Automated Detection and Characterization of Biosignatures for Understanding the Origins of Life

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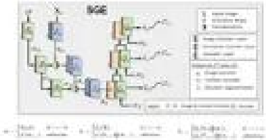
Motivation

- Increased interest in astrobiological research
- Need a tool for automated and remote assessment of imaging data
- Many practical CV and ML issues with data
- Learn from known, discover unknown
- Known: Ediacaran double ripples, definitive signs of life
- Unknown: Cambrian life, extraterrestrial origin of life

Ediacarn Ripple Formations – Cross-sectional View

SPACESeg overview



Proposed Approach

- SPACESeg: Scene-aware Perception Automation using Composite Embedding for Segmentation
- Two submodules:
  - CORA: Composite-image Optimization Region Activation
  - SGE : Saliency Guided Encoder
- Detect perceptually meaningful features, discard confusing artifacts

Results

- SPACESeg outperforms its deep learning counterparts (Figure 1a)
- CORA alone outperforms unsupervised methods in rejecting difficult artifacts (Figure 1b)
- CORA and SGE compliment each other under varying practical imaging conditions to bootstrap overall SPACESeg performance (Figure 1c)

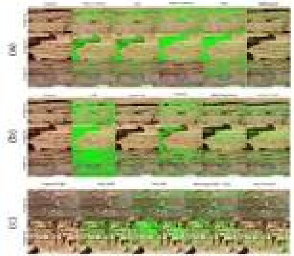


Figure 1: Results of SPACESeg

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