DEEPAK K. GUPTA

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EDUCATION

Delft University of Technology, The NetherlandsSep 2013 - Aug 2017Shell-NWO Computational Sciences for Energy Research (CSER) ProgrammePhD in Computational Science

Indian Institute of Technology (ISM) Dhanbad, India Integrated (5 yr.) M.Sc. Tech. in Applied Geophysics Overall GPA: 8.48/10 (Rank 1; Director's Gold Medal)

RESEARCH EXPERIENCE

Transmute AI Research

Research Scientist and Founding Member

- Transmute AI Research is a non-profit research group that focuses around experienced AI researchers mentoring early career students from prestigious universities providing them the opportunity to work on cutting-edge AI projects.
- Our research is self-funded through additional consultancy projects, including the use of AI for geophysical problems (funded by Aramco Overseas).
- Our fundamental research projects include designing efficient neural networks through pruning, improving binarized neural networks, explicitly learning group equivariance in CNN and tackling hard challenges in object tracking.
- Research output published at ICLR'21 and under review at ICIP'21 and CVPR'21 workshop.

Informatics Institute (QUVA Lab), University of Amsterda	m Jan 2019 - Jan 2021
Postdoctoral Researcher (Deep learning, computer vision)	Amsterdam, Netherlands

· Projects and responsibilities included:

- Developing deep learning algorithms for improved visual object tracking. My focus is on tackling hard challenges such as occlusion and in-plane rotations through modifications to network architecture. Other projects include tracking under constraints with goals of improved surveillance and video summarization.
- Developing efficient inductive representation learning methods for hypergraphs. Our focus is on developing matrix-free methods that use efficient aggregation methods and can be used for large-scale representation learning problems.
- Supervising students on projects related to efficient neural architecture design, stochastic semantic segmentation, biological cell tracking, reducing model decay in long-term object tracking, and developing VQ-VAE based generative models for modification of selective patches in images.

SpectrumAI

Scientific Advisor

 \cdot Deep learning-based object tracking for livestock monitoring.

- Leading research on the development of multi-object tracking methods for livestock monitoring.
- Together with our client *Serket BV*, we have built a large-scale segmentation dataset from livestock videos of pigs. In addition to an upcoming research article, this dataset will be made publicly available soon.
- Supervised several research interns and BS thesis students exploring different aspects of this research.

May 2020 - Dec 2020 Amsterdam, Netherlands

July 2008 - May 2013

Jan 2021 - Present

Amsterdam, Netherlands

Shell Technology Center, Royal Dutch Shell

Researcher (Applied machine learning, computer vision)

- \cdot Unsupervised/semi-supervised learning based real-time automated detection of energy events in passive microseismic data.
- · Application of deep learning methods in automating parts of seismic data processing.

Faculty of 3mE, Delft University of Technology Researcher

- · Topology optimization (TO) for high-resolution designs (*PhD project*, Apr 2014 Aug 2017).
 - Developed a combined mesh and penalization adaptivity based TO scheme.
 - Established uniqueness bounds and identified numerical artefacts in multiresolution TO methods.
 - Formulated a *dp*-adaptive scheme for high-resolution structural designs.
- · Optimization of metallization design in solar cells (*PhD project*, Sep 2013 July 2017).
 - Developed a novel 2D finite element model for numerical modeling of the electrical parameters.
 - Optimized metallization designs for freeform geometries and variable conditions.
- · Deep learning based models for noise reduction and data recovery (Aug 2016 Aug 2017).
 - Developed a stacked autoencoder framework to learn geophysical models for denoising purposes.
 - Explored the potential of convolutional autoencoders in denoising of geophysical data.

EarthByte Group, University of Sydney	Dec 2012 - Jan 2013
Visiting Student	Sydney, Australia

 \cdot Developed a C++ based plate rotation utility in the *GPlates* software.

Schlumberger Asia Services Ltd.	June 2012 - July 2012
Summer Intern	Dehradun, India
· Machine Learning based automated correlation of well logs and ident	tification of lithological features.

- Developed a pattern-recognition approach based on sliding window and normalized cross-correlation.
- Implemented the algorithm using *Ocean* API as a plugin for *Petrel* software.

Indian Institute of Technology (ISM)	Jan 2010 - Mar 2013
Research Student	Dhanbad, India

- $\cdot\,$ Soft computing for intelligent interpretation of petroleum data and characterization of reservoirs (M.Sc. thesis: Mar 2012 Mar 2013).
 - Implemented a least square fitting based semi-automated tool for prediction of missing log data.
 - Developed a global optimization based tool for the prediction of reservoir properties.
 - Formulated an ant colony method based approach for automated horizon selection in seismic data.
- Recursive ant colony optimization (RACO) (May 2011 Apr 2012).
 - Proposed a recursive variant of ACO well suited for continuous optimization problems.
 - Tested applicability of RACO on various geophysical examples.
- · Computational seismicity analysis and earthquake forecasting (Jan 2010 Apr 2011).
 - Developed a stress transfer model for Chamoli-Uttarkashi region using *Coulomb* software.
 - Developed *FractalAnalyzer*, a MATLAB based GUI for earthquake forecasting based on multifractal analysis.

Nov 2017 - Jan 2019 Bangalore, India

Sep 2013 - Aug 2017

Delft, The Netherlands

PUBLICATIONS

Note: Names are marked with * for more than one first author. My supervisor role marked with †. **Journals**

Total count: 14, published: 13, submitted: 1

- Grama D., Dahele M., van Rooij W., Slotman B., Gupta[†] D.K. and Verbakel W., 2021, Deep learningbased markerless lung tumour tracking in radiotherapy using siamese networks, *Medical Image Anal*ysis (submitted).
- · Franken^{*} J. F., Leur^{*} R. R., Gupta[†] D.K. *et al.*, 2021, Uncertainty estimation for deep learningbased automated analysis of 12-lead electrocardiograms, *European Heart Journal - Digital Health* (accepted with minor revisions).
- · Leur^{*} R. R., Taha^{*} K., Bos M., van der Heijden J.F., Gupta[†] D.K. *et al.*, 2020, Discovering diseasespecific electrocardiogram features using a novel deep learning-based approach: proof-of-concept in phospholamban gene mutation carriers, *Circulation: Arrythmia and Electrophysiology*.
- Gupta D.K., Langelaar, M. and van Keulen F., 2020, Design and analysis adaptivity in multi-resolution topology optimization, *International Journal for Numerical Methods in Engineering*, 121 (3), 450-476.
- · Garg^{*} A., Vos^{*} A., Bortych^{*} N., Gupta D.K. and Verschuur D.J., 2019, Spatial aliasing removal using deep learning super-resolution, *First Break*, 37 (9), 87-92.
- · Gupta D.K., Langelaar, M. and van Keulen F., 2018, QR-patterns: Artefacts in multiresolution topology optimization, *Structural and Multidisciplinary Optimization*, 58 (4), 1335-1350.
- Gupta D.K., Barink M. and Langelaar M., 2018, CPV solar cell modeling and metallization optimization, Solar Energy, 159, 868-881.
- Gupta D.K., van der Veen G.J., Aragon, M.A., Langelaar M. and van Keulen F., 2017, Bounds for decoupled design and analysis discretizations in topology optimization, *International Journal for Nu*merical Methods in Engineering, 111 (1), 88-100.
- · Gupta D.K., Barink M., Galagan Y. and Langelaar M., 2017, Integrated front-rear grid optimization of free-form solar cells, *IEEE Journal of Photovoltaics*, 7 (1), 294-302.
- · Gupta D.K., Langelaar M., Barink M. and van Keulen F., 2015, Optimizing front metallization patterns: Efficiency with aesthetics in free-form solar cells, *Renewable Energy*, 86, 1332-1339.
- Gupta D.K., Langelaar M., Barink M. and van Keulen F., 2015, Topology optimization of front metallization patterns for solar cells, *Structural and Multidisciplinary Optimization*, 51 (4), 941-955.
- · Roy P.N.S. and Gupta D.K., 2015, FractalAnalyzer: A MATLAB Application for Multifractal Seismicity Analysis, *Seismological Research Letters*, 86 (5), 1424-1431.
- · Gupta D.K., Bhowmick D. and Roy P.N.S., 2015, Himalayan hazard study on the basis of stress and strain state of 1991 Uttarkashi earthquake using coulomb stress transfer model, *Geomatics, Natural Hazards and Risk*, 6 (2), 131-148.
- Shankar U., Gupta D.K., Bhowmick D. and Sain K., 2013, Gas hydrate and free gas saturations using rock physics modelling at site NGHP-01-05 and 07 in the Krishna-Godavari Basin, eastern Indian margin, *Journal of Petroleum Science and Engineering*, 106, 62-70.
- Gupta D.K., Gupta, J.P., Arora, Y. and Shankar U., 2013, Recursive ant colony optimization: a new technique for the estimation of function parameters from geophysical field data, *Near Surface Geophysics*, 11 (3), 325-339.

Conference Proceedings

Total count: 22, published/accepted: 17, submitted/preprint: 5

- · Gupta, D.K., Arya, D. and Gavves, E., 2021, Rotation Equivariant Siamese Networks for Tracking, Conference on Computer Vision and Pattern Recognition (CVPR'21).
- · Chavan^{*} A., Bamba^{*} U., Tiwari^{*}, R. and Gupta^{*†} D.K., 2021, Rescaling CNN through Learnable Repetition of Network Parameters, *arXiv:2101.05650* (submitted to *ICIP'21*).

- Tiwari^{*} R., Bamba^{*} U., Chavan^{*} A. and Gupta^{*†} D.K., 2021, ChipNet: Budget-aware pruning with Heaviside continuous approximations, *International Conference on Learning Representations (ICLR'21)*.
- · Filtenborg, M., Gavves, E. and Gupta[†], D.K., 2020, Siamese Tracking with Lingual Object Constraints, arXiv:2011.11721.
- · Arya D., Gupta D.K., Rudinic S. and Worring M., 2020, HyperSAGE: Generalizing inductive representation learning on hypergraphs, *arXiv:2010.04558v1*.
- · Cardenas B., Arya D. and Gupta[†] D.K., 2020, Generating annotated coherent high-fidelity images containing multiple objects, arXiv:2006.12150v2 (submitted to ICIP'21).
- · Kassapis E., Dikov G., Gupta[†] D.K., and Nugteren C., 2020, Calibrated adversarial refinement for stochastic segmentation *arXiv:2006.13144* (submitted to *ICCV'21*).
- · Bos^{*} M., van de Leur^{*} R., Vranken J., Gupta[†] D.K., et al., 2020, Automated Comprehensive Interpretation of 12-lead Electrocardiograms Using Pre-trained Exponentially Dilated Causal Convolutional Neural Networks *Computing in Cardiology (CinC Conference)*, 1-4. [oral]
- · Gupta D.K., Gavves E. and Smeulders A.W.M., 2020, Tackling occlusion in siamese tracking using structured dropouts, 25th International Conference on Pattern Recognition (ICPR'20), 1-8.
- Gavves E., Tao R., Gupta D.K. and Smeulders A.W.M, 2020, Model decay in long-term tracking, 25th International Conference on Pattern Recognition (ICPR'20), 1-8.
- Panteli^{*} A., Gupta^{*}, D.K., de Bruin N. and Gavves E., 2020, Siamese tracking of cell behavior patterns, Medical Imaging and Deep Learning (MIDL'20) Conference, 1-18.
- Arya* D., Olij* R., Gupta D.K., Gazzar A.E., van Wingen, G., Worring M. and Thomas R.M., 2020, Fusing Structural and Functional MRIs using Graph Convolutional Networks for Autism Classification, *Medical Imaging and Deep Learning (MIDL'20) Conference*, 1-15.
- Shrivastava R., Gupta D.K., Phadke S. and Goudsewaard J., 2019, Intelligent Microseismic Event Detection Using Kirchhoff Migration Style Stacking in Combination with Iterative Clustering based Segmentation, 81st EAGE Conference and Enxhibition, 1-5. [oral]
- Swierstra M.K., Gupta[†] D.K. and Langelaar M., 2019, Automated and Accurate Geometry Extraction and Shape Optimisation of 3D Topology Optimisation Results, *NAFEMS European Conference:* Simulation-Based Optimisation. [oral]
- Gupta D.K., Langelaar M., and van Keulen F., 2016, Combined mesh and penalization adaptivity based topology optimization 57th AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 09453, 1-12. [oral]
- · Gupta D.K., Langelaar M., van Keulen F. and Barink M., 2014, Topology Optimization: An effective method for designing front metallization patterns of solar cells 4th International Conference on Engineering Optimization, CRC Press, 323-328.
- · Bhowmick, D., Gupta D.K., Malhotra, M. and Shankar, U., 2014, A New Tool for Estimation of Gas Hydrate Saturation, 76th EAGE Conference and Exhibition, 1-4.
- Gupta D.K., Langelaar M., Barink M. and van Keulen F., 2014, Topology Optimization: An effective method for designing front metallization patterns of solar cells 2014 IEEE 40th Photovoltaic Specialist Conference (PVSC), 2471-2475.
- · Gupta D.K., Bhowmick, D., Shankar, U. and Sain, K., 2012, Transformation From Acoustic to Reservoir Properties Based on Ant Colony Model and Effective Medium Theory 2012 SEG Annual Meeting, 1-4.
- Bhowmick, D., Gupta D.K. and Shankar, U., 2012, Estimation of Gas Hydrate Saturation Using Rock Physics Modelling-A Case Study in the Krishna-Godavari Region, 5th EAGE St. Petersburg International Conference and Exhibition, 1-4. [oral]
- Arora, Y., Gupta D.K., Gupta, J.P. and Singh, U.K., 2012, Inversion of 1D VES Data Using New a Technique Called Recursive Ant Colony Optimization (RACO), 5th EAGE St. Petersburg International Conference and Exhibition, 1-4. [oral]

• Gupta D.K., Arora, Y., Singh, U.K. and Gupta, J.P., 2012, Recursive Ant Colony Optimization for estimation of parameters of a function, *IEEE 2012 1st International Conference on Recent Advances* in Information Technology (RAIT), 448-454. [oral]

Workshop Proceedings

Total count: 4, published: 4, submitted: 0

- Bhattacharya^{*} S., Arya D., Bhowmick D., Thomas R. T. and Gupta^{*†} D. K., 2020, Improving solar cell metallization designs using convolutional neural networks, *Deep Learning for Simulation (SimDL)*, *ICLR'21 workshops*.
- Kuipers T., Arya D. and Gupta[†] D.K., 2020, Hard Occlusions in Visual Object Tracking, ECCV'20 Workshops, 1-14.
- Gupta D.K., Bruijn N., Panteli A. and Gavves E., 2019, Tracking-assisted segmentation of biological cells, *Medical Imaging meets NeurIPS (Med-NeurIPS'19)*, 1-4.
- · Kristan et al., 2019, The seventh visual object tracking (VOT2019) results, Visual Object Tracking, ICCV'19 workshops.

TECHNICAL STRENGTHS

Computer Languages	C, C++, Python, MATLAB, JAVA, C#
Software Libraries	Pytorch, Tensorflow, Keras, deal.II
Operating systems	Linux, MacOS, Windows

GRANTS/AWARDS/SCHOLARSHIPS

2018	:	Shell Special Recognition Award
2014	:	Gene Golub SIAM Summer Fellowship
2013-17	:	Shell-NWO Computational Sciences for Energy Research (CSER) Fellowship
2013	:	Director's Gold Medal at IIT (ISM) Dhanbad
2013	:	SEG-ENI Scholarship
2012	:	SEG Foundation Grant
2012	:	SPG India Student Grant
2008-13	:	SHE-INSPIRE Fellowship from Dept. of Science & Tech., Govt. of India

REVIEWER

Journals	:	IJCV, SMO (Springer), IJNME (Wiley), Geophysics (SEG)
Conferences	:	ICCV'21, ICML'19, ICCV'19, ECMLPKDD'19, EAGE'16, EAGE'15, EAGE'14.

REFERENCES

Prof. dr. ir. Arnold Smeulders	Prof. dr. ir. Fred van Keulen
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