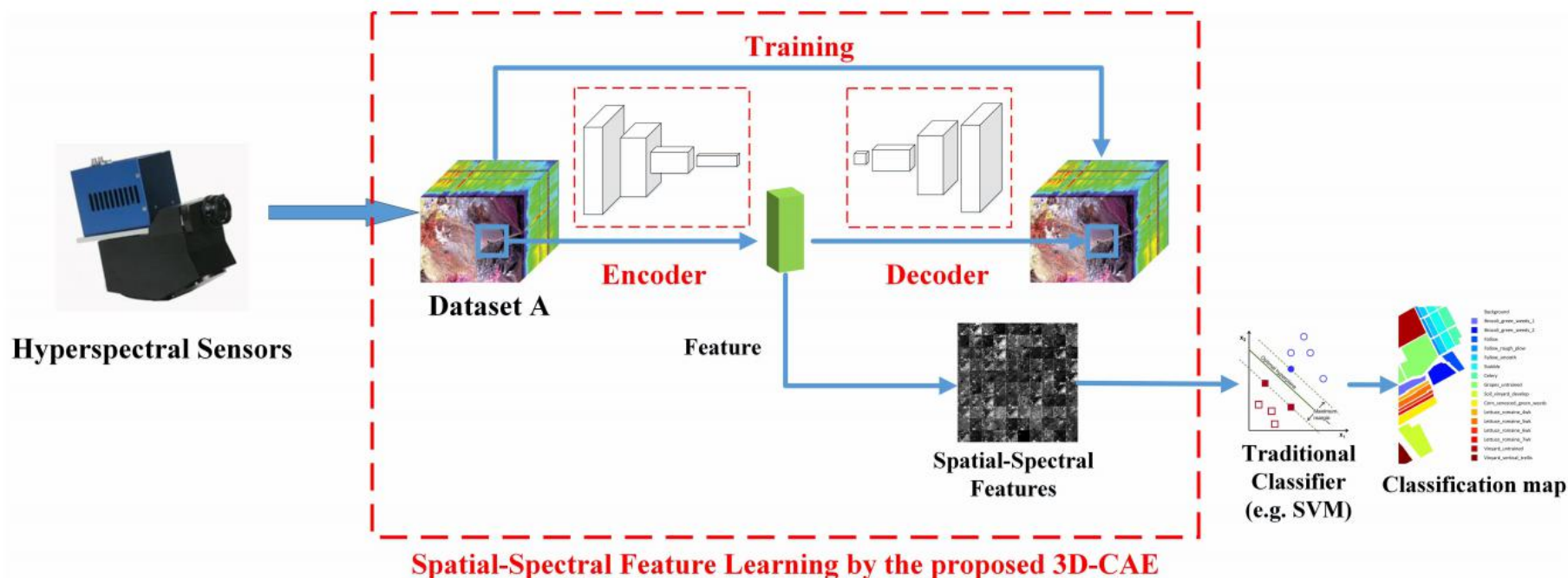


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Method



[1] S. Mei, J. Ji, Y. Geng, Z. Zhang, X. Li, and Q. Du, "Unsupervised Spatial–Spectral Feature Learning by 3D Convolutional Autoencoder for Hyperspectral Classification," IEEE Transactions on Geoscience and Remote Sensing, vol. 57, no. 9, pp. 6808-6820, 2019.



`batchsize = 32, learning_rate = 0.001; weight_decay = 0.0005, epoch = 6`

Roadmap



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Kappa系数 (Kappa Coefficient)

它是通过把所有真实参考的像元总数 (N) 乘以混淆矩阵对角线 (X_{KK}) 的和再减去各类中真实参考像元数与该类中被分类像元总数之积之后, 再除以像元总数的平方减去各类中真实参考像元总数与该类中被分类像元总数之积对所有类别求和的结果。

总体分类精度 (Overall Accuracy)

等于被正确分类的像元总和除以总像元数。被正确分类的像元数目沿着混淆矩阵的对角线分布, 总像元数等于所有真实参考源的像元总数。

平均分类精度 (Average Accuracy)

数据集中每一类分类精度的平均值。

Experiment KNN



```
1 class: ( 4574.0 / 6531.0 ) 0.7003521665901087
2 class: ( 13197.0 / 18549.0 ) 0.7114669254407245
3 class: ( 1524.0 / 1999.0 ) 0.7623811905952976
4 class: ( 2699.0 / 2964.0 ) 0.9105937921727395
5 class: ( 1236.0 / 1245.0 ) 0.9927710843373494
6 class: ( 3548.0 / 4929.0 ) 0.7198214648001623
7 class: ( 1144.0 / 1230.0 ) 0.9300813008130081
8 class: ( 2554.0 / 3582.0 ) 0.7130094919039642
9 class: ( 846.0 / 847.0 ) 0.9988193624557261
total right num: 31322.0
total test num: 41876.0
Overall accuracy: 0.7479701977266214
Average accuracy: 0.8265885310121202
Kappa: 0.6790583915659619
```

Experiment SVM



```
dataset shape: (610, 340, 103)
1 class: ( 5243.0 / 6531.0 ) 0.8027867095391211
2 class: ( 16078.0 / 18549.0 ) 0.8667852714432045
3 class: ( 1655.0 / 1999.0 ) 0.8279139569784892
4 class: ( 2848.0 / 2964.0 ) 0.9608636977058029
5 class: ( 1234.0 / 1245.0 ) 0.9911646586345382
6 class: ( 4596.0 / 4929.0 ) 0.9324406573341448
7 class: ( 1109.0 / 1230.0 ) 0.9016260162601626
8 class: ( 3070.0 / 3582.0 ) 0.8570630932439978
9 class: ( 846.0 / 847.0 ) 0.9988193624557261
total right num: 36679.0
total test num: 41876.0
Overall accuracy: 0.8758955010029611
Average accuracy: 0.9043848248439098
Kappa: 0.8383647611093908
```

Experiment 3D-CAE+ SVM



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3D-CAE能够有效地提取到图像的空谱特征，对于后续分类任务有很好的促进作用；相比于SVM，KNN算法效果一般，主要原因在于HSI图像结构比较复杂，用简单的投票机制很难有效地进行分类。



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谢 谢 大 家