

Appendix 1. Attributes Used to Classify Lesser Snow Geese (*Chen caerulescens caerulescens*).

Table A1.1. List of spatial, spectral and texture attributes used to classify Snow Geese in aerial imagery of Canadian Arctic breeding colonies. Each spectral and texture attribute is calculated for each of the image's spectral bands (in this case, red, green and blue). Attribute descriptions are from ENVI 5.3 (Exelis Visual Information Solutions, Boulder, CO, USA) help files.

Attribute	Description
<i>Spatial attributes</i>	
Area	Total area of the object, minus the area of the holes.
Length	The combined length of all boundaries of the object, including the boundaries of the holes.
Compactness	A shape measure that indicates the compactness of the object. A circle is the most compact shape with a value of $1 / \pi$. Compactness = $\text{Sqrt}(4 * \text{Area} / \pi) / \text{outer contour length}$
Convexity	A measure of object convexity. The convexity value for a convex object with no holes is 1.0, while the value for a concave object is less than 1.0. Convexity = $\text{length of convex hull} / \text{Length}$
Solidity	A shape measure that compares the area of the object to the area of a convex hull surrounding the object. The solidity value for a convex object with no holes is 1.0, and the value for a concave object is less than 1.0. Solidity = $\text{Area} / \text{area of convex hull}$
Roundness	A shape measure that compares the area of the object to the square of the maximum diameter of the object. The "maximum diameter" is the length of the major axis of an oriented bounding box enclosing the object. The roundness value for a circle is 1, and the value for a square is $4 / \pi$. Roundness = $4 * (\text{Area}) / (\pi * \text{Major_Length}^2)$
Form Factor	A shape measure that compares the area of the object to the square of the total perimeter. The form factor value of a circle is 1, and the value of a square is $\pi / 4$. Form_Factor = $4 * \pi * (\text{Area}) / (\text{total perimeter})^2$
Elongation	A shape measure that indicates the ratio of the major axis of the object to the minor axis of the object. The major and minor axes are derived from an oriented bounding box containing the object. The elongation value for a square is 1.0, and the value for a rectangle is greater than 1.0. Elongation = $\text{Major_Length} / \text{Minor_Length}$
Rectangular Fit	A shape measure that indicates how well the shape is described by a rectangle. This attribute compares the area of the object to the area of the oriented bounding box enclosing the object. The rectangular fit value for a rectangle is 1.0, and the value for a non-rectangular shape is less than 1.0. Rectangular_Fit = $\text{Area} / (\text{Major_Length} * \text{Minor_Length})$
Major Length	The length of the major axis of an oriented bounding box enclosing the object.
Minor Length	The length of the minor axis of an oriented bounding box enclosing the object.
<i>Spectral attributes</i>	
Spectral Mean	Mean value of the pixels comprising the object in band x.
Spectral Max	Maximum value of the pixels comprising the object in band x.
Spectral Min	Minimum value of the pixels comprising the object in band x.
Spectral STD	Standard deviation value of the pixels comprising the object in band x.
<i>Texture attributes</i>	
Texture Range	Average data range of the pixels comprising the region inside the texture kernel in band x.
Texture Mean	Average value of the pixels comprising the region inside the texture kernel in band x.
Texture Variance	Average variance of the pixels comprising the region inside the texture kernel in band x.
Texture Entropy	Average entropy value of the pixels comprising the region inside the kernel in band x.