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Reflectance and Transmittance Imaging for Quality Assessment in Agriculture and Manufacturing

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Supervised by: V.R. Herath[1], R. Godaliyadda[1], P. Ekanayake[1], S.K. Navarathnarajah[2], S.N.P. Athukorala[3]

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Abstract- This study introduces a novel multispectral imaging system for quality estimation. Cost-effective and portable, it uses machine learning and signal processing techniques. Its dual-mode operation combines reflectance and transmittance imaging for enriched features. It excels in estimating soil moisture, classifying soils, and counting microcystis cells in water, revolutionizing agriculture and food industries
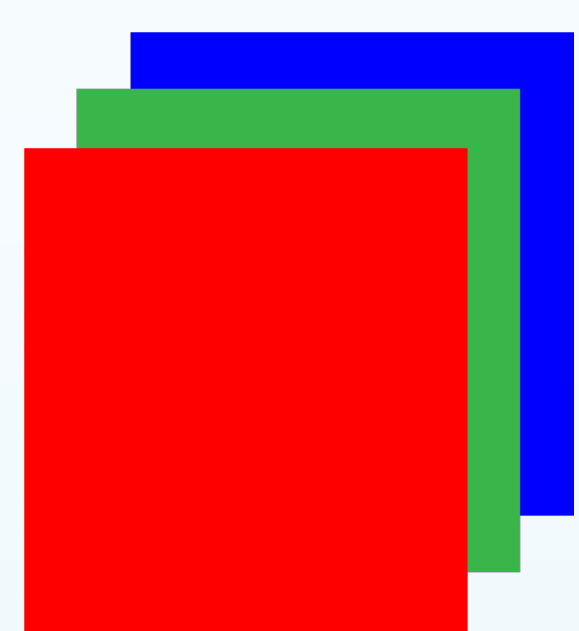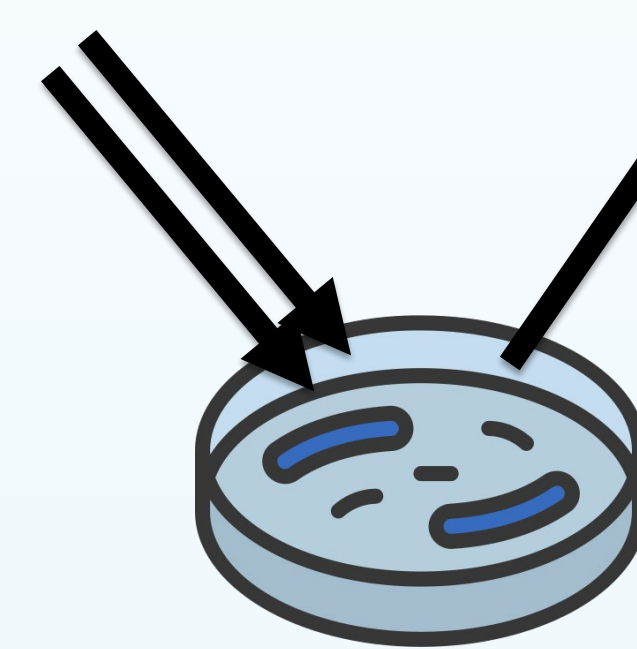
RGB Imaging
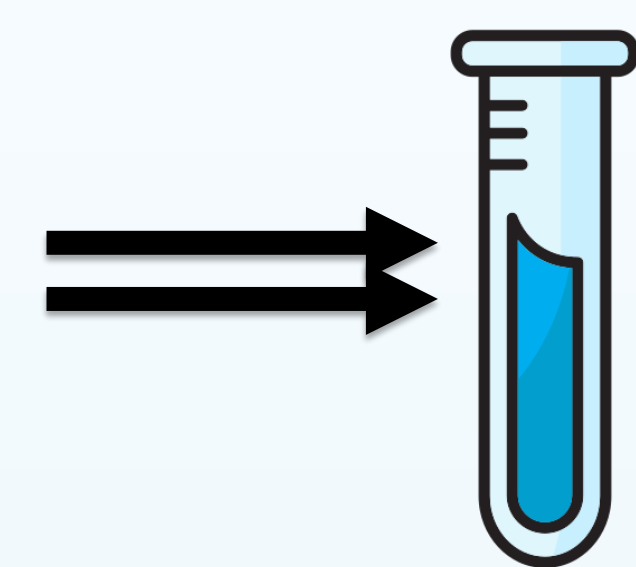Captures only 3 (red, green, and blue) spectral bands
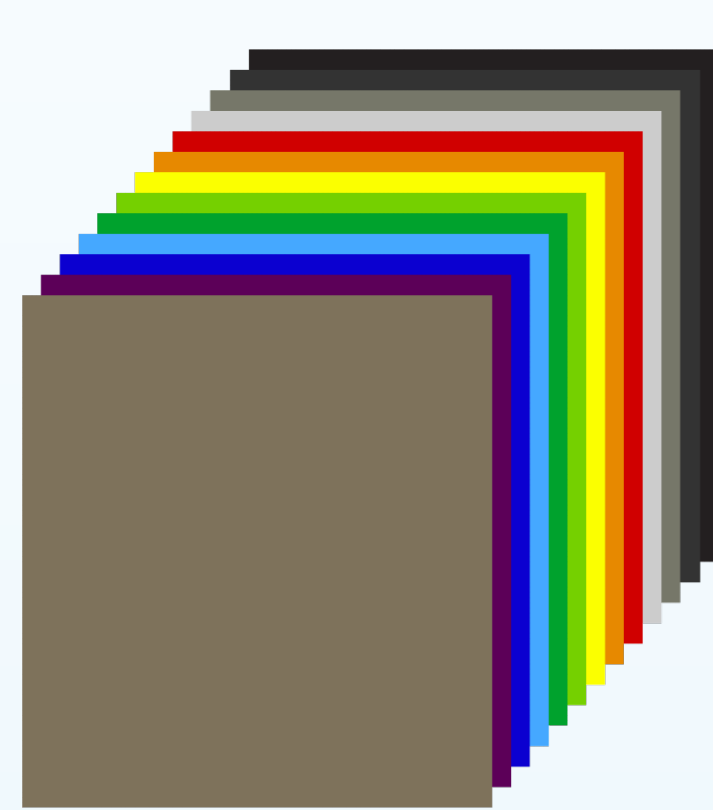
Multispectral Imaging
Captures a wide range of spectral bands, ranging from near UV to near IR
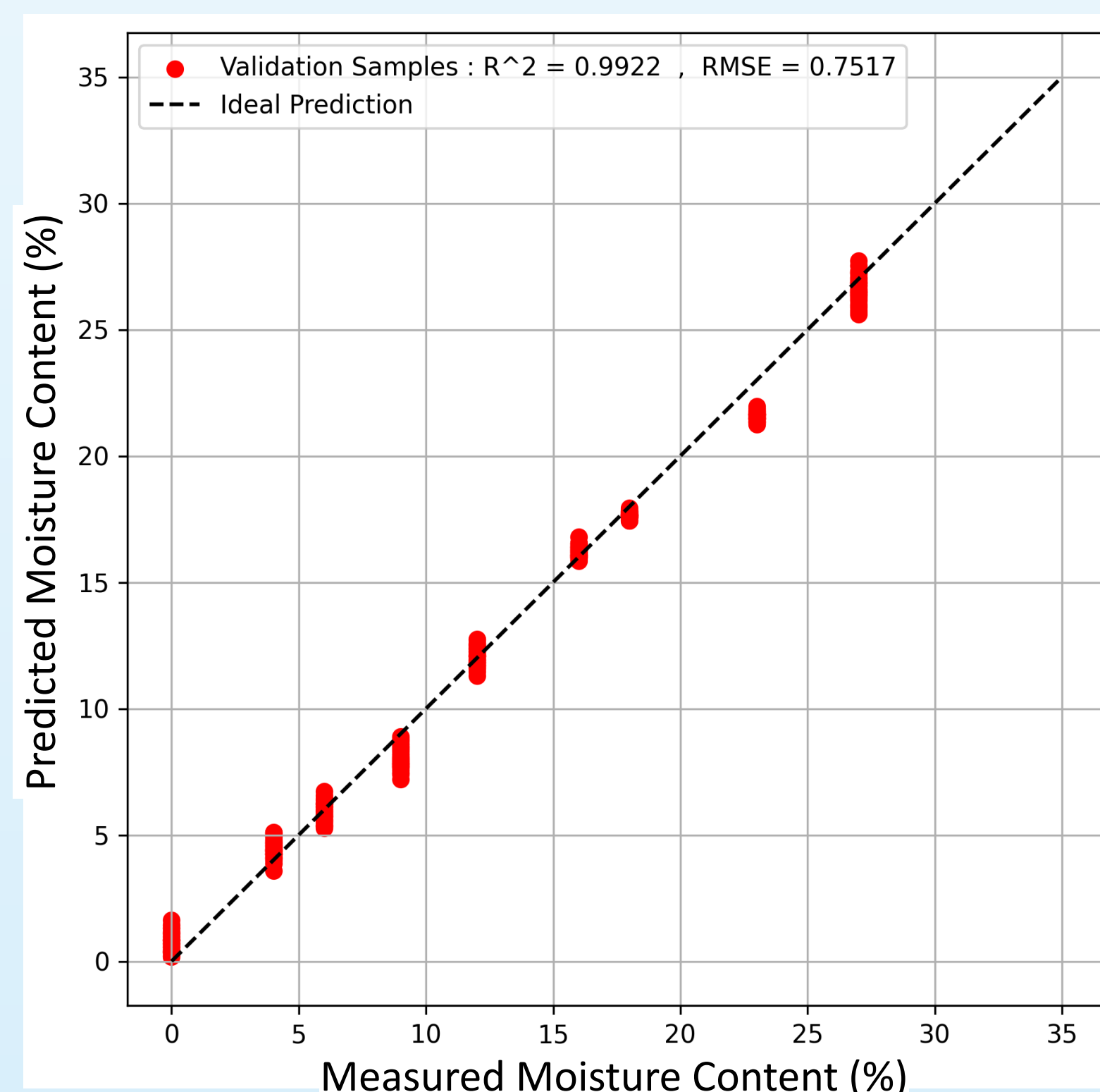
Reflectance Imaging
Reflected Light

Transmittance Imaging
Transmitted Light

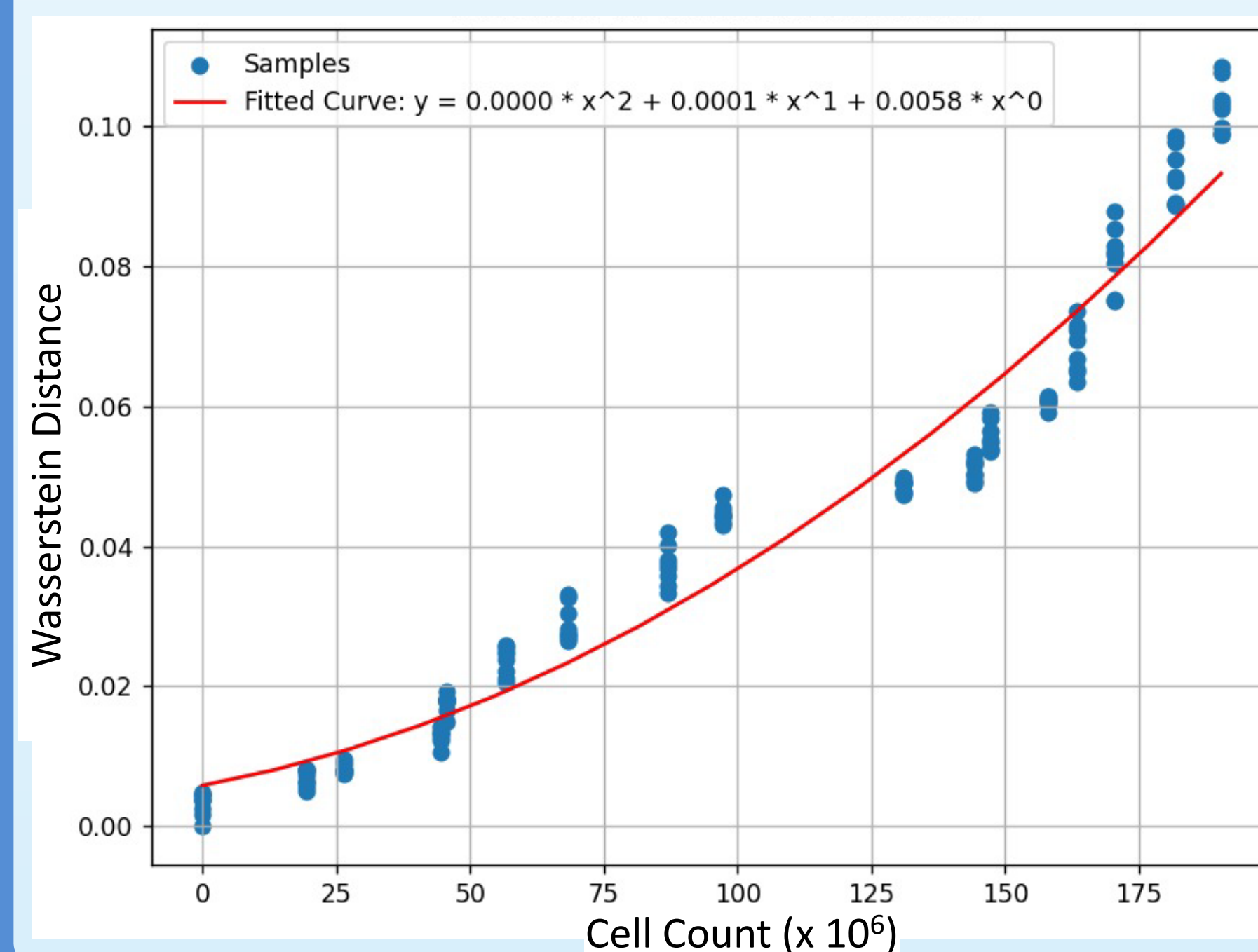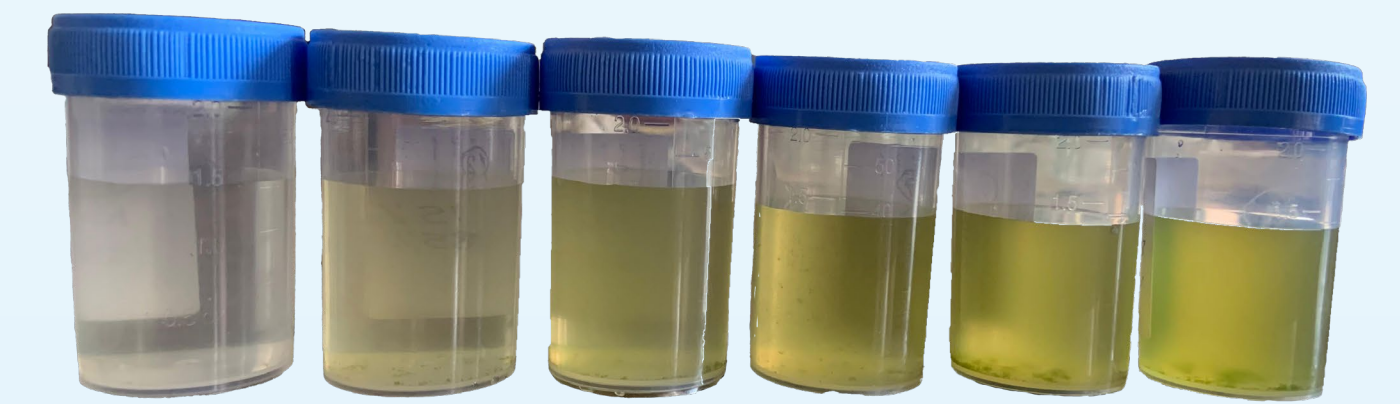## 1. Reflectance Multispectral Imaging for Soil Moisture Content Estimation

- Knowledge of soil moisture content is vital for optimizing irrigation, boosting crop yields, and preventing soil degradation.

- Variation of predicted vs measured soil moisture content.
- The regression neural network yielded an R^2 of 99% in predicting the soil moisture content for validation.

2. Transmittance Multispectral Imaging for Microcystis Cell Count Estimation in Water

- The algae *Microcystis aeruginosa*, triggers toxic algal blooms, polluting drinking water, endangering aquatic ecosystems, and causing severe health risks, including liver damage and neurological disorders.


- Variation of Wasserstein distances with Microcystis cell counts.
- The functional mapping is capable of estimating the cell growth with an R^2 of 96%.

3. Reflectance Multispectral Imaging for Soil Texture Classification

- Soil classification optimizes agricultural practices and crop productivity by identifying suitable soil types for specific crops.
- The existing methods of classification are time-consuming and rely on manual sampling and lab analysis.

Developed classifier models are able to classify the USDA soil classes with a maximum of 98% accuracy
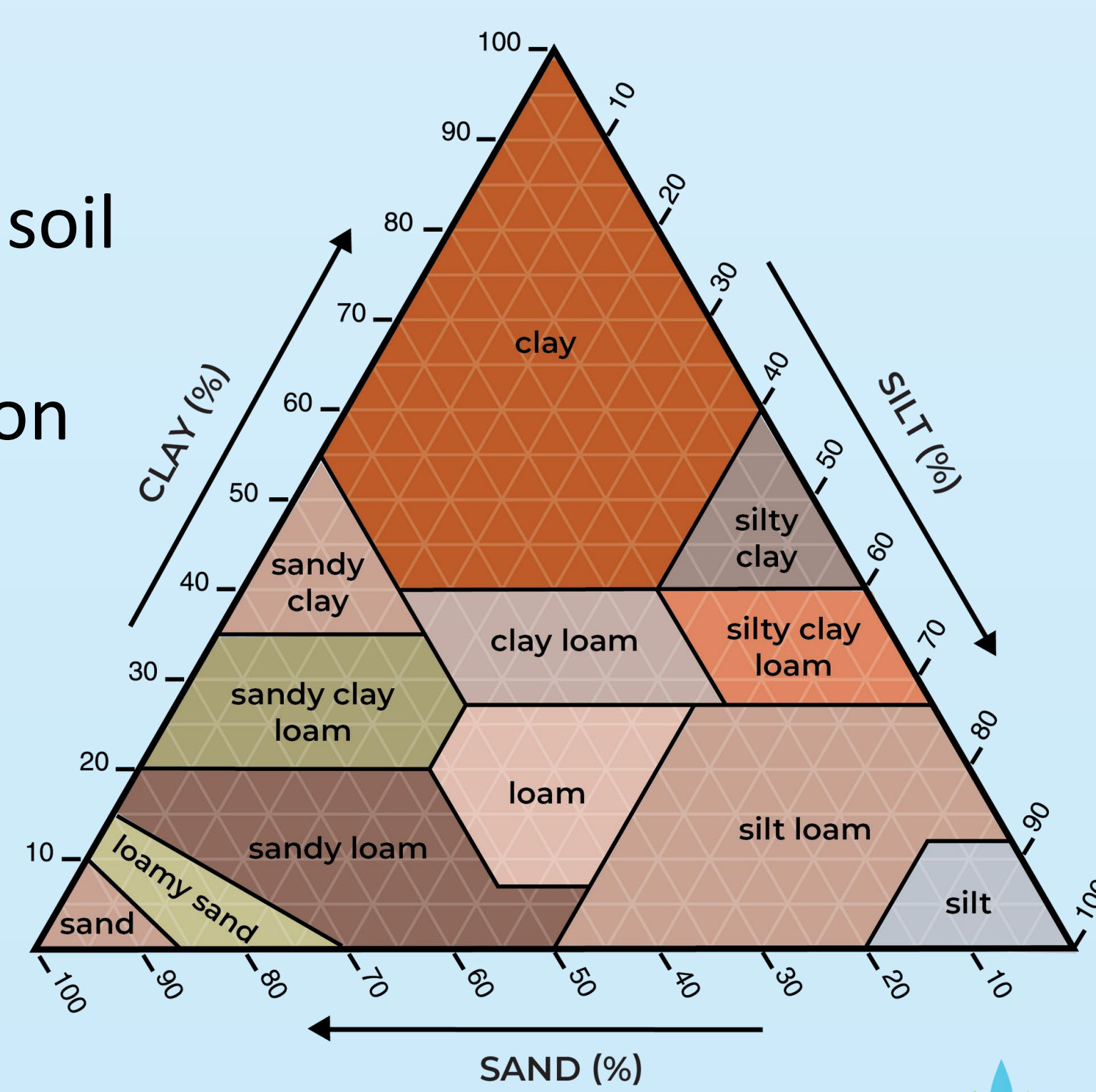
The USDA Soil Texture Triangle
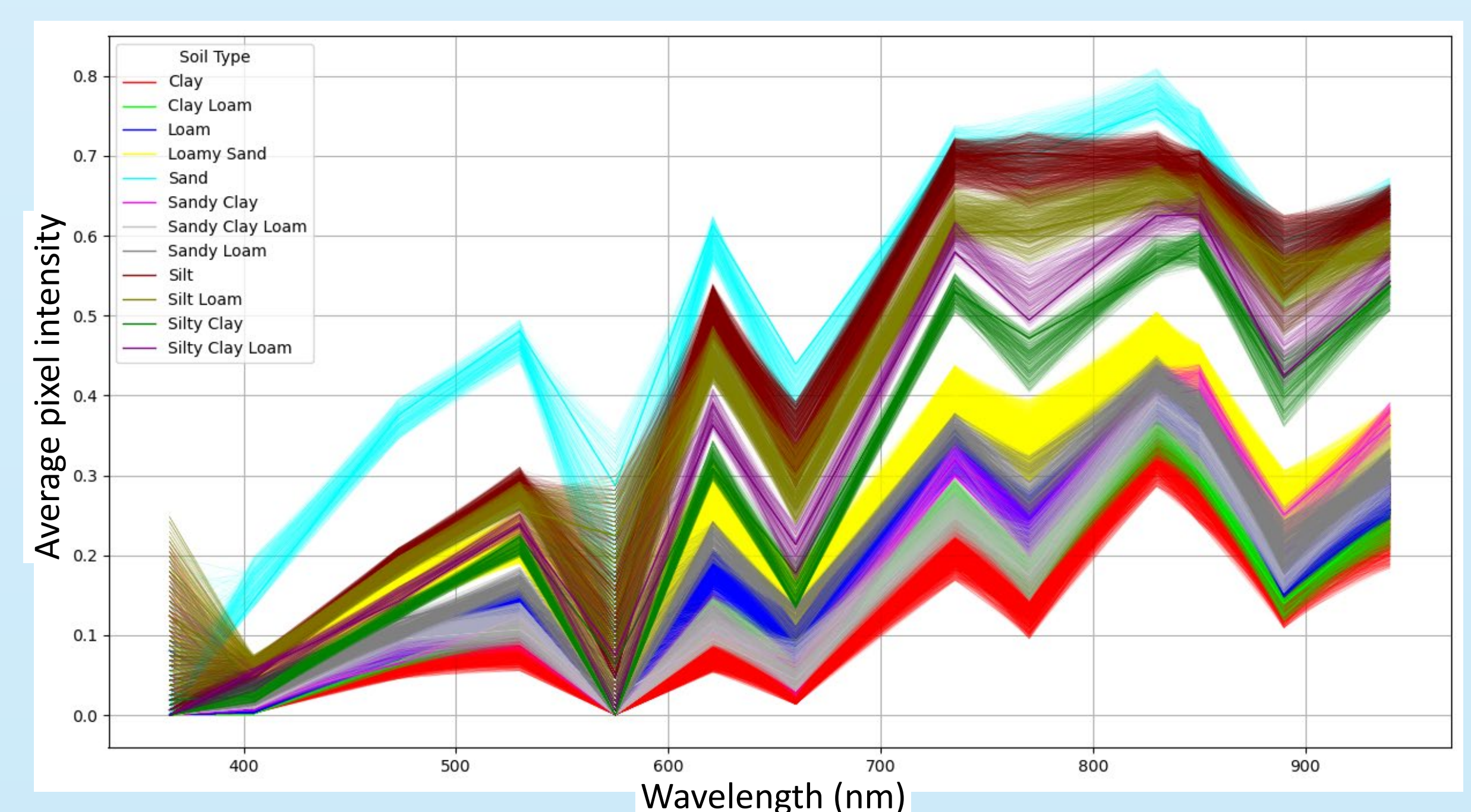
Spectral Signatures of Soil Classes as Defined by the USDA Soil Classification System

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