Testing Instructions
for Early Growth Vigor Phenotyping in Rice

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1. Overview

This document provides instructions for testing the pretrained models associated with the study:

"Phenology-oriented evaluation of early growth vigor in rice using time-series UAV LiDAR and multispectral phenotyping."

The purpose of these materials is to support **editorial review and reproducibility assessment**.

The provided resources allow users to verify model compatibility, input–output structure, and inference behavior without requiring access to full training code or original experimental datasets.

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2. Provided Materials

The GitHub repository includes the following components:

- **Pretrained model weights** (.pth format)
  - Tiller number estimation model
  - Leaf age estimation model
  - Early growth vigor proxy estimation model
- **Example input data**
  - Structural phenotypic features derived from UAV LiDAR
  - Multispectral vegetation index features
- **Documentation files**
  - This testing instruction document
  - README describing repository contents

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3. Input Data Description

The pretrained models operate on **pre-extracted phenotypic features**, consistent with the workflow described in Sections 2.3 and 2.4 of the manuscript.

3.1 Structural Phenotypic Features

Structural features are derived from UAV LiDAR point clouds and may include, but are not limited to:

- Estimated tiller number
- Leaf age
- Plant height
- Canopy height statistics

Example structural feature files are provided in **CSV format**, where:

- Each row corresponds to a single plant or plot observation
- Each column represents a phenotypic feature
- Feature order and dimensionality follow the definitions described in the manuscript

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3.2 Multispectral Features

Multispectral inputs consist of vegetation indices calculated from UAV multispectral imagery,

such as:

- NDVI
- EVI
- GNDVI
- Red-edge-based indices

Example multispectral features are also provided in **CSV format** and aligned temporally with the corresponding structural features.

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4. Model Inference Procedure (Conceptual)

The pretrained models were implemented using **PyTorch** and trained on NVIDIA GPU hardware.

To test the models, users should follow these conceptual steps:

1. **Prepare input features**
    - Ensure that structural and multispectral features are organized according to the formats illustrated in the example files.
    - Temporal sequences should be ordered consistently with the acquisition timeline.
2. **Load pretrained model weights**
    - Load the appropriate .pth file corresponding to the target task (tiller number, leaf age, or early growth vigor proxy).
3. **Perform forward inference**
    - Apply the trained network architecture described in Section 2.4 of the manuscript to the input features.
    - No retraining or fine-tuning is required.
4. **Obtain model outputs**
    - The model outputs estimated phenotypic values or relative early growth vigor proxy scores for the input samples.

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5. Output Description

Depending on the selected model, outputs may include:

- Estimated tiller number
- Estimated leaf age
- Relative early growth vigor proxy values

Outputs are numerical values that can be directly compared across samples to evaluate **relative differences in early establishment and phenological progression**.

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6. Notes on Reproducibility and Scope

- The provided example data are intended **only to demonstrate input format and model compatibility** and do not represent full experimental datasets.
- The pretrained models are designed for **phenology-oriented evaluation under uniform environmental conditions**, as described in the manuscript.
- Full source code and original UAV datasets are not publicly released due to ongoing research activities and institutional data management policies.

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7. Contact Information

For questions regarding data access or model usage, please contact the corresponding author:

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