Devinder Kumar
Post-Doctoral Fellow, Stanford University

CONTACT INFORMATION	1070 Arastradero Road Cognitive & Sys. Neurosc. Lab Stanford University Palo Alto, CA-94304, USA	*Phone:* +1-650-431-8536 *Office:* Suite 200 *E-mail:* devkumar@stanford.edu *Website:* www.devinderkumar.com

RESEARCH INTERESTS

My research centers around Deep Learning and its application in Computer Vision and Explainable AI.

EDUCATION

University of Waterloo, Waterloo, Ontario Canada

PhD, SYDE, Jan 2017- Feb 2020
GPA: 93/100

- Dissertation Topic (in the field of XAI): Class Based Strategies for Understanding Neural Networks
- Advisor: Dr. Alexander Wong (Canada Research Chair, Medical Imaging & AI) and Dr. Graham Taylor (Canada Research Chair, ML Systems, CIFAR AI Chair, Vector Inst./ UGuelph)

University of Waterloo, Waterloo, Ontario Canada

MASc., SYDE, Sept 2014- Aug 2016
GPA: 91/100

- Dissertation Topic: Deep Learning based Omni-directional Place Recognition for Challenging Environments
- Advisor: Dr. Steven Waslander and Prof. David A. Clausi

National Institute of Technology, Warangal, Andhra Pradesh India

B.Tech, EEE, July 2009 - May, 2013
Graduated with distinction

- Dissertation Topic: MATLAB Based Simulation of Photovoltaic Cell

EXPERIENCE

Stanford University, Palo Alto, CA, USA

Postdoctoral Fellow   **March 2020 - Present**
Postdoctoral Fellow at the Stanford Cognitive & Systems Neuroscience Laboratory (SCSNL) under the supervision of Prof. Vinod Menon in School of Medicine, Stanford University.

Scale AI, Montreal, QB, Canada

AI Expert Committee Member   **Sept 2020 - Present**
AI expert committee member involved in the validation of ventures for Scale AI's $20M accelerate program. Scale AI is Canada's AI Supercluster; an investment and innovation hub that supports the application of AI to supply chains.

Industrial Consultant, Waterloo, ON, Canada

Lead Consultant/Advisor   **Aug 2017 - Feb 2020**
Lead, advised and Implemented AI based POC solutions for various large and mid sized corporations in different sectors such as manufacturing, mining, automation, via UWaterloo & independent projects.

NextAI Program (NEXT Canada), Toronto, Ontario, Canada

Lead AI Scientist in Residence   **Feb 2018 - Sept 2019**

Lead of the AI scientist team that provided scientific and technical support to start-ups selected in yearly co-hort of NextAI accelerator.

NextAI Program (NEXT Canada), Toronto, Ontario, Canada

AI Scientist in Residence   **Feb, 2017 - Sept 2017**

Acted as a scientific mentor for seven new AI based start-ups. Provided scientific and technical support to these teams that are working on a wide variety of projects, and employing a number of tools and platforms.

Philips Research (HQ), Eindhoven, Netherlands

Deep Learning Intern, Data Science Team   **Aug, 2016 - Dec, 2016**

Worked with the data science team to develop machine learning tools using state-of-the art visualization techniques to visualize the decision making of deep learning networks and finding biases in the learned models.

University of Waterloo, Waterloo, Ontario Canada

Graduate Student   **Sept, 2014 - Feb 2020**

Includes current PhD & MASc. research along with Masters level coursework and other research projects.

Teaching Assistant   **May 2015 - Feb 2020**

- SYDE 111: Fundamental Engineering Math 1
- SYDE 112: Fundamental Engineering Math 2
- SYDE 211: Advanced Engineering Math 1
- SYDE 223: Data Structures and Algorithms

Duties at various times have included office hours, marking and leading weekly tutorials.

LIP-6, University Pierre et Marie Curie, Paris, France

Research Engineer   **Feb, 2014 - Aug, 2014**

Created a new dataset of 101 categories of 101k food images (UPMC-101) and performed deep learning based experiments for fine grained classification task for VISIIR project.
http://visiir.univ-lr.fr/

IUPR, Technische Universitat Kaiserslautern, Kaiserslautern, Germany

Summer Visiting Researcher   **May, 2012 - July, 2012**

Implemented single-shot camera calibration for the camera calibration pipeline of Decapod project.
https://sites.google.com/site/decapodproject/

Indian Institute of Science, Bangalore, India

Summer Visiting Researcher   **May, 2011 - July, 2011**

Developed a single camera marker based tool for human motion analysis for applications in biomechanics.

Honors and
Awards

Awarded President Graduate Scholarship (PGS) at University of Waterloo 2018-19

Awarded International Ontario Graduate Scholarship (OGS) (1/5 awards at UWaterloo) 2018-19

Best Paper Award at Transparent and Interpretable Machine Learning Workshop at 31st Neural

Information Processing & Systems (NIPS) 2017

Awarded President Graduate Scholarship (PGS) at University of Waterloo 2017-18

Awarded International Ontario Graduate Scholarship (OGS) (1/5 awards at UWaterloo) 2017-18

Awarded CIFAR scholarship to attend DL & RL Summer School, MILA, UMontreal, 2017

University of Waterloo International Doctoral Student Award 2017

Magna Cum Laude Award, Annual Meeting of the Imaging Network of Ontario, 2016.

University of Waterloo International Masters Student Award 2015, 2016.

Millennium Graduate Bursary, University of Waterloo, 2015

Gold Medal for Excellence in Research (Electrical Department), NIT Warangal, 2013

World Semi-finalist for the Dell Social Innovation Challenge, 2012

Best Paper Award (Undergrad) IEEE Region 10 Paper Contest across Asia-Pacific Region, 2012

Institute Merit Scholarship for excellent Academic performance, NIT Warangal, 2010

Ranked 1st in High School out of 300 student, 2008

PUBLICATIONS
SUMMARY

Citations: 741, H-index: 10, I-index: 11

PUBLICATIONS
JOURNALS

D. Kumar et. al, "Spontaneous numerosity recognition in humans", Nature Communications *In preparation*

S. Ryali, K. Supekar, R.Yuan , **D. Kumar**, C. D. L. Angeles, V. Menon,"Identification of robust, reproducible and interpretable brain signatures of autism and clinical symptom severity using a dynamic time-series deep neural network", Biological Psychiatry (Journal) *Submitted*, 2021

A. Nagi, **D. Kumar**, D. Sola, K. Scott, "RUF: Effective Sea Ice Floe Segmentation Using End-to-End RES-UNET-CRF With Dual Loss", Remote Sensing (Journal) *Submitted*, 2021

D. Kumar*, V Sankar*, D. Clausi, G. W. Taylor, A. Wong. SISC: End-to-end Interpretable Discovery Radiomics-Driven Lung Cancer Prediction via Stacked Interpretable Sequencing Cells. IEEE Access, 2019

A. Ziletti, **D. Kumar**, M. Scheffler and L. M. Ghiringhelli. Insightful classification of crystal structures using deep learning. **Nature Communications** 9, A:2775, 2018

D. Kumar, Graham W. Taylor, Alexander Wong. Opening the Black Box of Financial AI with CLEAR-Trade: A CLass-Enhanced Attentive Response Approach for Explaining and Visualizing Deep Learning-Driven Stock Market Prediction. Journal of Computational Vision and Imaging Systems (JCVIS), 2017

D.Kumar , A. Singh, S.N. Omkar. A Novel Visual Cryptographic Method for Color Images. International Journal of Image, Graphics and Signal Processing, Vol. 6, Issue. 6, pp. 49-56, May, 2013

S. Karanam, A. Singh, **D.Kumar**. Karate with Constructive Learning. International Journal on Image and Video Processing , Vol. 2, Issue-3, pp: 382-386, February, 2012.

D. Kumar, A. Singh. Occluded Human Tracking and Identification using Image Annotation. International Journal of Image, Graphics and Signal Processing , Vol.4, No.12, November 2012.

D. Kumar, A. Singh. Annotation Supported Occluded Object Tracking. International Journal on Image and Video Processing, Vol. 3, Issue: 1, August, 2012.

A. Singh and **D. Kumar**. Integrating Occlusion and Illumination Modeling for Object Tracking using Image Annotation. International Journal of Image, Graphics and Signal Processing, Vol. 4, Number. 10, pp: 40-47, September 2012

A. Singh, **D. Kumar**, K. Bacchuwar, A. Choubey, S. Karanan. Annotation Supported Contour Based Object Tracking With Frame Based Error. International Journal of Machine Learning and Computing (IJMLC), Vol. 2, No. 4, pp (s): 521-525, August 2012

A. Singh, **D. Kumar**, P. Srikanth, S. Karanam, N. Acharya. An Intelligent Multi-Gesture Spotting Robot to Assist Persons with Disabilities. International Journal of Computer Theory and Engineering, Vol. 4, No. 6, pp(s): 998-1001, December, 2012

A. Choubey, A. Singh, S. Karanam, **D.Kumar**, K. Bacchuwar. A Novel Signature Verification based Automatic Teller Machine. International Journal of Information and Electronics Engineering, Vol. 2, No. 4, pp (s): 570-574 , July 2012

P. Srikanth, A. Singh, **D.Kumar**, A. Nagrare, V. Angoth. A Comparison of Machine Learning Classifiers. Elsevier: SCOPUS International Journal of Advanced Materials and Information Technology Processing, 271-273, pp 149-153, 2011.

A. Singh, K. Bacchuwar, A. Choubey, S. Karanam, **D.Kumar**. An OMR Based Automatic Music Player. 3rd International Conference on Computer Research and Development, pp. 174-178, 2011.

D. Kumar, P. Siva, P. Marchwica and A. Wong. Unsupervised Domain Adaptation in Person Re-ID via k-Reciprocal Clustering and Large-scale Heterogeneous Environment Synthesis. Winter Conference on Applications of Computer Vision (WACV), 2020

D. Kumar, P. Siva, P. Marchwica and A. Wong. Establishing a Strong Baseline for Cross-Domain Person ReID. International Conference on Pattern Recognition (ICPR) *submitted*, 2020

D. Kumar, I. Ben-Daya, K. Vats, J. Feng, G. W. Taylor, A. Wong. Beyond Explainability: Leveraging Interpretability for Improved Adversarial Learning. Computer Vision and Pattern Recognition (CVPR) Workshop, 2019

D. Kumar, V Menkovski, Graham W. Taylor, Alexander Wong. Understanding anatomy classification through attentive response maps. IEEE 15th International Symposium on Biomedical Imaging (ISBI), 2018

D. Kumar, Graham W. Taylor, Alexander Wong. CLEAR-DR: Interpretable Computer Aided Diagnosis of Diabetic Retinopathy, 31st Neural Information Processing & Systems (NIPS) Transparent and Interpretable ML Workshop, 2017 *Best Paper Award.*

D. Kumar, Graham W. Taylor, Alexander Wong. Explaining the Unexplained: A CLass-Enhanced Attentive Response (CLEAR) Approach to Understanding Deep Neural Networks. Computer Vision and Pattern Recognition (CVPR) Workshop, 2017 *(Oral)*

D. Kumar, M.J.Shafiee, A.G. Chung, F. Khalvati, M.A. Haider and A. Wong. Discovery Radiomics for Pathologically-Proven Computed Tomography Lung Cancer Prediction. 14th International Conference on Image Analysis and Recognition (ICIAR), 2017 *(Oral)*

D.Kumar, H. Neher, A. Das, D. Clausi and S. Waslander. Deep Learning based Omni-directional

Place Recognition for Challenging Environments. 14th Conference on Computer and Robot Vision (CRV), Edmonton, AB, 2017 *(Oral)*.

D. Kumar, V. Menkovski. Understanding Anatomy Classification Using Visualization. 30th Neural Information Processing & Systems (NIPS) Machine Learning for Health (MLH) Workshop, 2016

A.G. Chung, M.J.Shafiee, **D. Kumar**, F. Khalvati, M.A. Haider and A. Wong. Discovery Radiomics for Multi-Parametric MRI Prostate Cancer Detection. Proc. Annual Meeting of the Imaging Network of Ontario, 2016. *Magna Cum Laude Paper Award.*

Shafiee, M. J., A. Chung, **D. Kumar**, A. Wong, F. Khalvati, and M. A. Haider. Discovery radiomics via StochasticNet sequencers for cancer detection. 29st Neural Information Processing & Systems (NIPS) Workshop on Machine Learning in Healthcare, 2015

X.Wang, **D. Kumar**, N.Thome, M.Cord, and F.Precioso. Recipe Recognition with large multimodal food dataset. IEEE International Conference on Multimedia & Expo Workshops (ICMEW),pg:1-6, 2015.

A. Wong, A.G. Chung, **D. Kumar**, M.J.Shafiee, , F. Khalvati and M.A. Haider. Discovery Radiomics for Imaging-driven Quantitative Personalized Cancer Decision Support. Vision Letters, 2015

D.Kumar, A. Wong and D. Clausi. Lung Nodule Classification Using Deep Features in CT Images. 12th Conference on Computer and Robot Vision (CRV), Halifax, NS, June, 2015.

A.Das, **D. Kumar**, A.E.Bably and S. Waslander. Taming the North: Multi-Camera Parallel Tracking and Mapping in Snow-Laden Environments. In proceedings Field and Service Robotics (FSR), June, 2015.

A. Singh, S. Karanam, and **D. Kumar**. Constructive Learning for Human-Robot Interaction. IEEE Potentials, Vol. 32, Issue: 4, pp(s): 13-19, Aug, 2013 *IEEE Best Student Paper Award (Region 10).*

S. Karanam, A. Singh, **D. Kumar**, A. Choubey, K. Bacchuwar. Analysis and Improvement of SNR using Time Slicing. 3rd International Conference on Digital Image Processing, Proc. SPIE 8009, Issue: 1, 2013.

A. Nagrare, A. Singh, P. Srikanth, **D.Kumar**, C. Dwith. A Comparison of Biclustering with Clustering Algorithms. 3rd Pacific-Asia Conference on Circuits, Communications and System (PACCS 2011), pp. 1-4, 2011

TALKS   Invited talk at the **Ulster University** Big Data Workshop, Belfast, Northern Ireland, "What clinicians should know about deep learning and explainable AI", April 14th, 2021

Invited talk at the **NextAI** 2020 Cohort, Toronto & Montreal, Canada, "Tips and Tricks for Training Neural Networks Effectively", March 27th, 2020

Invited guest talk at the **SPORTLOGIQ**, Montreal, Quebec on "Tips and Tricks for Training Neural Networks Effectively", Aug 26th, 2019

Invited keynote talk at the annual symposium of the **Project Management Institute (PMI)** south western Ontario chapter on "What Managers need to Know for AI Projects, Strategies to Identify and Overcome Pitfalls in AI Projects", April 25th, 2019

Invited talk at **Element AI** office Toronto & Montreal on "Explainable AI - Techniques, Challenges

and beyond Interpretability", Feb 2019

Invited talk at **Bank Of Montreal (BMO)**, Toronto on "Explainable AI - Techniques, Challenges and beyond Interpretability", Feb 2019

Invited Keynote Speech at **Big-Data/AI Toronto**, Conference, Toronto, Canada - "Challenges for Future AI- Scalability and Interpretability", May 2017

Invited talk at **Fritz-Haber-Institut der Max-Planck-Gesellschaft**, Berlin, Germany - "Visualizing the Decision Making Process of CNNs" Dec 2016

Invited talk at **Gustave Roussy Cancer Research Institute**, Paris, France - "Discovery Radiomics for Cancer detection: Intelligent bio-markers" May 2016

MEDIA COVERAGE

My research has been published and covered by the following media organizations and reports:

- "Better way found to determine the integrity of metals", EurekAlert (AAAS), July 2018
- "Better way found to determine the integrity of metals", Phys.org, July 2018
- "This Researcher Wants to Open the 'Black Box' of Financial AI", VICE's Motherboard, Oct 2017
- "New software could make it easier to adopt and trust AI systems that set insurance premiums", Canadian Underwriter Magazine, Oct 2017
- "Scientists developed software to make artificial intelligence systems more trustworthy", Technology.org, Oct 2017
- "Waterloo research paves the way for use of complex AI in the financial sector", Exchange Magazine, Oct 2017
- "Waterloo research paves the way for use of complex AI in the financial sector", Waterloo Media Relations Press Release, Oct 2017
- "Building trust in AI", Investment Executive, Oct 2017
- "Reading the minds of deep learning AI systems", Engineer the Future Magazine, Sept 2017
- "Reading the minds of deep learning AI systems", Waterloo Stories, June 2017

REVIEWER

I am now the managing editor for Journal of Computational Vision and Imaging Systems (JCVIS). In past I have acted as a reviewer for the following:

- IEEE Transactions on Image Processing (TIP)
- IEEE Transactions on Emerging Topics in Computational Intelligence
- IEEE Transactions on Multimedia
- IEEE Transactions on Industrial Informatics
- IEEE Journal of Biomedical and Health Informatics (JBHI)
- IEEE Reviews in Biomedical Engineering
- Journal of Translational Medicine (Spring-Nature)
- Lung Cancer (Elsevier-Journal)
- Computer Physics Communications (Elsevier-Journal)
- Bio-Med Central (BMC) Medical Imaging (Springer-Journal)
- Computer Methods and Programs in Biomedicine (Elsevier-Journal)
- Measurement: the Journal of the International Measurement Confederation (MEAS) (Elsevier-Journal)

- Medical & Biological Engineering & Computing (Springer-Journal)
- IEEE International Conference on Robotics & Automation, 2021
- 6th Annual Conference on Vision and Intelligent Systems, 2021
- 31st British Machine Vision Conference (BMVC), 2020
- International conference on Medical Imaging with Deep Learning (MIDL), 2018 & 2020
- IEEE Canadian Journal of Electrical and Computer Engineering
- Computer Assisted Radiology and Surgery (CARS) conference, 2017
- International Journal of Computer Assisted Radiology and Surgery (IJCARS)
- IEEE International Conference on Robotics and Systems (IROS), 2016

STUDENT
SUPERVISION

Griffin Young, Undergraduate Research Assistant (URA), Stanford University, May-Aug'20
Jeffery Feng, Undergraduate Research Assistant (URA), UWaterloo, Jan-Apr'19

SERVICE

Managing Editor, Journal of Computational Vision & Imaging Systems, Waterloo, 2017-present
Technical Committee Member, 6th Annual Conference on Vision and Intelligent Systems, 2021
Poster Session Chair, Toronto Machine Learning Summit (TMLS), Nov 20th-21st, Toronto, 2018
Chairman, Computer Vision & Image Processing Cluster, IEEE Student Branch NITW 2012-13

REFERENCES

Available upon request