Dr. Varun Chandola

Contact Information

Assistant Professor
Computer Science & Engineering
University at Buffalo
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Education

University of Minnesota, Twin Cities, MN

Ph.D., **Computer Science**, September 2009

- Thesis Topic: *Anomaly Detection for Symbolic Sequences and Time Series Data*
- Adviser: Professor Vipin Kumar
- Co-adviser: Professor Arindam Banerjee
- Thesis Committee: Professor Jaideep Srivastava, Professor Xiaotong Shen

Indian Institute of Technology Madras, Chennai, India

B.Tech., **Computer Science and Engineering**, May 2002

- Thesis Topic: *A Flexible Content Management System Using Semi-structured Data Model*
- Adviser: Professor P. Sreenivas Kumar

Professional Experience

University at Buffalo, SUNY — August 2013 to present
Assistant Professor (*Tenure track*)
Computer Science & Engineering

Oak Ridge National Laboratory — May 2011 to August 2013
Research Scientist
Computational Sciences and Engineering Division

Oak Ridge National Laboratory — October 2009 to April 2011
Postdoctoral Research Associate
Computational Sciences and Engineering Division

NASA Ames Research Center — March 2009 to July 2009
Visiting Researcher
Intelligent Data Understanding Group

Grant Support

NSF SaTC: Planned $500,000 for 5 years.
Title: *CAREER: Novel anomaly detection algorithms for continuous threat monitoring*
Role: Principal Investigator (Share - 100%)

NSF CSSI: Planned $600,000 for 3 years.
Title: *Elements: Software: vl.geo - A Geospatial Machine Learning and Visualization Library for Enabling Big Scientific Explorations.*
Role: Principal Investigator (Share - 50%)
Team: Ranga Raju Vatsavai (NCSU)
Duration: Aug. 16, 2018 - Aug. 15, 2021

NSF BIGDATA: Planned $1,000,000 for 3 years.
Title: BigData: IA: Scalable Non-linear Dimensionality Reduction Methods for Big Data Streams
Role: Principal Investigator (Share - 25%)

Team: Jaroslaw Zola, Nils Napp, Olga Wodo
Duration: Sep. 1, 2018 - Aug. 31, 2021.

AHRQ: Pending $2,241,364 for 4 years.
Title: *Patient Safety Learning Laboratory: Early Detection of Respiratory Compromise to Prevent Harm of the Hospitalized Opioid Treated Patient.*
Role: Co-Principal Investigator (Share - 20%)
Team: Lora Cavuto (PI), Manoj Mammen, Carla Jungquist
Duration: Sep. 1, 2018 - Aug. 31, 2022.

NSF: Awarded $999,990 for 5 years.
Title: MRI: Acquisition of High Performance Computing Infrastructure to Support Computational and Data Enabled Science and Engineering
Role: Co-Principal Investigator (Share - 10%)
Team: Thomas Furlani (PI), Jochen Autschbach, Abani Patra, Bruce Pitman
Duration: October 1, 2017 to September 30, 2022.

Google Cloud Platform $1.65K for 1 Year.
Title: *Google Cloud Platform Education Grant.*
Role: Principal Investigator (Share - 100%)
Duration: Sep. 1, 2016 to Aug. 31, 2017.

NSF: Awarded $200K for 1 year.
Title: *EAGER: An Investigation of the Propagation of Error-Resistant and Error-Prone Messages Over Large-Scale Information Networks.*
Role: Co-Principal Investigator (Share - 33%)
Team: Raghav Rao (PI), Manish Agrawal (USF)
Duration: Sep. 1, 2016 to Aug. 31, 2017.

DOE/ORNL: Awarded $150,000 for 3 Years.
Title: *Energy/Water Nexus Knowledge Discovery Framework.*
Role: Principal Investigator
Team: Budhendra Bhaduri (ORNL/PI), Robin Graham (ANL), Ian Foster (UIUC)
Duration: Aug. 1, 2016 to Sep. 30, 2018.

NSF: Awarded $4,975K for 5 Years.
Title: *CC*DNI DIBBs: Data Analysis and Management Building Blocks for Multi-Campus Cyberinfrastructure through Cloud Federation.*
Role: Co-Investigator and UB Science Lead (Share - 9-credit Tuition Support and Stipend for 1 RA student for 5 years)
Team: David Lifka (PI - Cornell), Thomas Furlani, Richard Wolski (UCSB)
Duration: October 1, 2015 to September 30, 2020.

NSF: Awarded $1,215K for 4 Years.
Title: *TWC: Medium: Collaborative: Data is Social: Exploiting Data Relationships to Detect Insider Attacks.*
Role: Co-Principal Investigator (Share - 25%)
Team: Hung Ngo (PI), Oliver Kennedy, Shambhu Upadhayaya
Duration: October 1, 2014 to September 30, 2018.

Microsoft Azure: Awarded $20K for 2 Years.
Title: *Microsoft Azure Research Award.*
Role: Principal Investigator.
Duration: Nov. 1, 2014 to Aug. 07, 2016.

Amazon Web Services: Awarded $5K for 1 Year.
Title: *AWS Machine Learning Research Grant.*

Role: Principal Investigator.
Duration: March 1, 2014 to February 29, 2016.

ORNL Laboratory Directors R&D Funds: Awarded $200K for 1 Year.
Title: *CoNNECT for Real-Time Building Energy and Grid Management.*
Role: Co-Principal Investigator (Share - 25%)
Team: Olufemi Omitoumu (PI)
Duration: October 1, 2012 to September 30, 2013.

Center for Medicare & Medicaid Services: Awarded $20M for 2 Years.
Title: *Knowledge Discovery Infrastructure for Healthcare.*
Role: Investigator and Task Lead (Beneficiary Call Center Use Case) (Share - 5%).
Team: Brian Worley (PI), Mallikarjuna Shankar, Edmon Begoli
Duration: October 1, 2011 to May 31, 2013.

National Geospatial Intelligence Agency: Awarded $350K for 1 Year.
Title: *Multi-disciplinary GEOINT Analysis, Project #266 (World Factbook Analysis).*
Role: Investigator and Data Mining Task Lead (Share - 33%)
Team: Budhendra Bhaduri (PI), Robert Stewart, Ranga Raju Vatsavai.
Duration: June 1, 2012 to May 31, 2013.

Awards and Honors

- Early Teacher of the Year Award, University of Buffalo, School of Engineering and Applied Sciences, 2016.
- Article on "Virtualization of Evolving Power Grid" included as one of the *best of the best* 32 articles in the IEEE Smart Grid Compendium, 2015.
- NASA Worldwind Europa Challenge, second prize in the University category, 2014.
- ORNL Significant Achievement Award for developing the Settlement Mapper Technology, 2013.
- ACM Computing Survey article on "Anomaly Detection: A Survey" listed as 4^{th} Most Cited Publication in Computer Science/Data Mining in last 5 years (Microsoft Academic Search).
- Special Recognition for contributions to "Knowledge Discovery for Health Care" project at ORNL, 2012.
- Awarded Best LDRD Project titled - "Spatiotemporal Data Mining Framework for Monitoring Biomass at Regional and Global Scales", under the ORNL Laboratory Director's Research and Development Program, 2011.
- Selected one of the best 6 papers at NASA CIDU conference, 2010.
- Doctoral dissertation nominated for ACM Best Dissertation award from Computer Science Department, 2009.
- Recipient of Student Travel Awards at ICDM 2005, ICDM 2008, and SDM 2009.
- Research Excellence Award by Department of Computer Science, University of Minnesota, 2005.
- Best student paper award at 5^{th} International Conference on Data Mining (ICDM), November 2005.

REFEREED JOURNAL - SUBMITTED

Student names in bold.

JS3. Scalable Learning Manifolds from Streaming Data. **Suchismit Mahapatra** (PhD student) and Varun Chandola. *Transactions on Knowledge and Data Discovery (TKDD), Under Submission, # pages - 14*, 2018. (*Impact factor: 1.98*)

JS2. Server, server in the cloud. Who is the fairest in the crowd? Marc Böhlen, Varun Chandola, **Amol Salunkhe** (PhD student). *Computational Culture, Under Review, # pages - 23*, 2017. (*Impact factor: NA*)

JS1. Methods for Longitudinal Disease Subtyping. **Duc Thanh Anh Luong** (PhD student), Prerna Chaudhary, Mahin Ramezani and Varun Chandola. *Journal of Healthcare Informatics Research, Under Review, # pages - 10*, 2018.

REFEREED JOURNAL - PUBLISHED

At UB - J6–J13, Before joining UB - J1–J5

J13. Query Log Compression for Workload Analytics **Ting Xie** (PhD student), Varun Chandola and Oliver Kennedy. *Very Large Databases*, 2018.

J12. Machine Learning for Energy-Water Nexus: Challenges and Opportunities. **Syed Mohammed Arshad Zaidi**, Varun Chandola, Melissa Allen, Ryan McManamay, Budhendra L. Bhaduri. *Journal of Big Earth Data (To Appear)*, 2018.

J11. A Survey of Analytical Methods for Inclusion in a New Energy-Water Nexus Knowledge Discovery Framework. Melissa R. Allen, **Syed Mohammed Arshad Zaidi**, Varun Chandola, April M. Morton, Christa M. Brelsford, Ryan A. McManamay, Binita KC, Jibonananda Sanyal, Robert N. Stewart, and Budhendra L. Bhaduri *Journal of Big Earth Data (To Appear)*, 2018.

J10. Modeling Mortality Risk in Homebound Older Adults using Routinely-Collected Nursing Data. Suzanne Sullivan, Varun Chandola, Bonnie Westra, and Sharon Hewner. *Journal of Advanced Nursing*, # pages - 31, 2018. (*Impact factor: 1.998*)

J9. Similarity Metrics for SQL Query Clustering. Gokhan Kul, **Duc Thanh Anh Luong** (PhD student), Ting Xie, Varun Chandola, Oliver Kennedy and Shambhu Upadhyaya. *IEEE Transactions on Knowledge and Data Engineering*, # Pages 16, 2018.

J8. Extracting Deep Phenotypes for Chronic Kidney Disease using Electronic Health Records. **Duc Thanh Anh Luong** (PhD student), **Dinh Tran** (PhD student), Varun Chandola, Chet Fox, Wilson Pace, Joseph Vassalotti, Jennifer Carroll, Miriam Dickinson, Matthew Withiam-Leitch, Nikhil Satchindanand, Min Yang, and Craig Smail. *eGems - Generating Evidence & Methods to Improve Patient Outcomes*, # pages - 15, 2017. (*Impact factor: N/A*)

J7. A Reference Based Analysis Framework for Understanding Anomaly Detection Techniques for Symbolic Sequences. Varun Chandola, Varun Mithal and Vipin Kumar. *Data Mining and Knowledge Discovery, Springer.* 28(3), pages 702–735, 2014. (*Impact factor: 1.987*)

J6. Image Based Characterization of Formal and Informal Neighborhoods in an Urban Landscape. Jordan Grasser, Anil Cheriyadat, Ranga R. Vatsavai, Varun Chandola, Jordan Long, and Edward Bright. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing.* 5(4), pages 1164–1176, 2012. (*Impact factor: 3.026*)

J5. GX-Means: A model-based divide and merge algorithm for geospatial image clustering. Ranga R. Vatsavai, Christopher T. Symons, Varun Chandola, and Goo Jun. *Procedia Computer Science.* Vol. 4, pages 186–195, 2011. (*Impact factor: N/A*)

J4. A Scalable Gaussian Process Analysis Algorithm for Biomass Monitoring. Varun Chandola and Ranga R. Vatsavai. *Statistical Analysis and Data Mining.* 4(4), pages 430–445, 2011. (*Impact factor: N/A*)

J3. Anomaly Detection for Discrete Sequences - A Survey. Varun Chandola, Arindam Banerjee, and Vipin Kumar. *IEEE Transactions on Knowledge and Data Engineering (TKDE)*, 24(5), pages 823–839, 2011. (*Impact factor: 2.067*)

J2. Anomaly Detection - A Survey. Varun Chandola, Arindam Banerjee, and Vipin Kumar. *ACM Computing Surveys (CSUR)*, 41(3), # pages - 58, 2009. (*Impact factor: 3.37*)

J1. Summarization - Compressing Data into an Informative Representation. Varun Chandola and Vipin Kumar. *Knowledge And Information Systems Journal (KAIS)*, 12(3), pages 355–378, 2007. (*Impact factor: 1.782*)

Refereed Conference Proceedings - Published

At UB - C13–C24, Before joining UB - C1–C12

C24. dynamicMF: A Matrix Factorization Approach to Monitor Resource Usage in High Performance Computing Systems. **Niyazi Sorkunlu** (PhD Student), **Duc Thanh Anh Luong** (PhD Student) and Varun Chandola. *6th IEEE International Conference on Big Data, BigData*, 2018.

C23. Entropy-Isomap: Manifold Learning for High-dimensional Dynamic Processes. **Frank Schoeneman** (PhD Student), Varun Chandola, Nils Napp, Olga Wodo, and Jaroslaw Zola. *6th IEEE International Conference on Big Data, BigData*, 2018.

C22. Detecting Data Leakage from Databases on Android Apps with Concept Drift. **Gökhan Kul** (PhD Student), Shambhu Upadhyaya and Varun Chandola. *17th IEEE International Conference On Trust, Security And Privacy In Computing And Communications*, 2018.

C21. S-Isomap++: Multi Manifold Learning from Streaming Data **Suchismit Mahapatra** and Varun Chandola. *IEEE International Conference on Big Data (IEEE BigData)*, # pages - 10, 2017

C20. Tracking System Behavior from Resource Usage Data. **Niyazi Sorkunlu**, Varun Chandola, and Abani Patra. *IEEE International Conference on Cluster Computing (IEEE Cluster)*, # pages - 9, 2017

C19. A k-means approach to clustering disease progressions. **Duc Luong** and Varun Chandola. *International Conference on Health Informatics (ICHI)*, # pages - 7, 2017

C18. Automatic Extraction of Deep Phenotypes for Precision Medicine in Chronic Kidney Disease. **Prerna Chaudhary**, Varun Chandola, and Chet Fox. *International Conference on Digital Health (ICDH)*, # pages - 10, 2017.

C17. Error Metrics for Learning Reliable Manifolds from Streaming Data Frank Schoeneman, **Suchismit Mahapatra** (PhD student), Nils Napp, Varun Chandola, and Jaroslaw Zola. *SIAM International Conference on Data Mining (SDM)*, # pages - 9, 2017. (*Acceptance Rate: N/A*)

C16. Exploiting Hierarchy in Disease Codes - A Healthcare Application of Tree Structured Sparsity-Inducing Norms. **Jialiang Jiang** (PhD student), Sharon Hewner and Varun Chandola. *In proceedings of the* 12^{th} *International Conference on Machine Learning and Data Mining*, # pages - 15, 2016. (*Acceptance Rate: N/A*)

C15. Modeling Graphs Using a Mixture of Kronecker Models. **Suchismit Mahapatra** (PhD student) and Varun Chandola. *Proceedings of the* 3^{rd} *IEEE International Conference on Big Data*, pages 727–736, 2015. (*Acceptance Rate:* $\sim 18.6\%$)

C14. Surface Reconstruction from Intensity Image using Illumination Model based Morphable Modeling. **Zhi Yang** (PhD student) and Varun Chandola. *Proceedings of* 10^{th} *International Conference on Computer Vision Systems (ICVS)*, pages 117–127, 2015. (*Acceptance Rate:* $\sim 50\%$)

C13. Bringing Big Data from Space to Desktop. Varun Chandola and Patrick Hogan. *Proceedings of the 2014 conference on Big Data from Space (BiDS'14)*, pages 233–235, 2014. (*Acceptance Rate: N/A*)

C12. Knowledge Discovery from Massive Healthcare Claims Data. Varun Chandola, Sreenivas R. Sukumar, and Jack C. Schryver. *Proceedings of the* 19^{th} *International ACM SIGKDD Conference on Knowledge Discovery and Data Mining*, pages 1312–1320, 2013. (*Acceptance Rate: 17%*)

C11. Large Scale Remote Sensing Data Mining for Biomass Monitoring: Recent Advances and Future Challenges. Ranga R. Vatsavai, Varun Chandola, and Budhendra Bhaduri. *Proceedings of* 7^{th} *International Conference on Geographic Information Science (GIScience)*, pages 2012. (*Acceptance Rate: N/A*)

C10. iGlobe: An Interactive Visualization and Analysis Framework for Geospatial Data. Varun Chandola, Budhendra Bhaduri, and Ranga R. Vatsavai. *Proceedings of* 2^{nd} *International Conference and Exhibition on Computing for Geospatial Research and Application (COM. Geo)*. 2011. (*Acceptance Rate: 34%*)

C9. Machine Learning Approaches for High-resolution Urban Land Cover Classification. Ranga R. Vatsavai, Varun Chandola, Anil Cheriyadat, Edward Bright, Bhaduri Budhendra, and Jordan Grasser. *Proceedings of* 2^{nd} *International Conference and Exhibition on Computing for Geospatial Research and Application (COM. Geo)*. 2011. (*Acceptance Rate: 34%*)

C8. Rapid Damage Assessment using High-resolution Remote Sensing Imagery: Tools and Techniques. Ranga R. Vatsavai, Mark Tuttle, Budhendra Bhaduri, Edward Bright, Anil Cheriyadat, and Varun Chandola. *Presented at International Geoscience and Remote Sensing Symposium (IGARSS)*. 2011. (*Acceptance Rate: N/A*)

C7. A Gaussian Process Based Online Change Detection Algorithm for Monitoring Periodic Time Series. Varun Chandola and Ranga R. Vatsavai. *Proceedings of SIAM International Conference on Data Mining (SDM)*. 2011. (*Acceptance Rate: 25%*)

C6. Multi-temporal Remote Sensing Image Classification - A Multi-view Approach. Varun Chandola and Ranga R. Vatsavai. *Proceedings of NASA Conference on Intelligent Data Understanding*. 2010. (*Acceptance Rate: N/A*)

C5. Scalable Time Series Change Detection for Biomass Monitoring Using Gaussian Process. Varun Chandola and Ranga R. Vatsavai. *Proceedings of NASA Conference on Intelligent Data Understanding (CIDU)*. 2010. (**Selected as one of the top 6 best papers at the conference.**) (*Acceptance Rate: N/A*)

C4. A Framework for Exploring Categorical Data. Varun Chandola, Shyam Boriah, and Vipin Kumar. *Proceedings of 2009 SIAM Data Mining Conference*. 2009. (*Acceptance Rate: 15%*)

C3. Comparative Evaluation of Anomaly Detection Techniques for Sequence Data. Varun Chandola, Varun Mithal, and Vipin Kumar. *Proceedings of* 8^{th} *International Conference on Data Mining (ICDM)*. 2008. (*Acceptance Rate: 9.67%*)

C2. Similarity Measures for Categorical Data: A Comparative Evaluation, Shyam Boriah, Varun Chandola and Vipin Kumar. *Proceedings of* 8^{th} *SIAM Data Mining Conference (SDM)*. 2008. (*Acceptance Rate: 15.67%*)

C1. Summarization - Compressing Data into an Informative Representation. Varun Chandola and Vipin Kumar. *Proceedings of* 5^{th} *International Conference on Data Mining (ICDM)*. 2005. (**Awarded one of the top 3 best student papers at the conference**). (*Acceptance Rate: 13.8%*)

TUTORIALS

T4. Anomaly Detection: Theory and Practice. Varun Chandola and Sanjay Chawla. *IEEE International Conference on Data Mining (ICDM)*. 2011.

T3. Machine Learning: A Tutorial. Varun Chandola. *CDSE Days*. 2016.

T2. Data Mining for Anomaly Detection. Arindam Banerjee, Varun Chandola, Aleksandar Lazarevic, Vipin Kumar, and Jaideep Srivastava. *ECML PKDD Conference*. 2008.

T1. Anomaly Detection: A Tutorial. Arindam Banerjee, Varun Chandola, Aleksandar Lazarevic, Vipin Kumar, and Jaideep Srivastava. *SIAM Data Mining Conference (SDM)*. 2008.

REFEREED WORKSHOP PROCEEDINGS

W12. WebGlobe - A cloud based geospatial analysis framework for interacting with climate data. **Arun Sharma**, **Syed Mohammed Arshad Zaidi**, Varun Chandola, Melissa R. Allen and Budhendra L. Bhaduri. *In Proceedings of the 7th International Conference on Analytics for Big Geospatial Data (BigSpatial)*, 2018.

W11. Exploiting Hierarchy in Disease Codes - A Healthcare Application of Tree Structured Sparsity-Inducing Norms. **Jialiang Jiang** (PhD student), Sharon Hewner and Varun Chandola. *In Proceedings of the SDM Workshop on Data Mining for Medicine and Healthcare*, 2016.

W10. Ettu: Analyzing Query Intents in Corporate Databases. Gökhan Kul, **Duc Luong** (PhD student), Ting Xie, Patrick Coonan, Varun Chandola, Oliver Kennedy and Shambhu Upadhyaya. *In Proceedings of the WWW Workshop on Empirical Research Methods in Information Security*, 2016.

W9. A Big Data Approach to Rumor Mitigation in Twitter Microblog: A Case of Boston Bombings. Rohit Valecha (PhD student), Ankit Sultania (MS student), Varun Chandola, Manish Agrawal and H. Raghav Rao. *Proceedings of the* 13^{th} *Workshop on e-Business (WeB)*, 2015.

W8. Development of a computational and data-enabled science and engineering Ph.D. program. Paul T. Bauman, Varun Chandola, Abani Patra and Matthew Jones *Proceedings of SC EduHPC Workshop*, 2014.

W7. Spatiotemporal Data Mining in the Era of Big Spatial Data: Algorithms and Applications. Ranga R. Vatsavai, Varun Chandola, Scott Klasky, Auroop Ganguly, Anthony Stefanidis, Shashi Shekhar. *Proceedings of* 1^{st} *International Workshop on Analytics for Big Geospatial Data (BigSpatial)*. 2012.

W6. Implementing a Gaussian Process Learning Algorithm in Mixed Parallel Environment. Varun Chandola and Ranga R. Vatsavai. *Proceedings of Super computing*

(SC) Workshop on Latest Advances in Scalable Algorithms for Large-Scale Systems (ScalA). 2011.

W5. Using Time Series Segmentation for Deriving Vegetation Phenology Indices from MODIS NDVI Data. Varun Chandola, Dafeng Hui, Lianhong Gu, and Ranga R. Vatsavai. *Proceedings of* 1^{st} *ICDM Workshop on Knowledge Discovery from Climate Data: Prediction, Extremes, and Impacts*. 2010.

W4. An In Depth Scalability Analysis of a Gaussian Process Training Algorithm. Varun Chandola and Ranga R. Vatsavai. *Proceedings of Super Computing (SC) Workshop on Latest Advances in Scalable Algorithms for Large-Scale Systems (ScalA)*. 2010.

W3. Scalable Hyper-parameter Estimation for Gaussian Process Based Time Series Analysis. Varun Chandola and Ranga R. Vatsavai. *Proceedings of* 4^{th} *SIGKDD Workshop on Large-scale Data Mining: Theory and Applications (LDMTA)*. 2010.

W2. A Reference Based Analysis Framework for Analyzing System Call Traces. Varun Chandola, Shyam Boriah, and Vipin Kumar. *Proceedings of* 6^{th} *Annual Cyber Security and Information Intelligence Research Workshop (CSIIRW)*. 2010.

W1. DDDAS/ITR: A Data Mining and Exploration Middleware for Grid and Distributed Computing. Jon B. Weissman, Vipin Kumar, Varun Chandola, Eric Eilertson, Levent Ertoz, Gyorgy Simon, Seonho Kim, and Jinoh Kim. *Proceedings of Workshop on Dynamic Data Driven Application Systems - DDDAS*. 2007.

Book Chapters R4. Analyzing Big Spatial & Big Spatiotemporal Data: A Case Study of Methods and Applications. Varun Chandola, Ranga R. Vatsavai, Devashish Kumar, and Auroop Ganguly. *Big Data Analytics, eds. Vijay Raghavan, Calyumpadi R. Rao and Venu Govindaraju*, Elsevier Publications, 2015.

R3. Fraud Detection in Healthcare. Varun Chandola, Sreenivas R. Sukumar, and Jack C. Schryver. *Healthcare Data Analytics, eds. Chandan Reddy and Charu Aggarwal*. 2014.

R2. Data Analysis for Real Time Identification of Grid Disruptions. Varun Chandola, Omitaomu Olufemi and Steve N. Fernandez. *Computational Intelligent Data Analysis for Sustainable Development, eds. Ting Yu, Nitesh Chawla, and Simeon Simoff, Taylor and Francis*. 2012.

R1. Data Mining for Cyber Security. Varun Chandola, Eric Eilertson, Levent Ertoz, Gyorgy Simon and Vipin Kumar. *Data Warehousing and Data Mining Techniques for Computer Security, ed. Anoop Singhal, Springer*. 2006.

Invited Articles A3. Anomaly Detection: A Modern Perspective. Varun Chandola, Arindam Banerjee, and Vipin Kumar. *Encylopedia of Machine Learning and Data Mining.* 2016.

A2. Virtualization of Evolving Power Grid. Olufemi Omitaomu, Varun Chandola, and Alexander Sorokine. *IEEE Smart Grid Newsletter*. 2012.

A1. Knowledge discovery from sensor data (SensorKDD). Varun Chandola, Olufemi Omitaomu, Auroop Ganguly, Ranga R. Vatsavai, Nitesh Chawla, Joao Gama, and Mohamed Gaber. *SIGKDD Explorations Newsletter*. 2011.

Edited Workshop Proceedings

E8. Sixth ACM SIGSPATIAL International Workshop on Analytics for Big Geospatial Data (BigSpatial). Varun Chandola and Ranga Raju Vatsavai. *Workshop Proceedings, 25th International Conference on Advances in Geographic Information Systems (SIGSPATIAL 2017)*, 2017.

E7. Fourth ACM SIGSPATIAL International Workshop on Analytics for Big Geospatial Data (BigSpatial).

E6. Fifth ACM SIGSPATIAL International Workshop on Analytics for Big Geospatial Data (BigSpatial). Varun Chandola and Ranga Raju Vatsavai. *Workshop Proceedings, 24th International Conference on Advances in Geographic Information Systems (SIGSPATIAL 2016)*, 2016.

E5. Fourth ACM SIGSPATIAL International Workshop on Analytics for Big Geospatial Data (BigSpatial). Varun Chandola and Ranga Raju Vatsavai. *Workshop Proceedings, 23rd International Conference on Advances in Geographic Information Systems (SIGSPATIAL 2015)*, 2015.

E4. Third ACM SIGSPATIAL International Workshop on Analytics for Big Geospatial Data (BigSpatial). Varun Chandola and Ranga Raju Vatsavai. *Workshop Proceedings, 22nd International Conference on Advances in Geographic Information Systems (SIGSPATIAL 2014)*, 2014.

E3. Second ACM SIGSPATIAL International Workshop on Analytics for Big Geospatial Data (BigSpatial). Varun Chandola and Ranga Raju Vatsavai. *Workshop Proceedings, 21st International Conference on Advances in Geographic Information Systems (SIGSPATIAL 2013)*, 2013.

E2. Fifth International Conference on Knowledge Discovery from Sensor Data (SensorKDD'11). Varun Chandola, Olufemi Omitaomu, Auroop Ganguly, Ranga R. Vatsavai, Joao Gama, Mohamed Gaber, and Nitesh Chawla [Proceedings Editors and Workshop Organizers] *Workshop Proceedings,* 17^{th} *International Conference on Knowledge Discovery and Data Mining (KDD)*. 2011.

E1. Fourth International Conference on Knowledge Discovery from Sensor Data (SensorKDD'10). Varun Chandola, Olufemi Omitaomu, Auroop Ganguly, Ranga R. Vatsavai, Joao Gama, Mohamed Gaber, and Nitesh Chawla [Proceedings Editors and Workshop Organizers] *Workshop Proceedings,* 16^{th} *International Conference on Knowledge Discovery and Data Mining (KDD)*. 2010.

Technical Reports

R3. Non-parametric Depth Estimation for Images from a Single Reference Depth. **Zhi Yang** (PhD student) and Varun Chandola. *UB CSE Technical Report 2014-01.* 2014.

R2. Detecting Anomalies in a Time Series Database. Varun Chandola, Deepthi Cheboli, and Vipin Kumar. *CS Technical Report 09-004, Computer Science Department, University of Minnesota.* 2009.

R1. A Multi-Step Framework for Detecting Attack Scenarios. Mark Shaneck, Varun Chandola, Haiyang Liu, Changho Choi, Gyorgy Simon, Eric Eilertson, Yongdae Kim, Zhi-li Zhang, Jaideep Srivastava, and Vipin Kumar. *CS Technical Report 06-004, Computer Science Department, University of Minnesota.* 2008.

Refereed Workshop Presentations

P6. AGU abstract

P5. Improving Quality of Care Using Data Science Driven Methods. Jialiang Jiang, Jessica Castner, Sharon Hewner and Varun Chandola. *Poster presented at UNYTE*

Scientific Session on Hitting the Accelerator: Health Research Innovation through Data Science, 2015.

P4. Spatio-temporal Analysis for Identifying Grid Disruptions. Varun Chandola, Olufemi Omitoumu, and Steven Fernandez. *Presented at* 1^{st} *International Workshop on Analytics for Cyber-physical Systems (ACS-2012)*. 2012.

P3. Open Source, Interactive, Real-Time Visualization and Analysis Framework for Geospatial Data. Uwe Rosebrock, Tisham Dhar, Patrick Hogan and Varun Chandola. *Presented at OzViz Conference*. 2011.

P2. iGlobe: Interactive Visualization and Analysis Framework for Geospatial Data. Patrick Hogan, Varun Chandola, Ranga R. Vatsavai, Tisham Dhar and Alexandru Babescu. *Presented at American Geophysical Union Fall Meeting (AGU)*. 2011.

P1. A Comparative Study of Vegetation Phenology Using MODIS and AmeriFlux Data. Dafeng Hui, Varun Chandola, Lianhong Gu, and Ranga R. Vatsavai. *American Geophysical Union Fall Meeting (AGU)*. 2010.

Invited Talks

I19. Talk at RIT

I18. Talk at UoR

I17. Talk at IPIAM 2017 meeting

I16. Data Driven Fraud Detection. *1st International Program on Data Analytics for Banking and Financial Institutions.*, May 2017, Buffalo, NY.

I15. Scaling Non-linear Dimensionality Reduction Methods to Handle Massive Data Streams. *7th SC Workshop on Big Data Analytics*. November, 2016, Salt Lake City, UT.

I14. Talk at IPIAM 2016 meeting

I13. Finding Anomalies via Message Passing. *CDSE Days Invited Talk*. April 2016.

I12. Accelerating Gaussian Process Based Statistical Methods for Spatio-temporal Analysis. *International Indian Statistical Association Conference*, December 2015, Pune, India.

I11. Scaling Gaussian Process Analysis for Big Spatiotemporal Data. 10^{th} *International Workshop on Spatial and Spatiotemporal Data Mining* (SSTDM), November 2015, Atlantic City, NJ.

I10. Open source tools for Geospatial Analysis. *Google Developer Group DevFest*, October 2015, Buffalo, NY.

I9. Anomaly Detection. *4th International Program on Information Assurance and Management, IPIAM*, September 2015, Niagara Falls, NY.

I8. IGlobe: Bringing Big Data from Space to Desktop. 36^{th} *Annual Symposium on Remote Sensing of the Environment, ISRSE*, May 2015, Berlin, Germany.

I7. Data Science for Social Good - Lessons Learned and Future Directions. *Buffalo Big Data Meetup*, October 2014, Buffalo, NY.

I6. Anomaly Detection. *3rd International Program on Information Assurance and Management, IPIAM*, September 2014, Niagara Falls, NY.

I5. Large Scale Machine Learning for Massive Remote Sensing Data — A Case Study in Biomass Monitoring. *ASPRS Annual Meeting*. March 2013, Baltimore, MD.

I4. iGlobe: Bridging the Gap Between Weather and GIS. *NASA World Wind Department of Defense Apps Meeting.* October 2012, Washington, DC.

I3. iGlobe: Bringing Weather to WorldWind for Interactive Analysis. *NASA World Wind Department of Defense Apps Meeting.* March 2012, Mountain View, CA.

I2. High Performance Spatiotemporal Data Mining. *US Department of Energy Fall Creek Falls Meeting.* October 2010, Memphis, TN.

I1. Anomaly Detection for Symbolic Sequences. *NASA Conference on Intelligent Data Understanding.* September 2008, Washington, D.C.

PATENTS

Detection of Multi-step Computer Processes such as Network Intrusions. **Varun Chandola**, Eric Eilertson, Haiyang Liu, Mark Shaneck, Changho Choi, Gyorgy Simon, Yongdae Kim, Vipin Kumar, Jaideep Srivastava, and Zhi-li Zhang. *US Patent Published Application No. 20080276317.* 2008.

Settlement Mapping Systems. Anil M. Cheriyadat, Eddie A. Bright, **Varun Chandola**, Jordan B. Graesser, Budhendra L. Bhaduri. *US Patent Published Application No. .* 2015.

SOFTWARE

iGlobe: An open source tool for interactive analysis and visualization of climate data. http://www.cse.buffalo.edu/ chandola/iglobe/iglobe.html.
NASA Tech Brief - http://www.techbriefs.com/component/content/article/13850.

Sequence Anomaly Detection (SQUAD): A package of anomaly detection techniques for sequences. http://www.cse.buffalo.edu/ chandola/software.html

Minnesota Anomaly Detection System (MINDS): A data mining based intrusion detection software package. http://www.cs.umn.edu/research/MINDS.
NSF Press Release - http://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=100488.

TEACHING

CSE 474/574 - Introduction to Machine Learning Spring 2014(145 students), Spring 2015 (220 students), Spring 2016 (233 students), Spring 2017 (281 students)

CSE 740 - Large Scale Machine Learning and Big Data Fall 2013 (20 students), Fall 2014 (20 students), Fall 2015 (24 students)

EAS 503 - Programming and Database Fundamentals for Data Science Fall 2017 (28 students)

SERVICE

Departmental Service

- Computer Science & Engg., UB
  - Graduate Admissions Committee (2014, 2015)
  - Facilities Committee (2015)
  - Graduate Studies Committee (2015)
  - Student Awards Committee (2015, 2016)
  - Colloquium Committee (2014, 2016)
- Computational and Data Enabled Science & Engg., UB
  - Curriculum Committee (2014-)
  - SEAS M. Eng. in Data Science Planning Committee (2017-)
  - CDSE Outreach Committee (2015-)
  - Biostatistics Big Data Faculty Search Committee (2015-)

Panelist

- Panelist for NSF BigData, NSF IIS, NSF SaTC, and DOE ASCR.

Mentor Service

- Mentor for "Data Science for Social Good" summer fellowship at University of Chicago, June – August, 2014.
- Mentor in the SUNY Louis Stokes Alliance for Minority Participation (SUNY-LSAMP) program, June – August, 2014.

Editorial Service

- Guest Editor for special issue: "Big Spatial Data", Geoinformatica.
- Coordinating Editor for "Information Systems Frontiers", Springer.
- Guest Associate Editor for special issue: "Information Fusion, Data Analysis, and Knowledge Discovery in Hybrid Networks", Journal of Computer Networks and Communications.

Referee Service

- ACM Computing Surveys
- ACM Transactions on Knowledge and Data Discovery
- IEEE Transactions on Knowledge and Data Engineering
- SIAM Statistical Analysis and Data Mining
- Springer Machine Learning
- Journal of Machine Learning Research
- Data Mining and Knowledge Discovery
- Knowledge and Information Systems
- International Journal of Geographical Information Science
- Pattern Recognition
- Journal of Artificial Intelligence Research
- IEEE IET Information Security
- IEEE Systems, Man and Cybernetics, Part B
- Applied Stochastic Models in Business and Industry
- Journal of Aerospace Information Systems

Organization Committees

- CDSE Days Workshop (2014, 2015)
- ICDM 2015 (*Sponsorship Chair*)
- BigSpatial 2012, BigSpatial 2013, BigSpatial 2014, BigSpatial 2015, BigSpatial 2016, BigSpatial 2017 (*Workshop Co-chair*)
- ACS 2012, ACS 2013 (*Workshop Co-chair*)
- SensorKDD 2010, SensorKDD 2012, SensorKDD 2013 (*Workshop Co-chair*)
- PDAC 2011, PDAC 2012, PDAC 2013 (*Publicity Chair*)
- SSTDM 2011, SSTDM 2012, SSTDM 2013 (*Government, Industry, and Publicity Chair*)
- KDCloud 2014 (*Workshop Co-chair*)
- KDCloud 2011, KDCloud 2012, KDCloud 2013 (*Government, Industry, and Publicity Chair*)

Senior Program Committees

- SDM 2012, SDM 2014

Program Committees

- DASFAA 2016
- CIKM 2014, CIKM 2015, CIKM 2016, CIKM 2017
- IT-OT Analytics 2015
- HINA 2015
- BigData 2013
- SDM 2013
- ICRA 2012, ICRA 2013
- CIDU 2012
- PAKDD 2012
- Clim-KD 2011

PROFESSIONAL MEMBERSHIPS

- Association for Computing Machinery (ACM), Member, 2010–present
- Society for Industrial and Applied Mathematics (SIAM), Member, 2012–present

STUDENTS

- *Past*: Zhi Yang (PhD: 2015, First appointment: Continental Vision)
- *Current*: Suchismit Mahapatra, Duc Thanh Anh Luong, Niyazi Sorkunlu, Jialiang Jiang, Syed Zaidi, Yanbo Guo, Razie Fathi (CSE PhD Students), Amol Salunkhe, Sreelekha Guggilam (CDSE PhD Student)