Education

PhD in Information and Communication Engineering
Xi'an Jiaotong University, China (13/06/2019)
M.E. in Information and Communication Engineering
Xi'an Jiaotong University, China (15/06/2016)
B.Sc. Electrical (Telecommunication) Engineering
COMSATS Institute of Information Technology, Lahore, Pakistan (5/09/2013)

Academic Employment

Assistant Professor (2023 - present)
Department of Electrical and Computer Engineering, Aarhus University, Denmark
Postdoctoral Researcher (2019 – 2023)
Department of Geoscience, Aarhus University, Denmark
Department of Engineering, Aarhus University, Denmark
PhD Researcher (2016 – 2019)
Xi'an Jiaotong University, China
Lecturer/Lab Engineer (2013 – 2016)
COMSATS University Islamabad, Pakistan

Scientific Focus Area

Machine/deep learning, computer vision, geophysics, remote sensing
My objective is to pursue research and development in machine learning, computer vision, and their interdisciplinary applications to contribute to societal challenges. Currently, my research focuses on machine learning applications in geosciences providing rapid and computationally efficient solutions for subsurface imaging. I currently work on emerging geophysical technologies, e.g. transient electromagnetic (TEM) and surface nuclear magnetic resonance (sNMR). I am involved in building efficient machine learning methods for surrogating computationally expensive numerical modelling tools and developing computer-vision based feature extraction tools for ground water exploration in data-poor regions. My vision is to integrate machine learning in geophysical technologies which would play a critical role in making the technology user-friendly, easy to use and widely available that can deliver access to safe water in developing nations.

Project Participation/Management Experience

SuperTEM – Semi-airbone TEM and TEM monitoring (2021 - present)
A project focusing on two novel usages of TEM. (1) Subsurface imaging at very high resolution using a semi-airborne TEM instrument; (2) Imaging dynamic processes in the subsurface, in particular changing groundwater levels. Within SuperTEM, I am leading the development of automated TEM data processing and inversion strategies for the airborne TEM data. I will also develop a machine learning based time-lapse inversion framework to accurately resolve the water table depth at a very high-resolution. It is funded by Innovation Fund Denmark and Poul Due Jensen Foundation.
SiTEM – African Groundwater Project (2021 - present)
A project delivering a cost-efficient scheme for geological mapping in data-poor regions to locate most attractive borehole sites for safe groundwater. I am leading the development of computer vision based geological lineament extraction tools to optimize survey locations with highest likelihood of success. It is funded by Poul Due Jensen Foundation.
Flood and Drought sNMR Project (2021 - present)
The project that aims to better integrating surface NMR within the hydrological forecasting workflow. I am leading research in the noise modelling from systematic noise sources using by means of deep learning methods. I have also been involved in data collection. It is funded by Independent Research Fund Denmark.
MapField – Nitrate Retention Project(2019 - 2022)
The project focuses on developing hydro-geophysical and geochemical tools to map the subsurface and predict the nitrate vulnerability for precise and sustainable fertilization use. In this project, I was a part of field-team responsible for data collection. I also plan/oversee research activities on improving modelling capabilities of machine learning for data interpretation. It is funded by Innovation Fund Denmark.
GeoFysikSamarbejdet - GFS (2019 - 2021)
This project involves the development and improvement of geophysical methods, interpretation algorithms, etc. Within GFS, I have been conducting research on improving the computational efficiency of TEM data interpretation methods. I have also developed a hybrid framework to maintain subsurface imaging accuracy while significantly improving computational efficiency. It was funded by Danish Environmental Protection Agency.

(Co-)Supervision Experience

PhD students (2), Aarhus University, Xi'an Jiaotong University
Siyuan He – Investigation on TEM-IP data using deep learning methods (2022 – present)
M. Ali Raza - Deep learning based multinational vehicle license plate detection in a multi-lane(2018 - present)
Masters students (5), Aarhus University, Xi'an Jiaotong University

Kristoffer Christiansen – End-to-end denoising of sNMR data using U-Net (2022-23)
Anders Peter Doktor – Delineation of groundwater potential zones through remote sensing (2022 - 2023)
Mads Rosendahl – Identifying and denoisng spikes from sNMR data by deep learning (2022-23)
Julian Johannsen – Application of remote sensing to groundwater hydrology (2022 – 23)
Waqar Riaz – Character recognition of multinational vehicle license plates (2016 - 18)

Teaching Experience

Instructor (1),
Geo-modelling and Machine Learning, Aarhus University (Fall 2022)
Guest Lectures (1),
Introduction to Machine Learning, Xi'an Polytechnic University (Fall 2018)
Lab Instructor (1),
Digital Communication Systems, COMSATS University Islamabad (Spring 2014)
Principles of Communication Systems, COMSATS University Islamabad (Spring 2014)
Analog Communication Systems, COMSATS University Islamabad (Spring 2014)
Digital Signal Processing, COMSATS University Islamabad(Fall 2013)

Academic Awards

Xi'an Jiaotong University Scholarship for Doctoral studies(2016 - 2019)
Xi'an Jiaotong University Scholarship for Masters studies(2014 - 2016)
Outstanding International Student Award by Xi'an Jiaotong University (2016)
IEEE Final Year Engineering Project Competition - Second position (2013)

Invited/Keynote Talks

Emerald Geomodelling – Automated data processing of airborne TEM data (2022)
Jilin University – Machine learning applications in geosciences(2021)
Aarhus Geosoftware – Improving capability of geoscientific softwares (2021)
Grundfos Hackathon - Enhancing success rate of wells in data-poor regions (2020)
Xi'an Jiaotong University- Secrets to surviving and thriving in a PhD program(2019)

International collaboration

34.8% publications co-authored with international researchers (SciVal statistics 2023)
Collaborations with Geological Survey of Sweden, Institute of Geological and Nuclear Sciences (GNS) New Zealand, University of Neuchatel, Jilin University, Aarhus Geosoftware, Aarhus GeoInstruments and EMerald Geomodelling.

Publikationer

A DATA DRIVEN APPROACH FOR ROBUST INVERSION OF INDUCED POLARIZATION EFFECTS IN TRANSIENT ELECTROMAGNETIC DATA
Asif, M. R., Maurya, P. K., Foged, N. & Christiansen, A. V., jul. 2023, *APPLICATION OF GEOPHYSICS TO ENGINEERING AND ENVIRONMENTAL PROBLEMS: SYMPOSIUM. 35TH 2023. (SAGEEP 2023).* Curran Associates, s. 82-82 (SAGEEP Proceedings).

DL-RMD: a geophysically constrained electromagnetic resistivity model database for deep learning applications
Asif, M. R., Foged, N., Bording, T. S., Larsen, J. J. & Christiansen, A. V., mar. 2023, I: Earth System Science Data. 15, 3, s. 1389-1401 13 s.

A Novel Normalization Method of Transient Electromagnetic Data for Efficient Neural Network Training
He, S., Cai, H., Christiansen, A. V. & Asif, M. R., 2023. 5 s.

Automated data processing of a large-scale airborne time-domain electromagnetic survey by a deep learning expert system
Asif, M. R., Kass, A., Westerhoff, R., Rawlinson, Z. & Christiansen, A. V., 2023.

Automated Processing of a Large-Scale Airborne Electromagnetic Survey by Deep Learning
Asif, M. R., Kass, A., Westerhoff, R., Rawlinson, Z., Christiansen, A. V. & Bording, T. S., 2023. 5 s.

Comparison of tTEM-IP and ERT-IP: Cases from Mine Tailing Sites in Sweden
Meldgaard Madsen, L., Asif, M. R., Maurya, P. K., Kühl, A. K., Domenzain, D., Jensen, C., Martin, T., Bastani, M. & Persson, L., 2023.

Investigating the Integration of Neural Networks in Least-Squares Method for Airborne Electromagnetic Data Inversion
Asif, M. R., Maurya, P. K., Larsen, J. J. & Christiansen, A. V., sep. 2022, s. 1-5.

Integrating neural networks in least-squares inversion of airborne time-domain electromagnetic data
Asif, M. R., Foged, N., Maurya, P. K., Grombacher, D. J., Christiansen, A. V., Auken, E. & Larsen, J. J., jul. 2022, I: Geophysics. 87, 4, s. E177-E187 11 s.

Deep learning based expert system to automate time-domain electromagnetic data processing
Asif, M. R., Maurya, P. K., Christiansen, A. V., Larsen, J. J. & Auken, E., mar. 2022, *34th Symposium on the Application of Geophysics to Engineering and Environmental Problems, SAGEEP 2022*. J and N Group, Ltd., s. 6 1 s. (Proceedings of the Symposium on the Application of Geophyics to Engineering and Environmental Problems, SAGEEP, Bind 2022-March).

A Neural Network-Based Hybrid Framework for Least-Squares Inversion of Transient Electromagnetic Data
Asif, M. R., Bording, T. S., Maurya, P. K., Zhang, B., Fiandaca, G., Grombacher, D. J., Christiansen, A. V., Auken, E. & Larsen, J. J., 2022, I: IEEE Transactions on Geoscience and Remote Sensing. 60, 4503610.

Automated transient electromagnetic data processing for ground-based and airborne systems by a deep learning expert system
Asif, M. R., Maurya, P. K., Foged, N., Larsen, J. J., Auken, E. & Christiansen, A. V., 2022, I: IEEE Transactions on Geoscience and Remote Sensing. 60, 14 s., 5919814.

Deep Convolutional Auto-Encoder for Automated Processing of Airborne Time-Domain Electromagnetic Data
Asif, M. R., Larsen, J. J., Auken, E. & Christiansen, A. V., 2022, s. 1-5.

Removal of powerline noise in geophysical data sets with a scientific machine-learning based approach
Larsen, J. J., Lévy, L. & Asif, M. ~., 2022, I: IEEE Transactions on Geoscience and Remote Sensing. 60, 10 s., 5923410.

Machine learning based fast forward modelling of ground-based time-domain electromagnetic data
Bording, T. S., Asif, M. R., Barfod, A. S., Larsen, J. J., Zhang, B., Grombacher, D. J., Christiansen, A. V., Engebretsen, K. W., Pedersen, J. B., Maurya, P. K. & Auken, E., apr. 2021, I: Journal of Applied Geophysics. 187, 9 s., 104290.

Effect of Data Pre-Processing on the Performance of Neural Networks for 1-D Transient Electromagnetic Forward Modeling
Asif, M. R., Bording, T. S., Barfod, A. S., Grombacher, D. J., Maurya, P. K., Christiansen, A. V., Auken, E. & Larsen, J. J., feb. 2021, I: IEEE Access. 9, s. 34635-34646 12 s.

Complete automation of time-domain transient electromagnetic data processing using deep convolutional autoencoder
Asif, M. R., Larsen, J. J., Maurya, P. K., Christiansen, A. V. & Auken, E., 2021.

Effect of Data Normalization on Neural Networks for the Forward Modelling of Transient Electromagnetic Data,
Asif, M. R., Bording, T. S., Barfod, A. S., Auken, E. & Larsen, J. J., dec. 2020.

An adaptive approach for multi-national vehicle license plate recognition using multi-level deep features and foreground polarity detection model
Raza, M. A., Qi, C., Asif, M. R. & Khan, M. A., 2020, I: Applied Sciences. 10, 6, 21 s., 2165.

Effect of data normalization on neural networks for the forward modelling of transient electromagnetic data
Asif, M. R., Bording, T. S., Barfod, A. S., Auken, E. & Larsen, J. J., 2020, *26th European Meeting of Environmental and Engineering Geophysics, Held at Near Surface Geoscience 2020.* European Association of Geoscientists and Engineers, EAGE, 061. (26th European Meeting of Environmental and Engineering Geophysics, Held at Near Surface Geoscience 2020).

Improving computational efficiency of forward modelling for ground-based time-domain electromagnetic data using neural networks
Asif, M. R., Bording, T. S., Barfod, A. A. S., Zhang, B., Larsen, J. J. & Auken, E., 2020.

License plate detection for multi-national vehicles – a generalized approach
Asif, M. R., Qi, C., Wang, T., Fareed, M. S. & Khan, S., dec. 2019, I: Multimedia Tools and Applications. 78, 24, s. 35585-35606 22 s.

Data Redundancy-Control Energy-Efficient Multi-Hop Framework for Wireless Sensor Networks
Ahmed, G., Zhao, X., Fareed, M. M. S., Asif, M. R. & Raza, S. A., 1 okt. 2019, I: Wireless Personal Communications. 108, 4, s. 2559-2583 25 s.

License Plate Detection for Multi-national Vehicles: An Illumination Invariant Approach in Multi-lane Environment
Asif, M. R., Qi, C., Wang, T., Sadiq Fareed, M. & Ali Reza, S., 16 jul. 2019, I: Computers & Electrical Engineering. 78, s. 132-147 16 s.

Salient region detection through salient and non-salient dictionaries
Fareed, M. M. S., Chun, Q., Ahmed, G., Murtaza, A., Asif, M. R. & Fareed, M. Z., mar. 2019, I: PLOS ONE. 14, 3, e0213433.

Investigation on Projection Space Pairs in Neighbor Embedding Algorithms
Zhang, Z., Qi, C. & Asif, M. R., 2 feb. 2019, *2018 14th IEEE International Conference on Signal Processing Proceedings, ICSP 2018.* Baozong, Y., Qiuqi, R., Yao, Z. & Gaoyun, A. (red.). Institute of Electrical and Electronics Engineers Inc., s. 125-128 4 s. 8652441. (International Conference on Signal Processing Proceedings, ICSP, Bind 2018-August).

Appearance-based salient regions detection using side-specific dictionaries
Fareed, M. M. S., Chun, Q., Ahmed, G., Murtaza, A., Asif, M. R. & Fareed, M. Z., 2 jan. 2019, I: Sensors (Switzerland). 19 , 2, 421.

Feature Matching Improvement through Merging Features for Remote Sensing Imagery
Karim, S., Zhang, Y., Brohi, A. A. & Asif, M. R., 1 dec. 2018, I: 3D Research. 9, 4, 52.

An efficient region proposal method for optical remote sensing imagery
Karim, S., Zhang, Y., Yin, S. & Asif, M. R., 31 okt. 2018, *2018 IEEE International Geoscience and Remote Sensing Symposium, IGARSS 2018 - Proceedings.* Institute of Electrical and Electronics Engineers Inc., s. 2455-2458 4 s. 8518098. (International Geoscience and Remote Sensing Symposium (IGARSS), Bind 2018-July).

Performance Evaluation of Local Image Features for Multinational Vehicle License Plate Verification
Rizwan Asif, M., Qi, C., Bibi, I., Sadiq Fareed, M., Zhang, Z. & Zhang, Z., 18 okt. 2018, *2018 IEEE Intelligent Vehicles Symposium, IV 2018.* Institute of Electrical and Electronics Engineers Inc., s. 2170-2175 6 s. 8500534. (IEEE Intelligent Vehicles Symposium, Proceedings, Bind 2018-June).

Saliency detection by exploiting multi-features of color contrast and color distribution
Sadiq Fareed, M. M., Chun, Q., Ahmed, G., Asif, M. R. & Fareed, M. Z., aug. 2018, I: Computers and Electrical Engineering. 70, s. 551-566 16 s.

Image processing based proposed drone for detecting and controlling street crimes
Karim, S., Zhang, Y., Laghari, A. A. & Asif, M. R., 15 maj 2018, *2017 17th IEEE International Conference on Communication Technology, ICCT 2017.* Institute of Electrical and Electronics Engineers Inc., s. 1725-1730 6 s. (International Conference on Communication Technology Proceedings, ICCT, Bind 2017-October).

An improvement of vehicle detection under shadow regions in satellite imagery
Karim, S., Zhang, Y., Ali, S. & Asif, M. R., 2018, *Ninth International Conference on Graphic and Image Processing, ICGIP 2017.* Yu, H. & Dong, J. (red.). SPIE - International Society for Optical Engineering, 106154D. (Proceedings of SPIE - The International Society for Optical Engineering, Bind 10615).

Comparative analysis of feature extraction methods in satellite imagery
Karim, S., Zhang, Y., Asif, M. R. & Ali, S., 1 dec. 2017, I: Journal of Applied Remote Sensing. 11, 4, 042618.

Teaching Tool for a Control Systems Laboratory Using a Quadrotor as a Plant in MATLAB
Khan, S., Jaffery, M. H., Hanif, A. & Asif, M. R., nov. 2017, I: IEEE Transactions on Education. 60, 4, s. 249-256 8 s., 7836322.

Maximum mean discrepancy regularized sparse reconstruction for robust salient regions detection
Fareed, M. M. S., Chun, Q., Ahmed, G., Rizwan Asif, M. & Bibi, I., 1 maj 2017, I: Signal Processing: Image Communication. 54, s. 66-80 15 s.

Multinational vehicle license plate detection in complex backgrounds
Asif, M. R., Qi, C., Hussain, S., Sadiq Fareed, M. & Khan, S., 23 mar. 2017, I: Journal of Visual Communication and Image Representation. 46, s. 176-186 11 s.

Multiple licence plate detection for Chinese vehicles in dense traffic scenarios
Asif, M. R., Chun, Q., Hussain, S. & Fareed, M. S., 1 okt. 2016, I: IET Intelligent Transport Systems. 10, 8, s. 535-544 10 s.

Multiple License Plate Detection for Chinese Vehicles in Dense Traffic Scenarios
Asif, M. R., Qi, C., Hussain, S. & Sadiq Fareed, M., okt. 2016, I: IET Intelligent Transport Systems. 10, 8, 19 s.

A novel trignometric energy functional for image segmentation in the presence of intensity in-homogeneity
Hussain, S., Chun, Q., Asif, M. R., Khan, M. S., Zhaoqiang, Z., Fareed, M. S. & Zhe, Z., 25 aug. 2016, *2016 IEEE International Conference on Multimedia and Expo, ICME 2016.* IEEE Computer Society, 7552994. (Proceedings - IEEE International Conference on Multimedia and Expo, Bind 2016-August).

Active Contours for image segmentation using complex domain-based approach
Hussain, S., Qi, C., Asif, M. R. & Sohrab Khan, M., 21 jan. 2016, I: IET Image Processing. 10, 2, s. 121-129 9 s.

Publications Refereed For

IEEE Transactions on Geoscience and Remote Sensing, IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Intelligent Transportation Systems, IEEE Transactions on Multimedia, IEEE Transactions on Vehicular Technology, IEEE Access, Engineering Applications of Artificial Intelligence, Computers & Geosciences, Geophysics, IET Image Processing, Electronics Letters, Sensors, etc.