

Accuracy Assessment



Geography 581
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Accuracy Assessment

The comparison of a classification with ground-truth data to evaluate how well the classification represents the real world.

Steps involved in Accuracy Assessment:

- What will be accomplished with the assessment
- Select a method
 - *Confidence-building assessment
 - *Model-based inference
 - *Design-based inference



Accuracy Assessment

#

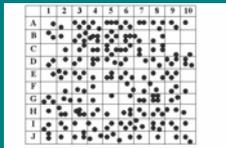
Decide sample size:

#

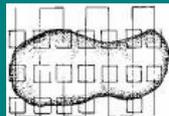
- Observations per class
- Binomial or multinomial distributions
- Rule of thumb is 50 samples for each land-cover class
- If large area or land-use categories are greater than 10, 75-100 samples per class
- May take fewer samples of low variability classes like water/forest

Accuracy Assessment

Select Sampling Method:



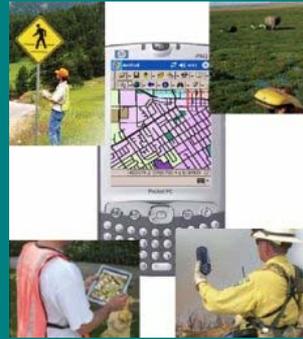
- Random sampling
- Systematic sampling
- Stratified random sampling
- Stratified systematic unaligned sampling
- Cluster sampling



Accuracy Assessment

Obtain Ground-Reference Data:

- Temporal obligations
- May use a much higher spatial/spectral resolution image if budget/time does not permit ground truthing
- Some analysts use 'training' pixels although these can bias the error matrix because they are not random



Create Error (confusion/contingency) Matrix:

Classified Image	Reference Data					Row total
	Residential	Commercial	Wetland	Forest	Water	
Residential	70	5	0	13	0	88
Commercial	3	55	0	0	0	58
Wetland	0	0	99	0	0	99
Forest	0	0	4	37	0	41
Water	0	0	0	0	121	121
Column total	73	60	103	50	121	407

Overall Accuracy = $382/407 = 93.86\%$

Producer's Accuracy (omission error)

Residential = $70/73 = 96\%$ 4% omission error
 Commercial = $55/60 = 92\%$ 8% omission error
 Wetland = $99/103 = 96\%$ 4% omission error
 Forest = $37/50 = 74\%$ 26% omission error
 Water = $121/121 = 100\%$ 0% omission error

User's Accuracy (commission error)

Residential = $70/88 = 80\%$ 20% commission error
 Commercial = $55/58 = 95\%$ 5% commission error
 Wetland = $99/99 = 100\%$ 0% commission error
 Forest = $37/41 = 90\%$ 10% commission error
 Water = $121/121 = 100\%$ 0% commission error

Accuracy Assessment

Computation of K_{hat} Coefficient of Agreement

$$\hat{K} = \frac{N \sum_{i=1}^k x_{ii} - \sum_{i=1}^k (x_{i+} \times x_{+i})}{N^2 - \sum_{i=1}^k (x_{i+} \times x_{+i})}$$

$$\sum_{i=1}^k x_{ii} = (70 + 55 + 99 + 37 + 121) = 382$$

$$\sum_{i=1}^k (x_{i+} \times x_{+i}) = (88 \times 73) + (58 \times 60) + (99 \times 103) + (41 \times 50) + (121 \times 121) = 36,792$$

$$\text{therefore } \hat{K} = \frac{407(382) - 36792}{407^2 - 36792} = \frac{155474 - 36792}{165649 - 36792} = \frac{118682}{128857} = 92.1\%$$

Accuracy Assessment

Producer's accuracy: How well a certain area can be classified (omission error)

User's accuracy: Reliability, probability a pixel class on the map represents the category on the ground (commission error)

Overall accuracy: Dividing the total number of correct pixels (diagonal) by the total number of pixels in the error matrix

Kappa_(Hat): Measure of agreement between the classification map and the reference data

Accuracy Assessment

Problems and Difficulties:

- Sampling
- Temporal/reliable ground data
- Misregistration
- Distribution

A	A	A	A	A	A	A	A
A	A	A	A	A	A	A	A
A	A	A	A	A	A	A	A
A	A	A	A	A	A	A	A
A	A	A	A	A	A	A	A

IMAGE CLASSIFIER

A	A	A	A	A	A	A	A
U	A	F	A	U	U	U	A
U	A	A	A	A	U	A	A
A	A	A	A	A	U	U	A
A	A	A	A	A	A	A	A

GROUND DATA

Accuracy Assessment

Questions????????????????????????????????

References:

- Introductory Digital Image Processing 3rd Ed.
John R. Jensen
- Computer Processing of Remotely-Sensed
Images 3rd Ed. Paul M. Mather
- Error Matrix for Map Comparison and
Accuracy Assessment. UofA Biological
Sciences -GIS