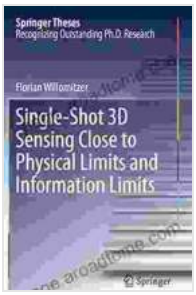
Single Shot 3D Sensing Close to Physical Limits and Information Limits



Single-Shot 3D Sensing Close to Physical Limits and Information Limits (Springer Theses) by Rob Roy

★★★★★ 5 out of 5

Language	: English
File size	: 51531 KB
Text-to-Speech	: Enabled
Screen Reader	: Supported
Enhanced typesetting	: Enabled
Word Wise	: Enabled
Print length	: 268 pages

Single-shot 3D sensing is a powerful imaging technology that has the potential to revolutionize a wide range of applications, including robotics, autonomous navigation, and medical imaging. This book provides a comprehensive overview of the latest advances in single-shot 3D sensing, focusing on theoretical limits and practical challenges.

Theoretical Foundations

The first part of the book covers the theoretical foundations of single-shot 3D sensing. This includes a detailed overview of the mathematics of projection and reconstruction, the theory of compressed sensing, and the fundamental limits imposed by physics and information theory.

Mathematics of Projection and Reconstruction

Single-shot 3D sensing relies on the principles of projection and reconstruction. Projection refers to the process of capturing a 3D scene using a single 2D image. Reconstruction refers to the process of recovering the 3D structure of the scene from the 2D image. The mathematics of projection and reconstruction are based on the principles of linear algebra and geometry.

Theory of Compressed Sensing

Compressed sensing is a powerful mathematical technique that allows the recovery of a signal from a small number of measurements. Compressed sensing is based on the principle that natural signals are often sparse or compressible. This means that they can be represented using a small number of coefficients. Compressed sensing exploits this sparsity to recover the signal from a small number of measurements.

Fundamental Limits

The fundamental limits of single-shot 3D sensing are imposed by physics and information theory. Physical limits include the diffraction limit and the noise limit. Information limits include the entropy limit and the sampling limit. These limits impose fundamental constraints on the accuracy and resolution of single-shot 3D sensing systems.

Practical Applications

The second part of the book focuses on practical applications of single-shot 3D sensing. This includes a range of applications from object classification and recognition to depth estimation and 3D reconstruction.

Object Classification and Recognition

Single-shot 3D sensing can be used to classify and recognize objects in a scene. This is achieved by extracting features from the 3D data and using these features to train a classification or recognition model.

Depth Estimation

Single-shot 3D sensing can be used to estimate the depth of a scene. This is achieved by measuring the time of flight of light between the sensor and the scene. Depth estimation is used in a variety of applications, including autonomous navigation and robotics.

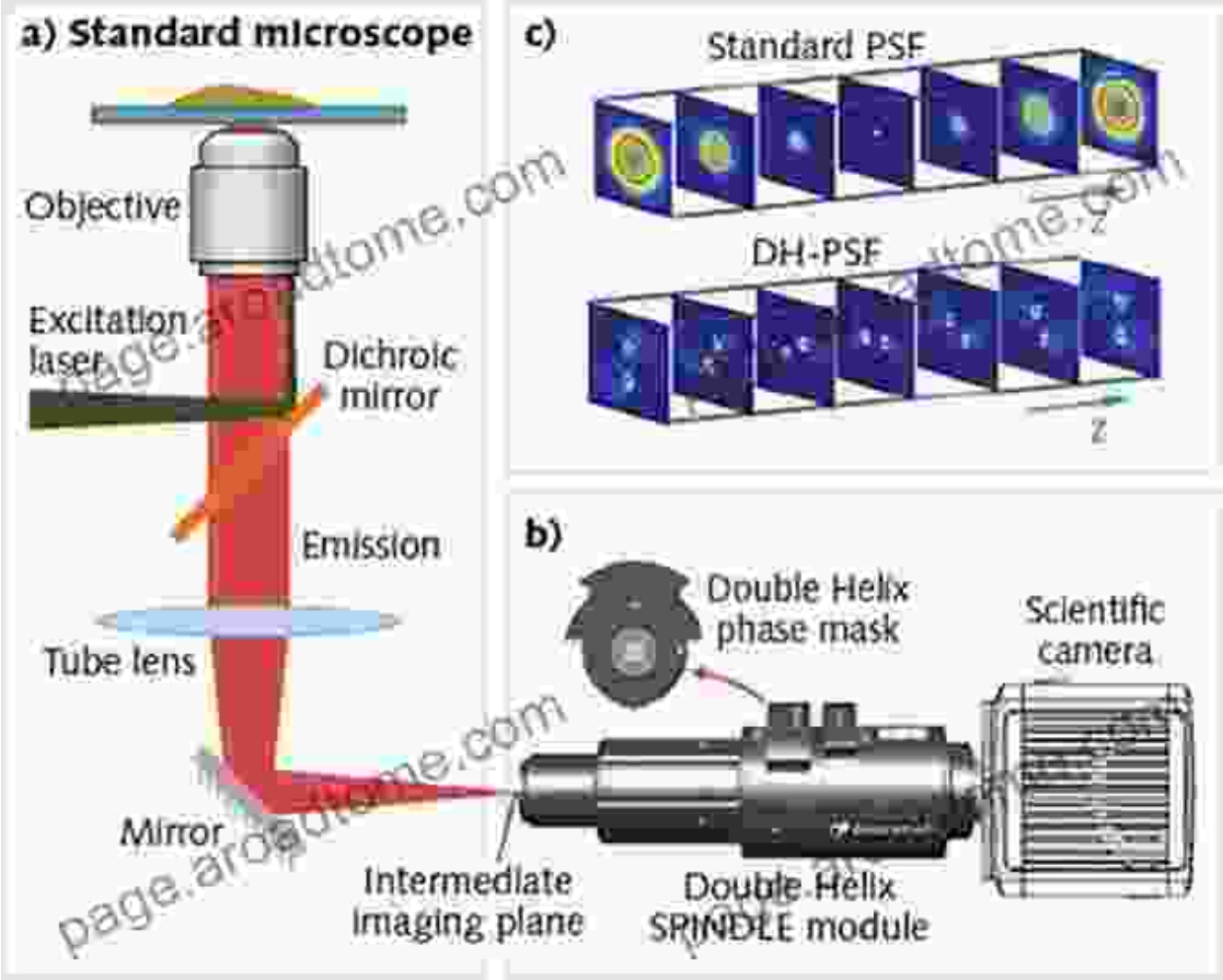
3D Reconstruction

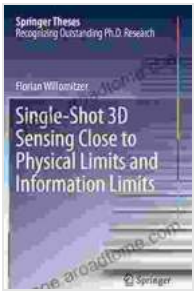
Single-shot 3D sensing can be used to reconstruct a 3D model of a scene. This is achieved by combining the depth information with the 2D image data. 3D reconstruction is used in a variety of applications, including medical imaging and industrial inspection.

Future Prospects and Challenges

The final chapter of the book discusses the future prospects and challenges of single-shot 3D sensing. This includes a discussion of the potential impact of this technology on various industries and applications, as well as the challenges that need to be overcome to achieve widespread adoption of single-shot 3D sensing.

This book provides a comprehensive overview of the latest advances in single-shot 3D sensing. It covers fundamental concepts, system design, and algorithmic approaches, and presents cutting-edge research on single-shot 3D sensing close to physical limits and information limits. The book is a valuable resource for researchers, engineers, and students working in the field of single-shot 3D sensing.





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