

# Machine Interpretation of Line Drawing Images

Technical Drawings,  
Maps and Diagrams

Sergey Ablameyko and Tony Pridmore



Springer

## ABBREVIATIONS

P	Post Office
PH	Public House
MS	Milestone
CH	Clubhouse
PC	Public Car
TH	Town Hall
CG	Coast Guard

# Machine Interpretation Of Line Drawings

**Ken-ichi Kanatani**



## **Machine Interpretation Of Line Drawings:**

Machine Interpretation of Line Drawings Kōkichi Sugihara, 1986 This book solves a long standing problem in computer vision the interpretation of line drawings and in doing so answers many of the concerns raised by this problem particularly with regard to errors in the placement of lines and vertices in the images Sugihara presents a computational mechanism that functionally mimics human perception in being able to generate three dimensional descriptions of objects from two dimensional line drawings The objects considered are polyhedrons or solid objects bounded by planar faces and the line drawings are single view pictures of these objects Sugihara s mechanism has several potential applications It can facilitate man machine communication by extracting object structures automatically from pictures drawn by a designer which can be particularly useful in the computer aided design of geometric objects such as mechanical parts and buildings It can also be used in the intermediate stage of computer vision systems used to obtain and analyze images in the outside world The computational mechanism itself is not accompanied by a large database but is composed of several simple procedures based on linear algebra and combinatorial theory Contents Introduction Candidates for Spatial Interpretation Discrimination between Correct and Incorrect Pictures Correctness of HiddenPart Drawn Pictures Algebraic Structures of Line Drawings Combinatorial Structures of Line Drawings Overcoming Superstrictness Algorithmic Aspects of Generic Reconstructibility Specification of Unique Shapes Recovery of Shape from Surface Information Polyhedrons and Rigidity Kokichi Sugihara is Professor in the Department of Mathematical Engineering and instrumentation Physics Faculty of Engineering the University of Tokyo Tokyo Japan Machine interpretation of Line Drawings is included in The MIT Press Series in Artificial Intelligence edited by Patrick Henry Winston and Michael Brady Machine Interpretation of Line Drawing Images Sergey

Ablameyko, Tony Pridmore, 2012-12-06 Line drawing interpretation is a challenging area with enormous practical potential At present many companies throughout the world invest large amounts of money and human resource in the input of paper drawings into computers The technology needed to produce an image of a drawing is widely available but the transformation of these images into more useful forms is an active field of research and development Machine Interpretation of Line Drawing Images describes the theory and practice underlying the computer interpretation of line drawing images and shows how line drawing interpretation systems can be developed The authors show how many of the problems can be tackled and provide a thorough overview of the processes underpinning the interpretation of images of line drawings **Machine**

**Interpretation of Line Drawings** Dorian Goldstein, University of Waterloo. Department of Systems Design, 1984

Machine Interpretation of Line Drawing Images Sergey Ablameyko, Tony Pridmore, 2000-08-17 **Group-Theoretical Methods in Image Understanding** Ken-ichi Kanatani, 2012-12-06 Image understanding is an attempt to extract knowledge about a 3D scene from 2D images The recent development of computers has made it possible to automate a wide range of systems and operations not only in the industry military and special environments space sea atomic plants etc but also in

daily life As we now try to build ever more intelligent systems the need for visual control has been strongly recognized and the interest in image understanding has grown rapidly Already there exists a vast body of literature ranging from general philosophical discourses to processing techniques Compared with other works however this book may be unique in that its central focus is on mathematical principles Lie groups and group representation theory in particular In the study of the relationship between the 3D scene and the 2D image geometry naturally plays a central role Today so many branches are interwoven in geometry that we cannot truly regard it as a single subject Nevertheless as Felix Klein declared in his Erlangen Program the central principle of geometry is group theory because geometrical concepts are abstractions of properties that are invariant with respect to some group of transformations In this text we specifically focus on two groups of transformations One is 2D rotations of the image coordinate system around the image origin Such coordinate rotations are indeed irrelevant when we look for intrinsic image properties

**Line Drawing Interpretation** Martin Cooper, 2010-06-07

Based on the author's considerable research this book contains state-of-the-art reviews of work in drawing interpretation and discrete optimization It covers both drawings of polyhedral objects as well as complex curved objects

**Discrete and Computational Geometry** Jin Akiyama, Mikio Kano, Masatsugu Urabe, 2004-05-26 This volume consists of those papers

presented at the Japan Conference on Discrete and Computational Geometry 98 The conference was held 9-12 December 1998

at Tokai University in Tokyo Close to a hundred participants from 10 countries participated Interest in Computational Geometry surfaced among engineers in Japan about twenty years ago while interest in Discrete Geometry arose as a natural extension of the research of a group of graph theorists more recently One of the goals of the conference was to bring together these two groups and to put them in contact with experts in these fields from abroad This is the second conference in the series The plan is to hold one every year and to publish the papers of the conferences every two years The organizers thank the sponsors of the conference namely The Institute of Educational Development of Tokai University Grant in Aid of the Ministry of Education of Japan A Saito A 10304008 Mitsubishi Research Institute Sanada Institute of System Development Japan Process and Upward They also thank especially T Asano D Avis V Chvátal H Imai J Pach D Rapaport M Ruiz J O'Rourke K Sugihara T Tokuyama and J Urrutia for their interest and support

**Multispectral Image Processing and Pattern**

**Recognition** Jun Shen, Patrick Shen-pei Wang, Tianxu Zhang, 2001 A study of multispectral image processing and pattern recognition It covers geometric and orthogonal moments minimum description length method for facet matching an integrated vision system for ALV navigation fuzzy Bayesian networks and more

*Interactive Sketch-based Interfaces and Modelling for Design* Alexandra Bonnici, Kenneth P. Camilleri, 2023-05-31 Sketching is a natural and intuitive communication tool used for expressing concepts and ideas that are difficult to communicate through text or speech alone In design applications drawings are used at various stages of the design process from the early concept drawings scribbled on a piece of paper to immersive interactions in which users manipulate and adjust the 3D form of an object in virtual or augmented

reality environments This variety in drawing activities brings about the need for different interpretation strategies that support not only the sketching activity itself but also allow sketch based interactions such as sketch based queries to take place In this book we explore the different drawing approaches used in design and the algorithms required for processing and interpreting the different sketches and drawings in design The book is divided into two parts The first part focuses on sketching in the 2D domain This includes the digitization of offline and paperbased sketches techniques for online sketch recognition observations of user drawing habits algorithms for inferring depth from 2D drawings as well as non photorealistic rendering techniques that are then applied to sketch based queries The second part of the book focuses on 3D sketching in virtual or augmented reality spaces Here we present the processing and rendering of the 3D strokes the different interaction devices available for 3D sketching and look at different applications where immersive 3D sketching has been applied with success

**Graphics Recognition. Recent Advances** Atul K. Chhabra, Dov Dori, 2003-06-29 This edited volume contains refereed and improved versions of select papers 1 that were presented at the third IAPR Workshop on Graphics Recognition GREC 99 held at Rambagh Palace in Jaipur India 26 27 September 1999 The workshop was organized by the TC10 Technical Committee on Graphics Recognition of the IAPR Edited volumes from the previous two workshops in this series are also available as Lecture Notes in Computer Science volumes 1072 and 1389 Graphics recognition is the study of techniques for computer interpretation of images of line drawings and symbols This includes methods such as vectorization symbol recognition and table and chart recognition for applications such as engineering drawings schematics logic drawings maps diagrams and musical scores Some recently developed techniques include graphics based information or drawing retrieval and recognition of online graphical strokes With the recent advances in the field there is now a need to develop benchmarks for evaluating and comparing algorithms and systems Graphics recognition is a growing field of interest in the broader document image recognition community The GREC 99 workshop was attended by fifty five people from fifteen countries The workshop program consisted of six technical sessions Each session began with a half hour invited talk which was followed by several short talks Each session closed with a half hour panel discussion where the authors fielded questions from the other participants Several interesting new research directions were discussed at the workshop

**Semantic Modeling for the Acquisition of Topographic Information from Images and Maps** Wolfgang Förstner, Lutz Plümer, 1997-05-01 Acquiring spatial data for geoinformation systems is still mainly done by human operators who analyze images using classical photogrammetric equipment or digitize maps possibly assisted by some low level image processing Automation of these tasks is difficult due to the complexity of the object the topography and the deficiency of current pattern recognition and image analysis tools for achieving a reliable transition from the data to the high level description of topographic objects It appears that progress in automation only can be achieved by incorporating domain specific semantic models into the analysis procedures This volume collects papers which were presented at the Workshop SMATI 97 The workshop focused on

Semantic Modeling for the Acquisition of Topographic Information from Images and Maps This volume offers a comprehensive selection of high quality and in depth contributions by experts of the field coming from leading research institutes treating both theoretical and implementation issues and integrating aspects of photogrammetry cartography computer vision and image understanding Graphics Recognition. Algorithms and Applications Dorothea Blostein, Young-Bin Kwon, 2003-06-30 This book presents refereed and revised papers presented at GREC 2001 the 4th IAPR International Workshop on Graphics Recognition which took place in Kingston Ontario Canada in September 2001 Graphics recognition is a branch of document image analysis that focuses on the recognition of two dimensional notations such as engineering drawings maps mathematical notation music notation tables and chemical structure diagrams Due to the growing demand for both o line and on line document recognition systems the eld of graphics recognition has an exciting and promising future The GREC workshops provide an opportunity for researchers at all levels of experience to share insights into graphics recognition methods The workshops enjoy strong participation from researchers in both industry and academia They are sponsored by IAPR TC 10 the Technical Committee on Graphics Recognition within the International Association for Pattern Recognition Edited volumes from the previous three workshops in this series are available as Lecture Notes in Computer Science Vols 1072 1389 and 1941 After the GREC 2001 workshop authors were invited to submit enhanced versions of their papers for review Every paper was evaluated by three reviewers We are grateful to both authors and reviewers for their careful work during this review process Many of the papers that appear in this volume were thoroughly revised and improved in response to reviewers suggestions Advances In Structural And Syntactic Pattern Recognition - Proceedings Of The International Workshop Horst Bunke, 1993-02-23 Pattern recognition is an active area of research with many applications some of which have reached commercial maturity Structural and syntactic methods are very powerful They are based on symbolic data structures together with matching parsing and reasoning procedures that are able to infer interpretations of complex input patterns This book gives an overview of the latest developments and achievements in the field Computer Analysis of Images and Patterns Dmitry Chetverikov, Walter Kropatsch, 1993-08-30 This volume constitutes the proceedings of the 5th International Conference on Computer Analysis of Images and Patterns CAIP 93 held in Budapest Hungary in September 1993 Formerly the events in this biennial conference series were thought as a forum where East European researchers and professionals from academia and industry had an opportunity to discuss their results and ideas with Western colleagues active in image processing and pattern recognition Now CAIP 93 has a much more international scope and in the future these conferences will not any longer take place only in East European countries but roam throughout whole Europe Besides invited talks by Belikova Gimel farb Haralick and Roska the volume contains 114 contributions either presented as lectures or posters and carefully selected by a highly competent international program committee from a total of some 230 submissions thus the book gives a thorough survey on recent research results and their



applications in image processing and pattern recognition The proceedings is organized in 20 sections for example on image data structures image processing edges and contours Hough transforms and related methods shape motion 3 D vision character recognition and document processing biomedical applications industrial applications and neural networks

*Lectures on Perception* Michael T. Turvey, 2018-10-31 *Lectures on Perception An Ecological Perspective* addresses the generic principles by which each and every kind of life form from single celled organisms e g diffugia to multi celled organisms e g primates perceives the circumstances of their living so that they can behave adaptively It focuses on the fundamental ability that relates each and every organism to its surroundings namely the ability to perceive things in the sense of how to get about among them and what to do or not to do with them The book s core thesis breaks from the conventional interpretation of perception as a form of abduction based on innate hypotheses and acquired knowledge and from the historical scientific focus on the perceptual abilities of animals most especially those abilities ascribed to humankind Specifically it advances the thesis of perception as a matter of laws and principles at nature s ecological scale and gives equal theoretical consideration to the perceptual achievements of all of the classically defined kingdoms of organisms Archaea Bacteria Protocista Fungi Plantae and Animalia **AI and Cognitive Science '89** Alan Smeaton, Gabriel

McDermott, 2012-12-06 This volume contains the texts of papers presented at the Second Irish Conference on Artificial Intelligence and Cognitive Science held at Dublin City University in September 1989 This Conference has now become the major annual forum in Ireland for the presentation and discussion of current research work in the multi disciplinary area of Artificial Intelligence Papers in this volume have been divided into seven sections which vary in their subject matter Image processing human computer interaction planning applications and theory of expert systems learning speech and natural language processing and semantics represents as broad a spectrum of AI and AI related topics as can be found in current AI research This harmonises quite well with the aims and scope of the AICS 89 conference which were to provide a forum for industry and academic research to discuss AI and AI related topics and we were delighted that such a broad coverage of topics was achieved Despite the broad nature however none of the papers are primarily review articles each paper presents new research results within its own specific area *Advanced Intelligent Computing Theories and Applications - With Aspects of Theoretical and Methodological Issues* De-Shuang Huang, Laurent Heutte, Marco Loog, 2007-07-31 This volume in conjunction with the two volumes CICS 0002 and LNAI 4682 constitutes the refereed proceedings of the Third International Conference on Intelligent Computing held in Qingdao China in August 2007 The 139 full papers published here were carefully reviewed and selected from among 2 875 submissions Collectively these papers represent some of the most important findings and insights into the field of intelligent computing Proceedings 1997 Symposium on Document Image Understanding Technology David Doermann, 1997 *Electrical Engineering - Volume I* Kit Po Wong, 2009-11-30 Electricity is

an integral part of life in modern society It is one form of energy and can be transported and converted into other forms

Throughout the world electricity is used to light homes and streets cook meals power computers and run industrial plants Electricity is so integrated with our way of living that electricity consumption per person is used to measure the levels of economic development of countries Any disruptions to electricity supply or blackouts will lead to huge financial loss and threats to lives well being in the community Electrical engineering is the profession and study of generating transmitting controlling and using electrical energy It offers a wide range of exciting opportunities to those looking for a fulfilling challenging and professional career Electrical engineers are the designers of modern electrical machinery power systems transportation and communication systems They work in various sectors of the community as well including the building industry the manufacturing industry the construction industry consultancy services technology development education services as well as government In these volumes the essential aspects and fundamentals of electrical engineering are presented In depth knowledge of various areas of electrical engineering are disseminated by learned scholars in their fields It is hoped that readers will find all the writings comprehensive informative and interesting It is further hoped that these fundamentals will assist the readers to study advanced topics in electrical engineering If the readers are electrical engineers themselves it is hoped that the articles will broaden their horizon in electrical engineering and provide them with the necessary knowledge to further their profession as electrical engineers

### **Object Representation in Computer Vision II**

Jean Ponce, Andrew Zisserman, 1996-09-25 This book constitutes the strictly refereed post workshop proceedings of the second International Workshop on Object Representation in Computer Vision held in conjunction with ECCV 96 in Cambridge UK in April 1996 The 15 revised full papers contained in the book were selected from 45 submissions for presentation at the workshop Also included are three invited contributions based on the talks by Takeo Kanade Jan Koenderink and Ram Nevatia as well as a workshop report by the volume editors summarizing several panel discussions and the general state of the art in the area



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different applications. The. Precision Speed Control of A DC Motor Using Fuzzy Logic ... Precision Speed Control of A DC Motor Using Fuzzy Logic Controller Optimized by ... Universiti Teknologi Malaysia, ACKNOWLEDGMENT Johor, Malaysia, in 2011. He ... DC Motor Control | Automation & Control Engineering Forum Jun 20, 2022 — I have a 1 HP DC motor that I'm currently manually controlling using a Dayton 1F792 DC Speed Control unit. I want to automate the following ...