Muhammad Ishfaq Hussain, Ph.D.

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Brief

I hold a Ph.D. in Computer Science and Electrical Engineering from GIST, where I contributed to a joint **GIST–MIT** research collaboration. My expertise lies in self-driving cars and large-scale AI systems. I have authored over 30 peer-reviewed publications and hold a patent in machine learning and computer vision, including work on digital twins and visual LLMs. With a solid background in programming and software engineering, I currently conduct research in an AI group at GIST and hold permanent residency in Korea.

Education

2018 – August 2023 **Ph.D. in Machine Learning and Computer Vision (Gwangju Institute of Science and Technology GIST, Gwangju, Rep. of Korea)** .
Thesis title: *Predictive Modelling through data fusion for Autonomous Driving Systems*

2014 – 2016 **MS. Computer Software Engineering, (National University of Science and Technology NUST, Islamabad, Pakistan)**.
Thesis title: *LSTM Neural Nodes for spatio-temporal Analysis*.

Work / Research / Teaching Experience

Aug, 2025 – **Post. Doctoral Research Fellow**, **AI, Convergence Department**, Gwangju Institute of Science and Technology, **GIST** Gwangju **Rep. of Korea**.

July, 2024 – Aug, 2025 **Post. Doctoral Research Fellow**, **Div. of National Science & Technology Data** Large-Scale Artificial Intelligence **(AI) Research Group**, Korea Institute of Science and Technology Information, KISTI **Rep. of Korea**.

Sep, 2023 – Jul 2024 **Post. Doctoral Research Fellow** School of Electrical Engineering and Computer Science, **GIST** Gwangju **Rep. of Korea**.

2018 – Aug, 2023 **Research Assistant** GIST Gwangju **Rep. of Korea**.

2019 – 2021 **Teaching Assistance** GIST Gwangju **Rep. of Korea**

2013 – 2014 **Software Developer** Gumption Technologies, Pakistan.

Research Publications

Journal Articles

1. **M. I. Hussain**, M. Van Linh, Z. Naz, U. Fatima, Y. Ko, and M. Jeon, "Swir-lightfusion: Multi-spectral semantic fusion of synthetic swir with thermal ir (lwir/mwir) and rgb," *Cluster Computing*, vol. 29, no. 1, p. 48, 2026, impact factor=4.5.
2. **M. I. Hussain**, Z. Naz, M. A. Rafique, and M. Jeon, "Advancing autonomous driving: Depthsense with radar and spatial attention," *IEEE Sensors Journal*, vol. 25, no. 2, pp. 3698–3707, 2025, impact factor=4.5. DOI: https://doi.org/10.1109/JSEN.2024.3493196.
3. Y. L. Jae, **M. I. Hussain**, K. Lee, H. S. shim, S. Han, and Y. Donghun, "Transfer learning-based super-resolution for high-precision medical imaging," *IEEE Access*, 2025, impact factor=3.6. DOI: 10.1109/ACCESS.2025.3587263.

4. **M. I. Hussain**, M. A. Rafique, W.-G. Jung, B.-J. Kim, and M. Jeon, "Segmentation and morphology computation of a spiky nanoparticle using the hourglass neural network," *ACS omega*, 2023, impact factor=4.2. DOI: 10.1021/acsomega.3c00732.

5. **M. I. Hussain**, M. A. Rafique, J. Kim, M. Jeon, and W. Pedrycz, "Artificial proprioceptive reflex warning using emg in advanced driving assistance system," *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 31, pp. 1635–1644, 2023, impact factor=5.2. DOI: 10.1109/TNSRE.2023.3153120.

6. **M. I. Hussain**, S. Azam, M. A. Rafique, A. M. Sheri, and M. Jeon, "Drivable region estimation for self-driving vehicles using radar," *IEEE Transactions on Vehicular Technology*, vol. 71, no. 6, pp. 5971–5982, 2022, impact factor=7.1. DOI: 10.1109/TVT.2022.3074450.

7. S. Azam, F. Munir, M. A. Rafique, A. M. Sheri, **M. I. Hussain**, and M. Jeon, "N2c: Neural network controller design using behavioral cloning," *IEEE Transactions on Intelligent Transportation Systems*, vol. 22, no. 7, pp. 4744–4756, 2021, impact factor=8.5. DOI: 10.1109/TITS.2020.2973682.

8. **M. I. Hussain**, M. A. Rafique, H. Jang, M. Jeon, and D. Shim, "Camera-radar extrinsic calibration for autonomous driving," *KIISE Transactions on Computing Practices*, vol. 29, no. 1, pp. 38–43, 2021.

9. Z. Khan, **M. I. Hussain**, N. Iltaf, J. Kim, and M. Jeon, "Contextual recommender system for e-commerce applications," *Applied Soft Computing*, vol. 109, p. 107 552, 2021, impact factor=8.263. DOI: 10.1016/j.asoc.2021.107552.

Conference Proceedings

1. Z. Naz, F. Asghar, **M. I. Hussain**, *et al.*, "Regional attention-enhanced swin transformer for clinically relevant medical image captioning," in *arXiv preprint arXiv:2511.09893*, 2025.

2. **M. I. Hussain**, Z. Naz, L. MA Van, and M. Jeon, "A light gradient residual encoder-decoder network for multimodal image fusion," in *IEEE International Conference on Intelligent Computing, Communication, Networking and Services (ICCNS)*, 24-27 Sept. 2024, Dubrovnik, Crotia, Sep. 2024.

3. L. V. Ma, **M. I. Hussain**, K.-C. Yow, and M. Jeon, "3d multi-object tracking employing ms-glmb filter for autonomous driving," in *IEEE (13th International Conference on Control, Automation and Information Sciences (ICCAIS))*, 26-28 Nov. 2024, Hanoi City, Vietnam, Sep. 2024.

4. Z. Naz, **M. I. Hussain**, S. Kim, and M. Jeon, "Biomedical image captioning with fine-tuned llm: A git-swin transformer approach," in *Korean Database Conference KDBC*, Jeju, South Korea, Nov. 2024.

5. **M. I. Hussain**, M. A. Rafique, S. Khurbaev, *et al.*, "Deployment of digital twin in robotics and autonomous driving using ros architecture," in *3rd IFSA Automation, Robotics and Communications for Industry 4.0/5.0 (ARCI' 2023)*, 22-24 February 2023, Chamonix, France, Feb. 2023.

6. **M. I. Hussain**, M. A. Rafique, A. M. Sheri, and M. Jeon, "Drivable region estimation for self-driving vehicles using radar," in *IEEE Intelligent Vehicles Symposium*, Accepted as Journal Paper Presentation, IV-2023, Anchorage, Alaska, USA, Jun. 2023.

7. **M. I. Hussain**, M. A. Rafique, K. Yeongmin, *et al.*, "Esdnet: An encoder-sequencer-decoder network for lane detection to facilitate autonomous driving," in *IEEE (23rd International Conference on Control, Automation and Systems)*, 17-20 October 2023, Yeosu, Korea, Oct. 2023.

8. Z. Khan, U. Fatima, **M. I. Hussain**, R. Khalimjanov, and M. Jeon, "An implementation study of drivable region predictions," 2023, pp. 1300–1302.

9. M. Linh Van, **M. I. Hussain**, J. Park, J. Kim, and M. Jeon, "Adaptive confidence threshold for bytetrack in multi-object tracking," in *2023 12th International Conference on Control, Automation and Information Sciences*, 27-29, November. 2023, Hanoi, Vietnam, Nov. 2023.

10. M. A. Rafique, **M. I. Hussain**, B.-G. Lee, H. K. Kim, and M. Jeon, "Vehicle can bus data prediction using transformers with auxiliary decoder loss," in *41st IEEE Int. Conf. on Consumer Electronics (ICCE)*, 6-9 January 2023, Las Vegas, US, Jan. 2023.
11. **M. I. Hussain**, M. Rafique, Z. Khan, S. Khurbaev, R. Khalimjanov, and M. Jeon, "Monocular vision-based autonomous driving and pid controller," in *Korea Software Congress 2022*, 20-23 December 2022, Jeju, South Korea, Dec. 2022.
12. **M. I. Hussain**, M. Rafique, Z. Khan, S. Khurbaev, R. Khalimjanov, and M. Jeon, "Monocular vision-based autonomous driving and pid controller," in *Korea Software Congress-2022*, 20-23 December 2022, Jeju, South Korea, Dec. 2022.
13. **M. I. Hussain**, M. A. Rafique, S. Khurbaev, and M. Jeon, "Exploring data variance challenges in fusion of radar and camera for robotics and autonomous driving," in *International Conference on Control, Mechatronics and Automation (ICCMA)*, 9-12 November 2022, Nov. 2022.
14. M. Rafique, **M. I. Hussain**, S. Dubey, S. Khurbaev, and M. Jeon, "A monocular camera bird-eye-view generation using lane markers prior," in *International Conference on Control, Automation and Systems (ICCAS)*, 27 November-1 December 2022, Busan, South Korea, Nov. 2022.
15. M. A. Rafique, **M. I. Hussain**, M. A. Hassan, W.-G. Jung, B.-J. Kim, and M. Jeon, "Automated single particle growth measurement using segmentation," in *18th IEEE Int. Conf. on Advanced Video and Signal-Based Surveillance Hybrid (AVSS)*, 29 November-2 December 2022, Madrid, Spain, Nov. 2022.
16. **M. I. Hussain**, M. Rafique, H. Su, and M. Jeon, "Camer-radar external parameter calibration for autonomous driving," in *Korea Software Congress 2021*, 20-22 December 2021, Outstanding Paper Presentation Award, South Korea, Dec. 2021.
17. Z. Khan, **M. I. Hussain**, F. Munir, U. Fatima, S. Azam, and M. Jeon, "Modified rc car for uni-modal autonomous parking," in *Korea Software Congress 2021*, 20-22 December 2021, South Korea, Dec. 2021.
18. **M. I. Hussain**, S. Azam, F. Munir, Z. Khan, and M. Jeon, "Multiple objects tracking using radar for autonomous driving," in *IEEE International IOT, Electronics and Mechatronics Conference (IEMTRONICS)*, 2020.
19. **M. I. Hussain**, Z. Khan, H. Akram, Y. Ko, and M. Jeon, "Comparative analysis of simultaneous localization and mapping (slam)," in *Korea Software Congress KSC-2020*, 2020.
20. S. Azam, F. Munir, A. M. Sheri, **M. I. Hussain**, Y. Ko, and M. Jeon, "Data fusion of lidar and thermal camera for autonomous driving," in *Applied Industrial Optics Meeting*, Washington DC, USA, 2019.
21. **M. I. Hussain**, J. JiWon, Y. Jongmin, A. M. Sheri, and M. Jeon, "Long shot term memory (lstm) neural nodes for spatio-temporal analysis," in *Korea Software Congress KSC-2019*, 2019.
22. F. Munir, S. Azam, **M. I. Hussain**, A. M. Sheri, and M. Jeon, "Autonomous vehicle: The architectural aspect of self driving car," in *Sensors, Signal and Image Processing (SSIP)*, Prague, Czech, 2018.

Patent

1. **M. I. Hussain**, K. Yeongmin, and M. Jeon, *Apparatus and method for enhancing monocular camera depth estimation performance through vehicle radar information fusion*. Korean Patent 10-2022-0160456, 2023.

Research Project Participation

1. 2025.08 - 2029.12 Advanced AI modelling & decision-making; safe / reliable AI **DGIST, InnoCORE**
2. 2024.07 - 2025.08 Development of Computer Vision algorithm - 3D models for medical imaging (CT/MRI/ultrasound) - a virtual representation of a human body - **KISTI**
3. 2024.07 - 2025.08 Development of situation awareness and decision support algorithms based on large-scale AI models - Visual LLM (Large Language Models) **KISTI**

4. 2018.03 - 2024.02 - Development of global multi-target object detection / tracking and event prediction techniques based on real-time video analysis – DeepView **GIST**
5. 2021.09 - 2024.07 - **GIST- MIT Collaboration** Extending Contrastive Learning to new data modalities and resource-limited devices **GIST**
6. 2022.05 - 2024.07 Development of service robot and contents supporting children's reading activities based on AI **GIST**
7. 2023.01 - 2024.07 Mobile environment multi-target tracking technology (Sensor Fusion of RGB /MWIR /SWIR) **GIST**
8. 2018.03. - 2024.07 - Development of core autonomous driving and driving assistance technology and establishment of platform - Utilized Lidar Camera Radar GPS & IMU Sensor's **GIST**

Award / Scholarship / Invited Speaker

2025	**Keynote Speaker** - **AI for Fire and Investigation with recent trends**, Busan Fire and Investigation, **Rep. of Korea**.
2024	**Excellence Paper Award**, Korea Next Generation Computing Society.
2021	**Outstanding Paper Award**, Korea Software Congress KSC.
2022	**Electrical Engineering and Computer Science (EECS) Outstanding Research Performance (1st Prize) - 2022**, Gwangju Institute of Science and Technology GIST.
	RA Scholarship - 2021, Gwangju Institute of Science and Technology GIST.
2018	**Korean Government Scholarship (for Ph. D)**, Gwangju Institute of Science and Technology GIST.

References

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