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Soil Texture Analysis

- Hydrometer
- Laser analyzer
- Pipette method

Soil Profiling (Spectroscopy)

Geophysical Field Mapping

On-the-Spot Analyzer (OSA)

Soil Image Sensing
Soil Microscopy

In Situ Analysis
- Aggregates
- Moisture
- Fogging

Laboratory Sample Testing
- Dino-Lite AD-7013MT
  - Resolution: 5 MP
  - Magnification: 200X
- Microscope holder
- Scratch-resistant glass
- Air-dried and 2-mm mesh sieved soil sample

Image Examples

Image Processing
- Pre-processing
  - Void removal
  - Aggregation
- Color analysis
  - RGB color space
  - HSV color space
  - Gabor feature space
- Texture analysis
  - Geostatistics
  - PLSR
  - Wavelet analysis

Bag of Visual Words (BoVW) Model
BoVW Results

Textural Image Analysis

Preliminary Results

Wavelet Transform

Summary

• Low-cost microscopy can be used to visualize soil particles down to 1 μm
• Variable soil moisture and aggregation add challenges
• Color analysis to predict soil organic matter is similar to other optical techniques
• Wavelet analysis is promising and does not require sensor calibration
• The prototype system for laboratory analysis provides high-quality imagery

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