Post-classification and GIS

Lecture 9
March 25, 2005
Why?

salt-and-pepper
Apply majority or minority analysis to a classification image.

- Use majority analysis to change spurious pixels within a large single class to that class. You enter a kernel size and the center pixel in the kernel will be replaced with the class value that the majority of the pixels in the kernel has.

- If you select Minority analysis, then the center pixel in the kernel will be replaced with the class value that the minority of the pixels in the kernel has.
Majority filter: example

Binary image with 5% 'Salt&Pepper' noise

3x3 majority filter

20% 'Salt&Pepper' noise

3x3 majority filter
Majority filter applied

Maximum likelihood result

Legend key
- Grass
- High density urban
- Low density urban
- Row crops
- Small grain crops
- Non-row crops
- Bare soil
- Forest
- Wetland
- Water

Stuckens et al., 2000
Remote Sensing of Env.
Clump Classes

- Clump adjacent similar classified areas together using morphological operators. Classified images often suffer from a lack of spatial coherency (speckle or holes in classified areas). The selected classes are clumped together by first performing a dilate operation and then an erode operation on the classified image using a kernel of the size specified in the parameters dialog.
Morphology Filters

- **Dilate Filter** commonly known as fill, expand, or grow. It **fill holes** smaller than the structural element (kernel) in a binary or grayscale image.

- **Erode Filter** commonly known as shrink or reduce. It **removes islands** of pixels smaller than the structural element (kernel) in a binary or grayscale image.

- **Open Filter**: erosion + dilation

- **Close Filter**: dilation + erosion

- Clump is a close filter.

- Morphology kernels are just a structuring element and should not to be confused with convolution kernels.
Dilation

- Binary dilation operator

\[ g(x, y) = OR\left[ W \{ f(x, y) \} \right] := dilate(f, W) \]

- Effects
  - Expands the size of 1-valued objects
  - Smoothes object boundaries
  - Closes holes and gaps
Example: blob separation/detection by erosion

Original binary image circles

Erosion by 11x11 structuring element

Erosion by 21x21 structuring element

Erosion by 27x27 structuring element
Small hole removal by closing

Original binary mask

Difference to original mask

Dilation 5x5

Closing 5x5
Sieve Classes

- Sieve Classes to solve the problem of isolated pixels occurring in classification images. Sieving classes removes isolated classified pixels using blob grouping. The sieve classes method looks at the neighboring 4 or 8 pixels to determine if a pixel is grouped with pixels of the same class. If the number of pixels in a class that are grouped is less than the value that you enter, those pixels will be removed from the class. When pixels are removed from a class using sieving, black pixels (unclassified) will be left.
Combine Classes

- Use Combine Classes to selectively combine classes in classified images
Classification to vector

- Convert your classified classes into vector .evf
- Convert the .evf to .shp then ArcGIS can open it.
- ArcGIS can open ENVI’s .img file
An example

SAM

Combine

Sieve

Clump
<table>
<thead>
<tr>
<th>Images</th>
<th>Time</th>
<th>Active crops</th>
<th>Fallow land</th>
</tr>
</thead>
</table>
| IKONOS | 2000, Aug.-2001,Feb. | SAM threshold: 0.03  
Combine  
Sieve threshold: 4  
Clump operator: $6 \times 6$  
Sieve threshold: 400  
Clump operator: $9 \times 9$  
Class to vector | SAM threshold: 0.03  
Combine  
Sieve threshold: 2  
Clump operator: $10 \times 10$  
Sieve threshold: 200  
Class to vector |
|        | 2001, Jul. 15      | SAM threshold: 0.10  
Combine  
Sieve threshold: 3  
Class to vector | SAM threshold: 0.05  
Combine  
Sieve threshold: 3  
Class to vector |
|        | 2001, Apr. 26      | SAM threshold: 0.08  
Combine  
Sieve threshold: 6  
Clump operator: $2 \times 2$  
Sieve threshold: 10  
Class to vector | SAM threshold: 0.06  
Combine  
Sieve threshold: 10  
Class to vector |
| ETM+   | 2000, Sept. 07     | SAM threshold: 0.13  
Combine  
Sieve threshold: 50  
Class to vector | SAM threshold: 0.05  
Combine  
Sieve threshold: 50  
Class to vector |
|        | 2000, June 10      | SAM threshold: 0.13  
Combine  
Sieve threshold: 10  
Class to vector | SAM threshold: 0.05  
Combine  
Sieve threshold: 10  
Class to vector |
|        | 1999*, Sept. 12    | SAM threshold: 0.35  
Combine  
Sieve threshold: 10  
Class to vector | SAM threshold: 0.20  
Combine  
Sieve threshold: 25  
Class to vector |