List of Publications of Dr. Sankar K. Pal

List of 21 Books, 20 Conference Proceedings, 500 Research Papers (including 295 in International Journals, 62 in Edited Books, 143 in Conference Proceedings), and 3 US Patents.

a) Articles Published in Journals

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Implementation of Two-Dimensional Recursive Digital Filters by Sectioning", *IEE Proceedings-F*, vol. 129, no. 5, pp. 373-380, 1982.

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d) Books

Authored Books:

1. S.K. Pal and D. Dutta Majumder, Fuzzy Mathematical Approach to Pattern Recognition, John Wiley & Sons (Halsted), N.Y., 1986.

   ISBN: 0-470-27463-8, Pages: 280

   Foreword by: Prof. Lofti A. Zadeh, University of California, Berkeley.

   Contents: Introduction, Fuzzy Subsets and Properties, Classificatory Analysis, Preprocessing, Feature Selection and Primitive Extraction, Speech Recognition, Adaptive Classification, Fuzzy Grammars and Syntactic Recognition

   A detailed review of the book is provided by M. Roubens in *ACM Computing Reviews*, June 1987, pp. 308-309.

   The book received Best Production Award in the 7th World Book Fair, New Delhi, 1986.

   The book has been translated into Indonesian Bhasa and Chinese Languages. (https://www.tokopedia.com/maxisiahaan/fuzzy-pendekatan-matematik-untuk-pengenalan-pola-oleh-sankar-k-pal)

2. S.K. Pal and S. Mitra, Neuro-Fuzzy Pattern Recognition: Methods in Soft Computing, John Wiley, N.Y., 1999.

   ISBN: 0-471-34844-9, Pages: 408

   Foreword by: Prof. Lotfi A. Zadeh, University of California, Berkeley.

   Contents: Introduction, Fuzzy Logic and Neural Networks : Models, Integration, and Soft Computing, Pattern Classification, Other Applications of Fuzzy MLP, Self-

Organization, Pixel Classification, and Object Extraction, Feature Evaluation, Rule Generation and Inferencing, Using Knowledge-Based Networks and Fuzzy Sets, Rough-Fuzzy Knowledge-Based Networks.

Critical reviews of the book are provided by-
i)   Prof. Radim Belohlavek in Int. J. General Systems, 30(3), 411-413, May 2001 (https://doi.org/10.1080/03081070108960714) and
ii)   Prof. Scott Dick in IIE Transactions, 34(6), 585-587, 2002 (https://doi.org/10.1080/07408170208936921)

3. S.K. Pal and Simon C.K. Shiu, Foundation of Soft Case-Based Reasoning, John Wiley, N.Y., 2004.

    ISBN: 0-471-08635-5, Pages: 324

    Foreword by: Prof. Lotfi A. Zadeh, University of California, Berkeley.

    Contents: Introduction, Case Representation and Indexing, Case Selection and Retrieval, Case Adaption, Case-Base Maintenance, Applications, Fuzzy Logic, Artificial Neural Net- works, Genetic Algorithms, Rough Sets.

4. S.K. Pal and P. Mitra, Pattern Recognition Algorithms for Data Mining, Chapman & Hall CRC Press, Boca Raton, FL, 2004.

    ISBN: 1-58488-457-6, Pages: 280

    Foreword by: Prof. Lotfi A. Zadeh, University of California, Berkeley, Prof. Z. Pawlak, Polish Academy of Sciences, Warsaw, and Prof. Laveen N. Kanal, University of Maryland, College Park.

    Contents: Introduction, Multiscale Data Condensation, Unsupervised Feature Selection, Active Learning Using Support Vector Machine, Rough-fuzzy Case Generation, Rough-Fuzzy Clustering, Rough Self-Organizing Map, Classification, Rule Generation and Evaluation using Modular Rough-fuzzy MLP, Role of Soft-Computing Tools in KDD, Data Sets Used in Experiments.

5. S. Bandyopadhyay and S.K. Pal, Classification and Learning with Genetic Algorithms: Applications in Bioinformatics and Web Intelligence, Springer Verlag, Heidelberg, 2007.

    ISBN: 978-3-540-49606-9, Pages: 326

    Contents: Introduction, Genetic Algorithms, Supervised Classification Using Genetic Algorithms, Theoretical Analysis of the GA-Classifier, Variable String Lengths in GA-Classifier, Chromosome Differentiation in VGA-Classifier, Multi-objective VGA-Classifier and Quantitative Indices, Genetic Algorithms in Clustering, Genetic Learning in Bioinformatics, Genetic Algorithms and Web Intelligence, Appendices, References, Index.

    The book is unique in the sense of describing how a search technique, the genetic algorithm, can be used for pattern classification mainly through approximating decision boundaries, and it demonstrates the effectiveness of the genetic classifiers vis-a-vis several widely used classifiers, including neural networks. It provides a balanced mixture of theories, algorithms and applications, and in particular results from the bioinformatics and Web intelligence domains.

    The book has been critically reviewed and lauded in the IAPR newsletter, 30(4), page 12, 2008 (http://www.iapr.org/docs/newsletter-2008-04.pdf).

6. P. Maji and S.K. Pal, Rough-Fuzzy Pattern Recognition: Application in Bioinformatics and Medical Imaging, Wiley-IEEE, N.Y., 2012.

ISBN: 978-1-1180-0440-1, Pages: 312

Foreword by: Prof. Andrzej Skowron, University of Warsaw, Poland

Contents: Introduction, Rough-Fuzzy Hybridization and Granular Computing, Rough- Fuzzy Clustering: Generalized c-Means Algorithm, Rough-Fuzzy Granulation and Pattern Classification, Fuzzy-Rough Feature Selection using f-Information Measures, Rough Fuzzy c-Medoids and Amino Acid Sequence Analysis, Clustering Functionally Similar Genes from Microarray Data, Selection of Discriminative Genes from Microarray Data, Segmentation of Brain Magnetic Resonance Images, References, Index.

Emphasizing applications in bioinformatics and medical image processing, this text offers a clear framework that enables readers to take advantage of the latest rough-fuzzy computing techniques to build working pattern recognition models. The authors explain step by step how to integrate rough sets with fuzzy sets in order to best manage the uncertainties in mining large data sets. Chapters are logically organized according to the major phases of pattern recognition systems development, making it easier to master such tasks as classification, clustering, and feature selection. Numerous examples and case studies help readers better understand how pattern recognition models are developed and used in practice.

7. S.K. Pal, S.S. Ray and A. Ganivada, Granular Neural Networks, Pattern Recognition and Bioinformatics, Springer, Heidelberg, 2017.

ISBN: 978-3-319-57115-7, Pages: 227

Contents: Introduction to Granular Computing, Pattern recognition and Data Mining, Classification using Fuzzy Rough Granular Neural Networks, Clustering Using Fuzzy Rough Granular Self-organizing Map, Fuzzy Rough Granular Neural Network and Unsupervised Feature Selection, Granular Neighborhood Function for Self-organizing Map: Clustering and Gene Selection, Gene Function Analysis, RNA Secondary Structure Prediction: Soft Computing Perspective, Appendix, Index.

This book provides a uniform framework describing how fuzzy rough granular neural network technologies can be formulated and used in building efficient pattern recognition and mining models. Formation of granules in the notion of both fuzzy and rough sets is stated. Judicious integration in forming fuzzy-rough information granules based on lower approximate regions enables the network in determining the exactness in class shape as well as handling the uncertainties arising from overlapping regions; resulting in efficient and speedy learning with enhanced performance. Layered network and self-organizing analysis maps, which have a strong promise to Big data, are considered as basic modules.

The book is structured according to the major phases of a pattern recognition system (e.g., classification, clustering, and feature selection) with a balanced mixture of theory, algorithm and application. It covers the latest findings as well as directions for future research. Special emphasis is given to bioinformatics applications. The volume is recommended for both students and practitioners working in computer science, electrical engineering, data science, system design, pattern recognition, image analysis, neural computing, social network analysis, big data analytics, computational biology and soft computing.

8. D.B. Chakraborty and S.K. Pal, Granular Video Computing: with Rough Sets, Deep Learning and in IoT, World Scientific, Singapore, 2021.

ISBN: 978-981-122-711-0 (hardcover); 978-981-122-713-4 (e-book), pages: 256

Contents: Introduction: Video Processing, Granular Computing, Rough Sets, Deep Learning and IoT; Partial Supervised Tracking; Unsupervised Tracking; Unsupervised Occlusion Handling; Trustability Measures of Tracking Algorithms; Object Recognition and Deep Learning; Video Conceptualization; Index

This volume links the abstract concept of granular computing with object tracking and video analysis and their implementation in deep learning and the Internet of Things. It describes how different uncertainties, involved in the task of video processing, could be handled in rough set theoretic granular computing frameworks. Issues in video computing, such as object tracking from videos in constrained situations, occlusion/overlapping handling, measuring of the reliability of tracking methods, object recognition and linguistic interpretation in video scenes, and event prediction from videos, are the addressed in this volume. Methods to address the afore mentioned issues by reducing data dependency, as well as several unsupervised (without manual interaction/ labeled data/ prior information) methods are also described in this work. Rough-set approximation, and decision-making with rough rule-base are the two key features used in the book to deal with the incomplete knowledge-base, due to the unsupervised environments. Different aspects of rough sets (such as neighborhood rough sets, rough flow graph, adaptive rough rule-base) and granular computing (unequal granules, spatio-temporal granules, motion granules, and granulated deep learning) are explored based on the requirements of different problems along with their demonstration in real-time environments.

This book provides a balanced mixture between theory, algorithms and applications and shows the future scopes of the theories described in different applications. It may be used both as a textbook and reference book for graduate students and researchers in computer science, electrical engineering, system science, data science, and information technology, and is recommended for both students and practitioners working in computer vision, machine learning, video analytics, image analytics, artificial intelligence, system design, rough set theory, granular computing, and soft computing.

Edited Books:

9. J.C. Bezdek and S.K. Pal (Eds.), Fuzzy Models for Pattern Recognition: Methods that Search for Structures in Data, IEEE Press, N.Y., 1992.

   ISBN: 0-7803-0422-5, Pages: 539

   Foreword by: Prof. Lotfi A. Zadeh, University of California, Berkeley.

   Contents: Introduction, Cluster Analysis, Classifier Design and Feature Analysis, Image Processing and Machine Vision, Fuzzy Logic, Neural Networks and Learning in Pattern Recognition

   This book consists of 50 pages of original material (written by the authors) and 51 seminal papers (most of them are IEEE publications) reprinted from journals.

   The book was in the list of IEEE Best Seller books till 1995.

10. S.K. Pal and P.P. Wang (Eds.), Genetic Algorithms for Pattern Recognition, CRC Press, Boca Raton, Florida, 1996.

    ISBN: 0-8493-9467-8, Pages: 320

This book is unique of its kind and consists of 13 articles, written by leading scientists over the world, demonstrating how the effectiveness of Genetic Algorithms can be exploited for solving some existing problems of pattern recognition and for designing efficient systems.

11. S.K. Pal and A. Skowron (Eds.), Rough Fuzzy Hybridization: A New Trend in Decision Making, Springer Verlag, Singapore, 1999.

ISBN: 981-4021-00-8, Pages: 454

This is the first book on integrating rough sets and fuzzy sets for developing efficient decision making system with real life applications. It has 20 articles written by leading experts over the world.

12. S.K. Pal, A. Ghosh and M.K. Kundu (Eds.), Soft Computing for Image Processing, Physica Verlag, (Springer), Heidelberg, 2000.

ISBN: 3-7908-1268-4, Pages: 590

Foreword by: Prof. A. Rosenfeld, University of Maryland, College Park.

The volume provides a collection of 21 articles, written by leading experts all over the world, containing new material and describing, in a unified way with extensive real life applications, the merits and significance of performing different image processing/ analysis tasks in soft computing paradigm.

13. S.K. Pal, T.S. Dillon and D.S. Yeung (Eds.), Soft Computing in Case Based Reasoning, Springer Verlag, London, 2001.

ISBN: 1-85233-262-X, Pages: 372

Foreword by: Prof. H.J. Zimmenmann, Aachen, Germany.

The book, which is unique of its kind, describes how various soft computing tools can be applied to design and develop methodologies and systems with case based reasoning (CBR) for real life decision-making or recognition problems. It comprises 15 contributions from experts from all over the world.

14. S.K. Pal, A. Pal (Eds.), Pattern Recognition: From Classical to Modern Approaches, World Scientific, Singapore, 2001.

ISBN: 981-02-4684-6, Pages: 612

Foreword by: Prof. L. N. Kanal, University of Maryland, College Park.

The volume provides a collection of 21 articles, written by leading experts all over the world, describing the evolution and recent development of various pattern recognition methodologies with significant applications including data mining and knowledge discovery.

15. D. Zhang and S.K. Pal (Eds.), Neural Networks and Systolic Array Design, World Scientific, Singapore, 2002.

ISBN: 981-02-4840-7, Pages: 405

The volume, containing 16 chapters, describes in a unified way, the basic concepts, theories and characteristic features of integrating different facets of Neural Networks

(NNs) and Systolic Arrays (SAs), as well as presents recent developments and significant applications. The articles, written by experts from all over the world, demonstrate the various ways this integration can be made to efficiently design methodologies, algorithms and architectures, and also implementations, for NN applications.

16. A. Ghosh and S.K. Pal (Eds.), Soft Computing Approach to Pattern Recognition and Image Processing, World Scientific, Singapore, 2002.

ISBN: 981-238-251-8, Pages: 372

This volume provides a collection of sixteen articles containing review and new material. In a unified way, they describe the recent development of theories and methodologies in pattern recognition, image processing and vision using fuzzy logic, artificial neural networks, genetic algorithms, rough sets and wavelets with significant real life applications. The book details the theory of granular computing and the role of a rough-neuro approach as a way of computing with words and designing intelligent recognition systems. It also demonstrates applications of the soft computing paradigm to case based reasoning, data mining and bio-informatics with a scope for future research.

17. S.K. Pal, L. Polkowski and A. Skowron (Eds.), Rough-Neural Computing: Techniques for Computing with Words, Springer Verlag, Heidelberg, 2004.

ISBN: 3-540-43059-8, Pages: 734

Foreword by: Prof. Zdzistaw Pawlak, University of Information Technology and Management, Warsaw, Poland, and Prof. Lotfi A. Zadeh, University of California, Berkeley.

Exploring the potential and strength of neural networks, rough sets, and rough-fuzzy hybridization, this book is devoted to rough-neural computing, which is also related to the novel aspect of computing with words. It has 29 articles contributed by experts from all over the world and provides foundational and methodological issues as well as applications in various fields.

18. S.K. Pal and J.F. Peters (Eds.), Rough Fuzzy Image Analysis: Foundations and Methodologies, Chapman & Hall/CRC, Boca Raton, Florida, 2010.

ISBN: 978-1-4398-0329-5, Pages: 266

This is the first book under the series of Mathematical and Computational Imaging Sciences of Chapman & Hall/CRC. Emphasizing the utility of fuzzy, near and rough sets in image analysis, the volume having twelve chapters introduces the fundamentals and applications in the state of the art of rough-fuzzy image analysis. The volume is unique in the sense that it presents a new approach to image analysis using near sets and tolerance spaces; provides a complete implementation of near sets and offers the NEAR system for download on http://wren.ece.umanitoba.ca/; and covers an array of applications, particularly in medical imaging involving breast cancer diagnosis, laryngeal pathology diagnosis, and brain MR segmentation.

19. S.K. Pal, A. Petrosino and L. Maddalena, Handbook in Soft Computing for Visual Surveillance, Chapman & Hall/ CRC Press, Boca Raton, Florida, 2012.

ISBN: 978-1439856840, Pages: 342

Information on integrating soft computing techniques into video surveillance is widely

scattered among conference papers, journal articles, and books. Bringing this research together in one source, Handbook on Soft Computing for Video Surveillance illustrates the application of soft computing techniques to different tasks in video surveillance. Worldwide experts in the field present novel solutions to video surveillance problems and discuss future trends.

After an introduction to video surveillance systems and soft computing tools, the book gives examples of neural network-based approaches for solving video surveillance tasks and describes summarization techniques for content identification. Covering a broad spectrum of video surveillance topics, the remaining chapters explain how soft computing techniques are used to detect moving objects, track objects, and classify and recognize target objects. The book also explores advanced surveillance systems under development.

Incorporating both existing and new ideas, this handbook unifies the basic concepts, theories, algorithms, and applications of soft computing. It demonstrates why and how soft computing methodologies can be used in various video surveillance problems.

20. S. Misra and S.K. Pal (Eds.), Soft Computing Applications in Sensor Networks, Chapman & Hall/ CRC Press, Boca Raton, Florida, 2017.

ISBN: 13: 978-1-4822-9875-8, Pages: 284

The book provides research describing soft computing approaches in sensor networking, while investigating the novel solutions and discussing future trends in this field. With eleven chapters containing tutorials and new material, mostly written by prominent academicians, researchers and practitioners, the volume describes basic concepts, theory and algorithms that demonstrate why and how soft computing techniques can be used for sensor networking in different disciplines. Different case studies and applications topics considered include: smart node model for wireless sensor networks (WSNs), protocols for WSN routing, fault-tolerant routing in WSNs, optimal cluster head positioning in heterogeneous sensor networks, ubiquitous context aware services, energy-aware wireless body area networks in health care delivery, and the definition of various network entropy measures. After a brief tutorial-style introduction, each chapter provides a comprehensive description of the developments in its respective area.

21. A. Pal and S.K. Pal (Eds.), Pattern Recognition and Big Data, World Scientific, Singapore, 2017

ISBN: 978-98-1314-4545, Pages: 856

Containing twenty six contributions by experts from all over the world, this book presents both research and review material describing the evolution and recent developments of various pattern recognition methodologies, ranging from statistical, linguistic, fuzzy-set-theoretic, neural, evolutionary computing and rough-set-theoretic to hybrid soft computing, with significant real-life applications.

The volume provides state-of-the-art of classical and modern approaches to pattern recognition and mining, with extensive real life applications. It describes efficient soft and robust machine learning algorithms and granular computing techniques for data mining and knowledge discovery, and the issues associated with handling Big Data. Application domains considered include bioinformatics, cognitive machines (or machine mind developments), biometrics, computer vision, the e-nose, remote sensing and social network analysis.

e) Edited Conference Proceedings

1. N. Zhong, J. Bradshaw, S.K. Pal, D. Talia, J. Liu, and N. Cerrone (Eds.), Intelligent Agent

Technology (*Proc. 2004 IEEE/WIC/ACM International Conference, September 20-24, 2004, Beijing, China*), IEEE Computer Society, Los Alamitos, California, USA, 2004.

2. N. Zhong, S.K. Pal, Y.Y. Tang and J. Liu(Eds.), Wavelet Analysis and its Applica- tions and Active Media Technology (*Proc. International Computer Congress, May 28-30, 2004, Logistical Engineering University, P R China*), World Scientific Pub Co Inc. 2004.

3. S.K. Pal, S. Bandhyopadhyay, and S.N. Biswas (Eds.), Pattern Recognition and Machine Intelligence (*Proc. 1st International Conference on Pattern Recognition and Machine Intelligence (PReMI'05)*, December 20-22, 2005, Kolkata, India), Lecture Notes in Computer Science, Vol. 3776, Springer-Verlag, Berlin, 2005.

4. A. Ghosh, R.K. De and S.K. Pal (Eds.), Pattern Recognition and Machine Intelligence (*Proc. 2nd International Conference on Pattern Recognition and Machine Intelligence (PReMI'07)*, December 18-22, 2007, Kolkata, India), Lecture Notes in Computer Science, Vol. 4815, Springer-Verlag, Berlin, 2007.

5. V.D. Gesù, S.K. Pal and A. Petrosino (Eds.), Fuzzy Logic and Applications (*Proc. 8th International Workshop on Fuzzy Logic and Applications, (WILF 2009)*, June 9-12, 2009, Palermo, Italy), Lecture Notes in Artificial Intelligence, Vol. 5571, Springer-Verlag, Berlin, 2009.

6. S. Chaudhury, S. Mitra, C.A. Murthy, P.S. Sastry and S.K. Pal (Eds.), Pattern Recognition and Machine Intelligence (*Proc. 3rd International Conference on Pattern Recognition and Machine Intelligence (PReMI'09)*, December 16-20, Indian Institute of Technology, New Delhi, India, 2009), Lecture Notes in Computer Science, Vol. 5909, Springer, 2009.

7. D. Slezak, S.K. Pal, B.-H. Kang, J. Gu, H. Kuroda, T-h. Kim (Eds.), Signal Processing, Image Processing and Pattern Recognition (*Proc. Int. Conf. on Signal Processing, Image Processing and Pattern Recognition (SIP 2009)*, December 10-12, Jeju Island, Korea, 2009), Communications in Computer and Information Science, Vol. 61, Springer, 2010.

8. S.K. Pal, W.I. Groskey, N. Pissinou, T.K. Shih and D. Slezak (Eds.), Signal Processing and Multimedia (*Proc. Int. Conf. on Signal Processing, Image Processing and Pattern Recognition (SIP 2010)*, December 10-12, Jeju Island, Korea, 2010), Communica- tions in Computer and Information Science, Vol. 123, Springer, 2010.

9. S.O. Kuznetsov, D.P. Mandal, M.K. Kundu and S.K. Pal (Eds.), Pattern Recognition and Machine Intelligence (*Proc. 4th International Conference on Pattern Recognition and Ma- chine Intelligence (PReMI'11)*, June 27 - July 1, Higher School of Economics, Moscow, Russia, 2011), Lecture Notes in Computer Science, Vol. 6744, Springer, 2011.

10. M.K. Kundu, S. Mitra, D. Mazumdar and S.K. Pal (Eds.), Perception and Machine Intelligence (*Proc. 1st Indo-Japan Conference (PerMin 2012),* January 12-13, Kolkata, India, 2012), Lecture Notes in Computer Science, Vol. 7143, Springer-Verlag, Berlin, 2012.

11. P. Maji, A. Ghosh, M. Narasimha Murty, K. Ghosh and S.K. Pal (Eds.), Pattern Recognition and Machine Intelligence (*Proc. 5th International Conference on Pattern Recognition and Machine Intelligence (PReMI'13)*, December 10-14, 2013, Kolkata, India), Lecture Notes in Computer Science, Vol. 8251, Springer-Verlag, Berlin, 2013.

12. S.M. Thampi, A. Abraham, S.K. Pal and J.M.C. Rodriguez, (Eds.), Recent Advances in Intelligent Informatics (*Proc. 2nd International Symposium on Intelligent Informatics (ISI'13),* August 23-24, Mysore, India, 2013), Advances in Intelligent Systems and Computing, Vol. 235, Springer, Berlin, 2014.

13. M.K. Kundu, S. Chaudhury, S. Mitra, D. Mazumder and S.K. Pal (Eds.), Perception and Machine Intelligence, (*Proc. 2nd International Conference on Perception and Machine Intelligence Indo-Japan Conference (PerMin 2012),*February 26-27, 2015, Kolkata, India), ACM-ICPS, Vol. 0982, ACM, N.Y., 2015

14. M. Kryszkiewicz, S. Bandyopadhyay, H. Rybinski and S.K. Pal (Eds.), Pattern Recognition and Machine Intelligence (*Proc. 6th International Conference on Pattern Recognition and Machine Intelligence (PReMI'15), June 30 - July 3, 2015, Warsaw, Poland*), Lecture Notes in Computer Science, Vol. 9124, Springer-Verlag, Berlin, 2015.

15. B. Uma Shankar, K. Ghosh, D.P. Mandal, S.S. Ray, D. Zhang and S.K. Pal (Eds.), Pattern Recognition and Machine Intelligence (*Proc. 7th International Conference on Pattern Recognition and Machine Intelligence (PReMI'17), December 5-8, 2017, Kolkata, India*), Lecture Notes in Computer Science, Vol. 10597, Springer-Verlag, Berlin, 2017.

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