Annotation Manual: Wheat Seedling Dataset Annotation Guidelines

1. **Annotation Strategy Overview**

   To improve the quality of the dataset annotation, a local annotation strategy was adopted to enhance the accuracy of wheat seedling image annotations. Each seedling image in this dataset was individually annotated using LabelImg software. The annotation focused on the seedling's stem and covered an approximate physical length of 3 cm between its two leaves, with the soil contact surface serving as the baseline for annotation.

2. **Annotation Region and Method**

- **Annotation Region**: The annotation targets the seedling's stem, specifically from the seedling's stem and covers the distance between the root and the leaves, approximately 3 cm.
- **Annotation Method**: A rectangular bounding box is used to annotate each seedling, ensuring that the box tightly surrounds the seedling's stem. This method helps to reduce interference from the soil background and improves annotation accuracy.

3. **Conversion from Pixel to Actual Physical Length**

   To ensure consistency in the annotation scale, the conversion between pixel and physical length was calculated based on the camera's geometry parameters. The calculation process can be found in Section 2.4 of the paper.

4. **Annotation Quality Evaluation**

   To ensure consistency and reliability in the annotations, Intersection over Union (IoU) and Cohen’s κ coefficients were used to quantify inter-annotator consistency. A random selection of 100 images was evaluated, and the results showed high consistency, demonstrating the reliability of the annotations.

5. **Annotation Examples**

   Figure 5 in the paper illustrates examples of global and local annotation strategies with different plant spacings:

- **Figure 5(a)**: Global annotation strategy, with 5 cm plant spacing
- **Figure 5(b)**: Local annotation strategy, with 5 cm plant spacing
- **Figure 5(c)**: Local annotation strategy, with 3 cm plant spacing
- **Figure 5(d)**: Local annotation strategy, with 1 cm plant spacing
- **Figure 5(e)**: Bounding box example for the local annotation strategy

6. **Advantages of the Local Annotation Strategy**

   Compared to the global annotation strategy, the local annotation strategy significantly reduces interference from soil background information, enhancing the focus on seedling features. This makes the annotation more accurate and helps to improve the accuracy of the object detection model.