

Table S1. F1-measure (%) of the seven categories with different classification methods on spatially weakly dependent datasets in the Wuhan study area. SVM: support vector machine; RF: random forest; Resnet: deep residual network; CapsNet: capsule network; CNN: convolutional neural network (Visual Geometry Group Network16); Res2CapsNet: combination of Res2Net and CapsNet; ResCapsNet: combination of ResNet and CapsNet.

Class	SVM	RF	CapsNet	ResNet	CNN	Res2CapsNet	ResCapsNet
Surface-mined land	86.93 ± 0.88	87.44 ± 0.34	89.63 ± 0.27	99.25 ± 0.36	98.95 ± 0.72	97.32 ± 0.35	99.27 ± 0.28
Cropland	79.24 ± 0.94	76.52 ± 0.70	75.51 ± 0.33	96.75 ± 0.38	93.62 ± 0.39	94.26 ± 0.27	98.44 ± 0.39
Forest land	81.96 ± 1.03	82.84 ± 1.07	84.43 ± 0.73	92.50 ± 1.30	93.28 ± 0.91	91.67 ± 0.73	95.71 ± 0.51
Water	94.40 ± 0.20	90.21 ± 0.41	93.56 ± 0.80	99.24 ± 0.69	98.56 ± 0.39	97.92 ± 0.62	99.32 ± 0.40
Road	71.26 ± 1.15	78.60 ± 1.24	81.42 ± 1.22	99.53 ± 0.16	95.85 ± 0.28	98.73 ± 0.55	99.38 ± 0.68
Residential land	69.03 ± 0.99	65.97 ± 0.40	73.89 ± 0.56	96.76 ± 0.53	92.48 ± 0.56	92.80 ± 0.14	97.69 ± 0.27
Bare surface land	95.45 ± 0.73	94.40 ± 0.62	99.26 ± 0.41	99.82 ± 0.12	98.37 ± 0.71	100.00	100.00

Table S2. F1-measure (%) of the seven categories with different classification methods on spatially independent datasets in the Wuhan study area. SVM: support vector machine; RF: random forest; Resnet: deep residual network; CapsNet: capsule network; CNN: convolutional neural network (Visual Geometry Group Network16); Res2CapsNet: combination of Res2Net and CapsNet; ResCapsNet: combination of ResNet and CapsNet.

Class	SVM	RF	CapsNet	ResNet	CNN	Res2CapsNet	ResCapsNet
Surface-mined land	61.54 ± 0.50	60.03 ± 0.73	61.32 ± 0.36	79.04 ± 0.29	69.55 ± 0.20	62.50 ± 0.31	76.35 ± 0.56
Cropland	76.41 ± 0.63	71.25 ± 1.05	82.84 ± 0.93	93.25 ± 0.37	72.68 ± 0.56	89.03 ± 1.02	91.42 ± 0.54
Forest land	93.43 ± 1.15	91.27 ± 1.10	91.26 ± 0.81	98.40 ± 0.84	97.42 ± 0.27	97.28 ± 0.70	100
Water	90.68 ± 0.41	93.26 ± 0.98	93.46 ± 0.57	93.87 ± 0.62	99.81 ± 0.61	99.34 ± 0.16	95.76 ± 0.27
Road	81.02 ± 0.66	64.49 ± 1.49	37.34 ± 1.57	56.12 ± 1.25	61.02 ± 0.58	45.16 ± 1.22	55.92 ± 0.80
Residential land	78.63 ± 0.98	75.22 ± 0.44	63.68 ± 0.74	72.85 ± 0.39	70.59 ± 0.63	78.63 ± 0.73	85.24 ± 1.26
Bare surface land	67.24 ± 0.42	45.63 ± 0.79	62.43 ± 0.90	76.28 ± 0.51	67.23 ± 0.42	75.94 ± 0.53	76.44 ± 0.75

Table S3. F1-measure (%) of the seven categories with different classification methods on spatially weakly dependent datasets in the Xinjiang study area. SVM: support vector machine; RF: random forest; Resnet: deep residual network; CapsNet: capsule network; CNN: convolutional neural network (Visual Geometry Group Network16); Res2CapsNet: combination of Res2Net and CapsNet; ResCapsNet: combination of ResNet and CapsNet.

Class	SVM	RF	CapsNet	ResNet	CNN	Res2CapsNet	ResCapsNet
Surface-mined land	76.78 ± 0.81	70.65 ± 0.67	90.81 ± 1.03	93.69 ± 0.31	88.56 ± 0.72	90.67 ± 0.55	92.34 ± 0.33
Cropland	82.12 ± 0.89	74.63 ± 0.60	89.47 ± 0.35	94.33 ± 0.38	93.15 ± 0.61	92.91 ± 0.40	95.91 ± 0.73
Forest land	90.54 ± 1.20	86.32 ± 1.31	94.26 ± 0.24	97.32 ± 0.92	94.09 ± 0.52	94.33 ± 0.39	97.86 ± 0.59
Water	98.06 ± 0.80	97.04 ± 0.60	97.04 ± 0.87	97.98 ± 0.74	96.95 ± 0.62	98.27 ± 0.97	98.98 ± 0.84
Road	40.17 ± 1.32	46.11 ± 0.75	81.27 ± 0.55	92.75 ± 1.07	85.04 ± 0.92	83.94 ± 1.24	90.30 ± 1.19
Residential land	79.90 ± 0.97	74.49 ± 0.45	92.34 ± 0.26	95.51 ± 0.66	93.84 ± 0.41	92.45 ± 0.41	96.84 ± 0.96
Bare surface land	50.31 ± 0.25	55.80 ± 0.44	60.49 ± 0.39	76.46 ± 0.40	72.41 ± 0.86	71.98 ± 0.19	79.76 ± 0.50

Table S4. F1-measure (%) of the seven categories with different classification methods on spatially independent datasets in the Xinjiang study area. SVM: support vector machine; RF: random forest; Resnet: deep residual network; CapsNet: capsule network; CNN: convolutional neural network (Visual Geometry Group Network16); Res2CapsNet: combination of Res2Net and CapsNet; ResCapsNet: combination of ResNet and CapsNet.

Class	SVM	RF	CapsNet	ResNet	CNN	Res2CapsNet	ResCapsNet
Surface-mined land	82.24 ± 0.32	74.63 ± 0.67	74.26 ± 0.27	68.42 ± 0.54	72.35 ± 0.97	78.40 ± 0.58	77.66 ± 0.39
Cropland	76.87 ± 0.36	61.42 ± 0.34	73.82 ± 0.49	84.46 ± 0.63	78.84 ± 0.38	80.14 ± 0.89	85.29 ± 0.58
Forest land	90.81 ± 0.95	82.64 ± 0.49	81.63 ± 0.57	91.40 ± 0.70	90.04 ± 1.15	90.47 ± 0.53	96.27 ± 0.62
Water	35.49 ± 0.84	48.43 ± 0.99	48.24 ± 0.89	35.09 ± 0.87	35.29 ± 1.26	36.67 ± 0.92	31.67 ± 0.74
Road	25.45 ± 1.24	20.81 ± 0.65	19.65 ± 1.17	28.81 ± 1.03	27.47 ± 1.10	23.82 ± 1.21	28.85 ± 0.89
Residential land	83.46 ± 0.12	75.49 ± 0.47	82.91 ± 0.52	81.43 ± 0.39	81.42 ± 0.35	84.69 ± 0.28	90.13 ± 0.41
Bare surface land	50.83 ± 0.17	40.47 ± 0.29	48.20 ± 0.36	66.27 ± 0.30	58.44 ± 0.59	59.29 ± 0.36	65.61 ± 0.19

Table S5. Classification results using different methods under limited samples in the Wuhan study area.

Methods	Index	20	30	50
SVM	OA	74.17 ± 0.61	77.16 ± 1.22	79.73 ± 0.93
	F1-score	72.98 ± 0.82	76.78 ± 0.83	79.36 ± 0.66
	Kappa	68.22 ± 0.47	72.86 ± 2.02	75.83 ± 1.62
RF	OA	70.57 ± 0.92	73.24 ± 1.13	75.73 ± 1.02
	F1-score	70.10 ± 1.14	72.68 ± 0.95	75.61 ± 1.17
	Kappa	65.31 ± 1.08	68.02 ± 0.67	71.62 ± 2.04
CapsNet	OA	74.90 ± 1.47	78.44 ± 0.94	86.18 ± 1.30
	F1-score	74.66 ± 1.25	78.16 ± 0.92	86.28 ± 1.33
	Kappa	70.47 ± 0.93	74.53 ± 1.38	85.04 ± 1.49
ResNet	OA	73.52 ± 0.81	76.53 ± 0.59	85.54 ± 1.26
	F1-score	72.55 ± 1.26	76.11 ± 0.95	85.08 ± 0.80
	Kappa	67.78 ± 0.92	72.01 ± 0.90	82.29 ± 1.41
CNN	OA	75.96 ± 1.38	78.10 ± 0.65	79.32 ± 0.69
	F1-score	75.12 ± 1.25	77.88 ± 0.66	77.65 ± 0.67
	Kappa	71.39 ± 0.89	74.35 ± 0.97	73.77 ± 1.55
ResCapsNet	OA	75.88 ± 1.06	79.71 ± 1.55	87.60 ± 0.44
	F1-score	75.35 ± 1.17	79.05 ± 1.53	87.27 ± 1.33
	Kappa	71.95 ± 0.96	75.40 ± 0.90	85.44 ± 0.94

Table S6. Classification results using different methods under limited samples in the Xinjiang study area.

Methods	Index	20	30	50
SVM	OA	62.58 ± 0.78	65.28 ± 1.09	68.45 ± 1.32
	F1-score	62.40 ± 1.22	65.16 ± 0.94	68.37 ± 0.99
	Kappa	57.09 ± 1.35	60.12 ± 1.45	63.72 ± 0.95
RF	OA	57.68 ± 1.21	60.43 ± 1.45	64.10 ± 0.72
	F1-score	57.16 ± 0.78	59.84 ± 0.59	63.36 ± 1.33
	Kappa	49.88 ± 1.04	52.77 ± 1.46	56.41 ± 1.53
CapsNet	OA	64.81 ± 0.76	68.38 ± 0.92	72.42 ± 1.31
	F1-score	61.93 ± 1.24	62.57 ± 0.97	59.39 ± 1.75
	Kappa	57.16 ± 0.96	58.49 ± 0.84	56.73 ± 0.95
ResNet	OA	68.89 ± 0.80	70.35 ± 1.69	72.75 ± 1.72
	F1-score	63.19 ± 1.54	65.86 ± 1.56	72.83 ± 1.37
	Kappa	59.92 ± 0.73	62.36 ± 1.55	69.17 ± 1.57
CNN	OA	68.97 ± 0.64	70.79 ± 1.59	73.03 ± 1.41
	F1-score	64.27 ± 1.51	66.43 ± 1.22	68.57 ± 0.97
	Kappa	59.09 ± 1.54	61.63 ± 0.75	64.49 ± 0.84
ResCapsNet	OA	68.36 ± 0.67	71.25 ± 1.29	75.23 ± 0.78
	F1-score	63.37 ± 1.23	71.02 ± 0.81	74.99 ± 0.86
	Kappa	60.06 ± 1.04	66.87 ± 1.26	69.89 ± 1.53