CURRICULUM VITAE

ALEX VAKANSKI

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EDUCATIONAL BACKGROUND

Graduate Studies:	Toronto Metropolitan University, Toronto, Canada **Ph.D. Degree** in Mechanical and Industrial Engineering Year Graduated: 2013
Graduate Studies:	Ss. Cyril and Methodius University, Skopje, Macedonia **Master of Applied Science** in Mechanical Engineering Year Graduated: 2003
Undergraduate Studies:	Ss. Cyril and Methodius University, Skopje, Macedonia **Bachelor of Mechanical Engineering** in Hydraulics, Pneumatics, and Automation Year Graduated: 1998

WORKING HISTORY

July '23 – current	University of Idaho Industrial Technology, College of Engineering 1776 Science Center Drive, Idaho Falls, Idaho 83402, USA *Position: Associate Professor*
August '17 – July '23	University of Idaho Industrial Technology, College of Engineering 1776 Science Center Drive, Idaho Falls, Idaho 83402, USA *Position: Assistant Professor*
August '14 – August '17	University of Idaho Industrial Technology, College of Engineering 1776 Science Center Drive, Idaho Falls, Idaho 83402, USA *Position: Clinical Assistant Professor*
January '14 – August '14	Sheridan College School of Mechanical and Electrical Engineering & Technology 7899 McLaughlin Rd., Brampton, Ontario L6Y 5H9, Canada *Position: Partial Load Professor*
March '13 – February '14	Toronto Metropolitan University Department of Mechanical and Industrial Engineering 350 Victoria Street, Toronto, Ontario M5B 2K3, Canada *Position: Postdoctoral Researcher*
September '08 – March '13	Toronto Metropolitan University Department of Mechanical and Industrial Engineering 350 Victoria Street, Toronto, Ontario M5B 2K3, Canada *Position: Ph.D. Studies Research Assistant*

July '09 - September '09 National Research Council – Institute for Aerospace Research
5145 Decelles Avenue, Montreal, Quebec H3T 2B2, Canada
Position: Visiting Researcher

Research Interests

- Machine learning and artificial intelligence
- Robotics / robot learning / visual servoing of robots
- Computer vision and image processing
- Biomedical informatics

Published Works

Books

1. **A. Vakanski**, and F. Janabi-Sharifi, *Robot Learning from Visual Observation*, John Wiley & Sons, Inc., 208 pages, ISBN-10: 1119091802, ISBN-13: 978-1119091806, 2017.

Journal Publications

1. F. Alharbi, and **A. Vakanski**, "Machine Learning Methods for Cancer Classification Using Gene Expression Data: A Review," *Bioengineering*, vol. 10, no. 2, pp. 1–26, 2023.
2. B. Shareef, **A. Vakanski**, P. E. Freer, and M. Xian, "ESTAN: Enhanced small tumor-aware network for breast ultrasound image segmentation," *Healthcare*, vol. 10, no. 11, pp. 1–14, 2022.
3. S. Butte, **A. Vakanski**, K. Duellman, H. Wang, and A. Mirkouei, "Potato crop stress identification in aerial images using deep learning-based object detection," *Agronomy Journal*, vol. 113, no. 5, pp. 3991–4002, 2021.
4. **A. Vakanski**, M. Xian, and P. Freer, "Attention enriched deep learning model for breast tumor segmentation in ultrasound images," *Ultrasound in Medicine and Biology*, vol. 46, no. 10, pp. 2819–2833, 2020.
5. Y. Liao, **A. Vakanski**, M. Xian, D. Paul, and R. Baker, "A review of computational approaches for evaluation of rehabilitation exercises," *Computers in Biology and Medicine*, vol. 119, article no. 103687, 2020.
6. Y. Liao, **A. Vakanski**, and M. Xian, "A deep learning framework for assessing physical rehabilitation exercises," *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 28, no. 2, pp. 468–477, 2020.
7. C. Williams, **A. Vakanski**, S. Lee, and D. Paul, "Assessment of physical rehabilitation movements through dimensionality reduction and statistical modeling," *Medical Engineering & Physics*, vol. 74, pp. 13–22, 2019.
8. R. E. Hiromoto, M Haney, **A. Vakanski**, and B. Shareef, "Toward a secure IoT architecture," Advanced Control Techniques in Complex Engineering Systems: Theory and Applications, Springer's book: *Studies in Systems, Decision, and Control*, vol. 203, pp. 297–323, 2019.
9. L. Li, **A. Vakanski**, "Generative adversarial networks for generation and classification of physical rehabilitation movement episodes," *International Journal of Machine Learning and Computing*, vol. 8, no. 5, 2018.
10. **A. Vakanski**, H-p. Jun, D. Paul, and R. Baker, "A data set of human body movements for physical rehabilitation exercises," *Data*, vol. 3, no. 2, pp. 1–15, Jan. 2018.
11. **A. Vakanski**, F. Janabi-Sharifi, and I. Mantegh, "An image-based trajectory planning approach for robust robot programming by demonstration," *Robotics and Autonomous Systems*, vol. 98, pp. 241-257, 2017.
12. **A. Vakanski**, J. M. Ferguson, and S. Lee, "Metrics for performance evaluation of patient exercises during physical therapy," *International Journal of Physical Medicine & Rehabilitation*, vol. 5, no. 3, pp. 1–6, 2017.
13. **A. Vakanski**, J. M. Ferguson, and S. Lee, "Mathematical modeling and evaluation of human motions in physical therapy using mixture density neural networks," *Journal of Physiotherapy and Physical Rehabilitation*, vol. 1, no. 4, pp. 1–10, 2016.
14. **A. Vakanski**, F. Janabi-Sharifi, and I. Mantegh, "Robotic learning of manipulation tasks from visual perception using a Kinect sensor," *Int. Journal of Machine Learning and Computing*, vol. 4, no. 2, pp. 163–169, 2014.

15. **A. Vakanski**, I. Mantegh, A. Irish, and F. Janabi-Sharifi, "Trajectory learning for robot programming by demonstration using Hidden Markov Model and Dynamic Time Warping," *IEEE Trans. on Systems, Man, and Cybernetics-Part B: Cybernetics*, vol. 42, no. 4, pp. 1039–1052, 2012.
16. E. Nematollahi, **A. Vakanski**, and F. Janabi-Sharifi, "A second-order conic optimization-based model for visual servoing," *Journal of Mechatronics*, vol. 22, no. 4, pp. 444–467, 2012.
17. F. Janabi-Sharifi, and **A. Vakanski**, "Analysis of visual acuity and motion resolvability as measures for optimal visual perception of the workspace," *Applied Ergonomics*, vol. 42, no. 3, pp. 473–486, 2011.

Conference Proceedings

1. H. Wang, M. Xian, **A. Vakanski**, and B. Shareef, "SIAN: Style-guided instance-adaptive normalization for multi-organ histopathology image synthesis," in *Proc. of the IEEE International Symposium on Biomedical Imaging* (ISBI 2023), Cartagena de Indias, Colombia, 2023, pp. pp. 1–5.
2. S. Butte, H. Wang, **A. Vakanski**, and M. Xian, "Enhanced Sharp-GAN for histopathology image synthesis," in *Proc. of the IEEE International Symposium on Biomedical Imaging* (ISBI 2023), Cartagena de Indias, Colombia, 2023, pp. pp. 1–5.
3. S. Sun, M. Xian, and **A. Vakanski**, "MIRST-DM: Multi-Instance RST with drop-max layer for robust classification of breast cancer," in *Proc. of the International Conference on Medical Image Computing and Computer Assisted Intervention* (MICCAI 2022), Singapore, Singapore, 2022, pp. 1–10.
4. S. Butte, H. Wang, M. Xian, and **A. Vakanski**, "Sharp-GAN: Sharpness loss regularized GAN for histopathology image synthesis," in *Proc. of the International Symposium on Biomedical Imaging* (ISBI 2022), Kolkata, India, 2022, pp. 1–5.
5. J. Shi, **A. Vakanski**, M. Xian, J. Ding, and C. Ning, "EMT-Net: Efficient multitask network for computer-aided diagnosis of breast cancer," in *Proc. of the International Symposium on Biomedical Imaging* (ISBI 2022), Kolkata, India, 2022, pp. 1–5.
6. H. Wang, M. Xian, and **A. Vakanski**, "TA-Net: Topology-aware network for gland segmentation," in *Proc. of the Winter Conference on Applications of Computer Vision* (WACV 2022), Waikoloa, USA, pp. 1-9, 2022.
7. B. Zhang, **A. Vakanski**, and M. Xian, "BI-RADS-Net: An explainable multitask learning approach for cancer diagnosis in breast ultrasound images," in *Proc. of the 31st IEEE International Workshop on Machine Learning and Signal Processing* (MLSP 2021), Gold Coast, Australia, pp. 1-6, 2021.
8. **A. Vakanski**, and M. Xian, "Evaluation of complexity measures for deep learning generalization in medical image analysis," in *Proc. of the 31st IEEE International Workshop on Machine Learning and Signal Processing* (MLSP 2021), Gold Coast, Australia, pp. 1-6, 2021.
9. B. Shareef, M. Xian, and **A. Vakanski**, "STAN: Small tumor-aware network for breast ultrasound image segmentation," in *Proc. of the IEEE International Symposium on Biomedical Imaging* (ISBI), Iowa City, USA, 2020.
10. H. Wang, M. Xian, and **A. Vakanski**, "Bending loss regularized network for nuclei segmentation in histopathology images," in *Proc. of the IEEE International Symposium on Biomedical Imaging* (ISBI), Iowa City, USA, 2020.
11. S. Butte, **A. Vakanski**, and M. Xian, "Deep learning for industrial IoT-empowered processes: Methods, applications, infrastructure, and practical considerations," in *Proc. of the IEEE Workshop on Microelectronics and Electron Devices*, Boise, USA, pp. 1-5, 2019.
12. M. Ghahramani, **A. Vakanski**, and F. Janabi-Sharifi, "6D object pose estimation for robot programming by demonstration," in *Proc. of the International Symposium on Optomechatronic Technologies*, Cancun, Mexico, pp. 1–6, 2018.
13. R. E. Hiromoto, M. Haney, and **A. Vakanski**, "A secure architecture for IoT with supply chain risk management," in *Proc. of the IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems*, Bucharest, Romania, pp. 1–6, 2017.
14. **A. Vakanski**, F. Janabi-Sharifi, and I. Mantegh, "Transferring skills to robots for tasks with cyclic motions via dynamical systems approach," in *Proc. of the Int. Symposium on Optomechatronic Technologies*, Paris, France, 2012, pp. 1–6.
15. **A. Vakanski**, F. Janabi-Sharifi, I. Mantegh, and A. Irish, "Trajectory learning based on Conditional Random Fields for robot programming by demonstration," in *Proc. of the IASTED Int. Conf. on Robotics and Applications*, Cambridge, USA, 2010, pp. 401–408.
16. **A. Vakanski**, A. Tuneski, and D. Babunski, "Design of digital control using frequency response methods," in *Proc. of the Third Int. Conf. on Applied Automatic Systems*, Ohrid, Macedonia, 2003, pp. 283–289.

17. **A. Vakanski**, A. Tuneski, and D. Babunski, "Time-optimal control of non-linear discrete systems," in *Proc. of the Third Int. Conf. on Applied Automatic Systems*, Ohrid, Macedonia, 2003, pp. 187–193.

PATENTS

1. **A. Vakanski**, and F. Janabi-Sharifi, *Image-based Trajectory Robot Programming Planning Approach*, U.S. Patent 10,112,303 (filed Aug. 25, 2016, granted Oct. 30, 2018). Based on International Patent Application PCT/CA2014/05101 (Oct. 2014).
2. **A. Vakanski**, and F. Janabi-Sharifi, *Image-based Robot Trajectory Planning Approach*, Canada Patent 2,928,645 (filed Apr. 20, 2015, granted Oct. 26, 2021). Based on International Patent Application PCT/CA2014/051016 (Oct. 2014).

THESES

1. A. Vakanski, "Statistical Modeling, Planning, and Control for Vision-Based Robot Programming by Demonstration", 2013, **Ph.D. Thesis**, Department of Mechanical and Industrial Engineering, Toronto Metropolitan University, Toronto, Canada. Supervisors: Dr. Farrokh Janabi-Sharifi, Dr. Iraj Mantegh.
2. A. Vakanski, "Digital Dynamic Control of Read-Write Systems in a Disk Drive", 2003, **M. Sc. Thesis**, Faculty of Mechanical Engineering, Ss. Cyril and Methodius University, Skopje, Macedonia. Supervisor: Dr. Atanasko Tuneski.
3. A. Vakanski, "Control of Robots in the Interactive Environment", 1998, **B. Eng. Diploma Work**, Faculty of Mechanical Engineering, Ss. Cyril and Methodius University, Skopje, Macedonia. Supervisor: Dr. Atanasko Tuneski.

RESEARCH EXPERIENCE

University of Idaho (Idaho Falls, USA) Assistant/Associate Professor

- *Breast cancer detection in ultrasound images: December 2018 – present*
  The project employs machine learning for the development of robust and explainable models for detection and segmentation of breast tumors in ultrasound images. Our research team developed approaches for integrating prior knowledge of visual saliency into deep learning-based tumor segmentation, design of explainable models for cancer diagnosis using the BI-RADS lexicon, detection of small-size tumors in breast images, and segmentation of histopathology images for breast cancer detection.
- *Modeling and assessment of patient exercises in physical rehabilitation programs: May 2016 – present*
  The research employs deep neural networks for modeling and assessment of movements by patients undertaking physical rehabilitation therapy. The modeling approach is based on a hierarchical multi-layer architecture designed to handle spatial and temporal variations in captured movement data using motion capture sensors. The research team created the UI-PRMD dataset (University of Idaho – Physical Rehabilitation Movement Dataset) to facilitate model training and validation.
- *Crop health assessment in precision agriculture: June 2018 – present*
  The project goal is to develop novel methods for processing of aerial images of crop fields collected with a multispectral sensor mounted on an unmanned aerial system. To this end, we designed a neural network architecture for discrimination of healthy and stressed plants in potato fields.
- *Robotic visual learning: October 2016 – present*
  The research project is a continuation of my previous work on the commercialization of a system for image-based robotic learning. The work is sponsored by the Idea 2 Innovation grant by NSERC Canada. The project focuses on improving the object tracking, pose estimation, and graphical user interface for the prototype of a robotic learning system. The project also employs ROS software for robot control and for interfacing the system components.

Toronto Metropolitan University (Toronto, Canada) Postdoctoral Research Fellow

- *Robotic visual learning: March 2013 – February 2014*
  The research goal is commercialization of an approach for image-based robotic learning, which I developed during the Ph.D. studies. The work was sponsored by the Scientists and Engineers in Business, which is a joint initiative by Toronto Metropolitan University and the Federal Economic Development Agency for Southern Ontario, dedicated to supporting commercialization of innovative research ideas. I co-founded a start-up company for developing a

prototype system for robotic learning from task observations. The company, named *Visual Learning Robotics*, was granted a U.S. Patent for the approach for image-based robot learning.

Toronto Metropolitan University (Toronto, Canada) Research Assistant

- *Robot programming by demonstration: February 2009 – February 2013*
  The objective is to teach robots new tasks from observation of demonstrations by using probabilistic modeling of demonstrated motions. I developed approaches based on Hidden Markov Models and Conditional Random Fields to address the problems of stochastic task modeling at a trajectory level of abstraction, and generation of a trajectory for task reproduction by a robot learner. Other investigated aspects of the problem include: formulation of the learning process as a constrained optimization problem for direct learning in the image space of a vision camera sensor, and the use of dynamical movement primitives for learning cyclic motions.
- *Visual servoing of robots: May 2008 – September 2012*
  The research developed a hybrid robot control method for simultaneous optimization of features trajectories in the image space of a camera and the trajectory of a robot's end-point in the Cartesian space. Another research challenge involved integration of a visual servoing-tracking algorithm for robust execution of trajectories learned from observation of demonstrations.
- *Visual perception of the workspace: October 2009 – May 2010*
  The project investigated the visual perception of human workers and employed visual acuity and motion resolvability as metrics for improved ergonomics with regard to the visual perceptibility of the workspace.

Teaching Experience

- Industrial Technology, University of Idaho (Idaho Falls, USA)
  Computer Integrated and Robotics Manufacturing Technology (INDT 453): Spring 2020, Spring 2021, Spring 2023
  Project and Program Management (INDT 448): Spring 2021, Spring 202, Spring 2023
  Manufacturing Systems (INDT 353): Fall 2015, Fall 2016, Fall 2017
  Fundamentals of Unmanned Aerial Systems (INDT 473): Spring 2017, Fall 2019, Spring 2022
  Mechatronics Systems (INDT 474): Fall 2015, Fall 2016, Fall 2018
  Introduction to Industrial Technology (INDT 310): Fall 2021, Fall 2022, Fall 2023
  Quality Assurance Organization and Management (INDT 444): Spring 2021, Fall 2022, Fall 2023
  Adversarial Machine Learning (CS 487/587): Fall 2020, Fall 2021, Spring 2023
  Special Topics: Python Programming for Data Science (Cs 404/504): Fall 2022, Fall 2023
  Introduction to Non-Destructive Testing (INDT 475): Summer 2015, Spring 2019, Spring 2021
  Lean to Green Sustainable Technology (INDT 457): Spring 2015
  Project Engineering (CE 482): Spring 2015, Summer 2016, Spring 2017
  Engineering Graphics (ENGR 105): Spring 2017, Spring 2018, Spring 2019
- Faculty of Applied Science & Technology, Sheridan College (Brampton, Canada)
  Applied Electricity (ENGI 15592): Winter 2014
  Engineering Graphics (ENGI 10146): Winter 2014
  Computer Assisted Design for 3D Models (CADD 20229): Summer 2014
  Instrumentation and Process Control (ANGI 29875): Summer 2014
- Department of Mechanical Engineering, Toronto Metropolitan University (Toronto, Canada)
  Integrated Manufacturing (MEC 8009): Winter 2013

Awards

- *ASNT Faculty Grant Award* awarded by the American Society for Non-destructive Testing (2018).
- *ASNT Faculty Grant Award* awarded by the American Society for Non-destructive Testing (2015).
- *Scientist and Engineers in Business Fellowship* awarded by the Federal Economic Development Agency for Southern Ontario and Toronto Metropolitan University (03. 2013/ 03. 2014).
- *Italian Machine Tool Technology Award,* awarded by the Italian Trade Commission (2011).

Certification

- *Professional Engineer Faculty Restricted Licence* granted by the Board of Licensure of Professional Engineers and Professional Land Surveyors of Idaho (2017).
- *Certified Technology Manager* granted by the Association for Technology, Management, and Applied Engineering (2017).
- *Remote Pilot Airman Certificate* granted by the Federal Aviation Agency (2017).

Reviewing Services

- *IEEE Transactions on Cybernetics*: 2014 – present.
- *International Journal of Advanced Robotic Systems*: 2014 – present.
- *Journal of Intelligent and Robotic Systems*: 2014 – present.
- *IEEE/ASME Transactions on Mechatronics*: 2013 – present.
- *Journal of Robotics – An Open Access Journal*: 2012 – present.
- *IEEE International Conference on Robotics and Automation*: 2012 – present.
- *IEEE/RSJ International Conference on Intelligent Robots and Systems*: 2013 – present.

  and a number of other journals and international conferences.

Editorial Services

- Associate Editor for *Frontiers in Manufacturing Technology (Frontiers)*, Automated Systems section: 2022 – present.
- Guest Editor for *Bioengineering (MDPI)*, Special Topics Issue: *Bioengineering for Physical Rehabilitation,* 2022 – 2023.
- Guest-editor for *Healthcare (MDPI)*, Special Topics Issue: *Trustworthy Computer-Aided Diagnosis of Breast Cancer using Ultrasound*, co-editors: Min Xian, and Aleksandar Vakanski, 2022 – 2023.
- Guest editor for *Frontiers in Manufacturing Technology (Frontiers)*, Research Topic collection *AI-driven Robotic Technologies for Industry 4.0*, co-editors: Aleksandar Vakanski, and Amir Shabani, 2022 – 2023.

Conference Organization

- Member of the Technical Committee at multiple conferences: *Biotechnology* (Rome, Italy, 2019); *International Joint Conference on Robotics, Automation, and Mechatronics* (Wellington, New Zealand, 2018); *International Conference on Intelligent Robotic and Control Engineering* (Chengdu, China, 2018); *International Conference on Manufacturing Technologies* (San Diego, USA, 2017); *International Conference on Material Engineering and Manufacturing Technologies* (Shanghai, China 2019; Beijing, China, 2018; Busan, Korea, 2017); *International Conference on Mechanical, Electronics and Computer Engineering* (New York, USA, 2016).
- Program Chair at the *International Conference of Machine Learning and Computing*, Florence, Italy, 2015.
- Session Chair at the *International Conference of Machine Learning and Computing*, Toronto, Canada, 2014.

Membership

- *Association for Technology Management and Applied Engineering*: 2015 – present.
- *IEEE Robotics and Automation Society*: 2010 – present.