Figure 2   Flow chart for calculating the azimuth and spacing of maize plants
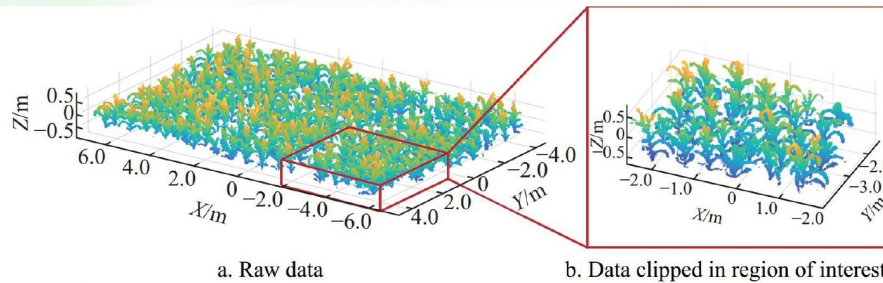

Figure 3   Point cloud data clipped in region of interest from the raw data
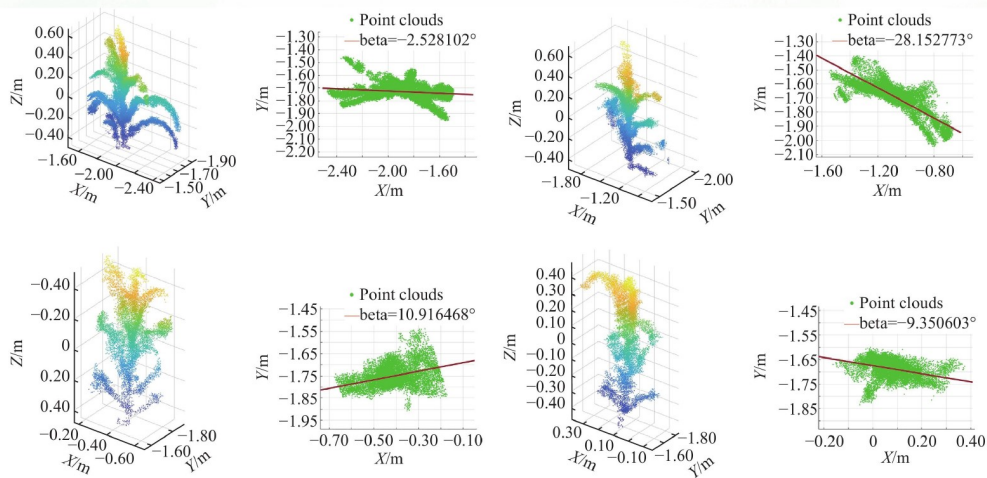

Figure 7   Calculation of maize growth direction angle by PCA

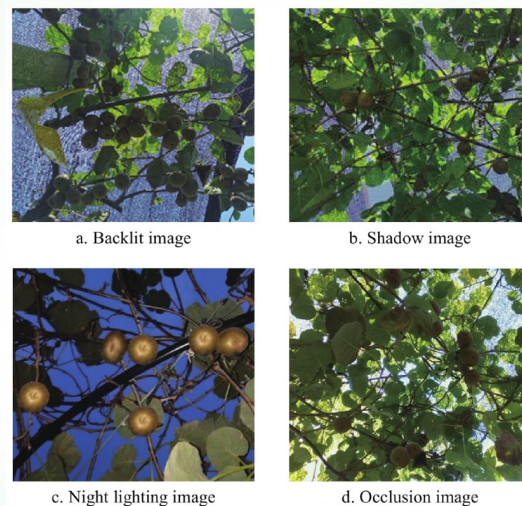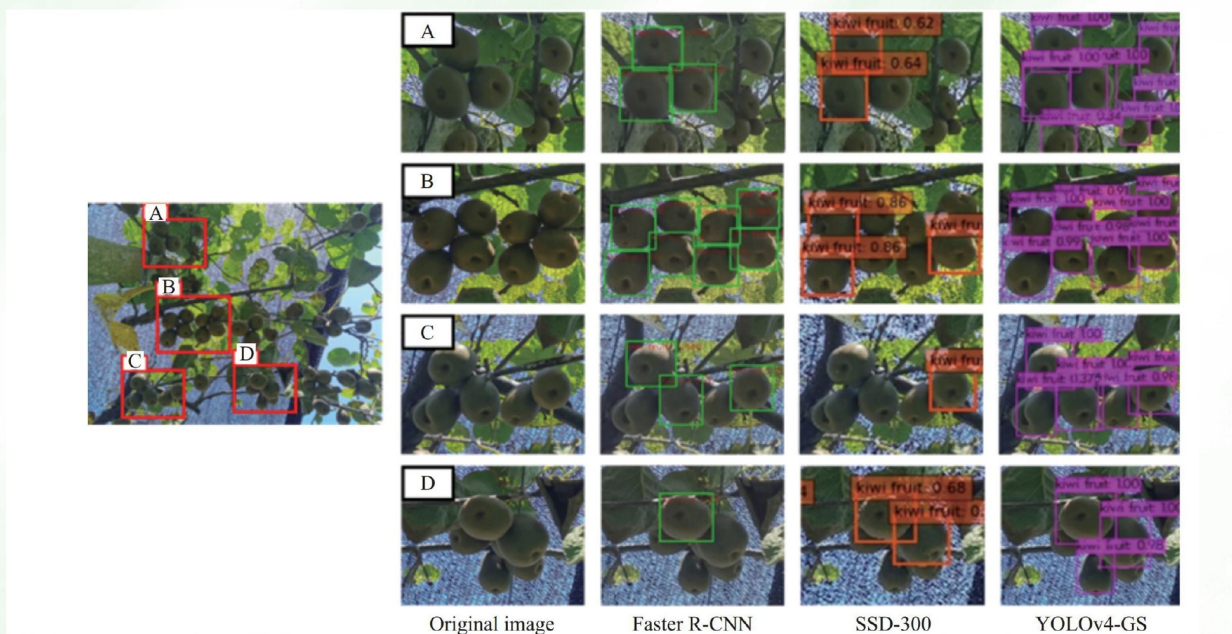**Figure 9   Experiments of picking kiwifruits**

a. Backlit image b. Shadow image

c. Night lighting image d. Occlusion image

Figure 1 Kiwifruit image examples in natural environments

Original image Faster R-CNN SSD-300 YOLOv4-GS

Note: Label "A" represents the detection of small target kiwifruits. Labels "B" and "C" represent the detection of dense clusters of kiwifruits. Label "D" represents the detection of obscured kiwifruits.

Figure 8 Detection results of the three models
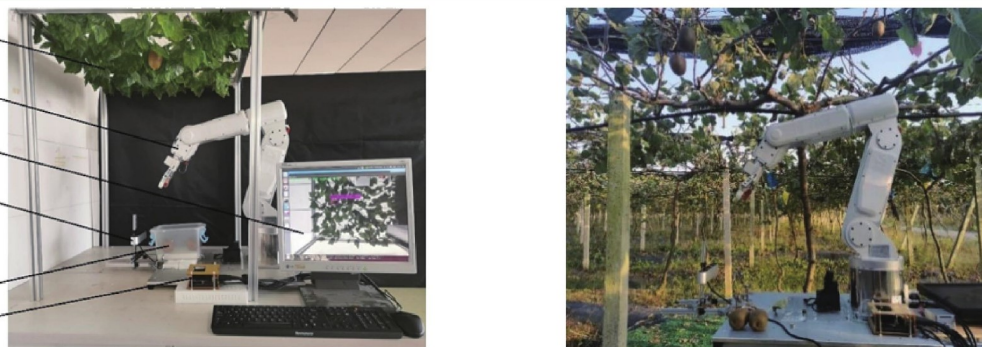
Note: 1. Indoor kiwifruits scaffolding;
2. S6H4D_Plus six-axis manipulator;
3. Identification interface;
4. ZED binocular stereo camera;
5. Collection box; 6. Jetson Xavier NX system
a. Indoor picking experiment

b. Orchard picking experiment

Figure 9 Experiments of picking kiwifruits