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Towards Tree-level  
Evapotranspiration Estimation  
with Small UAVs in Precision  
Agriculture

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# Preface

Evapotranspiration (ET) estimation is important for precision agriculture, especially precision water management. Mapping the ET temporally and spatially can identify variations in the field, which is useful for evaluating soil moisture and assessing crop water status. ET estimation can also benefit the water resources management and weather forecast. As a new remote sensing platform, researchers are gaining interests in the potential of small UAVs in precision agriculture, especially on heterogeneous crops, such as vineyard and orchards. However, there are still challenges to develop reliable tree-level water stress detection method using UAV-based high-resolution images. Within this monograph, contributions are made to take steps closer towards tree-level ET estimation and water stress detection.

It is important to evaluate the methods for tree-level ET estimation and water status inference. Thus, in Chapter 5, the authors proposed a reliable tree-level ET estimation method using UAV high-resolution multispectral images. A framework was also established using a linear regression model between the NDVI and  $K_c$  to estimate the actual daily ET. In Chapter 6, the authors developed a reliable tree-level water stress detection method using UAV-based high-resolution thermal images. The concept of complexity-informed machine learning (CIML) was proposed and its performance was proved on the classification of tree-level irrigation treatments. A convolutional neural network (CNN) model and its performance was also evaluated on the tree-level water status inference.

The roadmap of this monograph is shown in Fig. 0.1. In Chapter 2 and 3, the authors reviewed the most commonly used ET estimation methods with small UAVs. In Chapter 4 and 5, reliable tree-level ET estimation methods were developed using high-resolution UAV images. In Chapter 6, the authors evaluated the reliability of the UAV thermal camera on the individual tree water status inference. Finally, conclusions and future works are presented in the last chapter.

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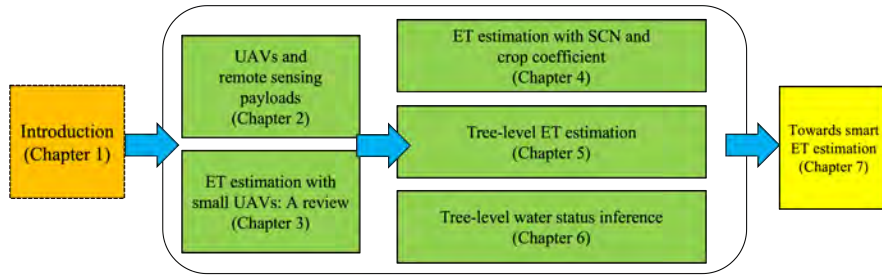


Fig. 0.1 Book roadmap.

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