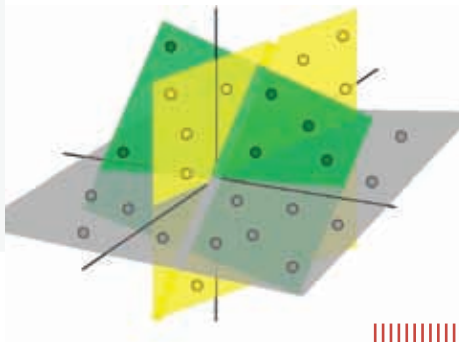
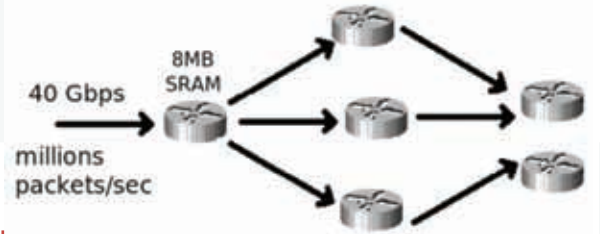


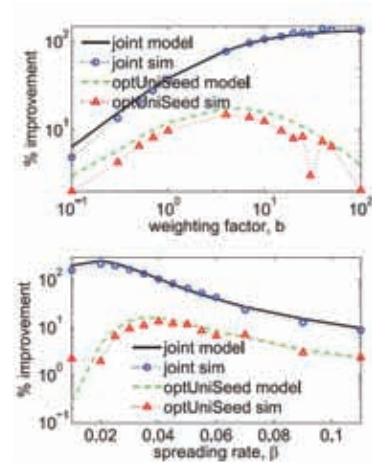
An algorithm to find the most frequent items in a data stream will have only a single pass since the huge amounts of data cannot be stored. With goal of minimizing the space used in such a computation, a new algorithm has been developed (**Bhattacharyya A**, Dey P and Woodruff DP. An Optimal Algorithm for  $\ell_1$ -Heavy Hitters in Insertion Streams and Related Problems. *Proceedings of the 35th ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems (PODS '16)*. 2016. 385-400).



In many applications, such as machine learning, it is useful to partition a hypergraph—find strongly connected groups of nodes with sparse connections between groups. An error bound for a hypergraph partitioning algorithm has been derived using statistical analysis (Ghoshdastidar D and **Dukkipati A**. Consistency of Spectral Hypergraph Partitioning under Planted Partition Model. *Annals of Statistics*. 2017. 45(1):289-315).

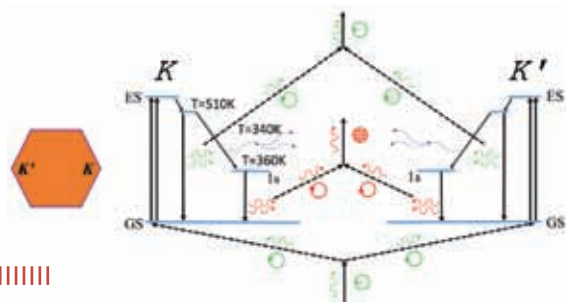


To spread information in a social network that has nodes of various degrees, it is better to allocate campaign resources using an optimal control method rather than use other strategies such as allocating resources uniformly throughout the campaign period, or doing so only during initial periods of the campaign (Kandhway K and **Kuri J**. Optimal Resource Allocation Over Time and Degree Classes for Maximizing Information Dissemination in Social Networks. *IEEE/ACM Transactions on Networking*. 2016. 24(5):3204-3217).



# RESEARCH SNAPSHOTS 2016

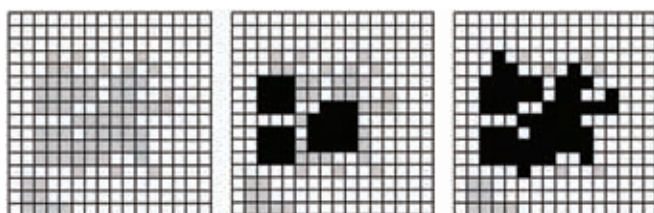
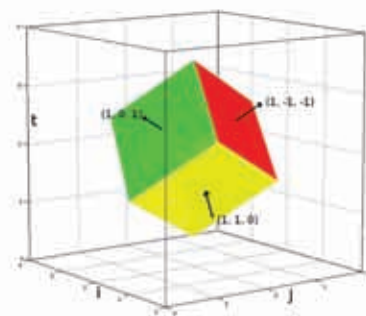
Room temperature valley coherence established using off-resonant excitation in monolayer transition metal dichalcogenides. Hot photoluminescence and Raman probe reveal energy relaxation pathways for photoexcited valley-coherent hot carriers (Kallatt S, Umesh G and **Majumdar K**. Valley-Coherent Hot Carriers and Thermal Relaxation in Monolayer Transition Metal Dichalcogenides. *Journal of Physical Chemical Letters*. 2016. 7(11):2032–2038).



Recording articulatory movements during speech production using electromagnetic articulograph involves placing several sensors on lips, jaw, tongue, and velum in the midsagittal plane, which can reconstruct the vocal tract shape with an average error of 2-3 mm (Afshan A and **Ghosh PK**. Improved Subject-Independent Acoustic-to-Articulatory Inversion. *Speech Communication*. 2015. 66:1-16).

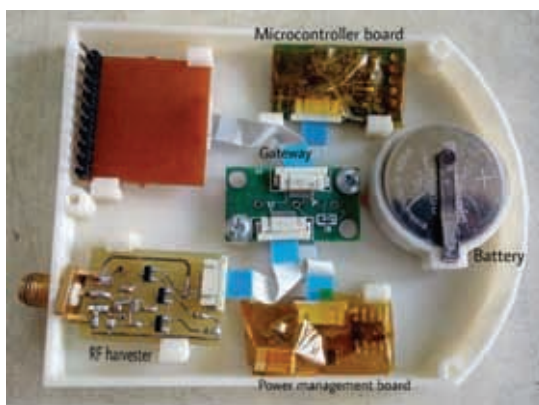
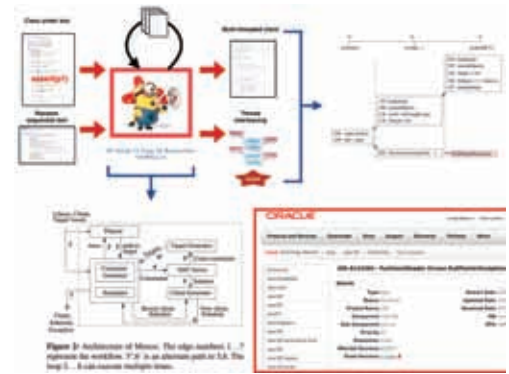


Tiling of iterations is used for parallel execution of loops in stencil computing, but existing methods for tiling can be inefficient. A better method is to use tiles of “diamond” shape, and an algorithm to find such tiles has now been developed (**Bondhugula U**, Bandishti V and Pananilath I. Diamond Tiling: Tiling Techniques to Maximize Parallelism for Stencil Computations. *IEEE Transactions on Parallel and Distributed Systems*. 2016. 99:1-16).



In magnetic media, artifacts that occur due to thermal asperities and media defects can lead to data erasures. Locating such erasures and recovering the data from these regions is necessary for reliable storage. A new model to study such defects and identify burst erasures has been developed, having greater than 90% accuracy (Matcha CK and **Srinivasa SG**. Defect Detection and Burst Erasure Correction for TDMR. *IEEE Transactions on Magnetics*. 2016. 52(11)).

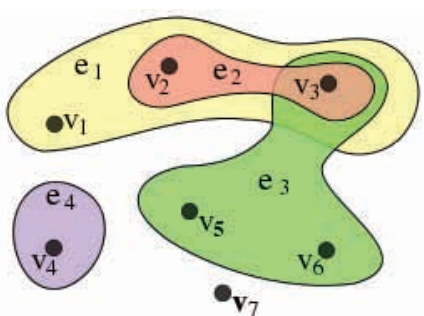
A dynamic program analysis framework to automatically generate crashes in concurrent software libraries (Samak M, Tripp O and **Ramanathan MK**. Directed synthesis of failing concurrent executions. *Proceedings of the 2016 ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages, and Applications*. Pages 430-446).



A battery-cum-harvested energy platform for guaranteed sensing and life time extension of sensor nodes. The novelty lies in the power management board. This modular design permits one or several harvesting sources that can be interfaced. The system is expected to work for at least 10 years (**Prabhakar TV**, Boeing ANRC project 2016).

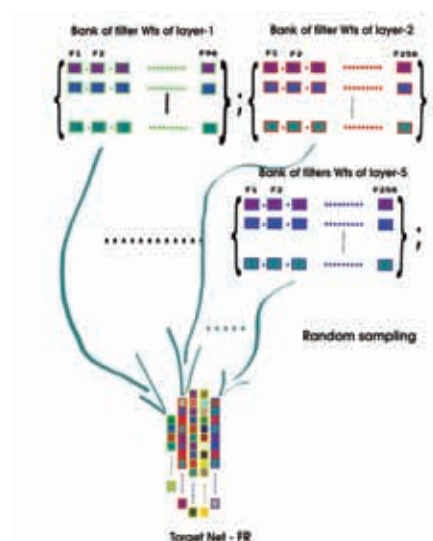


Demonstration of the feasibility of sparse signal recovery based wireless channel estimation. The experiment shows that by exploiting the inherent sparsity of wireless channels in the lag domain, one can reduce the pilot density (number of symbols used for channel estimation) by a factor of four and yet obtain the same performance as conventional channel estimation algorithms. This demonstration was presented by the lab of **CM Murthy** at the 9th International Conference on COMMunication Systems & NETworkS (COMSNETS, January 2017).



Separating any pair of disjoint edges of a hypergraph using a hyperplane normal to one of the axes may require embedding the vertices of the hypergraph in a higher-dimensional space. The smallest such dimension where this is possible is the separation dimension of the hypergraph. This study shows that the separation dimension of a hypergraph equals the boxicity of its line graph. (Basavaraju M, **Chandran LS**, Golumbic MC, Mathew R and Rajendraprasad D. Separation Dimension of Graphs and Hypergraphs. *Algorithmica*. 2016. 75:187-204).

Deep Neural Networks are among the most successful machine learning algorithms today. The figure represents a proposed method for efficient learning of deep Convolutional Neural Networks (CNNs) by reusing previously learnt filters. (Keerthi S, **Sastry PS** and Ramakrishnan KR. Bank of weight filters for deep CNNs. 8th Asian Conference on Machine learning (ACML2016), Hamilton, New Zealand, November 16 -18, 2016).



## RESEARCH HIGHLIGHTS

The Division of Electrical Sciences comprises four Departments: Computer Science and Automation; Electrical Communication Engineering; Electrical Engineering; and Electronic Systems Engineering.

A feature of the Division's R&D activities is its forays into contemporary, inter-disciplinary, and nationally relevant themes including Cyberphysical Systems, Cybersecurity, Data Science, and Neurocomputing. The Division is also actively participating in Institute level programs on Smart Energy, Smart Water, Smart Cities, and Devices for Healthcare, and Electronics for the Strategic Sector.