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# **USING GIS AND REMOTE SENSING TECHNIQUES TO ASSESS SPATIAL VARIABILITY WITHIN BACTERIAL BIOFILMS**

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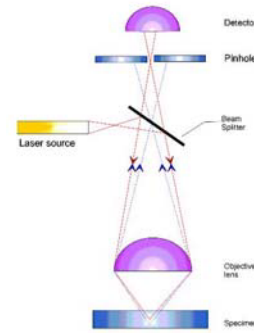
# Basic Principle



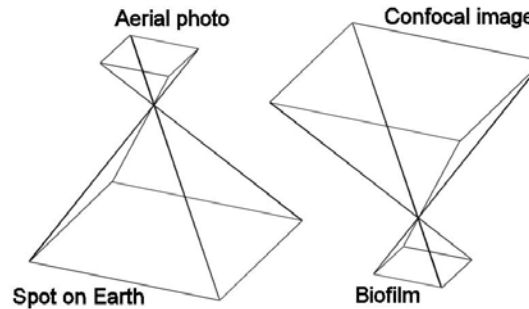
**Aerial  
Photography**

**Two types of  
remote sensing**

Diagram to illustrate the theory of the  
Laser Scanning Confocal Microscope.

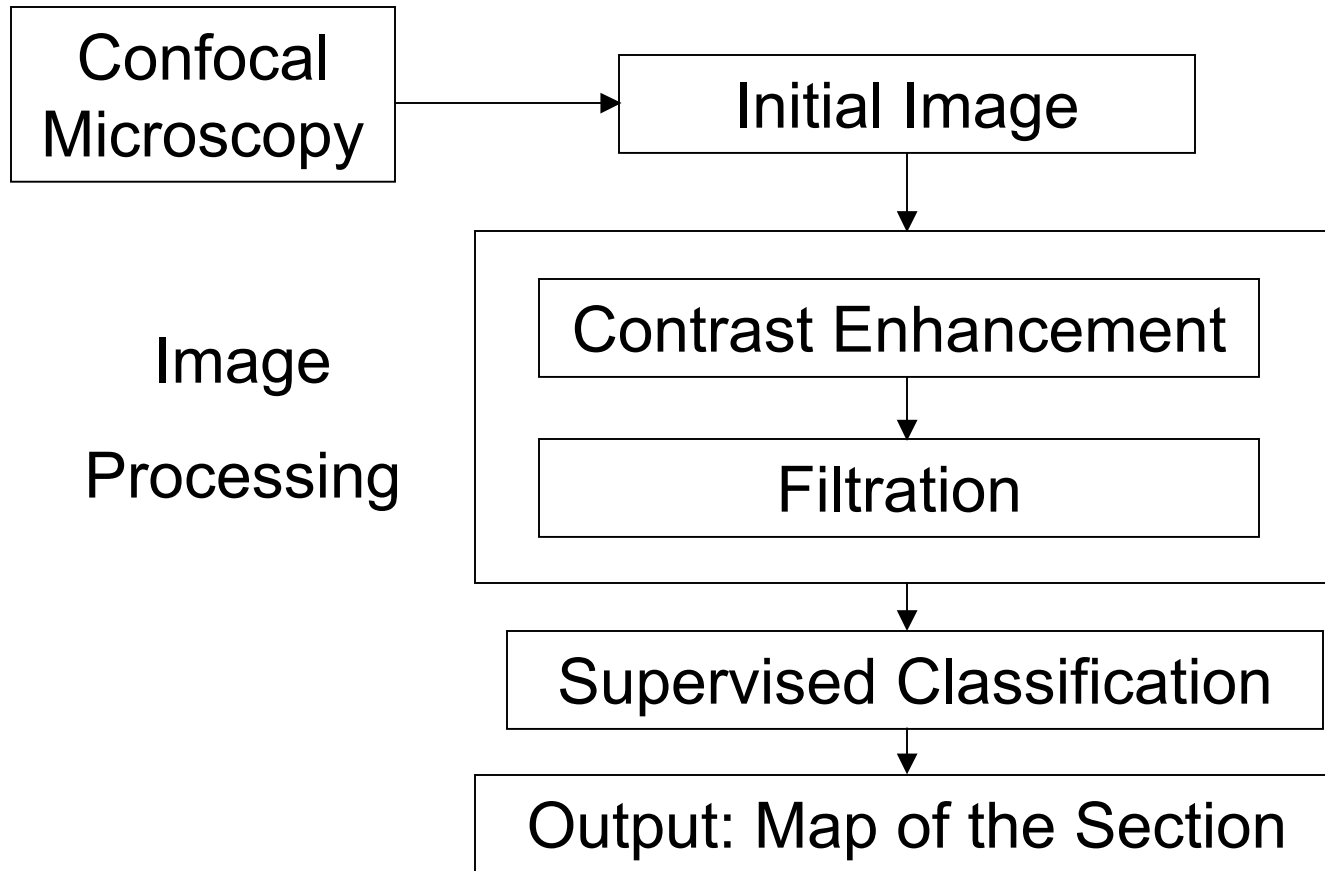


**Confocal  
Microscopy  
Image**

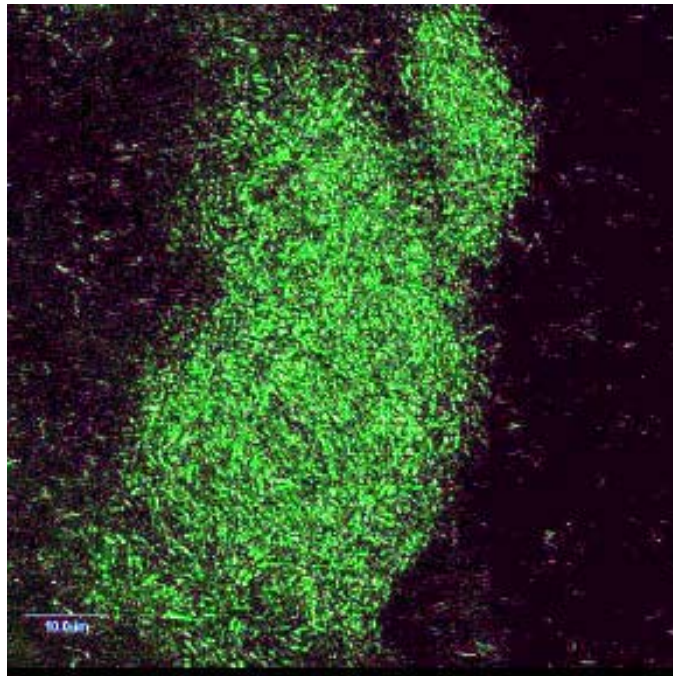


**Scale makes the difference!**

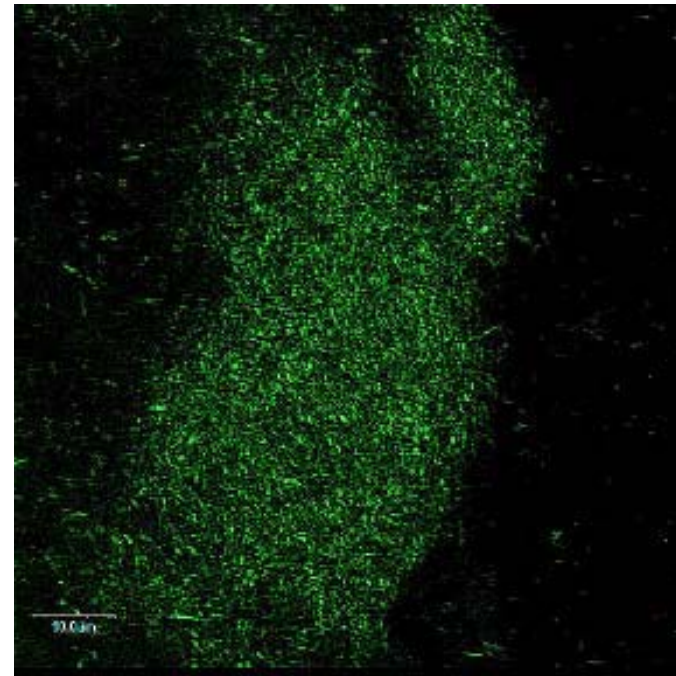
# Methodology



# Example: Comparison between the Initial and the Enhanced Contrast Image

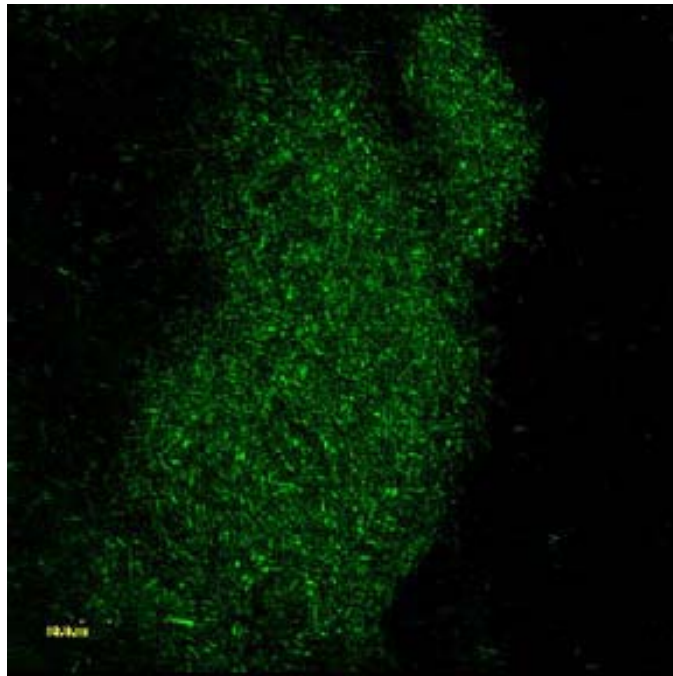


**Initial Image**

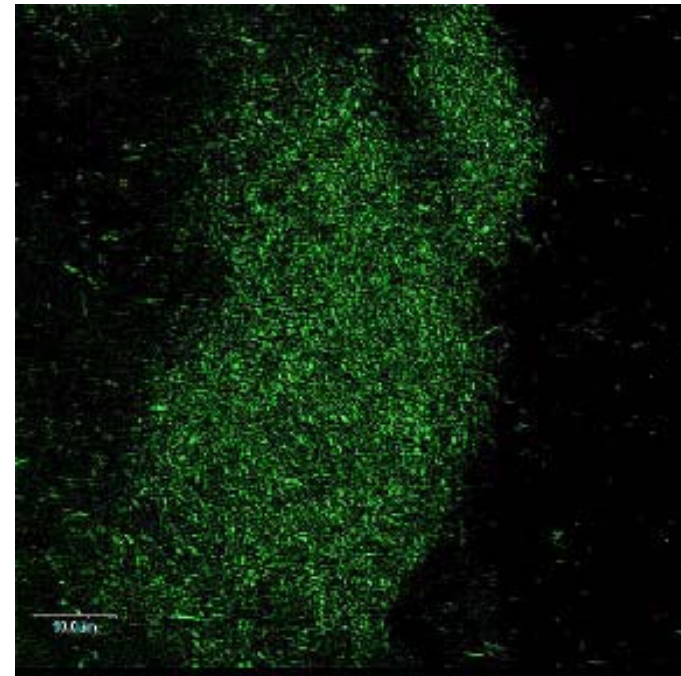


**Enhanced Contrast**

# Example (continued): Comparison between the Enhanced Contrast Image and the Filtered Image

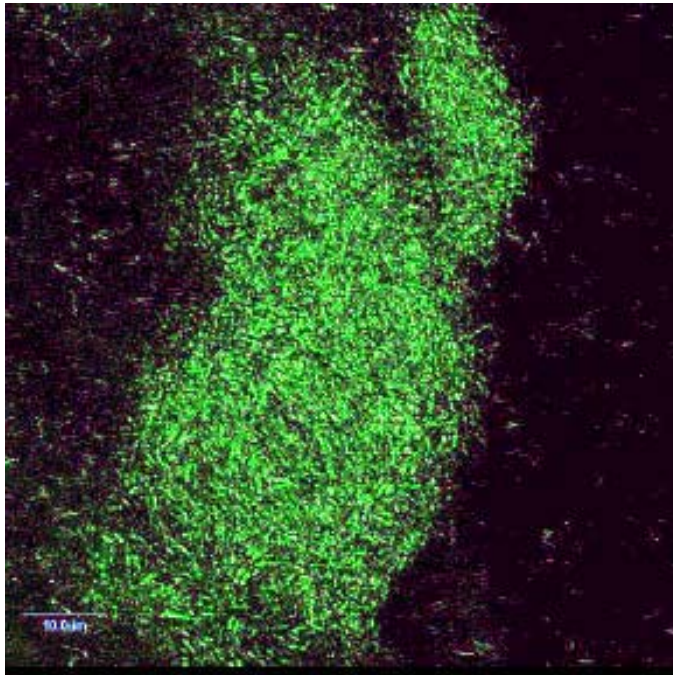


**Enhanced Contrast**

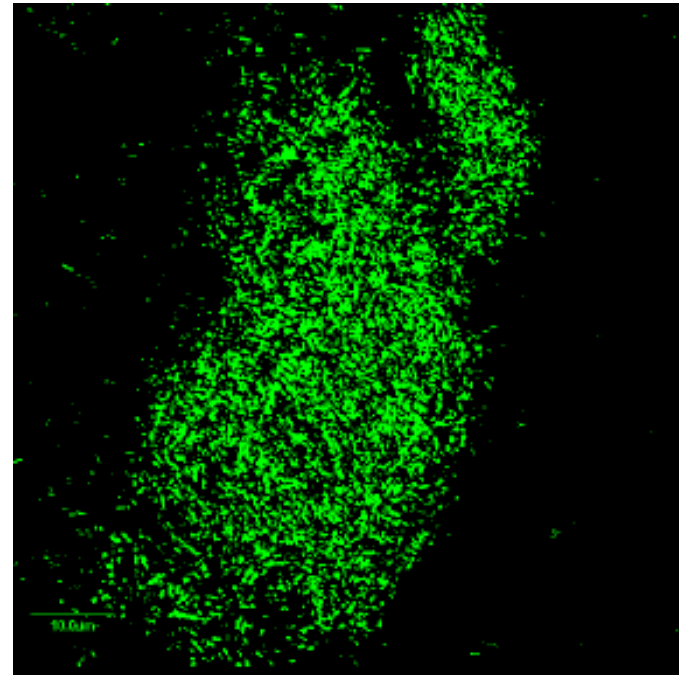


**Filtered Image**

## Example (continued): Comparison between the Initial Image and the Classified Image



**Initial Image**

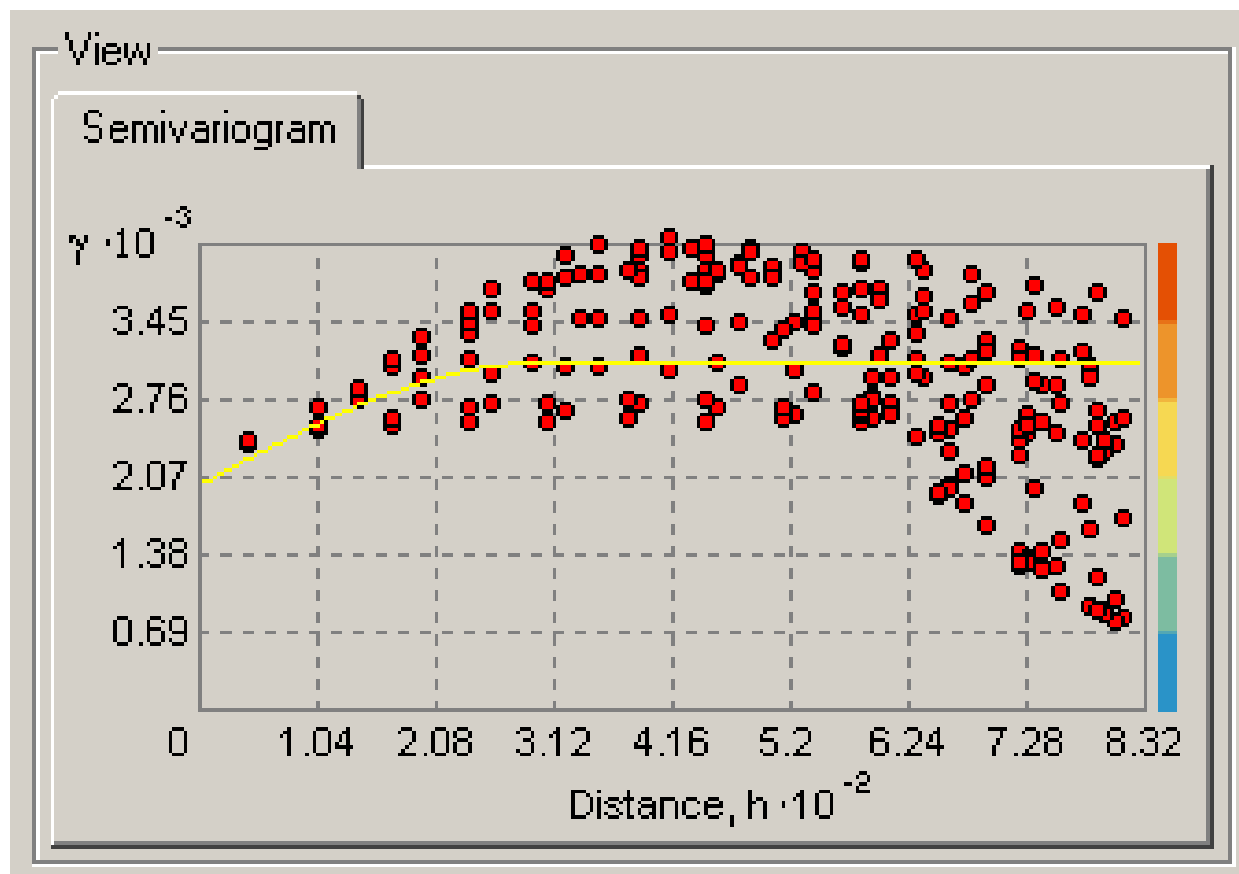


**Classified Image**

# Using Spatial Statistics

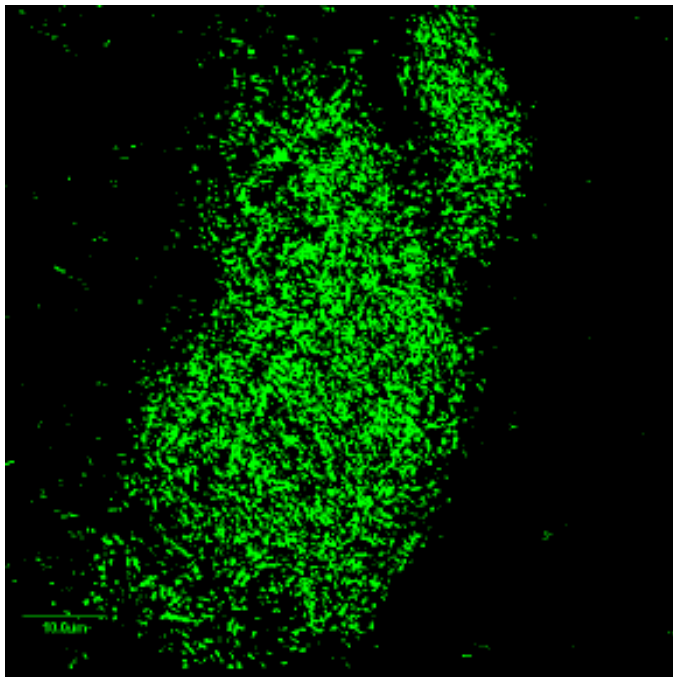
- Kriging
  - Named after mining geologist D. G. Krige
  - Spatial stochastic interpolation technique used in obtaining estimates of surface elevation using known elevation at specific points and semivariograms as weighting functions
  - Simple kriging assumes that the true mean of the data is constant and known

# Using Spatial Statistics: Semivariogram Corresponding to the Classified Map

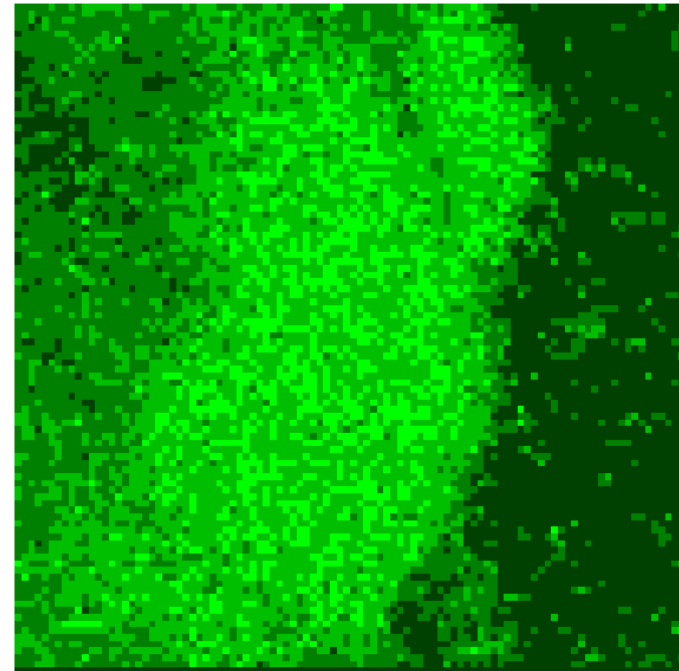




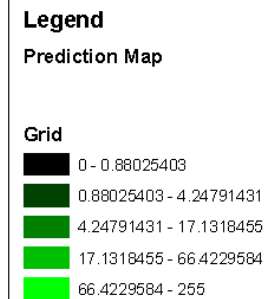
# Using Spatial Statistics: Results of Kriging



**Classified Image**



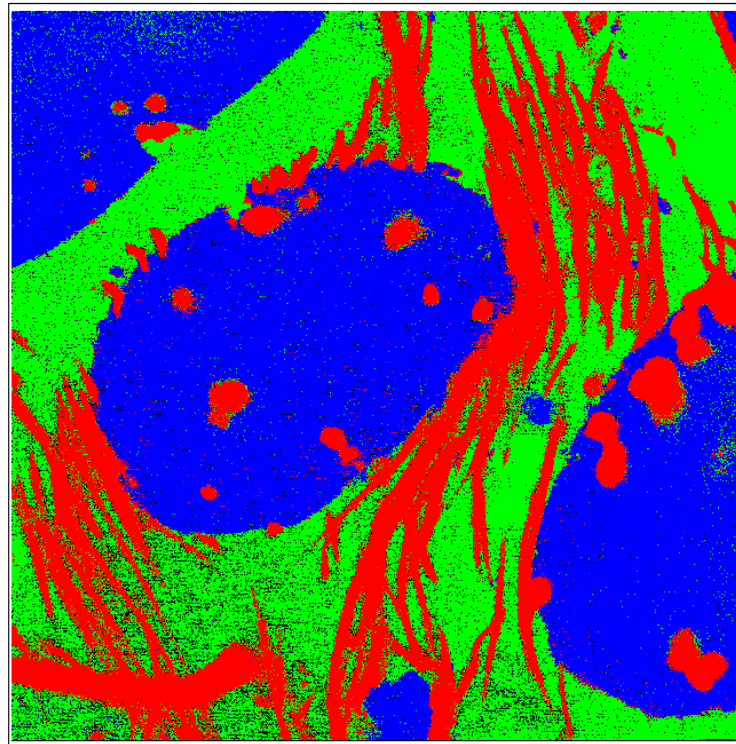
Simple Kriging:  
Prediction Map  
for Biofilm Image



# Future Directions: Classified Image of a Section through a Bahamas Stromatolite

## Bacteria from Bahamas Stromatolites

**Bahamas**  
■ Unclassified  
■ Sand Grains  
■ Exopolymeric Matrix  
■ Cyanobacteria  
■ No Data



Hypothesis: in some regions of the stromatolite, bacteria dig more canals than in the others.



Verify hypothesis using the method presented before.