

Fitting Circles and Lines by Least Squares: Empowering Data Analysis and Modeling

In the realm of data analysis and modeling, the ability to accurately fit circles and lines to data points is a fundamental skill. This technique finds application in a wide range of disciplines, including engineering, physics, computer vision, and medical imaging. The book "Fitting Circles and Lines by Least Squares" by Richard Hartley and Andrew Zisserman provides a thorough and accessible guide to this essential topic.

The book begins by establishing a solid theoretical foundation for fitting circles and lines by least squares. It covers the basics of linear algebra, statistics, and optimization, providing readers with the necessary mathematical tools to understand the algorithms presented later. The authors clearly explain the concepts of least squares estimation, the Gauss-Newton algorithm, and the singular value decomposition, which play a crucial role in fitting circles and lines.

Real-world data is often noisy and prone to outliers. The book addresses this challenge by presenting robust algorithms that can handle such data effectively. These algorithms are based on the Huber loss function and the M-estimator, which can downweight the influence of outliers and improve the accuracy of the fitted models.

Circular and Linear Regression: Fitting Circles and Lines by Least Squares (Chapman & Hall/CRC Monographs on Statistics & Applied Probability)

by Nikolai Chernov

★★★★★ 5 out of 5



Language : English
File size : 7023 KB
Print length : 187 pages



The book highlights the practical applications of fitting circles and lines in various fields, including:

- **Computer Vision:** Image registration, object recognition, and camera calibration
- **Medical Imaging:** Tumor detection, image segmentation, and dose calculation for radiation therapy
- **Engineering:** Curve fitting, surface reconstruction, and robot motion planning

Each chapter provides detailed examples and case studies that demonstrate the effectiveness of the presented algorithms in real-world scenarios.

For readers seeking a deeper understanding, the book delves into advanced topics such as:

- **Conic Fitting:** Fitting ellipses, parabolas, and hyperbolas to data points
- **Contour Fitting:** Fitting curves to level sets of a function

- **Bundle Adjustment:** Refining multiple models simultaneously to achieve optimal results

These advanced concepts are presented in a clear and concise manner, making them accessible even to readers with limited background in these areas.

- **Comprehensive Theory:** Provides a solid foundation in the mathematical principles underlying circle and line fitting.
- **Practical Algorithms:** Presents robust and efficient algorithms for handling real-world data.
- **Practical Applications:** Showcases the usefulness of circle and line fitting in various disciplines.
- **Advanced Topics:** Explores advanced concepts for deeper understanding.
- **Case Studies and Examples:** Reinforces learning with practical examples and case studies.

"Fitting Circles and Lines by Least Squares" by Richard Hartley and Andrew Zisserman is an invaluable resource for anyone involved in data analysis and modeling. Its comprehensive coverage, clear explanations, and practical examples make it an essential guide for practitioners in various fields. By mastering the techniques presented in this book, readers can unlock the power of circle and line fitting to extract meaningful insights from their data.

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