M.Tech. (Computational and Data Sciences) Admissions – 2017

Pre-interview Familiarization

Schedule:

10:00 AM – 10:45 AM: Introduction to CDS and M.Tech. (CDS) course program structure by Phaneendra Yalavarthy

10:45 AM – 11:30 AM: M.Tech(CDS) aptitude test and Interview process by Yogesh Simmhan

11:30 AM – 12:00 PM: Coffee Break

12:00 PM – 1:00 PM : Interactions with current MTech students and a tour of the department

http://cds.iisc.ac.in

Computational and Data Sciences (CDS)

- Part of interdisciplinary research division of IISc

- Formed on December 7, 2015 (> 1 year)

- All faculty/research labs/academic programs that were part of SERC were moved to CDS

- Located in SERC building

- Comes under faculty of engineering

Post Graduate Programs
at CDS

➢ Ph.D. – Doctoral program in Engineering

➢ M.Tech. (Research)–Masters program with thesis

➢ M. Tech (2 years): Masters program in Computational and Data Science

PEOPLE at CDS

Department of Computational and Data Sciences

- **Faculty**
  - ❑ Professors   5
  - ❑ Associate Professors   5
  - ❑ Assistant Professors   4+1
- **Students**
  - ❑ M.Tech.: 10+12 (II Year)
  - ❑ Masters by Research:22
  - ❑ Ph.D.: 31

- **Major Research Funding**
  - ❑ MHRD
  - ❑ DST, DIT, DBT, CSIR
  - ❑ MSR, IBM, Google, Yahoo, Boeing, TCS, AMD, Intel, …

Research Admission Streams
- ❑ Computer and Data Systems (CD-CS)
- ❑ Computational Science (CD-CP)

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Students @CDS

M.Tech. (Computational Science) – *existing program*

- Placements
    - Google
    - IBM
    - Yahoo
    - Nvidia
    - GE
    - Samsung
    - Financial firms like Mckinsey

- Further Studies
    - IISc Ph.D.
    - Ph.D. in top tier universities

2015: 2 Alumni as PhD students @ CDS
2016: 3 Alumni as New PhD students @ CDS

M.Tech. (Computational Science) Placements for outgoing batch*

COMPANY	Package (in Rs. Lakhs)
Oracle	22.5
Intel india	15
WALMART	21.77
Capital One	17.55
HP ENTERPRISE	15
NVIDIA	15.9
Intel India	15
Microsoft	21
Samsung R & D	25

* Data provided by placement cell as on Jan 30, 2017

Research Students

- Received Microsoft, TCS, and IBM Ph.D. fellowships

- Received international fellowships like SPIE Education Fellowships

- Numerous best paper awards

- Numerous travel fellowships from IBM, Google, and Yahoo

- Won many challenges, including recent GE Edison challenge

- Won prestigious fellowships line Humboldt fellowship after graduating

Research Areas @ CDS

Computer&Data Systems

- CAD for VLSI
- Computer Architecture
- Grid Application Research
- Cloud and Distributed Computing
- Machine Learning
- Database Systems
- Video Analytics

Computational Science

- Computational Electromagnetics
- Computational Photonics
- Medical Imaging
- Scientific Computing and Mathematical Libraries
- Computational Fluid Dynamics
- Computational Biology and Bioinformatics
- Numerical Linear Algebra

Computer Aided Design Laboratory

Soumitra Kumar Nandy   PhD (IISc)

Research
– Polymorphic ASICs
– Architecture of Runtime Reconfigurable SoC Platforms
– Compiling and Synthesis of Streaming Applications on Reconfigurable SoC Platforms
– QoS aware caching techniques for multi-core systems
– Architecture of Accelerators for applications in Bioinformatics, Deep Learning, Simulation, and Avionics

Publications
– Journals : 32,
– Conferences: 140

Research cooperation with
– SAFRAN
– STMicroelectronics
– Boeing
– Intel
– Bluespec
– Technical University, Delft, The Netherlands
– Leiden Institute of Advanced Computer Science, Leiden, The Netherlands
– Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

Technology Incubation
Morphing Machines Pvt. Ltd.

Middleware and Runtime Systems Lab

Sathish Vadhiyar Ph.D. (Tennessee)

Research

- **HPC Runtime Systems / Application Frameworks:**
  - Accelerator systems: CPU-GPU hybrid executions, programming models.
  - Large-scale systems: Scalability studies, processor allocation, mapping and remapping strategies on HPC network topologies.
  - Primary focus on irregular applications including graph applications, N-Body simulations, Molecular Dynamics (MD), and Adaptive Mesh Refinement (AMR) applications
  - Also worked with applications in climate science and visualization in collaboration with researchers working in these areas.

- **Middleware:**
  - Job Scheduling: prediction strategies and scheduling techniques for efficient job management on production supercomputer systems.
  - Fault Tolerance: For exascale applications using checkpointing and process replication.
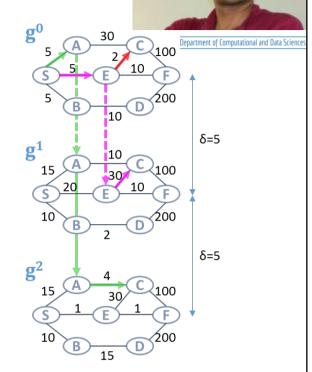
DREAM:Lab

Yogesh Simmhan PhD (Indiana Univ.)

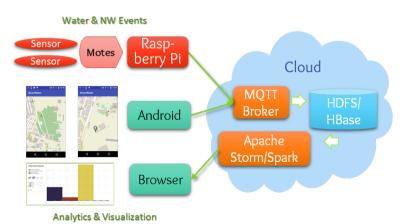- Distributed Research on Emerging Applications and Machines

Research Areas & Projects

- **GoFFish, GoDB**: Big Data platforms for time-series *graph analytics* & distributed graph querying

- **SmartCampus**: Software architectures for *Internet of Things*

- Event & stream processing across *edge & Cloud*

- Robust, Cost-efficient Scheduling of Dataflows on Clouds

Funding: DeitY, KSCST, NetApp, Microsoft, TechMahindra

Department of Computational and Data Sciences

Time-dependent Shortest Path using GoFFish

Water & NW Events

Analytics & Visualization

IoT for Smart Water Management @ IISc

Machine And Language Learning (MALL)

http://www.talukdar.net/
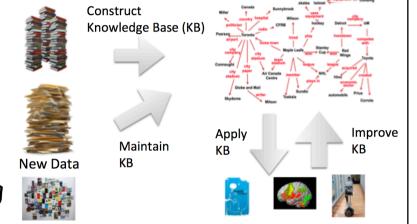
Partha Talukdar   PhD (U. Pennsylvania)

Department of Computational and Data Sciences

Research Topics

Machine Learning, Natural Language Processing (NLP)

Research Topics

Representation Learning for Machine Reading
Knowledge Graph Evaluation
Learning at Scale for Machine Reading
Goal-directed Knowledge Graph Construction
Entity-centric Knowledge Graph Expansion
Temporal Micro Reading
Deep Learning for Machine Reading

Construct Knowledge Base (KB)

New Data

Maintain KB

Apply KB

Improve KB

Automatically build, maintain, and make the Knowledge Graph available to intelligent applications (e.g., social media analysis, robotics, neuroscience, etc.) at the right granularity, right relevance, and right time.

Funding

Google Research, Accenture, Bosch, Nvidia

Database Systems Lab (DSL)

Jayant Haritsa   PhD (Wisconsin)

Research Topics

Query Optimization, Multilingual Databases, Data Mining, XML Databases
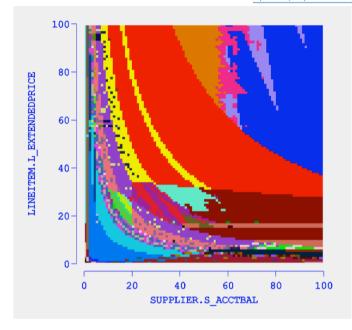
Major Projects

PICASSO: Visualization tool for analyzing behavior of industrial-strength database query optimizers

PLASTIC: Tool for reducing overheads of query optimization through plan recycling

MIRA: Multilingual database system for providing "natural-language-neutral" storage and operators

MASK: Algorithms for privacy-preserving mining of association rules

SUXESS: Database middleware for providing flexible cost-based solutions to XML storage and statistics

A diagram produced from the Picasso software tool capturing the complex and dense geometry of the optimality regions of different query optimizer strategies over the parameter space. The tool has been copyrighted by IISc and is currently in use at industrial and academic research institutions world-wide, serving as a powerful visual metaphor for understanding, investigating and redesigning database query optimizers.

Video Analytics Laboratory
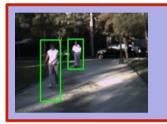
R. Venkatesh Babu, PhD(IISc)

Areas of Research

- Visual Surveillance and Monitoring
- Object Tracking
- Machine Learning in vision
- Human Activity Analysis
- Event Detection/Recognition
- Expression Recognition
- Crowd Behaviour Analysis
- Video Indexing and Retrieval
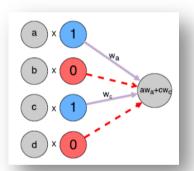- Compressed Domain Processing

R. Venkatesh Babu Ph.D. (IISc)

MULTI-EXPOSURE FUSION FOR DYNAMIC SCENES

DEEP LEARNING FOR EYE FIXATION PREDICTION AND SALIENT OBJECT SEGMENTATION

LEARNING THE ARCHITECTURE OF DEEP NEURAL NETWORKS
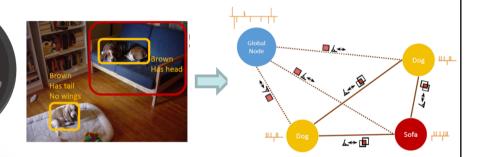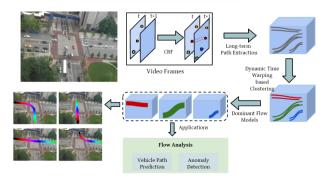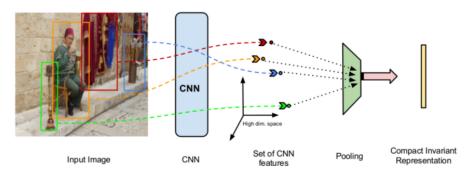
IMAGE RETRIEVAL USING DEEP ATTRIBUTE GRAPHS

DYNAMIC FLOW ANALYSIS FOR SURVEILLANCE

COMPACT REPRESENTATIONS USING DEEP OBJECT FEATURES

Anirban Chakraborty

Ph.D. (University of California, Riverside)

(Assistant Professor: starting in June 2017)

Research Areas:

Visual analytics, Data association over graphs, Data fusion and consistency, Applications of computer vision and machine learning in bio-medical image analysis, video surveillance.

Computational Science

Numerical Mathematics and Scientific Computing

Sashikumaar Ganesan, Dr.rer.nat. (Otto-von-Guericke U., Germany)

Research Interests
– Numerical (Finite Element) analysis and Mathematical modelling
– Stabilization methods, Multiscale methods, Numerical methods for turbulent flows
– Multigrid methods and ALE approach for computations of time-dependent domains
– Parallel algorithms and Scientific computing

Applications
– Free surface and two-phase flows with surfactants and heat transfer
– Moving contact line problems, Fluid-structure interaction
– PDEs and Surface PDEs in time-dependent domains
– Multidimensional equations, Population balance systems in time-dependent domains

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Computational Electromagnetics Lab

Atanu Mohanty   PhD (Brooklyn Polytechnic, New York)

Research Interests
- Analysis of ion traps
- Circuit models for eddy current problems

Current Research Activities
- Toroidal Ion Traps
- Induction Heating
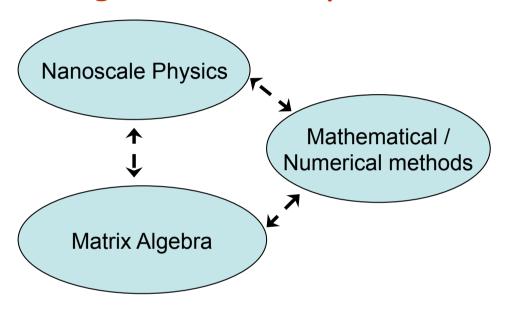- Magnetic Hysteresis

Past Research Activities
- Radar Absorbing Materials
- Microstrip Antennas
- MEMS Devices

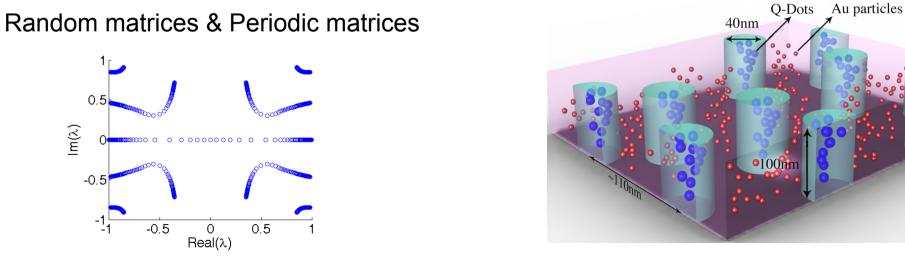**Funding/Collaboration**: DRDO

Comp. & Stat. Physics Group

Murugesan Venkatapathi PhD (Purdue)

Nanoscale Physics

Mathematical / Numerical methods

Matrix Algebra

Optical properties of nanoscale composites

N-body problems in emission

Q-Dots   Au particles

40nm

100nm

~110nm
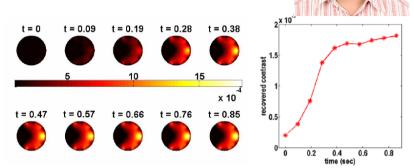
Random matrices & Periodic matrices

Im(λ)

Real(λ)

Medical Imaging Group

Phaneendra Yalavarthy
PhD (Dartmouth College, Hanover)

Research interests

Computational methods in medical imaging, multi-modal imaging, medical image reconstruction techniques, diffuse optical tomography, biomechanical modelling, neuroimaging

Dynamic Diffuse Optical Tomography

Research Projects

Breast Meshes – Simplification using topology preserving techniques
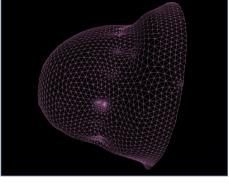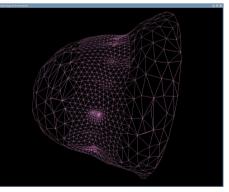
Medical Image Reconstruction:
- Dual Modality MRI-Diffuse Optical Tomographic Imaging
- Dynamic Diffuse Optical Tomography

Signal/Image Analysis:
- Automatic Lung Segmentation
- Computer Aided Diagnosis (CAD)
- Parametric modeling of breathing Signal

- ## Funding/Collaboration: Samsung, Indo-Europe (University of Twente, University of Bern), University College London, Brimingham University, ...

Structural Biology and Bio-computing

K. Sekar PhD(Madras)

http://www.physics.iisc.ernet.in/~dichome/sekhome/index.html

Research Interests

➢ Structural Biology

➢ Algorithm development

➢ Internet computing & creation of knowledgebases

➢ Structural Bioinformatics/Data Mining

Research Topics

❖ Elucidating the three-dimensional structure of protein molecules of biological importance.

❖ Developing algorithms for the identification of
  ✓ Interspaced repeats
  ✓ Repeat motifs in multiple sequences
  ✓ Protein structural similarities

❖ Creating web based computing engines and databases for the analysis of repeats, catalytic triads, salt bridges and protein structure comparison.

❖ Homopeptide repeats and disordered regions, present in *Mtb* H37Rv proteome, will be analyzed from a structure, function and evolutionary point of view.

Funding : DST, DBT and DIT, Govt. of India.
Collaboration : AIST Japan.

Biomolecular Computation Laboratory

Debnath Pal PhD (Bose Institute, Calcutta)

- Algorithm development for molecular biology
  - Protein-protein, protein-ligand interaction
  - Genome-wide function annotation
  - Analysis of regulatory elements in genome
  - Protein structure/conformation analysis and prediction

- Proteomics
  - Analysis of mass spectra of complex mixtures
  - Network modeling through expression profiling

- Microarray
  - Analysis of time-series data

Scientific Computation Laboratory

- **Soumyendu Raha,** PhD (Minnesota)

Current Research Interests:

- **Computational Mathematics**
  - **Constrained Stochastic Dynamical Systems**
  - **Constrained Dynamics with Delay and on Complex Networks**
  - **Data Assimilation to Constrained and Stochastic Dynamics**
- **Simulation & Accelerator Architecture**
  - **Numerical Algorithm & Coarse Grained Reconfigurable Architecture Co-design Applications**
- **Applications to**
  - **Aerospace and Robotics Control Systems**
  - **Biochemical Kinetics & Macro-molecular Chemistry**
  - **Crowd and Swarm Dynamics**

- **Funding** from Govt of India agencies (Dept of S&T, Space, Navy); Funded International Collaborations with Russian Academy of Sciences, Johannes Kepler University – Austria, Univ Amsterdam - Netherlands
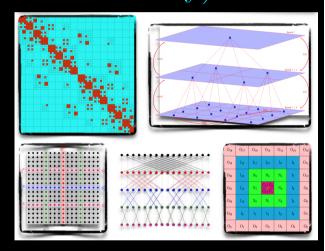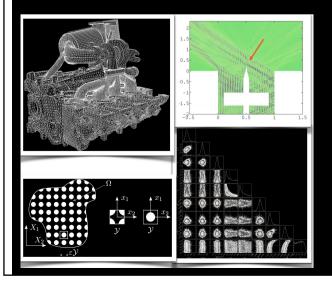
Thank You!