Dr. KRISHNA KANT CHINTALAPUDI

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Goal. To incubate and lead a disruptive solution or product that requires deep multi-disciplinary technological expertise.

Summary. I have 18+ years of corporate research experience in inventing novel and disruptive ideas and delivering them as products and platform solutions. I have

- pitched disruptive, novel ideas and opportunities for technological innovation for products/services to senior leadership (including Satya Nadella) and led incubation efforts with external as well as internal customers to deliver them as solutions, some of which have now been incorporated into Microsoft's products.
- contributed to next generation product definition and architecture specification and worked with external vendors and developers to deliver cutting edge solutions in established product lines such as Xbox.
- established thought leadership through fundamental research through 40+ peer reviewed research publications in flagship conferences with 8500+ citations and awarded 30+ USPTO patents. Received the ACM Test of Time Award.

Multi-disciplinary Research Experience and Technical Expertise

- AI/ML, Video Analytics, Machine Vision, Multi-armed Bandits, Reinforcement Learning
- Networking and Systems for Real-Time Applications - Gaming, Media Streaming and Hard Real-Time Control
- Wireless Communication, Embedded Networking, Systems, Internet of Things
- Signal/Image/Video Processing

Work Experience

- Principal Researcher, Microsoft Research, Redmond, Networking Research Group (Dec 2015-current)
- Researcher, Microsoft Research, India, Bangalore, Networking and Systems (Apr 2009- Dec 2015)
- Bosch Research and Technology Centre, Palo Alto, CA, USA (Sept 2005-Apr 2009)

Education

- PhD in Computer Science, University of Southern California, Los Angeles, CA – 2006.
- MS in Electrical Engineering, Networking, University of Southern California, Los Angles, CA – 2002.
- MS in Electrical Engineering, Signal Processing and Control Systems, Drexel University, Philadelphia, PA – 1999.
- BTech in Electrical Engineering, Indian Institute of Technology (IIT) Varanasi, India – 1997.

Product Impact

- Currently the architect and research lead for the communication solution between the next generation Xbox console and controllers/accessories.
- Led the research and delivered multi-label fusion for image classification, multi-object detection and image segmentation for Azure ML labelling service.
- Delivered a real-time video analytics solution for Bellevue Department of Transport for per-lane car counting and pedestrian detection from their live traffic cams.
- Selected among the top five researchers to pitch a novel disruptive business opportunity to Satya Nadella for the annual Disruptive Technology Review (DTR) at Microsoft. The idea was to leverage unused pager spectrum for city scale IoT. The pitch led to a solution with the company Compass Group for an IoT solution for field services (food catering, water and beverage distribution) that spanned 300 sq km and 100+ vehicles covering the cities of Seattle, Redmond, Sammamish, Bothell and Bellevue.
- Invented, built and delivered the EZ indoor location technology for Microsoft's Orion location service that was deployed in over 50 malls and airports.

Research Impact

- Received the prestigious ACM Test of Time Award for pioneering research on Structural Health Monitoring – "for its impact on early sensor networks and its broader impact in the area of Structural Health Monitoring in the civil engineering domain."
- 40+ peer reviewed academic publications in venues such as ICLR, SIGCOMM, NSDI, ASPLOS, Mobicom, Infocom, Mobihoc, with over 8500 citations.
- Served as a member of the FCC AI Technical Advisory Committee (2022-23).
- Pioneered the first large-scale automated image and video annotation system for machine vision applications in 2016 including a pipeline for data ingestion and pre-processing, generating and disseminating mini tasks for human workers, automated quality control based on multi-annotation fusion, active learning to minimize costs, automated worker pricing, worker payments and worker filtering. This research eventually fed into the Azure ML labelling service.
- Managed research partnerships with universities such as MIT, Carnegie Mellon University, University of Washington, University of Wisconsin Madison, Rice University etc. and co-mentored students as well as junior faculty. Several of my mentees and interns are now faculty in top US universities including MIT, Georgia Tech, NYU, Univ. of Wisconsin Madison, Cornell University, University of California, Riverside etc.

Select Project Summaries

- *Principal Researcher, Microsoft Research Labs Redmond, WA, U.S.A* Dec. 2020-present
  - **Communication Protocol Design for Next Generation Xbox Console and Accessories –** Co-architect and research lead for the communication protocol between the console and controllers/accessories for the next generation of Xbox console, controllers and gaming accessories. The protocol establishes the state-of-the-art in latency and power consumption, beating the existing design by 4X and 20%. I worked alongside multiple Xbox teams through the Business Opportunity Proposal, Product Definition, RFP and Vendor Selection, Architecture Specification, Engineering Verification as well as managed development with external vendors.
  - **Satyam and Multi-label fusion for Azure ML Labelling Service –** I conceived, architected, developed and deployed "Satyam", the first of its kind system developed to collect large scale groundtruth annotations for training, testing and maintenance of machine vision tasks for video analytics, including classification, object detection, segmentation and video tracking. Satyam provides a completely automated pipeline including data ingestion and pre-processing, creating tasks for human workers for groundtruth annotation, automated quality control loops based on multi-annotation fusion, active learning based sub-sampling, automated worker pricing and payments and worker filtering. The system has been extensively used within Microsoft Research to annotate millions of images. Satyam's multi-annotation fusion for quality control is now a part of the Azure machine labelling service within the Azure Machine Learning Platform.
  - **City Scale IoT for Field Services, Transportation and Logistics -** My idea was selected among the top five research projects in the annual Disruptive Technology Review and presented to Satya Nadella. It featured a novel technology of reusing paging frequency bands to transmit IoT data over long distances and offer 5-10x the range of technologies such as LoRA. I worked with the IoT business development team to put together a business plan to demonstrate its viability and with telecom deployment and planning companies to arrive at a deployment plan for the states of California and Illinois. Subsequently, I led a partnership with the Compass Group to develop a solution to support IoT services for food catering, water and beverage distribution, and facility management spanning 300 sq Km and over 100 vehicles across the cities of Bellevue, Sammamish, Redmond, Medina, Bothell and parts of Seattle.
  - **Real-Time Traffic Video Analytics for City of Bellevue –** I was part of a six-person research team for a solution towards real-time traffic video analytics for the city of Bellevue. I was responsible for designing, implementing and testing vision algorithms for real-time per lane car counting and traffic flow live video stream from traffic cameras.
- *Researcher, Microsoft Research Labs, Bangalore, India* Dec. 2009-2015
  - **Orion Indoor Location Service –** I pioneered the first technique for large scale indoor localization by leveraging crowdsourcing on mobile phones. It used AI-based techniques to learn the radio propagation models in the indoor environment from measurements crowdsourced from multiple users. The papers "EZ Localization" followed by "Zee" are considered pioneering and have over 2500 citations on Google Scholar. The research led to the Orion Indoor localization service from Microsoft that was shipped with the Windows Phone.
- *Senior Research Engineer, Bosch Research Laboratory, Palo Alto, CA, U.S.A* Dec. 2005-2009
  - **Wireless System for Hard Real-Time Industrial Control -** Industrial control systems require a high reliability of 10^-9, have strict latency bounds of 20ms. Working with a hardware designer, I designed, implemented, deployed and tested a PoC to demonstrate a new proprietary state of the art prototype wireless system that supported 120 wireless sensors that delivered the above requirements.

Awards and News Coverage

- **Accurate Media Time-Synchronization for Cloud Gaming (2023) –** Recent work on time-synchronization for cloud gaming published in SIGCOMM 2023, received wide news coverage including MIT news, Tech Times, Science Daily etc.
- **ACM Test of Time Award (2022) –** Awarded the ACM Test of Time Award for my pioneering work on structural health monitoring. The award is given to research that has had a significant impact on the field for over a decade.
- **Acoustic Information Theoretically Secure NFC on Mobile Phones (2013) –** Invented a new form of near-field communication (NFC) for mobile phones, one that even works on devices that lack any kind of specialized NFC hardware. This received news coverage tech magazines such as Slashdot, Computer World, The Register, Extremetech.

Professional and Academic Activities

- Member of Technical Advisory Committee for the FCC, AI Working group Mar 2022-till date
- Associate Editor, IEEE Transactions on Mobile Computing Jan 2014-Jan 2017
- Technical Program Committees: Mobicom'19, Mobicom'18, MobiSys' 17, MobiSys'13, SIGCOMM'12, COMSNETS'12, SECON'15, SECON '10, SECON'09, Workshop on Physical Analytics 2015,
- Technical Program Committee Co-Chair, Wireless Networking and Measurement, 2015
- Invited Expert Reviewer: SIGCOMM'21,'13,'14, NSDI '14, Ubicomp '12,'13,'14',15
- Invited Journal Reviews: Transactions on Mobile Computing, IEEE Transactions on Networking, IEEE Transactions on Parallel and Distributed Systems, Transactions on Sensor Networks

Publications

- "Ekho: Synchronizing Cloud Gaming Media Across Multiple Endpoints", Pouya Hamadanian, Doug Gallatin, Mohammad Alizadeh, Krishna Chintalapudi, *SIGCOMM 2023* (**Networking**, **Cloud Gaming**, **AR/VR**)
- "MCAL: Minimum Cost Human Labelling", Hang Qiu, Krishna Chintalapudi, Ramesh Govindan, *ICLR 2023* (**AI/ML**)
- "OpenLoRa: Validating LoRa Implementations through an Extensible and Open-sourced Framework", Manan Mishra, Daniel Koch, Muhammad Osama Shahid, Bhuvana Krishnaswamy, Krishna Chintalapudi, Suman Banerjee, NSDI 2023 (**Networking, IoT**)
- "Kodan: Addressing the Computational Bottleneck in Space", Brad Denby, Brandon Lucia, Shadi Noghabi, Krishna Chintalapudi, Ranveer Chandra, *ASPLOS 2023* (**AI, Compute in Space, Networking**)
- BSMA: scalable LoRa networks using full duplex gateways Raghav Subbaraman, Yeswanth Guntupalli,, Shruti Jain, Rohit Kumar, Krishna Chintalapudi, Dinesh Bharadia MobiCom '22: Proceedings of the 28th Annual International Conference on Mobile Computing And Networking October 2022 (**IoT**)
- "Towards a Cost vs. Quality Sweet Spot for Monitoring Networks", Nofel Yaseen, Behnaz Arzani, Krishna Chintalapudi, Vaishnavi Ranganathan, Felipe Vieira Frujeri, Kevin Hsieh, Daniel S. Berger, Vincent Liu, Srikanth Kandula, *HotNets 2021*, (**Networking, Telemetry**)
- "Concurrent Interference Cancellation: Decoding Multi-Packet Collisions in LoRa", Muhammad Osama Shahid, Millan Philipose, Krishna Chintalapudi, Suman Banerjee, Bhuvana Krishnaswamy, *ACM SIGCOMM 2021*, (**Networking, IoT**)
- "Optimizing Onsite Food Services at Scale", Konstantina Mellou, Luke Marshall, Krishna Chintalapudi, Patrick Jaillet, Ishai Menache, *ACM SIGSPATIAL 2020* (**IoT, Optimization**)
- "Blind Distributed MU-MIMO for IoT Networking over VHF Narrowband Spectrum", Chuhan Gao, Mehrdad Hessar, Krishna Chintalapudi, Bodhi Priyantha, *MobiCom 2019* (**IoT, Networking**)
- Creating the Perfect Illusion : What will it take to Create Life-Like Virtual Reality Headsets? Eduardo Cuervo, Krishna Chintalapudi, Manikanta Kotaru,HotMobile'18 February 2018 (**AR/VR**)
- "SATYAM: Democratizing Groundtruth for Machine Vision", Krishna Chintalapudi, Hang Qiu, Ramesh Govindan, (arXiv 2018) (**AI, Machine Vision, Video Analytics**)
- "Real-time Video Analytics: the killer app for edge computing", Ganesh Ananthanarayanan, Victor Bahl, Peter Bodík, Krishna Chintalapudi, Matthai Philipose, Lenin Ravindranath Sivalingam, Sudipta Sinha, IEEE Computer,2017 (AI/ML, Video Analytics)
- Skip-Correlation for Multi-Power Wireless Carrier Sensing Romil Bhardwaj, Krishna Chintalapudi, Ramachandran Ramjee, USENIX NSDI March 2017 (**Wireless Communication, Networking**)
- IQ-Hopping: Distributed Oblivious Channel Selection for Wireless Networks Apurv Bhartia, Deeparnab Chakrabarty, Krishna Chintalapudi, Lili Qiu, Bozidar Radunovic, Ramachandran Ramjee, MobiHoc '16 Proceedings of the 17th ACM International Symposium on Mobile Ad Hoc Networking and Computing, Paderborn, Germany July 2016 (**Wireless Communication, Networking**)
- A Critique of FCC'S TV White Space Regulations, Krishna Chintalapudi, Ramachandran Ramjee, GetMobile January 2016, Vol 20: pp. 20-25 (**Wireless Communication**)
- Enabling Physical Analytics in Retail Stores Using Smart Glasses Swati Rallapalli, Aishwarya Ganesan, Krishna Chintalapudi, Venkat Padmanabhan, Lili Qiu, ACM Mobicom 2014 September 2014 (**AI, Video Analytics**)
- Dhwani: Secure Peer-to-Peer Acoustic NFC, Krishna Chintalapudi, Venkat Padmanabhan, Ramarathnam Venkatesan, SIGCOMM August 2013 (**Wireless Communication**)
- Centaur : Locating Devices in an Office Environment, Krishna Chintalapudi, Venkat Padmanabhan, Mobicom August 2012 (**AI/ML, IoT**)
- Zee: Zero-Effort Crowdsourcing for Indoor Localization, Krishna Kant Chintalapudi, Venkat Padmanabhan, Rijurekha Sen, Mobicom August 2012 (**AI/ML, IoT**)
- WiFi-NC : WiFi Over Narrow Channels, Krishna Chintalapudi, Bozidar Radunovic, Vlad Balan, Michael Buettener, Vishnu Navda, Ramachandran Ramjee, Srinivas Yerramalli, NSDI April 2012 (**Wireless Communication, Networking**)
- WiFi-Nano : Reclaiming WiFi Efficiency through 800 ns slots, Eugenio Magsiretti, Krishna Chintalapudi, Bozidar Radunovic, Ramachandran Ramjee, Mobicom September 2011 (selected among top 5 contenders for best paper award) (**Wireless Communication, Networking**)
- SpecNet: Spectrum Sensing Sans FrontiÃ¨res Anand Padmanabha Iyer, Krishna Chintalapudi, Vishnu Navda, Ramachandran Ramjee, Venkat Padmanabhan, Chandra R. Murthy, 8th USENIX Symposium on Networked Systems Design and Implementation (NSDI) March 2011 (**Systems, Wireless Communication, Networking, IoT**)
- Indoor Localization Without the Pain Krishna Chintalapudi, Anand Padmanabha Iyer, Venkat Padmanabhan, Mobicom September 2010 (**AI/ML, IoT**)

- I-MAC – a MAC that learns Krishna Chintalapudi, International Conference on Information Processing in Sensor Networks (IPSN) April 2010 (**Wireless Communication, Networking**)
- On the Design of MAC Protocols for Low-Latency Hard Real-Time Discrete Control Applications Over 802.15.4 Hardware Krishna Chintalapudi, Lakshmi Venkatraman, SPOTS-IPSN January 2008 (**Wireless Communication, Networking**)
- M. Senel, K. Chintalapudi, D. Lal, A. Keshavarzian, E. Coyle, "A Kalman Filter Based Link Quality Estimation Scheme for Sensor Networks," Proceedings Globecom 2007. (**Networking, Wireless Communication**)
- K. Chintalapudi, J. Paek, O. Gnawali, T. Fu, K. Dantu, J. Caffrey, R. Govindan, E. Johnson, "Structural Damage Detection and Localization Using NetSHM", accepted in Proc. SPOTS/IPSN 2006. (**IoT**)
- K. Chintalapudi, Tat Fu, Jeonguep Paek, Nupur Kothari, Sumit Rangwala, John Caffrey, Ramesh Govindan, Erik Johnson, and Sami Masri, "Monitoring Civil Structures Using a Network of Wireless Sensors" IEEE Internet Computing, Speical Issue on Sensor Networks, 2006. (**IoT**)
- K. Chintalapudi,T. Fu, E. Johnson, R. Govindan," Distributed Structural Damage Detection and Localization Using Wireless Sensor Networks", Proc. of the 5th International Workshop on Structural Health Monitoring, September 2005. (**IoT**)
- K. Chintalapudi, J. Paek, R. Govindan, E. Johnson, "Embedded Sensing of Structures: A Reality Check", Proc. of the 11th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications, August 2005 (**IoT**)
- J. Paek, K. Chintalapudi, J. Caffrey, R. Govindan, S. Masri," A Wireless Sensor Network for Structural Health Monitoring: Performance and Experience," Proc. of the Second IEEE Workshop on Embedded Networked Sensors, May 2005 (**IoT**)
- K. Chintalapudi, E. A. Johnson and R. Govindan," Structural Damage Detection using Wireless Sensor-Actuator Networks," 13th Mediterranean Conference on Control and Automation, Cyprus, 27-29, June 2005. (**IoT**)
- Ning Xu, Sumit Rangalwala, Krishna Chintalapudi, Deepak Ganeshan, Alan Broad, Ramesh Govindan and Deborah Estrin, "A Wireless Sensor Network for Structural Monitoring," Proc. Sensys 2004. (**IoT**)
- John Caffrey, Ramesh Govindan, Eric Johnson, Bhaskar Krishnamachari, Sami Masri, Gaurav Sukhatme, Krishna Chintalapudi, Karthik Dantu, Sumit Rangwala, Avinash Sridharan, Ning Xu, Marco Zuniga, "Networked Sensing for Structural Health Monitoring," International Workshop on Structural Control, Columbia University, New York, June, 2004. (**IoT**)
- D.H. Whang, Ning Xu, Sumit Rangawala, K. Chintalapudi, R. Govindan, J. W. Wallace, "Development of an Embedded Networked Sensing System for Structural Health Monitoring", International Workshop on Smart Materials and Structures Technology, Hawai,2004. (**IoT**)
- K. Chintalapudi, A. Dhariwal, R. Govindan, G. Sukhatme, "Localization Using Ranging and Sectoring", INFOCOM 2004. (**IoT**)
- K. Chintalapudi, R. Govindan, "Localized Edge Detection In Sensor Fields" , Ad-hoc Networks Journal, 2003, pp.(273-291). (**IoT**)
- K. Chintalapudi and R Govindan, "Localized Edge Detection in Sensor Fields", Proc. IEEE SNPA, 2003. (**IoT**)
- Shahram Ghandeharizadeh, Christos Papadopoulos, Min Cai, Krishna K. Chintalapudi, "Performance of Networked XML-Driven Cooperative Applications", Proc. CIC 2002. (**Networking, Systems**)
- K.K.Chintalapudi and Moshe Kam, "Fuzzy Clustering of Star Shaped Objects," Proc. CISS'99, pp. (1280-1286). (**AI/ML**)
- Krishna Kant Chintalapudi and Moshe Kam, "The Credibilistic Fuzzy C Means Algorithm", Proc. IEEE SMC'98, pp.(2034-2040). (**AI/ML**)
- K.K.Chintalapudi and N.R.Pal, "A Novel Scheme to Reduce and Determine the Architecture of a Multilayer Perceptron Network," Proc. of the IEEE Conference on Systems, Man, and Cybernetics, pp. 2034-2040, 1998 (**AI/ML**)
- K.K.Chintalapudi and Moshe Kam "A Noise Resistant Fuzzy c Means", Proc. of the IEEE Conference on Fuzzy Systems, WCCI 98',1998. (**AI/ML**)
- N.R. Pal and K.K. Chintalapudi, "A Simple Procedure to Reduce the Size of a Multilayer Perceptron Network," International Journal of Knowledge Based Engineering Systems, Vol.2, No.3, pp.(145-163), 1998. (**AI/ML**)
- N.R Pal and K.K Chintalapudi, "Feature selection in a connectionist framework", International journal of Neural, Parallel and Scientific Computation. Vol.5, pp. (359-382), 1997. (**AI/ML**)