



Pedometrics 2017 (Wageningen, the Netherlands)

Using Digital Microscopy for Rapid Determination of Soil Texture and Prediction of Soil Organic Matter

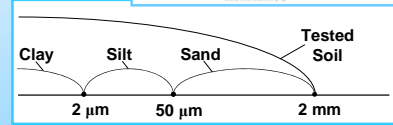
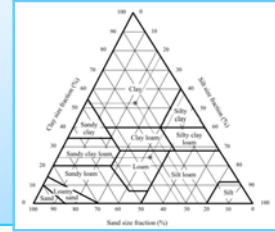
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Soil Texture Analysis

- Hydrometer
- Laser analyzer
- Pipette method



Geophysical Field Mapping



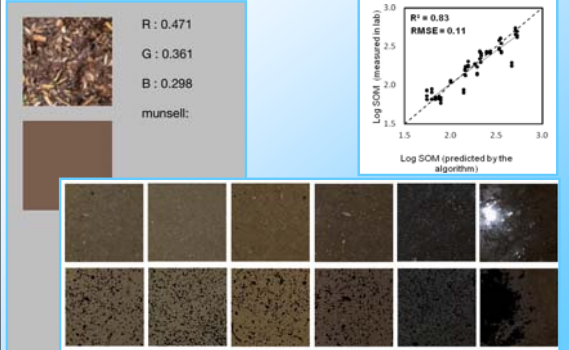
Soil Profiling (Spectroscopy)



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

Air-dried and 2-mm mesh sieved soil sample

Microscope holder

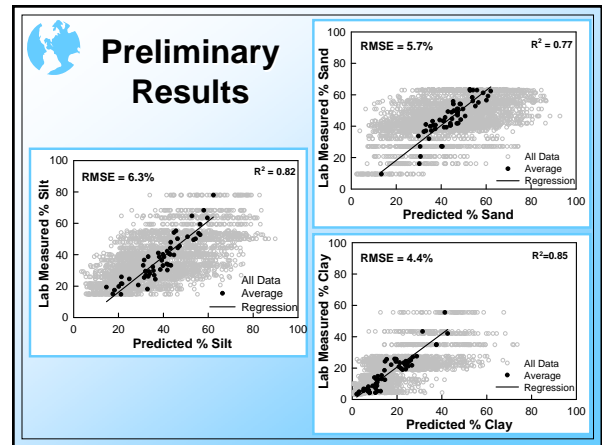
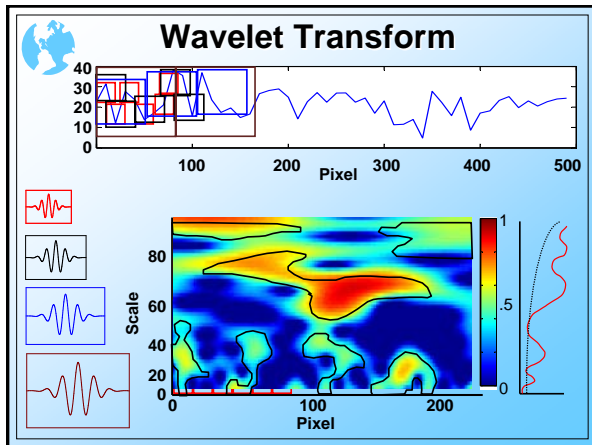
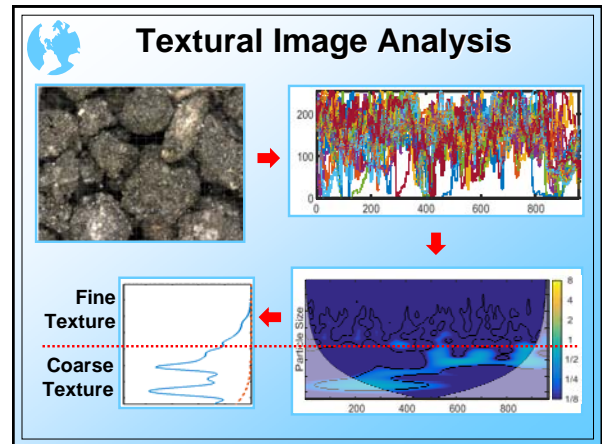
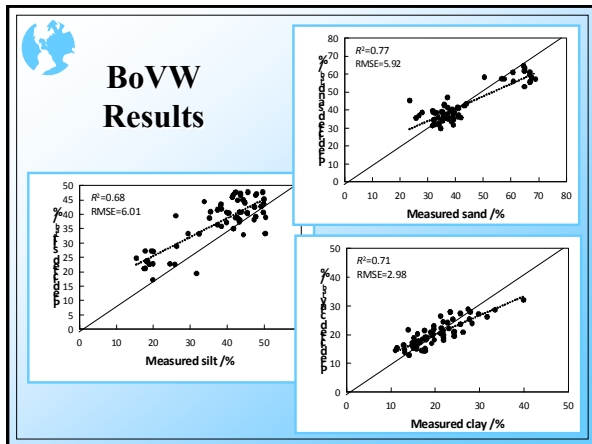
Scratch-resistant glass

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



- ### Summary
- Low-cost microscopy can be used to visualize soil particles down to $1 \mu\text{m}$
 - 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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