

Analog Digital Umiacs

In 1992 it seemed very difficult to answer the question whether it would be possible to develop a portable system for the automatic recognition and translation of spontaneous speech. Previous research work on speech processing had focused on read speech only and international projects aimed at automated text translation had just been terminated without achieving their objectives. Within this context, the German Federal Ministry of Education and Research (BMBF) made a careful analysis of all national and international research projects conducted in the field of speech and language technology before deciding to launch an eight-year basic-research lead project in which research groups were to cooperate in an interdisciplinary and international effort covering the disciplines of computer science, computational linguistics, translation science, signal processing, communication science and artificial intelligence. At some point, the project comprised up to 135 work packages with up to 33 research groups working on these packages. The project was controlled by means of a network plan. Every two years the project situation was assessed and the project goals were updated. An international scientific advisory board provided advice for BMBF. A new scientific approach was chosen for this project: coping with the complexity of spontaneous speech with all its pertinent phenomena such as ambiguities, self-corrections, hesitations and disfluencies took precedence over the intended lexicon size. Another important aspect was that prosodic information was exploited at all processing stages.

A two-volume annotated guide to 26,670 listings of live and print sources of information designed to facilitate the start-up, development, and growth of specific small businesses, as well as 26,158 similar listings for general small business topics. An additional 11,167 entries are provided on a state-by-state basis; also included are 965 relevant U.S. federal government agencies and branch offices.

The Exposome: A Primer is the first book dedicated to exposomics, detailing the purpose and scope of this emerging field of study, its practical applications and how it complements a broad range of disciplines. Genetic causes account for up to a third of all complex diseases. (As genomic approaches improve, this is likely to rise.) Environmental factors also influence human disease but, unlike with genetics, there is no standard or systematic way to measure the influence of environmental exposures. The exposome is an emerging concept that hopes to address this, measuring the effects of life-long environmental exposures on health and how these exposures can influence disease. This systematic introduction considers topics of managing and integrating exposome data (including maps, models, computation, and systems biology), "-omics"-based technologies, and more. Both students and scientists in disciplines including toxicology, environmental health, epidemiology, and public health will benefit from this rigorous yet readable overview.

This open access book brings together a set of original studies that use cutting-edge computational methods to investigate conflict at various geographic scales and degrees of intensity and violence. Methodologically, this book covers a variety of computational approaches from text mining and machine learning to agent-based modelling and social network analysis. Empirical cases range from migration policy framing in North America and street protests in Iran to violence against civilians in Congo and food riots world-wide. Supplementary materials in the book include a comprehensive list of the datasets on conflict and dissent, as well as resources to online repositories where the annotated code and data of individual chapters can be found and where (agent-based) models can be re-produced and altered. These materials are a valuable resource for those wishing to retrace and learn from the analyses described in this volume and adapt and apply them to their own research interests. By bringing together novel research through an international team of scholars from a range of disciplines, Computational Conflict Research pioneers and maps this emerging field.

The book will appeal to students, scholars, and anyone interested in the prospects of using computational social sciences to advance our understanding of conflict dynamics.

This book constitutes the refereed proceedings of the International Conference on Advances in Information Technology and Mobile Communication, AIM 2011, held at Nagpur, India, in April 2011. The 31 revised full papers presented together with 27 short papers and 34 poster papers were carefully reviewed and selected from 313 submissions. The papers cover all current issues in theory, practices, and applications of Information Technology, Computer and Mobile Communication Technology and related topics.

The 2009 International Symposium on Rule Interchange and Applications (RuleML 2009), collocated in Las Vegas, Nevada, with the 12th International Business Rules Forum, was the premier place to meet and to exchange ideas from all fields of rules technologies. The aims of RuleML 2009 were both to present new and interesting research results and to show successfully deployed rule-based applications. This annual symposium is the flagship event of the Rule Markup and Modeling Initiative (RuleML). The RuleML Initiative (www.ruleml.org) is a non-profit umbrella organization of several technical groups organized by representatives from academia, industry and public sectors working on rule technologies and applications. Its aim is to promote the study, research and application of rules in heterogeneous distributed environments such as the Web. RuleML maintains effective links with other major international societies and acts as intermediary between various 'specialized' rule vendors, applications, industrial and academic research groups, as well as standardization efforts from, for example, W3C, OMG, and OASIS. To emphasize the importance of rule standards RuleML 2009 featured, besides a number of tutorials on various rule aspects, a tutorial and a workshop dedicated to the newly released W3C Rule Interchange Format (RIF).

This groundbreaking work offers a first-of-its-kind overview of legal informatics, the academic discipline underlying the technological transformation and economics of the legal industry. Edited by Daniel Martin Katz, Ron Dolin, and Michael J. Bommarito, and featuring contributions from more than two dozen academic and industry experts, chapters cover the history and principles of legal informatics and background technical concepts – including natural language processing and distributed ledger technology. The volume also presents real-world case studies that offer important insights into document review, due diligence, compliance, case prediction, billing, negotiation and settlement, contracting, patent management, legal research, and online dispute resolution. Written for both technical and non-technical readers, Legal Informatics is the ideal resource for anyone interested in identifying, understanding, and executing opportunities in this exciting field.

The Handbook of Neural Computation is a practical, hands-on guide to the design and implementation of neural networks used by scientists and engineers to tackle difficult and/or time-consuming problems. The handbook bridges an information pathway between scientists and engineers in different disciplines who apply neural networks to similar problems.

This book constitutes the refereed proceedings of the Third International Conference on Ubiquitous Computing, Ubicomp 2001, held in Atlanta, GA, USA in September/October 2001. The 14 revised full papers and 15 revised technical notes were carefully selected during a highly competitive reviewing process from a total of 160 submissions (90 paper submissions and 70 technical notes submissions). All current aspects of research and development in the booming area of ubiquitous computing are addressed. The book offers topical sections on location awareness, tools and infrastructure, applications for groups, applications and design spaces, research challenges and novel input, and output.

Introduction to digital filters. Finite impulse-response filters. Design of linear-

phase finite impulse-response. Minimum-phases and complex approximation. Implementation of finite impulse-response filters. Properties of infinite impulse-response filters. Design of infinite impulse-response filters. Implementation of infinite impulse-response filters. Programs.

Handbook of Signal Processing Systems is organized in three parts. The first part motivates representative applications that drive and apply state-of-the-art methods for design and implementation of signal processing systems; the second part discusses architectures for implementing these applications; the third part focuses on compilers and simulation tools, describes models of computation and their associated design tools and methodologies. This handbook is an essential tool for professionals in many fields and researchers of all levels.

This book presents advances in matrix and tensor data processing in the domain of signal, image and information processing. The theoretical mathematical approaches are discussed in the context of potential applications in sensor and cognitive systems engineering. The topics and applications include Information Geometry, Differential Geometry of structured Matrix, Positive Definite Matrix, Covariance Matrix, Sensors (Electromagnetic Fields, Acoustic sensors) and Applications in Cognitive systems, in particular Data Mining.

These original contributions provide a current sampling of AI approaches to problems of biological significance; they are the first to treat the computational needs of the biology community hand-in-hand with appropriate advances in artificial intelligence. The enormous amount of data generated by the Human Genome Project and other large-scale biological research has created a rich and challenging domain for research in artificial intelligence. These original contributions provide a current sampling of AI approaches to problems of biological significance; they are the first to treat the computational needs of the biology community hand-in-hand with appropriate advances in artificial intelligence. Focusing on novel technologies and approaches, rather than on proven applications, they cover genetic sequence analysis, protein structure representation and prediction, automated data analysis aids, and simulation of biological systems. A brief introductory primer on molecular biology and AI gives computer scientists sufficient background to understand much of the biology discussed in the book. Lawrence Hunter is Director of the Machine Learning Project at the National Library of Medicine, National Institutes of Health.

Bitcoin is starting to come into its own as a digital currency, but the blockchain technology behind it could prove to be much more significant. This book takes you beyond the currency ("Blockchain 1.0") and smart contracts ("Blockchain 2.0") to demonstrate how the blockchain is in position to become the fifth disruptive computing paradigm after mainframes, PCs, the Internet, and mobile/social networking. Author Melanie Swan, Founder of the Institute for Blockchain Studies, explains that the blockchain is essentially a public ledger with potential as a worldwide, decentralized record for the registration, inventory, and transfer of all assets—not just finances, but property and intangible assets

such as votes, software, health data, and ideas. Topics include: Concepts, features, and functionality of Bitcoin and the blockchain Using the blockchain for automated tracking of all digital endeavors Enabling censorship-resistant organizational models Creating a decentralized digital repository to verify identity Possibility of cheaper, more efficient services traditionally provided by nations Blockchain for science: making better use of the data-mining network Personal health record storage, including access to one's own genomic data Open access academic publishing on the blockchain This book is part of an ongoing O'Reilly series. Mastering Bitcoin: Unlocking Digital Crypto-Currencies introduces Bitcoin and describes the technology behind Bitcoin and the blockchain. Blockchain: Blueprint for a New Economy considers theoretical, philosophical, and societal impact of cryptocurrencies and blockchain technologies.

This book describes computational problems related to kernel density estimation (KDE) – one of the most important and widely used data smoothing techniques. A very detailed description of novel FFT-based algorithms for both KDE computations and bandwidth selection are presented. The theory of KDE appears to have matured and is now well developed and understood. However, there is not much progress observed in terms of performance improvements.

This book is an attempt to remedy this. The book primarily addresses researchers and advanced graduate or postgraduate students who are interested in KDE and its computational aspects. The book contains both some background and much more sophisticated material, hence also more experienced researchers in the KDE area may find it interesting. The presented material is richly illustrated with many numerical examples using both artificial and real datasets. Also, a number of practical applications related to KDE are presented. Genetic programming (GP) is a systematic, domain-independent method for getting computers to solve problems automatically starting from a high-level statement of what needs to be done. Using ideas from natural evolution, GP starts from an ooze of random computer programs, and progressively refines them through processes of mutation and sexual recombination, until high-fitness solutions emerge. All this without the user having to know or specify the form or structure of solutions in advance. GP has generated a plethora of human-competitive results and applications, including novel scientific discoveries and patentable inventions. This unique overview of this exciting technique is written by three of the most active scientists in GP. See www.gp-field-guide.org.uk for more information on the book.

Comprehensive guide to the restoration of images degraded by motion blur, encompassing algorithms and architectures, with novel computational photography methods.

"Mesmerizing & fascinating..." —The Seattle Post-Intelligencer "The Freakonomics of big data." —Stein Kretsinger, founding executive of Advertising.com Award-winning | Used by over 30 universities | Translated into 9 languages An introduction for everyone. In this rich, fascinating — surprisingly accessible — introduction, leading expert Eric Siegel

reveals how predictive analytics (aka machine learning) works, and how it affects everyone every day. Rather than a “how to” for hands-on techies, the book serves lay readers and experts alike by covering new case studies and the latest state-of-the-art techniques. Prediction is booming. It reinvents industries and runs the world. Companies, governments, law enforcement, hospitals, and universities are seizing upon the power. These institutions predict whether you're going to click, buy, lie, or die. Why? For good reason: predicting human behavior combats risk, boosts sales, fortifies healthcare, streamlines manufacturing, conquers spam, optimizes social networks, toughens crime fighting, and wins elections. How? Prediction is powered by the world's most potent, flourishing unnatural resource: data. Accumulated in large part as the by-product of routine tasks, data is the unsalted, flavorless residue deposited en masse as organizations churn away. Surprise! This heap of refuse is a gold mine. Big data embodies an extraordinary wealth of experience from which to learn. Predictive analytics (aka machine learning) unleashes the power of data. With this technology, the computer literally learns from data how to predict the future behavior of individuals. Perfect prediction is not possible, but putting odds on the future drives millions of decisions more effectively, determining whom to call, mail, investigate, incarcerate, set up on a date, or medicate. In this lucid, captivating introduction — now in its Revised and Updated edition — former Columbia University professor and Predictive Analytics World founder Eric Siegel reveals the power and perils of prediction: What type of mortgage risk Chase Bank predicted before the recession. Predicting which people will drop out of school, cancel a subscription, or get divorced before they even know it themselves. Why early retirement predicts a shorter life expectancy and vegetarians miss fewer flights. Five reasons why organizations predict death — including one health insurance company. How U.S. Bank and Obama for America calculated the way to most strongly persuade each individual. Why the NSA wants all your data: machine learning supercomputers to fight terrorism. How IBM's Watson computer used predictive modeling to answer questions and beat the human champs on TV's Jeopardy! How companies ascertain untold, private truths — how Target figures out you're pregnant and Hewlett-Packard deduces you're about to quit your job. How judges and parole boards rely on crime-predicting computers to decide how long convicts remain in prison. 182 examples from Airbnb, the BBC, Citibank, ConEd, Facebook, Ford, Google, the IRS, LinkedIn, Match.com, MTV, Netflix, PayPal, Pfizer, Spotify, Uber, UPS, Wikipedia, and more. How does predictive analytics work? This jam-packed book satisfies by demystifying the intriguing science under the hood. For future hands-on practitioners pursuing a career in the field, it sets a strong foundation, delivers the prerequisite knowledge, and whets your appetite for more. A truly omnipresent science, predictive analytics constantly affects our daily lives. Whether you are a consumer of it — or consumed by it — get a handle on the power of Predictive Analytics.

This book constitutes revised selected papers from the International Conference on Advanced Computing, Networking and Security, ADCONS 2011, held in Surathkal, India, in December 2011. The 73 papers included in this book were carefully reviewed and selected from 289 submissions. The papers are organized in topical sections on distributed computing, image processing, pattern recognition, applied algorithms, wireless networking, sensor networks, network infrastructure, cryptography, Web security, and application security.

Buku ini merupakan sebuah tutorial untuk mulai memahami GIS dari sudut pandang perangkat lunak yang bernama ArcGIS. Sebuah perjalanan panjang ketika Penulis mengenal GIS di awal tahun 2000-an dengan perangkat lunak Arc/Info yang masih menggunakan perintah seperti halnya DOS namun powerful, berlanjut ke ArcView yang menggunakan antar muka ramah pengguna, hingga ArcGIS yang menggabungkan kemampuan kedua pendahulunya. Antar muka ramah pengguna dan powerful dalam pemrosesan data yang kompleks dan membutuhkan kapasitas tinggi merupakan keunggulan dari ArcGIS. Perangkat lunak yang akan menjadi penerus ArcGIS adalah ArcGIS Pro. Antar muka penerus ArcGIS ini berbeda dengan para pendahulunya. Jika pengguna sudah mulai membiasakan diri dengan antar muka perangkat lunak ArcGIS dan berbagai istilah di dalamnya, Penulis yakin pengguna akan mampu menguasai perangkat lunak GIS lainnya walaupun memiliki antar muka yang berbeda.

This synthesis lecture provides a survey of work on privacy in online social networks (OSNs). This work encompasses concerns of users as well as service providers and third parties. Our goal is to approach such concerns from a computer-science perspective, and building upon existing work on privacy, security, statistical modeling and databases to provide an overview of the technical and algorithmic issues related to privacy in OSNs. We start our survey by introducing a simple OSN data model and describe common statistical-inference techniques that can be used to infer potentially sensitive information. Next, we describe some privacy definitions and privacy mechanisms for data publishing. Finally, we describe a set of recent techniques for modeling, evaluating, and managing individual users' privacy risk within the context of OSNs. Table of Contents: Introduction / A Model for Online Social Networks / Types of Privacy Disclosure / Statistical Methods for Inferring Information in Networks / Anonymity and Differential Privacy / Attacks and Privacy-preserving Mechanisms / Models of Information Sharing / Users' Privacy Risk / Management of Privacy Settings

With existent uses ranging from motion detection to music synthesis to financial forecasting, recurrent neural networks have generated widespread attention. The tremendous interest in these networks drives *Recurrent Neural Networks: Design and Applications*, a summary of the design, applications, current research, and challenges of this subfield of artificial neural networks. This overview incorporates every aspect of recurrent neural networks. It outlines the wide variety of complex learning techniques and associated research projects. Each chapter addresses architectures, from fully connected to partially connected, including recurrent multilayer feedforward. It presents problems involving trajectories, control systems, and robotics, as well as RNN use in chaotic systems. The authors also share their expert knowledge of ideas for alternate designs and advances in theoretical aspects. The dynamical behavior of recurrent neural networks is useful for solving problems in science, engineering, and business. This approach will yield huge advances in the coming years. *Recurrent Neural Networks* illuminates the opportunities and provides you with a broad view of the current events in this rich field.

On May 23-25, more than 125 delegates from more than 20 countries gathered in Tallinn, Estonia, for the "Aligning National Approaches to Digital Preservation" conference. At the National Library of Estonia, this group explored how to create and sustain international collaborations to support the preservation of our digital cultural memory. This publication contains a collection of peer-reviewed essays that were

developed by conference panels and attendees in the months following ANADP. Rather than simply chronicling the event, the volume intends to broaden and deepen its impact by reflecting on the ANADP presentations and conversations and establishing a set of starting points for building a greater alignment across digital preservation initiatives. Above all, it highlights the need for strategic international collaborations to support the preservation of our collective cultural memory.

Doing Development Research is a comprehensive introduction to research in development studies, that provides thorough training for anyone carrying out research in developing countries. It brings together experts with extensive experience of overseas research, presenting an interdisciplinary guide to the core methodologies. Informed by years of research experience, Doing Development Research draws together many strands of action research and participatory methods, demonstrating their diverse applications and showing how they interrelate. The text provides:

- an account of the theoretical approaches that underlie development work
- an explanation of the practical issues involved in planning development research
- a systematic overview of information and data collecting methods in three sub-sections:
 - methods of social research and associated forms of analysis
 - using existing knowledge and records
 - disseminating findings/research

Using clear and uncomplicated language – illustrated with appropriate learning features throughout - the text guides the researcher through the choice of appropriate methods, the implementation of the research, and the communication of the findings to a range of audiences. This is the essential A-Z of development research.

Information Retrieval for E-Discovery

Since the initial work on constrained clustering, there have been numerous advances in methods, applications, and our understanding of the theoretical properties of constraints and constrained clustering algorithms. Bringing these developments together, *Constrained Clustering: Advances in Algorithms, Theory, and Applications* presents an extensive collection of the latest innovations in clustering data analysis methods that use background knowledge encoded as constraints. Algorithms The first five chapters of this volume investigate advances in the use of instance-level, pairwise constraints for partitional and hierarchical clustering. The book then explores other types of constraints for clustering, including cluster size balancing, minimum cluster size, and cluster-level relational constraints. Theory It also describes variations of the traditional clustering under constraints problem as well as approximation algorithms with helpful performance guarantees. Applications The book ends by applying clustering with constraints to relational data, privacy-preserving data publishing, and video surveillance data. It discusses an interactive visual clustering approach, a distance metric learning approach, existential constraints, and automatically generated constraints. With contributions from industrial researchers and leading academic experts who pioneered the field, this volume delivers thorough coverage of the capabilities and limitations of constrained clustering methods as well as introduces new types of constraints and clustering algorithms. The pursuit of artificial intelligence has been a highly active domain of research for decades, yielding exciting scientific insights and productive new technologies. In terms of generating intelligence, however, this pursuit has yielded only limited success. This book explores the hypothesis that adaptive growth is a means of moving forward. By emulating the biological process of development, we can incorporate desirable characteristics of natural neural systems into engineered designs and thus move closer towards the creation of brain-like systems. The particular focus is on how to design artificial neural networks for engineering tasks. The book consists of contributions from 18 researchers, ranging from detailed reviews of

recent domains by senior scientists, to exciting new contributions representing the state of the art in machine learning research. The book begins with broad overviews of artificial neurogenesis and bio-inspired machine learning, suitable both as an introduction to the domains and as a reference for experts. Several contributions provide perspectives and future hypotheses on recent highly successful trains of research, including deep learning, the Hyper NEAT model of developmental neural network design, and a simulation of the visual cortex. Other contributions cover recent advances in the design of bio-inspired artificial neural networks, including the creation of machines for classification, the behavioural control of virtual agents, the design of virtual multi-component robots and morphologies and the creation of flexible intelligence. Throughout, the contributors share their vast expertise on the means and benefits of creating brain-like machines. This book is appropriate for advanced students and practitioners of artificial intelligence and machine learning.

Is your memory hierarchy stopping your microprocessor from performing at the high level it should be? *Memory Systems: Cache, DRAM, Disk* shows you how to resolve this problem. The book tells you everything you need to know about the logical design and operation, physical design and operation, performance characteristics and resulting design trade-offs, and the energy consumption of modern memory hierarchies. You learn how to tackle the challenging optimization problems that result from the side-effects that can appear at any point in the entire hierarchy. As a result you will be able to design and emulate the entire memory hierarchy. Understand all levels of the system hierarchy -Xcache, DRAM, and disk. Evaluate the system-level effects of all design choices. Model performance and energy consumption for each component in the memory hierarchy.

This book develops the concepts underlying the design of adaptive arrays from first principles and is directed at research workers and designers whose mathematical background requires refurbishment in the special techniques which have accumulated around the field, often to the obscuration of the simple basic ideas.

Patent Retrieval addresses the question of how research and technology in the field of Information Retrieval assists, or even changes the processes of patent search. It is a survey of work done on patent data in relation to Information Retrieval in the last 20-25 years.

A statistical language model, or more simply a language model, is a probabilistic mechanism for generating text. Such a definition is general enough to include an endless variety of schemes. However, a distinction should be made between generative models, which can in principle be used to synthesize artificial text, and discriminative techniques to classify text into predefined categories. The first statistical language modeler was Claude Shannon. In exploring the application of his newly founded theory of information to human language, Shannon considered language as a statistical source, and measured how well simple n-gram models predicted or, equivalently, compressed natural text. To do this, he estimated the entropy of English through experiments with human subjects, and also estimated the cross-entropy of the n-gram models on natural text. The ability of language models to be quantitatively evaluated in this way is one of their important virtues. Of course, estimating the true entropy of language is an elusive goal, aiming at many moving targets, since language is so varied and evolves so quickly. Yet fifty years after Shannon's study, language models remain, by all measures, far from the Shannon entropy limit in terms of their predictive power. However, this has not kept them from being useful for a variety of text processing tasks, and moreover can be viewed as encouragement that there is still great room for improvement in statistical language modeling. Computational Photography combines plentiful computing, digital sensors, modern optics, actuators, probes, and smart lights to escape the limitations of traditional film cameras and enables novel imaging applications. This book provides a practical guide to topics in image capture and manipulation methods for generating compelling pictures for graphics, special effects, scene comprehension, and art. The computational techniques discussed cover topics

in exploiting new ideas in manipulating optics, illumination, and sensors at time of capture. In addition, the authors describe sophisticated reconstruction procedures from direct and indirect pixel measurements that go well beyond the traditional digital darkroom experience.

Ten years ago, the inaugural European Conference on Computer Vision was held in Antibes, France. Since then, ECCV has been held biennially under the auspices of the European Vision Society at venues around Europe. This year, the privilege of organizing ECCV 2000 falls to Ireland and it is a signal honour for us to host what has become one of the most important events in the calendar of the computer vision community. ECCV is a single-track conference comprising the highest quality, previously unpublished, contributed papers on new and original research in computer vision. This year, 266 papers were submitted and, following a rigorous double-blind review process, with each paper being reviewed by three referees, 116 papers were selected by the Programme Committee for presentation at the conference. The venue for ECCV 2000 is the University of Dublin, Trinity College. - unded in 1592, it is Ireland's oldest university and has a proud tradition of scholarship in the Arts, Humanities, and Sciences, alike. The Trinity campus, set in the heart of Dublin, is an oasis of tranquility and its beautiful squares, elegant buildings, and tree-lined playing- elds provide the perfect setting for any conference.

This handbook presents fundamental knowledge on the hardware/software (HW/SW) codesign methodology. Contributing expert authors look at key techniques in the design flow as well as selected codesign tools and design environments, building on basic knowledge to consider the latest techniques. The book enables readers to gain real benefits from the HW/SW codesign methodology through explanations and case studies which demonstrate its usefulness. Readers are invited to follow the progress of design techniques through this work, which assists readers in following current research directions and learning about state-of-the-art techniques. Students and researchers will appreciate the wide spectrum of subjects that belong to the design methodology from this handbook.

This book presents 13 peer-reviewed papers as written results from the 2005 workshop "Topology-Based Methods in Visualization" that was initiated to enable additional stimulation in this field. It contains a survey of the state-of-the-art, as well original work by leading experts that has not been published before, spanning both theory and applications. It captures key concepts and novel ideas and serves as an overview of current trends in its subject.

This book provides an introduction to the scientific fundamentals of groundwater and geothermal systems. In a simple and didactic manner the different water and energy problems existing in deformable porous rocks are explained as well as the corresponding theories and the mathematical and numerical tools that lead to modeling and solving them. This

This volume deals with land degradation, which is occurring in almost all terrestrial biomes and agro-ecologies, in both low and high income countries and

is stretching to about 30% of the total global land area. About three billion people reside in these degraded lands. However, the impact of land degradation is especially severe on livelihoods of the poor who heavily depend on natural resources. The annual global cost of land degradation due to land use and cover change (LUCC) and lower cropland and rangeland productivity is estimated to be about 300 billion USD. Sub-Saharan Africa (SSA) accounts for the largest share (22%) of the total global cost of land degradation. Only about 38% of the cost of land degradation due to LUCC - which accounts for 78% of the US\$300 billion loss – is borne by land users and the remaining share (62%) is borne by consumers of ecosystem services off the farm. The results in this volume indicate that reversing land degradation trends makes both economic sense, and has multiple social and environmental benefits. On average, one US dollar investment into restoration of degraded land returns five US dollars. The findings of the country case studies call for increased investments into the rehabilitation and restoration of degraded lands, including through such institutional and policy measures as strengthening community participation for sustainable land management, enhancing government effectiveness and rule of law, improving access to markets and rural services, and securing land tenure. The assessment in this volume has been conducted at a time when there is an elevated interest in private land investments and when global efforts to achieve sustainable development objectives have intensified. In this regard, the results of this volume can contribute significantly to the ongoing policy debate and efforts to design strategies for achieving sustainable development goals and related efforts to address land degradation and halt biodiversity loss.

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