Unveiling Soil-Vegetation Interactions: Reflection Relationships and an Attention-Based Deep Learning Approach for Carbon Estimation

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Existing Problem:

- Estimating SOC from satellite imagery is challenging in mixed landscapes with bare soil and vegetation, as traditional methods fail to account for complex soil-vegetation interactions, leading to inaccurate estimates.

Our Solution:

- Developed a correction coefficient matrix for Landsat 8 reflections and an attention-based deep neural network to minimize vegetation impact on soil.
- Demonstrated superior SOC estimation with results of R^2 =0.54, $RMSE$=4.42, and RPD=1.43 for bare soil, and R^2 =0.46, $RMSE$=5.45, and RPD=1.35 across mixed landscapes.

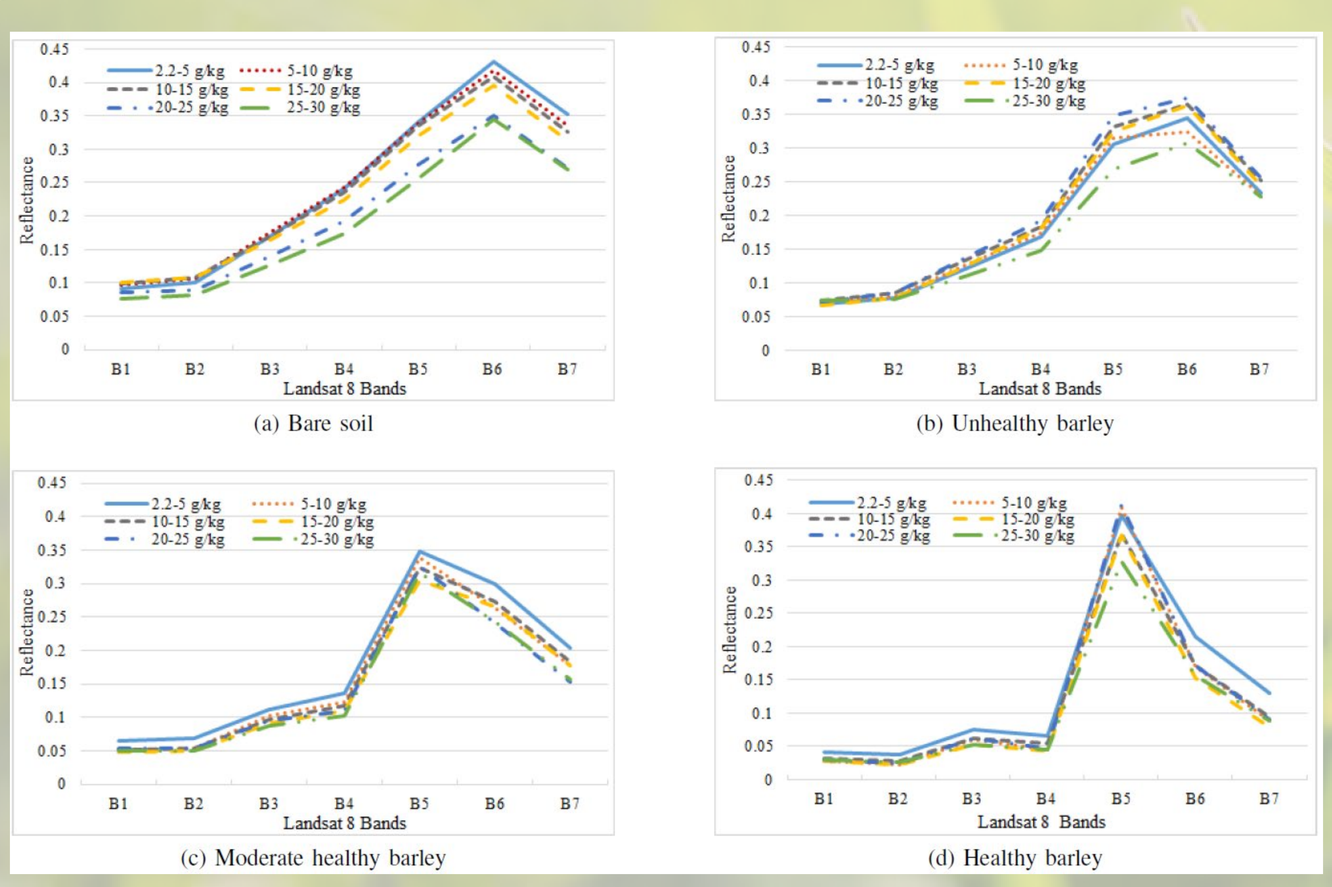

Fig. 1. Average reflection for bare soil and barley vegetation in different carbon range variation.

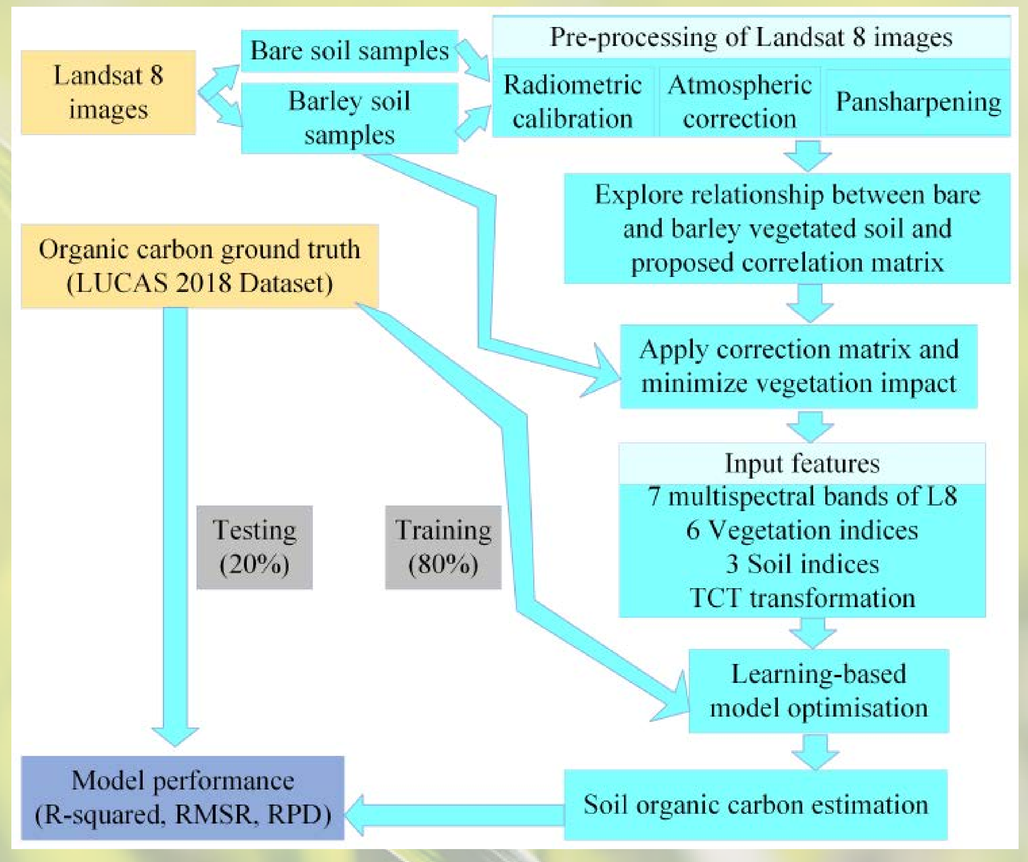

Fig. 2. Illustration of the regression framework employed in the proposed investigations.

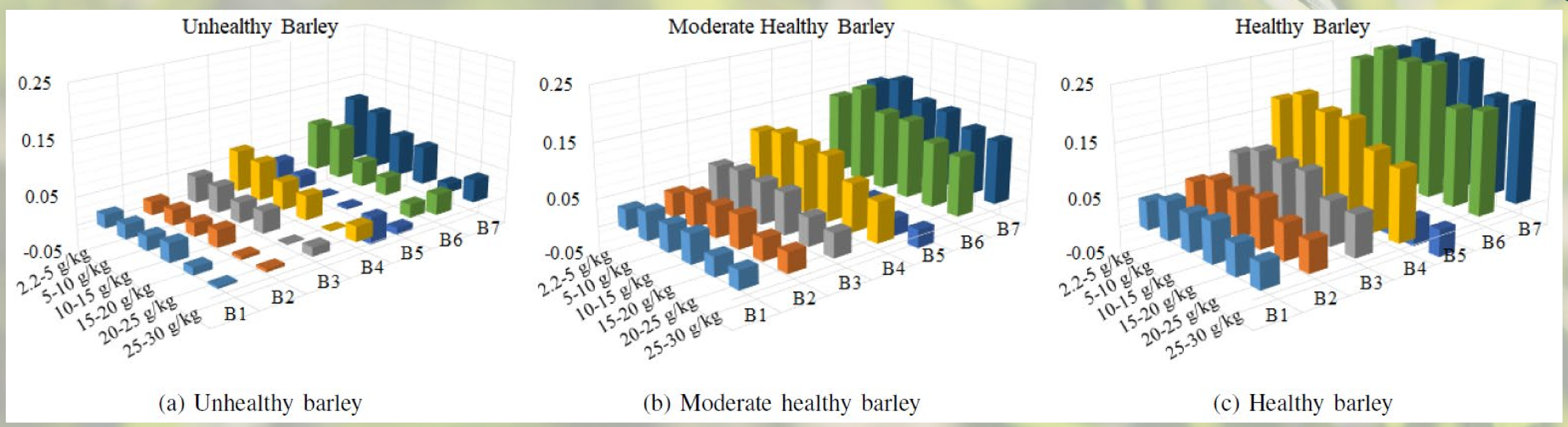

Fig. 3. Correction coefficient for unhealthy, moderate healthy, and healthy barley vegetation.

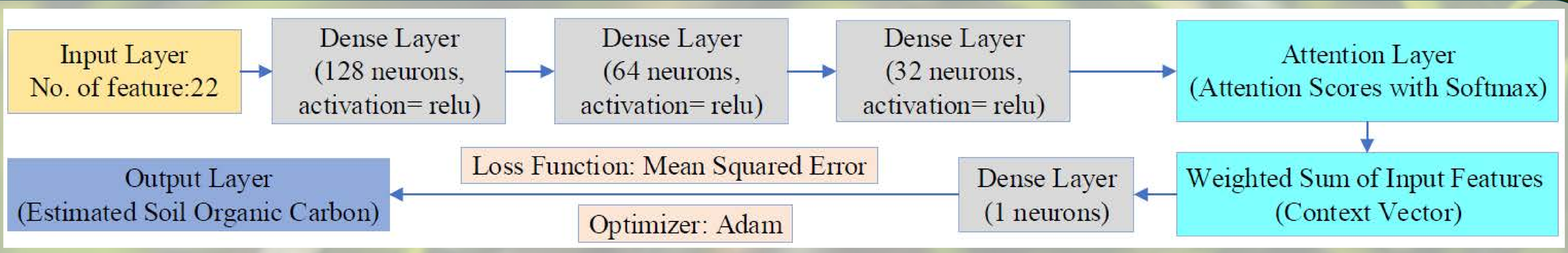

Fig. 4. Schematic representation of the proposed attention mechanism in the neural network architecture.

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