

Raj Kumar Rajendran

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Summary of Qualifications A combination of strong theoretical and system skills in computer networks, distributed systems and multimedia.

Exposure to a wide variety of problems, environments, tools and solution methodologies. Experience writing system, analytic and commercial software.

Research Interests Wired, wireless and ad-hoc computer networks, routing protocols, distributed-systems, video compression and semantics, multimedia, storage and databases.

Education Ph.D. Electrical Engineering, Columbia University, (Expected 2007)
Dissertation Topic: Strong Detection of Misconfiguration in networks.
Advisors: Dan Rubenstein, Vishal Misra

M.S. Computer Science, Columbia University, 1999

B.Tech. Engineering, The Indian Institute of Technology, Madras

Honors and Awards Second place, IEEE 2002 Sarnoff Symposium Student Paper Contest
Elected to Student Senate, Indian Institute of Technology, Madras.

Selected Publications Raj Kumar Rajendran, Vishal Misra, Dan Rubenstein. "Theoretical Bounds on Control Plane Self-Monitoring in Routing-Protocols" *ACM Sigmetrics 2007, San Diego, June 2007*

Raj Kumar Rajendran, Vishal Misra, Dan Rubenstein. "Strong Detection of Misconfigurations" *Brief Announcement, Principles of Distributed Computing (PODC) 2005, Las Vegas, July 2005,*
Full Version, Allerton, Illinois, Sept. 2006

Raj Kumar Rajendran, Dan Rubenstein. "Optimizing the quality of scalable video streams on P2P Networks" *Extended Abstract in ACM Sigmetrics 2004, New York, June 2004,*
Full Version in Journal of Computing Networks (JCN), June 2006

Raj Kumar Rajendran, Mihaela van der Scharr, Shih-Fu Chang. "FGS+:Optimizing the Joint SNR-Temporal Video Quality in MPEG-4 Fine Grained Scalable Coding" *IEEE International Symposium on Circuits and Systems 2002, Phoenix, May 2002*

Raj Kumar Rajendran, Shih-Fu Chang. "Image Retrieval with Sketches and Coherent Images" *International Conference on Multimedia Exposition 2000, New York, Aug 2000*

L. Golubchik, and Raj Kumar Rajendran. "A Study on the use of Tertiary Storage in Multimedia Systems." *Proceedings of the 16th IEEE Symposium on Mass Storage Systems, Washington, DC, March, 1998.*

Patents

S. F. Chang, A. Jaimes, Raj Kumar Rajendran, D. Zhong “Extracting Semantic Information from Video” *Columbia University, August, 2000*

A. Puri, R. L. Schmidt, R. K. Rajendran. “MPEG-4 Multimedia Object Search by Description” *AT&T, Jan 1999*

Research Experience

Graduate Research Assistant 2002-Present
Columbia University New York

Strong Detection of Misconfigurations: Thesis work sought to understand the inherent security of routing protocols in networks. It showed that individual nodes *can* sense misimplementation by other nodes by purely analysing unmodified state-information. Work established theoretical bounds on the classes of errors that can and can not be detected. Implemented practical algorithms for well-known static and dynamic-mobile routing protocols.

Further extended the idea of *strong detection* to identify and refresh temporally obsolete routes in dynamic ad-hoc networks. Demonstrated practicality and utility through an implementation of the technique for the AODV, DSR, DSDV and TORA routing protocols and by testing on the NS-2 environment.

Studied the problem of downloading video in bandwidth limited P2P networks: Showed that clients could achieve a required download rate through the use of layered video coding, buffering and clever scheduling of downloads from bandwidth limited server nodes. Derived theoretical offline performance bounds for optimal scheduling. Developed online heuristic algorithms that performed close to the bounds.

Image and Video Semantics: Extracted and indexed semantic information from images and videos. Used image-features and temporal-statistics in conjunction with character-recognition and learning techniques to annotate and guess semantically relevant portions of videos.

Databases and Multimedia Storage: Studied the utility of using tertiary-storage in multimedia servers. Extended the relational database model to improve its expressibility.

Summer Intern Summer 2006
Bell Labs, Lucent Technologies Murray Hill, NJ

Thwarting DDOS attacks through selective discard of requests: Developed a library for use by applications to degrade gracefully under dynamic denial-of-service (DDOS) attacks and overload conditions. The library uses machine-learning techniques and feedback from application to selectively discard requests.

Summer Intern Summer 2005
NEC Labs America Princeton, NJ

VoIP Overlay: Designed and implemented a VoIP overlay on PlanetLab that reroutes VoIP traffic so that voice quality is optimized. Additionally studied the effect of error-coding schemes and path-diversity techniques on voice quality.

Summer Intern Summer 2001
Philips Research, USA Scarborough, NY

MPEG-4 spatio-temporal scalability: Developed and implemented a spatio-temporal compression scheme for the MPEG-4 video codec. Conducted studies that provided guidelines on how limited bandwidth should be apportioned between spatial image quality and temporal video smoothness.

Summer Intern Summer 1999
AT&T Research Labs Red Bank, NJ
Semantic video and image search: Implemented a search feature that allowed users to search for visually similar items in a virtual shopping environment.

Employment Deutsche Bank Proprietary Trading New York, NY
Consultant 2001-2004 (Part Time)
Developed analytic, real-time software for equity-pairs and convertible bond trading. Implemented a responsive user-interface that allowed traders to annotate and quantize trading decisions. Helped found and manage an offshore software-development team based in Chennai, India for the traders.

BoxHill Systems New York, NY
Engineer 1994-1998
Developed Redundant Array of Inexpensive Disk (RAID) storage arrays. Implemented firmware that controlled the RAID system and developed interfaces for users to administer the RAID Systems.

Computer Skills *Languages:* Java, C++, Perl, UNIX, Windows
Software: Extensive experience in developing a wide variety of software: low-level device code, analytic software, application software and user-interfaces.
Systems: UNIX system administration.

Professional Service *Organizing Committee for:* IEEE Intl. Conf. on Multimedia Expo 2000
Reviewer for: Journal of Visual Communication and Image Representation, Journal of Visual Languages and Computing, Journal of Computer Vision and Image Understanding, ACM Transactions on Information Systems, IEEE Multimedia Signal Processing Workshop, IEEE Transactions on Circuits and Systems for Video Technology, Conference on Systems for Video Transmission, Research Grants Council.

Languages *Fluent:* Tamil
Beginner: French, Spanish, Hindi, Mandarin

Other Interests *Outdoors:* Hiking, Kayaking, Rock-Climbing
Sports: Squash, Ultimate Frisbee, Biking
Hobbies: Ceramic Pottery, Fiction, Film