

Safwan Wshah, University of Vermont

Assistant Professor
Department of Computer Science
Vermont Complex Systems Center

417 Innovation
Office: +1-(802) 656-8086
E-mail:
safwan.wshah@uvm.edu

SUMMARY

My journey with Machine Learning (ML) and its applications started in 2002 by applying ML for face recognition for my master thesis and then toward my Ph.D. in 2012. For my Ph.D. I joined one of the top labs, the Center of Excellence for Document Analysis and Recognition (CEDAR), under the supervision of Prof. Venu Govindaraju researching advanced algorithms for the challenging handwriting recognition problems. After graduating in 2012, I joined Xerox and then Palo Alto Research Center (PARC) to research and apply advanced machine learning algorithms to broad applications in education, medical, and transportation fields. As Assistant Professor, I joined the University of Vermont (UVM) computer science department in Fall 2017. I formed Vermont artificial intelligent Lab (VaiL) to research machine learning theory and its applications. Currently, the lab has four Ph.D. students and four masters. At VaiL, I've graduated two Ph.D. students and three Master students. I've published more than 16 journals and 22 conference papers and 20 patents. I have been awarded more than 780K as PI and 1.94M awarded to my lab as key personnel or co-investigator (from projects with a total of 8.2M). My fund came from NSF (two awards), NIH/R01, NOAA's National Water Center, the State of Vermont, the state of New York and Cold Regions Research and Engineering Laboratory (CRREL). The current pendings toward my lab is 750K. At UVM, I teach Machine Learning and Deep Learning. These are project-based courses taught to more than 600 students in which I supervised more than 200 different projects to develop ML algorithms for various real-world applications. I served as a reviewer and as a program committee member for many ML conferences and journals. In addition, I served as an NIH reviewer. I am always eager to contribute to science and teaching! For more information about my lab and interests, please visit our website at: <https://www.wshahgroup.com>.

RESEARCH INTERESTS

My research interests lie at the intersection of machine learning theory and application. I have broader interests in deep learning, computer vision, data analytics and image processing. In my lab we research algorithms to improve the adaptability and generalization of machine learning methods, in order to allow higher-quality applications to broader classes of real-life problems. Our core area is object understanding and geo-localization from ground, drone and satellite images. We also collaborate with groups from other fields such as Medical, Transportation, Energy, and Communication.

EDUCATION

University at Buffalo, Buffalo, NY USA

PhD, Department of Computer Science and Engineering, May 2008 to June 2012.

University of Cincinnati, Cincinnati, OH USA

PhD Student, Department of Electrical and Computer Engineering, Sep 2007 to May 2008.(Transferred to State University of New York at Buffalo)

The University of Jordan, Amman, Jordan

MSc. in Communication engineering, Department of Electrical Engineering, Sep 2002 to Jul 2005.

Princess Sumaya University, Amman, Jordan

BSc. in Electronics engineering, Department of Electronics Engineering, Oct. 1996 to Feb. 2001.

ACADEMIC
EXPERIENCE

University of Vermont, Burlington, VT, USA **August 2017 to Present**
Assistant Professor, Director of Vermont Artificial Intelligence Lab VaiL

At the Vermont Artificial Intelligence Laboratory (VaiL) we work at the intersection of machine learning theory and application. Our mission is to improve the adaptability and generalization of machine learning methods, in order to allow higher-quality applications to broader classes of real-life problems. Our core area is object understanding and geo-localization from the multiple sensory systems. We also collaborate with groups from other fields such as Medical, Transportation, Energy, and Communication. For a complete list of recent projects refer to: <http://www.wshahaigroup.com/>

GRANTS
AWARDED

Precision Design of Antimicrobial Peptides Against Bacterial Infections

Role: Co-investigator

Amount: \$1.9 M Total, \$516,040 to my lab (**awarded**).

Duration: 2022-2027

Funding source: NIH - R01, National Institute of General Medical Sciences (NIGMS).

Objects geo-localization from ground and satellite images

Role: Solo PI

Amount: \$780K (**awarded**) all toward my lab

Duration: 2018-2023 (More fund is expected after this period).

Funding source: Vermont Agency of Transportation, VT

RII Track-2 FEC: Advancing Research Towards Industries of the Future to Ensure Economic Growth for EPSCoR Jurisdictions - Advanced Wireless - Integration with Infrastructure Systems and IoT

Role: CO-PI, Effectively participated in grant writing and managing the Artificial Intelligence part of the proposal.

Amount: \$3.99M Total, \$406,692 to my lab (**awarded**)

Duration: 2021-2025

Funding source: NSF

RII Track-2 FEC: Explainable and Adaptable Artificial Intelligence for Advanced Manufacturing

Role: Key-personnel

Amount: \$1.02M Total, \$382,440 to my lab (**awarded**)

Duration: 2022-2026

Funding source: NSF

Cold Weather Summit-to-Shore Environmental Observation Network

Role: Key-personnel, Participated in grant writing.

Amount: \$2.2M Total, \$239,537 to my lab (**awarded**)

Duration: 2022-2025

Funding source: Cold Regions Research and Engineering Laboratory (CRREL)

CIROH: Forecasting the Incidence and Duration of Harmful Algal Blooms (HABs) at Daily, Weekly and Seasonal Scales

Role: Key-personnel

Amount: \$4M Total, \$420,240 to my lab (**awarded**)

Duration: 2022-2025

Funding source: NOAA's National Water Center.

Enabling Artificial Intelligence Tools to Improve Point of Care Ultrasound based Diagnosis

Role: PI

Amount: \$1.0 M Total, \$750,000 to my lab (Pending)

Duration: 2023-2028

Funding source: NIH

Machine Learning Algorithm for Power Systems Parameters Verification

Role: PI

Amount: \$90,000 (awarded)

Duration: 2019-2020

Funding source: The New York State Energy Research and Development Authority (NY-SERDA)

MRI: Acquisition of a GPU Accelerated Vermont Advanced Computing Core.

Role: CO-PI

Amount: \$893,120 (awarded) toward VACC computational infrastructure.

Duration: 2018-2021

Funding source: NSF

Machine Deep Learning for Detection of Endoleak after Endovascular Abdominal Aortic Aneurysm Repair.

Role: PI

Amount: \$25,000 (awarded)

Duration: 2018-2019

Funding source: UVMMC Department of Surgery, VT

OVPR Express

Role: PI

Amount: \$3,000 (awarded)

Duration: 2018-2019

Funding source: UVM OVPR

RESEARCH
EXPERIENCE

PARC - A Xerox Company, Webster, NY, USA June 2014 to August 2017
Research Scientist

Creating novel machine learning and image processing algorithms in computer vision and document imaging fields for transportation, healthcare and education. I implemented algorithms for object detection, tracking, image classification, and domain adaptation. Trained and tested deep learning models using Caffe, TensorFlow and MatConvNet under both Linux and Windows. Instructed internal course "Deep Learning in Computer Vision".

- **Vehicle Passenger Detection System:** Implemented scalable Deep Neural Networks algorithms for counting passengers in vehicles. Xerox Vehicle Passenger Detection System identifies the number of occupants in a vehicle with more than 95% accuracy, at speeds ranging from stop and go to 100 mph.
- **Digital Alternatives:** I led a team of 10 engineers to implement high advance image processing algorithms for document understanding captured from different sources (mobile camera, electronic, scanned, etc) in order to fill them electronically on fly. The objective of Xerox Digital Alternatives Tool is to maintain productivity and to reduce document workflow complexity in an always-connected world. For more information refer to [Xerox Digital Alternatives](#).
- **Xerox Ignite Educator Support System:** I implemented image processing and

deep learning approaches to recognize students handwriting for elementary schools handwriting. Ignite is a workflow and software solution that uses the power of data to transform K-12 education. Teacher would first scan students homework and/or exams into the Ignite system via a range of multifunctional input devices. For more information about the project refer to Ignite Educator Support System.

- **Human Video Analytics:** In this research advanced algorithms for human activities recognition in surveillance cameras, algorithms include detection, tracking and action recognition.
- **Surgical Video Analytics:** This Project is a collaboration with University of Rochester Medical Center (URMC) in which we the first to be known advanced Deep learning methods for action quality assessment in clinical settings. We analyzed videos captured in-vivo during a surgical procedure in order to evaluate the quality of the procedure, identify errors that have taken place, assess the expertise and skill level of the surgeon, and to provide coaching and feedback to students of surgery for each action.

Xerox Research Center, Webster, NY, USA
Research Scientist

August 2012 to May 2014

Creating new machine learning and image processing algorithms in document imaging fields for transportation, healthcare and education. I Implemented image processing and machine learning, deep learning algorithms for handwriting recognition, form understanding, form registration, form data extraction and word spotting.

- **Form Registration:** I implemented image processing algorithms for independent global and local form registration for health care transaction processing.
- **Crowd Sourcing for Medical Forms:** I developed image processing modules to process different medical forms with emphasis on their crowdsourcability.
- **Statistical Toolkit:** I develop high level statistical toolkit (C/C++) that implements statistical analysis and machine learning functionalities such as Neural network and convolutional neural networks.
- **Expression Spotting System:** I implemented deep learning algorithms to perform a low level of information retrieval that detect and recognize specific information such as mail address, email address, phone number, dates, numerical tables, page number, etc...
- **Handwriting and Machine Printed Text Separation:** I participated in implementing deep learning algorithms that separate handwritten from machine printed text in structured documents using denoised auto-encoders.

Center for Unified Biometrics and Sensors, University at Buffalo, Buffalo, NY
USA

Research Assistant

May 2008 to Sep. 2012

- **Keyword spotting in off-line Handwritten Documents :** I proposed a new approach to spot keywords in multilingual documents. I introduced filler and background models for keyword spotting that combines local scores and global word hypotheses scores to train a keywords detector based on Markov models.
- **Arabic Handwritten Recognition:** I developed features and statistical approaches to recognize full Arabic handwritten documents without the need for line segmentation. The method used n-gram language modeling to enhance the results. I developed advanced techniques based on continuous probability Connected Hidden Markov Models to gain the best performance on full Arabic document. The developed algorithms alleviated the need for segmenting Arabic text prior to recognition.

TEACHING
EXPERIENCE

Assistant Professor, University of Vermont, Computer Science Department (2017 until Present): I teach Machine Learning (CS 254) and Deep Learning (CS 354) courses. These courses offered for both graduate and undergraduate students in both in person and on-line modalities. Courses were developed from scratch. These are project-based courses in which each group of students implement machine learning algorithms from real-world data. Average students number is 45 students for the machine learning course and 20 students for the Deep learning. My teaching evaluations are at or mostly exceed the college teaching average scores.

Adjunct Professor, University of Rochester, Electrical and Computer Engineering Department (Fall-2016): I taught Digital Signal Processing course as primary instructor. The course had 45 students from graduate and undergraduate levels from Electrical and Biomedical Engineering Departments.

Industry Course, PARC (Fall-2015): Teaching *Deep Learning in Computer Vision* for more than 50 engineers and researchers from different backgrounds. At that time, the deep learning field was new and I designed the course based on my experience in the field in addition to the quick evolving science in this area at that time.

DOCTORAL
DISSERTATION

Title: "Word Spotting in Multilingual Handwritten Documents."
Advisor: Prof. Venu Govindaraju, SUNY Distinguished Professor.

I introduced a new approach for keywords spotting in multilingual handwritten documents based on statistical Markov models. The approach is script independent scalable over many languages such as English, Arabic and Devanagari and has many applications in information retrieval and indexing including language identification of handwritten documents.

MENTORING

I've graduated two PhD students from my lab at University of Vermont. Currently, I am supervising 8 students, Four PhD's and four MS student in Computer science, Complex systems programs and Electrical engineering. During my professional career as researcher at PARC and Xerox research labs I mentored four senior graduate students during their summer internships.

INDUSTRY
EXPERIENCE

Xerox, Webster, NY, USA
Software Engineer, Internship **May 2011 to Sep. 2011**

I created a framework to globally and locally register medical forms using advanced machine learning and pattern matching algorithms.

Applied Media Analysis, Collge Park, MD, USA
Software Engineer, Internship **May 2010 to Sep. 2010**

Research and development of software for Arabic Optical Character Recognition using continuous probability-Connected Hidden Markov Models. The developed algorithm alleviated the need for segmenting Arabic text prior to recognition. The algorithm performed concurrently both segmentation and recognition.

Copanion, Andover, MA, USA
Software Engineer, Internship **May 2009 to Sep. 2009**

Development of advanced convolutional neural network algorithms to recognize English handwritten text used for tax form recognition.

Lead Technologies
Software Engineer **Jan. 2001 to Sep. 2007**

Development and Research at different levels:

- Research in Image, Document, and Video processing algorithms.
- Implementing the developed algorithms under C, C++, Java, and .Net.
- Involved in training and guiding new members and update work guidelines.
- Team leader (9 Team members), managing and supervising all team projects.

JOURNAL
ARTICLES

- Wilson D, Zhang X, Sultani W, Wshah S. Visual and Object Geo-localization: A Comprehensive Survey, **resubmitted**, International Computer Vision Journal. 2022 January 11. (Impact factor: 11.54, contribution: Major).
- Mustafa Matar, Pablo Gill Estevez, Pablo Marchi , Francisco Messina , and Safwan Wshah, Transformer-Based Deep Learning Models for Forced Oscillation Localization, **Under review**, International Journal of Electrical Power & Energy Systems, (Impact factor 5.659), Contribution level: Major.
- F. Almutairy, L. Scekcic, R. Elmoudi and S. Wshah, Detection and Mitigation of GPS Spoofing Attacks against Phasor Measurement Units using Deep Learning, **resubmitted**, IEEE smart grid transactions. (Impact factor 8.2). Contribution level: Major.
- Mustafa Matar, Beilei Xu, Ramadan Elmoudi, Oluwaseyi Olatujoye and Safwan Wshah, Deep Learning-based Framework for Parameters Calibration of Power Generator Models using Event Playback Approach, **Accepted**, IEEE Access, (impact factor 4.34). Contribution level: Major.
- Wilson D, Alshaabi T, Van Oort C, Zhang X, Nelson J, Wshah S. Object Tracking and Geo-localization from Street Images, Remote Sensing, 2022 May (Impact factor 4.8). Contribution level: Major.
- Safwan Wshah, Beilei Xu, John Steinharter, Clifford Reilly, Classification of Clinically Relevant Intravascular Volume Status using Point of Care Ultrasound and Machine Learning, **resubmitted**, Journal of Medical Imaging, (Impact factor 3.6). Contribution level: avg.
- C. Van Oort, J. Ferrell, J. Remington, S. Wshah, and J. Li, "AMP-GAN: Facilitating the Design of Anti-Microbial Peptides", Chemical Science Journal – Impact factor 9.825), **revised**, 2021. Contribution level: Avg.
- F. Almutairy, L. Scekcic, R. Elmoudi and S. Wshah, "Accurate Detection of False Data Injection Attacks in Renewable Power Systems using Deep Learning", IEEE Access, (impact factor 3.367). Contribution level: Major.
- Van Oort CM, Ferrell JB, Remington JM, Wshah S, Li J. AMPGAN v2: Machine Learning-Guided Design of Antimicrobial Peptides. Journal of chemical information and modeling. 2021 Mar 31;61(5):2198-207. (impact factor 4.956). Contribution level: Major.
- K. McClure*, B. Erdreich, J. H.T.Bates, R. McGinnis, A. Masquelin, and **S. Wshah**, "Classification and Detection of Breathing Patterns with Wearable Sensors and Deep Learning", submitted, Sensors Journal, 2020. (impact factor 3.275)
- J. Ferrell, J. Remington, *C. Van Oort*, M. Sharafi, R. Aboushousha, Y. Janssen-Heininger and S. Schneebeil, M. Wargo, **S. Wshah** and J. Li "A Generative Approach toward Precision Antimicrobial Peptide Design", bioRxiv, 2020.
- L. Bonnell, B. Littenberg, , **S. Wshah**, G. Rose, "Automated Identification of Unhealthy Drinking: A Machine Learning Approach". Journal of the American Board of Family Medicine, 2020 (impact factor 2.7)
- F. Almutairy*, *T. Alshaabi*, J. Nelson, and , **S. Wshah**, "ARTS: Automotive Repository of Traffic Signs for the United States", IEEE Transactions on Intelligent Transportation Systems. 2019. (impact factor 6.31).

S Hahn, M Perry, , **S Wshah**, CS Morris, DJ Bertges, “Machine Deep Learning Accurately Detects Endoleak After Endovascular Abdominal Aortic Aneurysm Re-pair”, Journal of Vascular Surgery, 2019. (impact factor 3.7)

S. Wshah, C. Skalka and M. Price, “Machine Learning Methods for Post-Traumatic Stress Disorder Patient Prediction”, JMIR, 2019 (impact factor 5)

S. Wshah, G. Kumar , V. Govindaraju, Statistical script independent word spotting in offline handwritten documents, Pattern Recognition Journal, 2014.

S. Wshah, I. Mansour, A Robust Algorithm for Face Detection in Color Images Based on Color Segmentation and Neural Network Techniques, Dirasat, University of Jordan, Engineering Science, Volume 33, No. 2, 2006.

PEER-REVIEWED
CONFERENCE
PUBLICATIONS

Xiaohan Zhang, Xingyu Li, Waqas Sultani, Safwan Wshah, Cross-view Geo-localization via Learning Disentangled Geometric Layout Correspondence, **Under review**, NIPS 2022. (Acceptance Rate: 24.8%), Contribution level: Major.

Xiaohan Zhang, Waqas Sultani, Safwan Wshah, Cross-View Image Sequence Geo-localization, **Under review**, WACV 2022. (Acceptance Rate: 34.5%), Contribution level: Major.

Xiaohan Zhang, safwan Wshah, LanePainter: Lane Marks Enhancement via Generative Adversarial Network, ICPR 2022. (Acceptance Rate: 45%) . Contribution level: Major.

Safwan Wshah, Beilei Xu, Jason Bates, Katelin Morrissette, Deep fusion of ultrasound videos for Furosemide classification, IEEE International Symposium on Biomedical Imaging (ISBI), 2022. (Acceptance rate: 48%). Contribution level: Major.

F. Almutairy, R. Shadid, and **S. Wshah**, “Identification and Correction of False Data Injection Attacks against AC State Estimation using Deep Learning”. Submitted, The IEEE Power & Energy Society General Meeting, Accepted. 2020. Acceptance Rate ~**50%**

S. Wshah, R. Shadid , Y. Wu , *M. Matar* , B. Xu , W. Wu , Lin L., R. Elmoudi , “Deep Learning for Model Parameter Calibration in Power Systems”, 2020 IEEE International Conference on Power System Technology (POWERCON), Accepted, August, 2020. Acceptance Rate ~**50%**

W. Wu, L. Lin, **S. Wshah**, R. Elmoudi, B. Xu, “Generator Model Parameter Calibration Using Reinforcement Learning,” IEEE Green Energy and Smart Systems Conference (IGESSC), Accepted Nov. 2020. Acceptance Rate ~**40%**

L. Lin, W. Wu, **S. Wshah**, R. Elmoudi, B. Xu, “HPT-RL: Calibrating Power System Models based on Hierarchical Parameter Tuning and Reinforcement Learning,” IEEE International Conference on Machine Learning and Applications (ICMLA), Accepted, Dec., 2020. Acceptance Rate ~**30%**

A. Elhadad, T. Sullivan, **S. Wshah**, T. Xia, “Machine Learning for Respiratory Detection Via UWB Radar Sensor”, 2020 IEEE International Symposium on Circuits & Systems (ISCAS) Acceptance Rate ~**65%**

S. Hahn, C. Morris, D. Bertges, **S. Wshah**, “Deep Learning for Recognition of Endoleak after Endovascular Abdominal Aortic Aneurysm Repair”, submitted to IEEE International Symposium on Biomedical Imaging (ISBI), 2019. Acceptance Rate ~**40%**

S. Hamshaw , D. Denu, M. Holthuijzen, **S. Wshah**, D. Rizzo “Automating the classification of hysteresis in event concentration-discharge relationships”. SEDHYD 2019 conference, At Reno, Nevada. 2019. Acceptance Rate ~**65%**

S. Wshah, B. Xu, O. Bulan, J. Kumar, P. Paul, Deep learning architectures for domain adaptation in HOV/HOT lane enforcement, 2016 IEEE Winter Conference on Applications of Computer Vision (WACV 2016).

- B. Xu, O. Bulan, J. Kumar, **S. Wshah**, V. Kozitsky, P. Paul, Comparison of Early and Late Information Fusion for Multi-camera HOV Lane Enforcement , IEEE 18th International Conference on Intelligent Transportation Systems, (ITSC 2015).
- E. Gross, **S. Wshah**, I. Simmons, G. Skinnerl, A handwriting recognition system for the classroom, Fifth International Conference on Learning Analytics And Knowledge, (LAK 2015).
- O. Bulan, **S. Wshah**, R. Palghat, V. Kozitsky, A. Burry, USDOT Number Localization and Recognition From Vehicle Side-View NIR Images , IEEE Conference on Computer Vision and Pattern Recognition Workshops, (CVPR 2015).
- G. Kumar , **S. Wshah** ., G.Venu , Variational dynamic background model for keyword spotting in handwritten documents, Electronic Imaging. International Society for Optics and Photonics, (IS&T/SPIE 2013).
- G. Kumar , **S. Wshah** ., G.Venu , Segmentation-free keyword spotting framework using dynamic background model, In proceeding of: Document Recognition and Retrieval XX, (DRR 2013).
- S. Wshah.**, G. Kumar G., G. Venu , Multilingual Word Spotting in Offline Handwritten Documents , 21st International Conference on Pattern Recognition, (ICPR 2012).
- S. Wshah** ., Kumar G., Venu G., Script Independent Word Spotting in Offline Handwritten Documents Based on Hidden Markov Models, International Conference on Frontiers in Handwriting Recognition, (ICFHR 2012).
- S. Wshah**, G.Venu , C. Yanfen , L. Huiping , A Novel Lexicon Reduction Method for Arabic Handwriting Recognition, International Conference on Pattern Recognition, (ICPR 2010).
- S. Wshah** , S. Zhixin , G. Venu , Segmentation of Arabic Handwriting Based on both Contour and Skeleton Segmentation, Conference on Document Analysis and Recognition (ICDAR 2009).
- S. Wshah** , I. Mansour , (2005). A Robust Algorithm for Face Detection in Color Images, IASTED International conference on visualization, imaging, and image processing (2005), Spain, (VIIP 2005).
- ABSTRACTS**
- C. Van Oort*, B. Xu, L. Lin, **S. Wshah**, K. Morrissette, “Machine Learning Tools to Predict Clinical Outcomes of Hospitalized COVID-19 Patients”, In Review, Society for Critical Care Medicine Congress.
- B Erdreich, *K McClure*, AH Masquelin, R McGinnis, **S Wshah**, JHT Bates, Using Wearable Sensors and Deep Learning to Categorize and Detect Different Patterns of Breathing in Healthy Subjects, American Thoracic Society, 2020.
- L. Bonnell, B. Littenberg, **S. Wshah**, G. Rose, Automated identification of unhealthy drinking using routinely collected data: A machine learning approach, accepted poster to APHA 2018.
- SD Hamshaw, D Denu, MM Dewoolkar, M Holthuijzen, **S Wshah**, D Rizzo, Applying Deep Learning to Event Concentration-Discharge Hysteresis Patterns to Reveal Differences in Sediment Dynamics across Contrasting Watersheds, AGU Fall Meeting, 2018.
- D. Wilson, **S. Wshah**, “Sign-Hunter: Classification and Geo-Localization of US Traffic Signs”, VTrans Research Symposium 2020, 2020.
- M. Clark, T. Laracy, W. Burns, **S. Wshah**, G. L Galford, “Machine Learning for Early Warning of Cyanobacteria Blooms in Vermont’s Lake Champlain”, AGU, 2020.
- T. Osinsk, D. Arpit, **S. Wshah**, Ahmed Ghazi, Computer-generated assessment of technical surgical skills (CATS) , American Urological Association Annual Meeting, (AUA2016).

PATENTS

- S. Hahn*, C. Morris, D. Bertges, **S. Wshah**, Method and apparatus for detecting endoleaks on computerized tomography scans after endovascular aortic aneurysm repair, April 8, 2019, V0139.70127US00, (In review)
- S. Wshah**, B.i Xu, O. Bulan, System and method for expanding and training convolutional neural networks for large size input images, US Patent App. 15/194,757, 2019
- R Eschbach, PJ Emmett, **S. Wshah**, EN Chapman, Methods and systems of creating a confidence map for fillable forms, US Patent App. 14/816,142, 2018
- S. Wshah**, R. Bala, D. Arpit, Method and system for evaluating the quality of a surgical procedure from in-vivo video, US Patent App. 15/138,494, 2017
- S. Wshah**, B. Xu, O. Bulan, Multi-layer fusion in a convolutional neural network for image classification, US Patent App. 15/179,403, 2017
- Balamurugan, L. Stone, M. Samptha, R. Taylor, **S. Wshah**, Method and system for cost optimized crowdsourcing based enterprise form digitization, 20150052, 01, March 2015
- M. Maltz, **S. Wshah**, Building tables with row and column heading from a scanned form, 20150435, 09 Jul 2015
- S. Wshah**, M. Maltz, D. Venable, Method and system of identifying fillable fields of an electronic form, 20151112US01, 10 Dec 2015
- S. Wshah** , M. Campanelli , Character recognition method and system using digit segmentation and recombination, US Patent App. 15/149,483,2013
- S. Wshah** ,M. Campanelli, Global registration of filled-out content in an application form, US Patent App. 15/149,483, 2013.
- S. Wshah** ,M. Campanelli , Y. Zhou, Method and apparatus for classifying machine printed text and handwritten text, US Patent App. 14/284,592, 2014
- S. Wshah** , M. Campanelli , Methods and devices for form-independent registration of filled-out content, US Patent US Patent App. 14/196,108, 2014
- R. Eschbach , **S. Wshah**, Altering scans to include security features identifying scan origination, US Patent 9,258,452, 2014
- E. Gross, G. Skinner, **S. Wshah** , Isaiah L Simmons, Confirming automatically recognized handwritten answers, US Patent App. 14/627,457, 2014

HONORS &
AWARDS

- PARC Special Award for Contributions to the Most Innovative Project. 2015
- Graduate Teaching Assistantship, University at Buffalo, Sep. 2010 - May 2012.
- Graduate Research Assistantship, University at Buffalo, May 2008 - Sep. 2010.
- Graduate Research Assistantship, University of Cincinnati, Jan 2008 - May 2008.
- Graduate Teaching Assistantship, University of Cincinnati, Sep. 2007 - Jan 2008.

INVITED TALKS

- “**Deep Learning in Transportation Applications**”, Invited talk at UVM CEE University, November, 2017.
- “**Opportunities and Challenges of Machine Learning in Real-World Applications**”, Invited talk at PSUT University, January 2, 2018.
- “**Opportunities and Challenges of Machine Learning in Real-World Applications**”, Invited talk at UVM EBE University, Feb-2, 2018.
- “**Deep Learning in Radiology: Recent Advances, Challenges and Future Trends**”, Invited talk at UVMCC, Radiology department, September, 2018.
- “**Model Parameters Verification**”, Invited talk at UVM EBE, Feb-2, 2019.
- “**Machine learning challenges and opportunities in the Energy field**”, NY-SERDA, NY, Oct. 2019.

“**Deep Learning in Radiology: Recent Advances, Challenges and Future Trends**”,
University of Pittsburgh, Medical school. 2020

Invited speaker to NASPI, **Deep learning for model parameters calibration in power systems**, 2021

PROGRAM COMMITTEE	Publicity Chair, The International Conference on Document Analysis and Recognition (ICDAR) 2023 Intelligent Systems Conference, 2022. International Conference on Pattern Recognition (ICPR 2022, ICPR 2020, ICPR2019, ICPR 2018, ICPR2017) ASIP-2021 Asia Symposium on Image Processing. The 2017 International Conference on Advanced Technologies Enhancing Education (ICAT2E2017), 2017 The Seventh International Conference on Performance, Safety and Robustness in Complex Systems and Applications(PESARO 2017), 2017 ICDAR Conference on Document Analysis and Recognition, Nancy, France, 2015. Program Chair, 5th International Workshop on Multilingual OCR, Nancy, France, 2015. IEEE International Symposium on Multimedia (ISM2013).
REVIEWER FOR JOURNALS AND CONFERENCES	NIPS, ICPR, CVPR, ECCV, ICCV. Journal of Pattern recognition. Nature Communications. IEEE Transactions on Pattern Analysis and Machine Intelligence. International journal of computer vision International Journal of Pattern Recognition and Artificial Intelligence. Signal Image and Video Processing journal. Journal of smart science. Patterns Journal. IEEE Power & Energy society general meeting. Energies- Open Access Journal by MDPI IEEE PES General Meeting
EXTERNAL REVIEWER	I served as NIH study section reviewer for Emerging Imaging Technologies and Applications (EITA) program.
PROFESSIONAL MEMBERSHIPS	member of IEEE (Institute of Electrical and Electronics Engineers) and Computing Machinery (ACM)
TECHNICAL SKILLS	<i>Platforms:</i> Windows, UNIX <i>Programming Languages and toolkits:</i> Python, C, C++, Caffe, Torch, Matlab, OpenCV, .Net (C#, VB), Java, VB, SQL, Assembly, verilog. <i>Scripting Language:</i> Shell Scripts, Perl. <i>Web Technologies :</i> HTML, JavaScript, VBScript. <i>Tools :</i> DirectX, Nvidia GPU processing.