

# DILIP REDDY PATLOLLA

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## SUMMARY

Dilip Patlolla is a research scientist in the Geographic Information Science and Technology (GIST) Group at the Oak Ridge National Laboratory, which has been a pioneer in the development, implementation, and application of systems, science, and technology for geographic information. His primary responsibilities include: opening up new domains of application for HPC, GPU's, FPGA's by researching and developing computing algorithms, and ensuring best possible performance on current and next-generation architectures. He leads the research and development of mapping and characterizing global-scale human settlements using advanced computing methods – a challenging science problem that can have broad impact over several application domains.

## EDUCATION

**University of Tennessee, Knoxville (UTK)** **Fall 2006 - Fall 2009**  
Master of Science, Computer Engineering GPA: 3.75 / 4  
Thesis titled "A GPU based Implementation for Improved Online Rebinning Performance in Clinical 3 - D PET"

**Jawaharlal Nehru Technological University** **2002 - 2006**  
Bachelor of Technology, Electrical and Electronics Engineering GPA: 79 / 100  
Project titled "Design and Analysis of Hybrid stepper Motor"

## EXPERIENCE

**Research Scientist, Oak Ridge National Laboratory (ORNL)** **Jan 2011 – Present**

- Developed an advanced HPC and Machine Learning based framework, referred as SMTTool (Settlement Mapper Tool) that enables global-scale large-scale geospatial image data processing for human settlement mapping and understanding. Received **ORNL's 2013 Significant Event Achievement Award** for the effort. SMTTool output layer is being used by GIST to upgrade LandScan to LandScan HD and also by Gates Foundation for immunization and vaccinations in Northern Nigeria.
- Developed a CPU-GPU cluster implementation of image segmentation and feature extraction on high-resolution satellite imagery and successfully ported SMTTool to TITAN Super Computer. Received **ORNL Technical Accomplishment** award in recognition of the Accelerated Settlement Detection using High Performance Computing methods. This work was also a finalist for NVIDIA's 2015 Global Impact award.
- Co-PI for ORNL's Laboratory Directed Research and Development (LDRD) titled "Urban Typologies: Towards an ORNL Urban Information System" (2015) with a funding of \$1.3 million. LDRD supports cutting-edge research across ORNL and develops new capabilities in support of the Laboratory's research initiatives.
- Developed a GPU based machine-learning framework to process a large National Agricultural Imagery program 1-meter resolution imagery data for the entire US that could detect mobile home parks with greater accuracy, resulting in ORNL invention disclosure "Geospatial Semantic Mapper: Detecting Complex Urban Semantic Categories from Large Scale High Resolution Overhead Imagery" for possible commercialization,
- Understanding and detecting crop patterns and crop-pattern anomalies as part of a project to study analyze and characterize large areas of land in Bangladesh and the Eastern region of India. The project is a strategic partnership among ORNL, DOE and the International Maize and Wheat Improvement Center (CIMMYT).
- Elected as an inaugural member of the Urban Dynamic Institute (UDI) at Oak Ridge National Laboratory. The division directors, given the strong relevance and impact of the member's research on the mission of the institute have nominated inaugural members.
- Assess emerging technologies in architecture; parallel programming paradigms, and languages to provide input for HPC system procurements.
- Mentored Undergraduate student and helped in advancing the student's academic and professional goals. The result of the students work over the summer is in the process of publication.
- Analyzed Boltzmann Neutron Transport equations and ported it to GPU using CUDA and Python resulting in great speedups.
- Part of a team that investigated driver's behavior in vehicle crashes using facial recognition tools that led to an understanding of the contributing factors in vehicle crashes.

**Electrical Engineer II, Electronics R&D, Siemens Healthcare** **Aug 2009 – Dec 2010**

- Developed embedded software for front-end electronics and chip-to-chip communication through I2C bus.
- Successfully configured uClinux on NIOS II Processor in an Altera FPGA on a PET Coincidence processor to provide 10/100 Mbps Ethernet communications. Altera Triple Speed Ethernet mac core was used.

**Intern, Electronics R&D, Siemens Healthcare****Aug 2008 - Aug 2009**

- Investigated the suitability of Compute Unified Device Architecture (CUDA) enabled Graphics Processing Units (GPUs) for Positron Emission Tomography Time of Flight Rebinning algorithms and implemented the same, resulting an increase in the Rebinning performance by 20x over existing dedicated FPGA hardware.
- Presented a paper at IEEE Medical Imaging Conference 2009, Orlando on the resulting performance of these algorithms on GPU based architectures.
- Evaluated SATA Host Controller IP Cores available from three major IP Core vendors to chose the best suitable core for our requirements. Also handled the negotiation and communication with the three vendors.
- Assisted Sr. Staff Scientist in projects involving FPGA design and high-speed data acquisition.

**Graduate Research Assistant, UTK****Aug 2006 - May 2008**

- Evaluated applications and developed linear algebra software for computers systems that use Field Programmable Gate Arrays (FPGAs).
- Implemented Sparse Matrix Multiplication, QR Factorization of matrices for double precision floating point numbers applications on Virtex Family FPGAs and assessed the performance, which resulted in an efficient implementation of these applications.
- Developed new tools in VB.NET and C by implementing the features of visualization, geospatial analysis, statistical analysis using integrated modules to upgrade the Spatial Analysis and Decision Assistance (SADA) software application.

**SKILLS**

Knowledge of Machine Learning, High Performance Computing, Data Science, Computer Architecture, GPU Architecture, FPGA design, Object Oriented Programming and Software Development.

**Hardware Description Languages:** VHDL, Verilog HDL.

**GPU Programming Languages:** CUDA, Brook, OpenCL.

**High Level Languages:** C /C++ & Data Structures, VB.NET, C#, System C

**Design Tools:** ModelSim, Xilinx EDK, Xilinx IDE, MATLAB, Altera Quartus.

**Software Development Tools:** Microsoft Visual Studio

**Other:** Python, Pandas, Message Passing Interface (MPI), OpenMP, Boost, CUDA Thrust.

**PEER REVIEWED PUBLICATIONS**

- **Dilip. R. Patlolla**, J. E. Breeding, W. F. Jones, J. L. Everman, "A GPU-Based Architecture for Improved Online Rebinning Performance in Clinical 3-D PET", IEEE Nuclear Science Symposium and Medical Imaging Conference, October 2009.
- Bogdan Vacaliuc, **Dilip R. Patlolla**, Ed F. D'Azevedo, Gregory G. Davidson, John K. Munro Jr., Thomas M. Evans, Wayne Joubert, Zane W. Bell, "Python for Development of OpenMP and CUDA Kernels for Multidimensional Data", Symposium on Application Accelerators in High-Performance Computing 2011, July 2011.
- Chris Boehnen, Del Barstow, **Dilip R. Patlolla**, Christopher J. Mann, "A Standoff Multi-Modal Biometric System", Future of Instrumentation International Workshop, November 2011
- **Dilip R. Patlolla**, Anil M. Cheriyyadat, Jeanette E. Weaver, Eddie A. Bright, "Accelerating Satellite Image Based Large-Scale Settlement Detection with GPU", International Conference on Advances in Geographic Information Systems (ACM SIGSPATIAL GIS 2012), December 12, 2012
- K.P. Ziock, C.B. Boehnen, J.M. Ernst, L. Fabris, J.P. Hayward, **Dilip R. Patlolla**, V.C. Paquit, "Motion Correction for Passive Radiation Imaging of Small Vessels in Ship-to-Ship Inspections," IEEE Nuclear Science Symposium, N8-8, Anaheim, CA, 2012.
- Chris Boehnen, Del Barstow, **Dilip R. Patlolla**, Christopher J. Mann, "A Multi-Sample Standoff Multimodal Biometric System", 2012 IEEE Fifth International Conference on Biometrics: Theory, Applications and Systems (BTAS), September 23, 2012
- R Karthik, **DR Patlolla**, A Sorokine, DA White, AT Myers, "Building a secure and feature-rich mobile mapping service app using HTML5: challenges and best practices", Proceedings of the 12th ACM international symposium on Mobility management and wireless access, 2014
- **Dilip Patlolla**, Sophie Voisin, Harini Sridharan, and Anil Cheriyyadat, "GPU accelerated Textons and Dense SIFT features for human settlement detection from high-resolution satellite imagery." GeoComputation 2015, Dallas.
- B Bhaduri, **D Patlolla**, RR Vatsavai, A Cheriyyadat, W Lu, R Karthik, "Emerging trends in monitoring landscapes and energy infrastructures with big spatial data", SIGSPATIAL Special 6 (3), 35-45.
- Budhendra L Bhaduri, Harini Sridharan, **Dilip Reddy Patlolla**, Jacob J McKee, Raju Vatsavai, "Monitoring Landscape Dynamics at Global Scale: Emerging Computational Trends and Successes", The 1st International Workshop on Spatiotemporal Computing, 2015, Fairfax

- Ziock, K. P. and Boehnen, C. B. and Ernst, J. M. and Fabris, L. and Hayward, J. P. and Karnowski, T. P. and Paquit, V. C. and **Patlolla, D. R.** and Trombino, D. G., “Motion correction for passive radiation imaging of small vessels in ship-to-ship inspections”, Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, Volume 805, 1 January 2016, Pages 116–126

## POSTERS AND PRESENTATIONS

- “ID P3134: Accelerating Satellite Image Based Large-Scale Settlement Detection with GPU”, GPU Technology Conference 2013, San Jose
- “ID P4136: A GPU Accelerated Framework for Global-Scale Critical Infrastructure Mapping Using Satellite Imagery”, GPU Technology Conference 2014, San Jose
- Multi-Temporal Satellite Image Normalization for Human Settlement Detection at 2016 AAG Annual Meeting, San Francisco, California
- Incorporating the Non-Homogeneous Feature Difference Ratio into SMTTool at 2016 AAG Annual Meeting, San Francisco.
- Global Mapping of Human Settlements at Scale at 2016 AAG Annual Meeting, San Francisco.
- Uncertainty in Estimation of Bioenergy Induced LULC Change: Development of a New Change Detection Technique at 2015 AGU Fall Meeting, San Francisco.
- Open APIs, Open Source Development, and Open Architectures at 2015 AAG Annual Meeting, Chicago.
- High Performance Computing for Large Scale Settlement Mapping and Characterization using High Resolution Imagery at 2015 AAG Annual Meeting, Chicago.
- SMTTool: A GPU based Satellite Image Analysis Tool at The GPU Technology Conference 2015, San Jose
- A GPU-Based Computational Framework for Large-Scale Critical Infrastructure Mapping Using Satellite Imagery, Invited Talk at The GPU Technology Conference 2014, San Jose
- A Scalable Computational Framework for Large-Scale Critical Infrastructure Mapping Using Satellite Imagery at 2014 AAG Annual Meeting, Tampa.
- Accelerating Satellite Image Based Large-Scale Settlement Detection with GPU, Invited Talk at The GPU Technology Conference 2013, San Jose

## HONORS AND AWARDS

- **ORNL Significant Event Achievement Award** – April 2013 in recognition of significant contribution to the “Development of the Settlement Mapping Tool”.
- **ORNL Technical Accomplishment Award** – July 2015 in recognition of the “Accelerated Settlement Detection using High Performance Computing methods”.
- **Recognition:** March 2015, research has been among the five finalists for [NVIDIA’s Global Impact Award 2015](http://blogs.nvidia.com/blog/2015/02/27/mapping-the-world-with-gpus/). (<http://blogs.nvidia.com/blog/2015/02/27/mapping-the-world-with-gpus/>)
- **Recognition:** Highly Rated Speaker Rating at the GPU Technology Conference, San Jose, March 2015.
- **Recognition:** my session titled “SMTTool: A GPU based Satellite Image Analysis Tool” shortlisted as “12 GTC sessions Not to Miss” from ~550 sessions at the GPU Technology Conference, 2015. (<http://devblogs.nvidia.com/parallelforall/12-gtc-2015-sessions-not-to-miss/>), March 2015.
- **Best Paper** – “A Multi-Sample Standoff Multimodal Biometric System”, Poster Session 2012 at Biometrics: Theory, Applications and Systems (BTAS), 2012 IEEE, September 2012.
- **ORNL Supplement Performance Award** – Dec 2012.
- **Trainee Grant:** IEEE Medical Imaging Conference, Orlando, October 2009.

## PROFESSIONAL SERVICE

- **Chair and Judge:** 2016 CISG Robert Raskin Student Competition at the Association of American Geographers (AAG) 2016 Annual Meeting, San Francisco.
- **Judge:** 2016 Sigma Xi Student Research Showcase
- **Panelist:** GPU Technology Conference 2016 Advisory Panel, San Jose
- **Organizer:** High-performance and Large-scale GeoComputing at the Association of American Geographers (AAG) 2016 Annual Meeting, San Francisco.
- **Organizer:** CyberGIS Symposium: High-Performance and Large-Scale Geospatial Computing I: Architectures and Frameworks at the AAG 2015 Annual Meeting, Chicago.
- **Invitation:** Invited to present at The Deep Learning Summit, Boston 2015.
- **Organizer:** High-Performance and Large-Scale Geospatial Computing I: Architectures and Frameworks at the AAG 2014 Annual Meeting, Tampa.

- **Organizer:** High-Performance and Large-Scale Geospatial Computing II: Applications and Case Studies at the AAG 2014 Annual Meeting, Tampa.
- **Chair:** CyberGIS Symposium: High-Performance and Large-Scale Geospatial Computing II: Applications and Case Studies at the AAG 2015 Annual Meeting, Chicago.
- **Chair:** High-Performance and Large-Scale Geospatial Computing II: Applications and Case Studies at the AAG 2014 Annual Meeting, Tampa.
- **Panelist:** GPU Technology Conference 2015 Speaker and Alumni Advisory Panel, San Jose.
- **Board Member:** Elected as Board member of the AAG Cyberinfrastructure Specialty Group (CISG), 2015.
- **Technical Program Committee:** HiPC-15 (IEEE International Conference on High Performance Computing - 2015) Bangalore, India.
- **Technical Program Committee:** 2nd International Conference on Advances in Computing and Management, 15-17 Jan 2016, Pune, India.
- **Technical Program Committee:** International Conference on Soft Computing and Software Engineering, ICSCSE 2015, Berkeley.
- **Technical Program Committee:** BigSpatial-2014 – 3rd International Workshop on Analytics for Big Geospatial Data at ACM SIGSPATIAL 2014, Dallas.
- **Technical Program Committee:** HiPC-14 (IEEE International Conference on High Performance Computing - 2014) Goa, India.
- **Technical Program Committee:** ICNSC-14 (First International Conference on Networks & Soft Computing - 2014) India.
- **Technical Program Committee:** BigSpatial-2013 – 2nd International Workshop on Analytics for Big Geospatial Data at ACM SIGSPATIAL 2013.
- **Reviewer:** GeoInformatica: An International Journal on Advances of Computer Science for Geographic Information Systems, 2015
- **Reviewer:** Advanced Computing: An International Journal (ACIJ), 2015
- **Reviewer:** The International Journal of Computer Networks & Communications (IJCNC). 2014
- **Reviewer:** BigSpatial-2013: 2nd International Workshop on Analytics for Big Geospatial Data at ACM SIGSPATIAL 2013 BigSpatial-2013
- **Reviewer:** International Journal of Parallel Programming. 2014
- **Editorial Board:** International Journal of Soft Computing and Software Engineering.
- **Reviewer:** IEEE Transactions on Parallel and Distributed Systems Journal
- **Reviewer:** ICACCI 2014: Industry Track, – 3rd International Conference on Advances in Computing, Communications and Informatics.
- **Invited** to serve Judge for the 2015 Sigma Xi Student Research Showcase.
- **Invited** to serve as a judge for the 2015 Conrad Spirit of Innovation Challenge.  
The Conrad Challenge honors Apollo 12 astronaut, innovator and entrepreneur, Charles “Pete” Conrad, Jr. In its eighth successful year, the Conrad Challenge is an annual innovation and entrepreneurial student competition that brings together a dynamic community of innovators to develop extraordinary and viable solutions to benefit our world in one of four areas: Aerospace and Aviation, Cyber-Technology and Security, Energy and Environment and Health and Nutrition.

## MEMBERSHIPS

- Sigma Xi, The Scientific Research Society
- Eta Kappa Nu Academic Honor Society
- Senior Member: Institute of Electrical and Electronics Engineers
- Member: Association of Computing Machinery
- Board Member: AAG Cyberinfrastructure Specialty Group.