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Urban landscape classification using Chinese advanced high-resolution satellite imagery and an object-oriented multi-variable model

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Key words: ZY-1 02C satellite, Classification, Urban, Multi-variable model

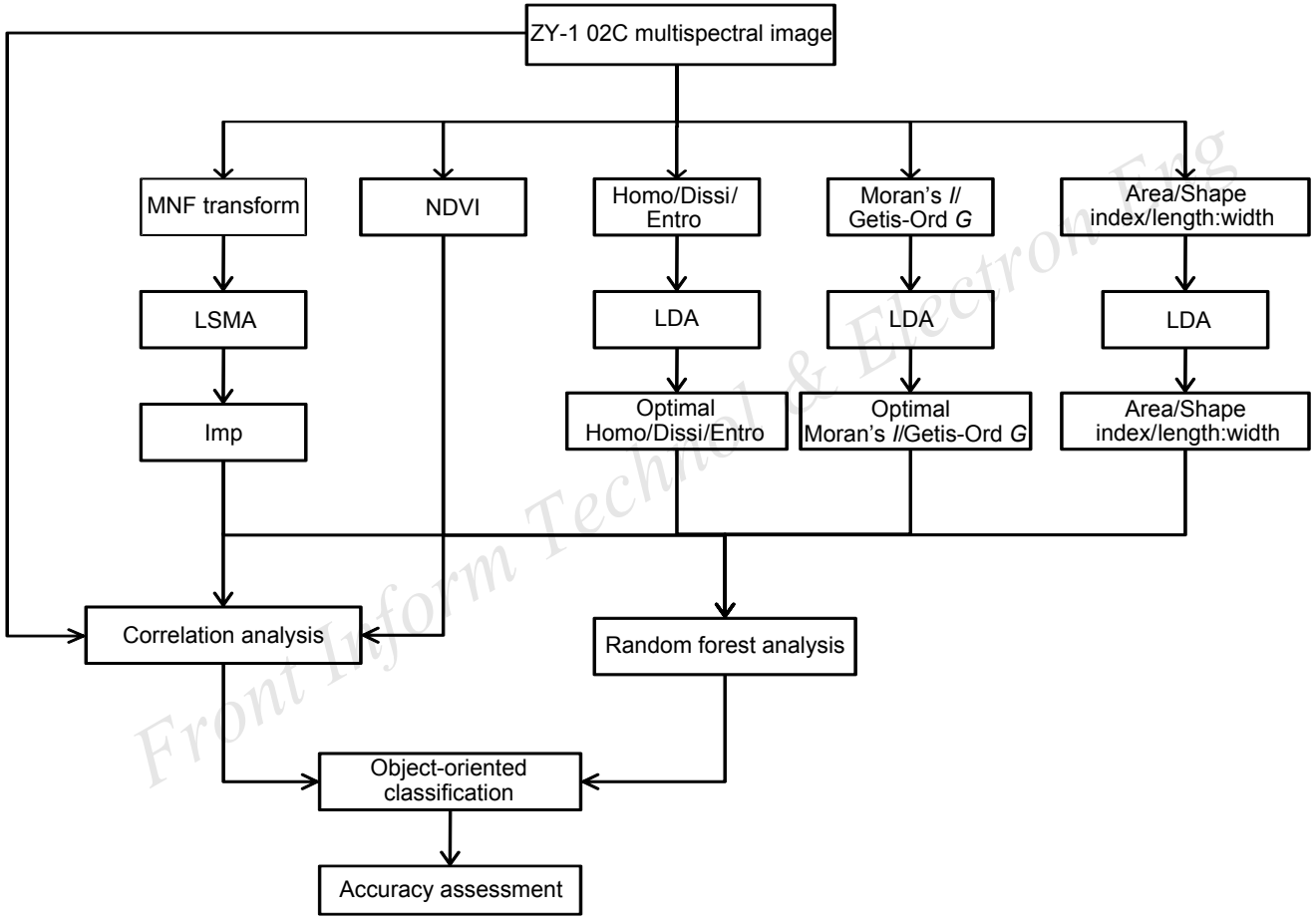
Contact: Li-gang Ma
E-mail: 11114054@zju.edu.cn
ORCID: http://orcid.org/0000-0001-9377-2189

Introduction

- Requirements of land-use mapping and monitoring by means of automated classification on remote sensing imagery have played an increasingly important role in decision-making and urban management.
- An overwhelming majority of satellite images are dominated by the United States and European space agencies. In recent years, China has launched a series of high-resolution satellites, among which ZY-1 02C is one of the most advanced.
- There is an urgent need to examine its utility and capabilities in detecting subtle changes in urban land use and land cover since it is equipped with only three spectral bands (green, red, NIR), which may increase the difficulty in discriminating urban targets.

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Framework of our method (1)



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Fig. 2 Flowchart of the proposed method consisting of impervious surface (Imp) extraction, homogeneity/dissimilarity/entropy (Homo/Dissi/Entro) and Moran's *I*/Getis-Ord *G* calculation, linear discriminant analysis (LDA), etc.

Framework of our method (2)

Step 1: homogeneity, dissimilarity, and entropy calculation

Step 2: LISA feature calculation

Step 3: shape related features

Step 4: impervious surface extraction

Step 5: LDA, correlation, and random forest analysis

Step 6: object based classification

Step 7: point and area based accuracy assessment

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Major results

Table 2 Overall accuracy, producer's accuracy (PA), user's accuracy (UA), and the kappa statistic produced by the object-oriented classifier

Classified data	Reference								PA (%)	UA (%)
	Residential	Commercial/Industrial/ Transportation	Forest	Groves	Water	Barren	Farmland	Total		
Residential	153	7	2	0	5	2	2	171	94.44	89.47
Commercial/Industrial/ Transportation	1	131	0	0	2	3	2	139	90.34	94.24
Forest	0	0	110	3	1	0	1	115	94.02	95.65
Groves	0	0	0	56	0	0	0	56	91.80	100.00
Water	0	0	0	0	91	0	0	91	91.92	100.00
Barren	3	3	0	0	0	55	0	61	87.30	90.16
Farmland	5	4	5	2	0	3	108	127	95.58	85.04
Total	162	145	117	61	99	63	113	760		

Overall classification accuracy=92.63%; overall kappa statistic=91.24%

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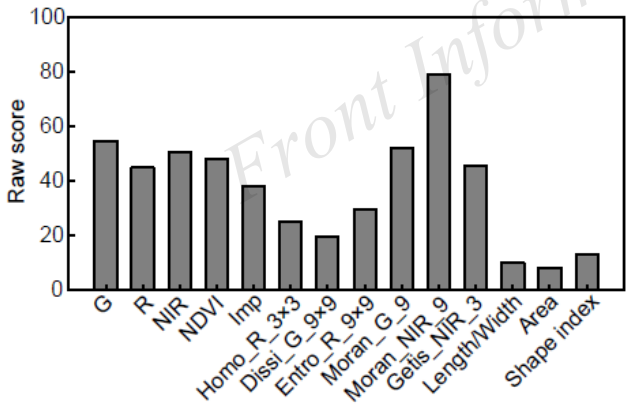


Fig. 6 Variable importance of the 14 features provided by the random forest algorithm

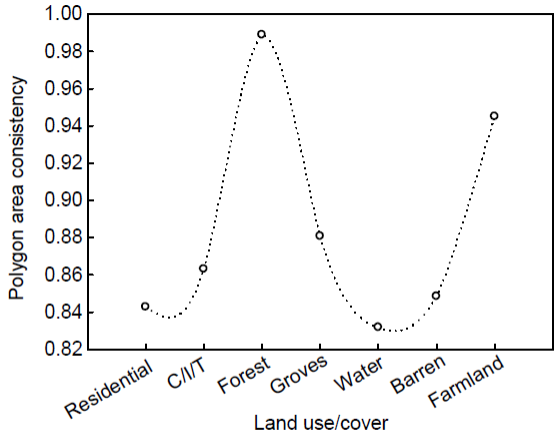


Fig. 8 Area evaluation results (C/I/T means commercial/ industrial/transportation)

Conclusions

- We have proposed a method that integrates five categories of variables using the combination of LDA and the random forest algorithm.

- Results derived from this method illustrated its effectiveness for urban landscape classification, and revealed the high quality of the Chinese ZY-1 02C multispectral image

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