INDIAN STATISTICAL INSTITUTE

SYSTEMS SCIENCE & INFORMATICS UNIT

COMPUTER AND COMMUNICATION SCIENCES DIVISION
8TH Mile, Mysore Road, R.V. College Post, Bangalore, India
http://www.isibang.ac.in/~mmprta/

REGISTRATION FORM

THREE–DAY WORKSHOP ON

Mathematical Morphology and Pattern Recognition: Theory and Applications

(26 – 28 March 2013)

http://www.isibang.ac.in/~mmprta

1. Name of the participant :
2. Designation and Affiliation : Student/Researcher/Faculty Member/Others
3. Official Address :
4. Telephone Number(s) : E-mail id:
5. Academic Qualification :
6. Whether Accommodation required ? :
   (If yes, Gender) :

Note:

- The Completed registration form (scanned or hard copy) must reach us on before **10th March 2013** to **The Head Systems Science and Informatics Unit, Indian Statistical Institute, Bangalore Centre, 8th Mile, Mysore Road, R.V. College Post, Bangalore – 560 059. ssiu@isibang.ac.in, bsdsagar@isibang.ac.in**, Fax: 080 – 28483070.
- Number of participants is restricted to 30. Selection would be based on the qualification and its relevance to the topic of the workshop. Registration fee is waived for selected participants.

Place:

Date: Signature of the Participant

For further details please contact
B.S. Daya Sagar and **Saroj Kumar Meher - Convenors** Contact #: 080-**28483001-5,** Extn**: 540/534/535**

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THREE–DAY WORKSHOP ON

MATHEMATICAL MORPHOLOGY AND PATTERN RECOGNITION: THEORY AND APPLICATIONS

26 – 28 MARCH 2013

TECHNICAL SPONSORSHIP

IEEE Bangalore Section
Institute of Electrical and Electronic Engineers

INTRODUCTION

A Three - Day Workshop on "Mathematical Morphology and Pattern Recognition: Theory and Applications" is being organized during 26 - 28 March, 2013 at the Systems Science and Informatics Unit (SSIU), Indian Statistical Institute - Bangalore Centre

The two tracks in this three-day workshop include "Mathematical Morphology: Theory and Applications" and "Pattern Recognition: Theory and Applications". A host of algorithms developed based on the concepts of mathematical morphology would be covered in a series of 12 lectures by B. S. Daya Sagar. Applications of both classical and modern Pattern Recognition techniques would be covered in a series of 10 lectures by Saroj Meher.

Organizers (Sagar and Saroj) have framed the sequence of lectures in such a way that there would be an excellent coherence. These lectures are mainly intended for Postgraduate students, Ph.D. scholars, Post-Docs and young faculty members who would like to venture into research on the topics of the workshop. The number of participants is restricted to 30.

LECTURES

Track 1: Mathematical Morphology: Theory and Applications (Speaker: B. S. Daya Sagar)

Processing of remotely sensed data in both spatial and frequency domains has received wide attention. The application of remote sensing in various fields is greatly realized in the last three decades. One of the data derivable from remotely sensed data is a Digital Elevation Model (DEM) that provides rich clues about physiographic constitution of Earth planet, and Earth-like planetary surfaces. Remotely sensed data are available for various phenomena related to terrestrial, lunar, planetary surfaces, and atmospheric phenomena such as clouds in spatiotemporal mode. To address the intertwined topics—like pattern retrieval, pattern analysis, spatial reasoning, and simulation and modeling for understanding spatiotemporal behaviors of several of terrestrial phenomena and processes that could be acquired through remote sensing mechanisms—various original algorithms and modeling techniques that are mainly based on mathematical morphology (Matheron 1975, Serra 1982), fractal geometry (Mandelbrot 1982), and chaos theory (May 1976) have been developed and their utility has been demonstrated. During this workshop, a series of lectures on theory and applications of mathematical morphology and scaling concepts in addressing those mentioned intertwined topics. The key links that were shown between those topics–would be highlighted in a set of SEVEN lectures with several parts in each lecture.

- Lecture 1: Introduction to Mathematical Morphology
- Lecture 2: Mathematical Morphology in Terrestrial Pattern Retrieval
- Lecture 3: Mathematical Morphology in Terrestrial Pattern Analysis
  - Lecture 3.1: Terrestrial Surface Characterization: a Quantitative Perspective
  - Lecture 3.2: Size distributions, Spatial Heterogeneity and Scaling Laws
  - Lecture 3.3: Morphologic Shape Decomposition: Scale Invariant and Shape-Dependent Measures
  - Lecture 3.4: Granulometries, Convexity Measures and Geodesic Spectrum for DEM
- Lecture 4: Mathematical Morphology in Geomorphologic Modelling and Simulation
  - Lecture 4.1: Fractal-Skeletal-Based Channel Network Model
  - Lecture 4.2: Synthetic Models to Understand Spatiotemporal Dynamics of Certain Morphological Processes
- Lecture 5: Mathematical Morphology in Quantitative Spatial Reasoning and Visualization
- Lecture 6: Mathematical Morphology in Spatial Interpolations
  - Lecture 6.1: Conversion of Point-Data into Polygonal Map via WSKIZ
  - Lecture 6.2: Visualization of spatiotemporal behavior of discrete maps via generation of recursive median elements
- Lecture 7: Quantitative Characterization of Complex Porous Phase via Mathematical Morphology and Fractal Geometry

Track 2: Pattern Recognition: Theory and applications (Speaker: Saroj Kumar Meher)

- Pattern Recognition:

  •Introduction,
  • Overview of different approaches
  • Decision boundaries
  • Discriminant functions (linear and non-linear)
  • Training and test sets
  • Parametric and nonparametric learning
  • Minimum distance classifiers, k-NN rule,
  • Unsupervised learning, basic hierarchical and non-hierarchical clustering algorithms,
  • Dimensionality reduction, similarity measures, feature selection criteria and algorithms, principal components analysis, some applications.
  • Semisupervised and co-training learning algorithms
- Intelligent method of PR: Fuzzy Logic and Applications:

  • Brief overview of crisp sets
  • The notion of fuzziness; what, why and when to apply fuzzy set (Probabilistic and possibilistic)
  • Operations on fuzzy sets; fuzzy numbers. Crisp relations, fuzzy relations, Max_-composition of fuzzy relation; Max_-transitive closure; probability measures of fuzzy events; fuzzy expected value. Approximate reasoning, different methods of rule aggregation and defuzzification
- Intelligent method of PR: Neural Networks and applications:

  • Introduction to neural networks, threshold logic, circuit realization. Introduction to biological neural networks, significance of massive parallelism. Perceptron, perceptron learning rule and its convergence, multilayered perceptron, learning algorithms, function approximation, generalization, VC-dimension.
  •Neuro-fuzzy computing and other hybridization, independent component analysis.
- Granular computing based pattern recognition:

  • Fuzzy granulation
  • Rough granulation
  • Neural granulation and
  • Hybridization of the above