Kunal Banerjee

Principal AI Scientist
SMIEEE, SMACM

Solventum
Bangalore, India
☎ +91-9432255217
✉ kunal.banerjee@solventum.com
✉ kunal.banerjee.cse@gmail.com
☞ https://kunalbanerjee.github.io/

Research Interests

Deep Learning, Responsible AI, High-Performance Computing, Program Analysis, Formal Methods.

Education

2010–2016	**PhD, Computer Science and Engineering**, *Indian Institute of Technology Kharagpur*, India.
Thesis:	*Translation Validation of Optimizing Transformations of Programs using Equivalence Checking*
Supervisors:	Prof. Chittaranjan Mandal and Prof. Dipankar Sarkar
GPA:	9.28/10 (based on courses taken)
2004–2008	**B.Tech.(Honors), Computer Science and Engineering**, *Heritage Institute of Technology*, (West Bengal University of Technology).
Thesis:	*TDMA Scheduling in Wireless Sensor Networks*
Supervisor:	Prof. Nabanita Das, Indian Statistical Institute, Kolkata
GPA:	8.49/10

Professional Experience

Dec 2025–Present	**AI Science**, *Solventum*.
Designation:	Principal AI Scientist
Sep 2020–Dec 2025	**Data Science Foundation**, *Walmart*.
Designation:	Principal Data Scientist (May 2023 – Dec 2025)
Designation:	Staff Data Scientist (Sep 2020 – Apr 2023)
Jan 2020–Aug 2020	**Artificial Intelligence Products Group**, *Intel*.
Designation:	Senior Deep Learning R&D Engineer
2015–2019	**Parallel Computing Lab**, *Intel Labs*.
Designation:	Research Scientist
Domains:	Parallel programming, code optimization, deep learning
2009–2012	**Sponsored Research and Industrial Consultancy**, *Indian Institute of Technology Kharagpur*.
Designation:	Senior Research Fellow
Sponsor:	Department of Science and Technology, Govt. of India
2008–2009	**Tata Consultancy Services**.
Designation:	Assistant System Engineer

Awards/Achievements

2025	Received Excellence Award from Walmart
2023	AV Luminary Award (Top 10 Data Scientists) from Analytics Vidhya

2022	Emerging Leaders in Data & Analytics award at Data World Summit
2021	Elevated to ACM Senior Member
2021	Nominated for Best Poster Award in the conference DeLTA 2021
2020	Elevated to IEEE Senior Member
2019	Gordy Award (Intel Labs' highest award)
2019	Invited paper in the journal Supercomputing Frontiers and Innovations
2019	Best Research Poster Award in "Artificial Intelligence and Machine Learning" track in the conference ISC 2019
2018	Divisional Recognition Award from Intel
2018	Techno Inventor Award (PhD) 2017 from India Electronics & Semiconductor Association (IESA)
2018	Best PhD Thesis Award at VLSI Design 2018
2017	Invited to present our TSE 2017 paper at Foundations of Software Engineering 2017
2015	Best PhD Forum Paper Award in the conference ISVLSI 2015
2013	Best Paper Award in the conference I-CARE 2013
2012	TCS Research Fellowship

Patents

1. Anirban Saha, Soumik Dasgupta, Anirban Chatterjee, **Kunal Banerjee**, Rahul Girotra, Chakradhar Vanarasi.
   Systems and Methods for Automated Machine Learning Model Query Generation. *(US Patent Record No. 81543305, 2025).*

2. Saptarshi Misra, Anirban Chatterjee, Pranay Dugar, **Kunal Banerjee**, Lalitdutt Parsai.
   System and Method for Enhancing Text in Images based on Super-Resolution. *(US Patent Record No. 81462813, 2022).*

3. Anirban Chatterjee, **Kunal Banerjee**, Binay Gupta, Lalitdutt Parsai, Geet Vudata.
   System and Method for Automatically Assessing Change Requests. *(US Patent Record No. 81461389, 2022).*

Selected Publications

Journals

1. Anirban Saha, Binay Gupta, Anirban Chatterjee, **Kunal Banerjee**.
   You Believe your LLM is Not Delusional? Think Again! A Study of LLM Hallucination on Foundation Models under Perturbation.
   Discover Data, Springer Nature, vol. 3, no. 20, 2025, pages: 1–9.

2. **Kunal Banerjee**, Evangelos Georganas, Dhiraj D. Kalamkar, Barukh Ziv, Eden Segal, Cristina Anderson, Alexander Heinecke.
   Optimizing Deep Learning RNN Topologies on Intel Architecture.
   Supercomputing Frontiers and Innovations, vol. 6, no. 3, 2019, pages: 64–85, **invited paper**.

3. Ramanuj Chouksey, Chandan Karfa, **Kunal Banerjee**, Pankaj Kalita, Purandar Bhaduri.
   A Counter-Example Generation Procedure for Path based Equivalence Checkers.
   IET Software, vol. 13, no. 4, 2019, pages: 280–285.

4. **Kunal Banerjee**, Dipankar Sarkar, Chittaranjan Mandal.
   Deriving Bisimulation Relations from Path Extension Based Equivalence Checkers.
   IEEE Transactions on Software Engineering (TSE), vol. 43, no. 10, 2017, pages: 946–953.

5. **Kunal Banerjee**, Dipankar Sarkar, Chittaranjan Mandal.
   Deriving Bisimulation Relations from Path Based Equivalence Checkers.
   Formal Aspects of Computing (FAC), vol. 29, no. 2, 2017, pages: 365–379.

6. Soumyadip Bandyopadhyay, Dipankar Sarkar, Chittaranjan Mandal, **Kunal Banerjee**, Krishnam Raju Duddu.
   A Path Construction Algorithm for Translation Validation using PRES+ Models.
   Parallel Processing Letters (PPL), vol. 26, no. 2, 2016, pages: 1–25.

7 **Kunal Banerjee**, Dipankar Sarkar, Chittaranjan Mandal.
Extending the FSMD Framework for Validating Code Motions of Array-Handling Programs.
IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD), vol. 33, no. 12, 2014, pages: 2015–2019.

8 **Kunal Banerjee**, Chandan Karfa, Dipankar Sarkar, Chittaranjan Mandal.
Verification of Code Motion Techniques using Value Propagation.
IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD), vol. 33, no. 8, 2014, pages: 1180–1193.

9 Chandan Karfa, **Kunal Banerjee**, Dipankar Sarkar, Chittaranjan Mandal.
Verification of Loop and Arithmetic Transformations of Array-Intensive Behaviours.
IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD), vol. 32, no. 11, 2013, pages: 1787–1800.

Conferences / Workshops

1 **Kunal Banerjee**, Binay Gupta, Meet Maheshwari, Lalitdutt Parsai, Geet Vudata, Soumik Dasgupta, Anirban Chatterjee.
Real-time Anomaly Prediction at Scale using Anomaly Detection Augmented with Regression.
International Conference on Data Science & Management of Data (CODS-COMAD) Dec'24, Jodhpur, India, 2024, (accepted).

2 Soumik Dasgupta, Anurag Wagh, Lalitdutt Parsai, Binay Gupta, Geet Vudata, Shally Sangal, Sohom Majumdar, Hema Rajesh, **Kunal Banerjee**, Anirban Chatterjee.
waLLMartCache: A Distributed, Multi-Tenant and Enhanced Semantic Caching System for LLMs.
International Conference on Pattern Recognition (ICPR), Kolkata, India, 2024, pages: 232–248.

3 Saptarshi Misra, **Kunal Banerjee**, Anirban Chatterjee.
BARGAIN: A Super-Resolution Technique to Gain High-Resolution Images for Barcodes.
International Conference on Data Science & Management of Data (CODS-COMAD), Bangalore, India, 2024, pages: 464–468.

4 Binay Gupta, Saptarshi Misra, Anirban Chatterjee, **Kunal Banerjee**.
Are you a Foodie looking for New Cookies to try out? Better not ask an LLM.
AIMLSystems, Bangalore, India, 2023, pages: 40:1–40:4.

5 Archit Bansal, **Kunal Banerjee**, Abhijnan Chakraborty.
These Deals Won't Last! Longevity, Uniformity and Bias in Product Badge Assignment in E-Commerce Platforms.
SIGIR Workshop On eCommerce (eCOM), Taipei, Taiwan, 2023, pages: 1–17.

6 Saptarshi Misra, Pranay Dugar, Anirban Chatterjee, Lalitdutt Parsai, **Kunal Banerjee**.
Designing a Vision Transformer based Enhanced Text Extractor from Product Images.
International Conference on Data Science & Management of Data (CODS-COMAD), Mumbai, India, 2023, pages: 208–212.

7 Meet Maheshwari, Binay Gupta, Anirban Chatterjee, **Kunal Banerjee**.
A Dynamic Attention Based Graph Neural Network for Anomaly Prediction in Multi-Variate Time-Series & Its Application in Network Monitoring.
International Conference on Data Science & Management of Data (CODS-COMAD), Mumbai, India, 2023, pages: 233–237.

8 Subhadip Paul, Anirban Chatterjee, Binay Gupta, **Kunal Banerjee**.
Developing a Noise-Aware AI System for Change Risk Assessment with Minimal Human Intervention.
CIKM Workshop on Human-in-the-Loop Data Curation (HIL-DC), Atlanta, USA, 2022, pages: 1–5.

9 Rahul Bajaj, **Kunal Banerjee**, Lalitdutt Parsai, Deepansh Goyal, Sachin Parmar, Divyajyothi Bn, Balamurugan Subramaniam, Chaitanya Sai, Tarun Balotia, Anirban Chatterjee, Kailash Sati.
WALTS: Walmart AutoML Libraries, Tools and Services.
Euromicro Conference on Software Engineering and Advanced Applications (SEAA), Gran Canaria, Spain, 2022, pages: 21–28.

10 Pranay Dugar, Aditya Vikram, Anirban Chatterjee, **Kunal Banerjee**, Vijay Agneeswaran.
Don't Miss the Fine Print! An Enhanced Framework To Extract Text From Low Resolution Images.
International Conference on Computer Vision Theory and Applications (VISAPP), Online, 2022, pages: 664–671.

11 Binay Gupta, Anirban Chatterjee, Subhadip Paul, Matha Harika, Lalitdutt Parsai, **Kunal Banerjee**, Vijay Agneeswaran.
Look Before You Leap! Designing a Human-Centered AI System for Change Risk Assessment.
International Conference on Agents and Artificial Intelligence (ICAART), Online, 2022, pages: 655–662.

12 Arkadip Basu, Rishi Singh, Chenyang Yu, Amarjeet Prasad, **Kunal Banerjee**.
Designing, Developing and Deploying an Enterprise Scale Network Monitoring System.
Innovations in Software Engineering Conference (ISEC), Gandhinagar, India, 2022, pages: 18:1–18:5.

13 Pranay Dugar, Rajesh Shreedhar Bhat, Asit Sharad Tarsode, Uddipto Dutta, **Kunal Banerjee**, Anirban Chatterjee, Vijay Srinivas Agneeswaran.
From Pixels To Words: A Scalable Journey Of Text Information From Product Images To Retail Catalog.
International Conference on Information and Knowledge Management (CIKM), Queensland, Australia, 2021, pages: 3787–3795.

14 **Kunal Banerjee**, Vishak Prasad C, Rishi Raj Gupta, Karthik Vyas, Anushree H, Biswajit Mishra.
Exploring Alternatives to Softmax Function.
Deep Learning Theory and Applications (DeLTA), Online, 2021, pages: 81–86,
(nominated for Best Poster Award).

15 Arkadip Basu, **Kunal Banerjee**.
Designing a Bot for Efficient Distribution of Service Requests.
Bots in Software Engineering (BotSE), Madrid, Spain, 2021, pages: 16–20.

16 Evangelos Georganas, **Kunal Banerjee**, Dhiraj Kalamkar, Sasikanth Avancha, Anand Venkat, Michael Anderson, Greg Henry, Hans Pabst, Alexander Heinecke.
Harnessing Deep Learning via a Single Building Block.
International Parallel & Distributed Processing Symposium (IPDPS), New Orleans, USA, 2020, pages: 222–233.
(Preliminary version accepted as research poster in SuperComputing 2019.)

17 Brunno F Goldstein, Sudarshan Srinivasan, Dipankar Das, **Kunal Banerjee**, Leandro Santiago, Victor C. Ferreira, Alexandre S. Nery, Sandip Kundu, Felipe M. G. Franca.
Reliability Evaluation of Compressed Deep Learning Models.
Latin American Symposium on Circuits and Systems (LASCAS), San Jose, Costa Rica, 2020, pages: 1–5.

18 Dhiraj Kalamkar, **Kunal Banerjee**, Sudarshan Srinivasan, Srinivas Sridharan, Evangelos Georganas, Mikhail E. Smorkalov, Cong Xu, Alexander Heinecke.
Training Google Neural Machine Translation on an Intel CPU Cluster.
International Conference on Cluster Computing (CLUSTER), Albuquerque, USA, 2019, pages: 1–10.

19 Evangelos Georganas, Sasikanth Avancha, **Kunal Banerjee**, Dhiraj Kalamkar, Greg Henry, Hans Pabst, Alexander Heinecke.
Anatomy Of High-Performance Deep Learning Convolutions On SIMD Architectures.
International Conference for High Performance Computing, Networking, Storage, and Analysis (SC), Dallas, USA, 2018, pages: 66:1–66:12.

20 **Kunal Banerjee**, Ramanuj Chouksey, Chandan Karfa, Pankaj Kumar Kalita.
Poster: Automatic Detection of Inverse Operations while Avoiding Loop Unrolling.
International Conference on Software Engineering (ICSE), Gothenburg, Sweden, 2018, pages: 175–176.

21 Dipankar Das, Naveen Mellempudi, Dheevatsa Mudigere, Dhiraj Kalamkar, Sasikanth Avancha, **Kunal Banerjee**, Srinivas Sridharan, Karthik Vaidyanathan, Bharat Kaul, Evangelos Georganas, Alexander Heinecke, Pradeep Dubey, Jesus Corbal, Nikita Shustrov, Roma Dubtsov, Evarist Fomenko, Vadim Pirogov.
Mixed Precision Training of Convolutional Neural Networks using Integer Operations.
International Conference on Learning Representations (ICLR), Vancouver, Canada, 2018, pages: 1–11.

22 **Kunal Banerjee**, Chittaranjan Mandal, Dipankar Sarkar.
An Equivalence Checking Framework for Array-Intensive Programs.
Automated Technology for Verification and Analysis (ATVA), Pune, India, 2017, pages: 84–90.

23 Soumyadip Bandyopadhyay, Santonu Sarkar, **Kunal Banerjee**.
An End-to-end Formal Verifier for Parallel Programs.
International Conference on Software Technologies (ICSOFT), Madrid, Spain, 2017, pages: 388–393.

24 **Kunal Banerjee**, Chittaranjan Mandal, Dipankar Sarkar.
Translation Validation of Loop and Arithmetic Transformations in the Presence of Recurrences.
Languages, Compilers, Tools and Theory for Embedded Systems (LCTES), Santa Barbara, USA, 2016, pages: 31–40.

25 **Kunal Banerjee**, Soumyadip Banerjee, Santonu Sarkar.
Data-Race Detection: The Missing Piece for an End-to-End Semantic Equivalence Checker for Parallelizing Transformations of Array-Intensive Programs.
International Workshop on Libraries, Languages and Compilers for Array Programming (ARRAY), Santa Barbara, USA, 2016, pages: 1–8.

26 **Kunal Banerjee**, Chittaranjan Mandal, Dipankar Sarkar.
A Translation Validation Framework for Symbolic Value Propagation Based Equivalence Checking of FSMDAs.
Source Code Analysis and Manipulation (SCAM), Bremen, Germany, 2015, pages: 247–252.

27 Soumyadip Bandyopadhyay, Dipankar Sarkar, **Kunal Banerjee**, Chittaranjan Mandal.
A Path-Based Equivalence Checking Method for Petri net based Models of Programs.
International Conference on Software Engineering and Applications (ICSOFT-EA), Colmar, France, 2015, pages: 319–329.

28 **Kunal Banerjee**, Chittaranjan Mandal, Dipankar Sarkar.
Translation Validation of Transformations of Embedded System Specifications using Equivalence Checking.
IEEE Computer Society Annual Symposium on VLSI (ISVLSI), Montpellier, France, 2015, pages: 183–186, **(received Best PhD Forum Paper Award)**.

29 **Kunal Banerjee**, Chittaranjan Mandal, Dipankar Sarkar.
Extending the Scope of Translation Validation by Augmenting Path Based Equivalence Checkers with SMT Solvers.
International Symposium on VLSI Design and Test (VDAT), Coimbatore, India, 2014, pages: 1–6.

30 Chandan Karfa, **Kunal Banerjee**, Dipankar Sarkar, Chittaranjan Mandal.
Experimentation with SMT Solvers and Theorem Provers for Verification of Loop and Arithmetic Transformations.
IBM Collaborative Academia Research Exchange (I-CARE), Delhi, India, 2013, pages: 3:1–3:4, **(received Best Paper Award)**.

31 **Kunal Banerjee**, Chandan Karfa, Dipankar Sarkar, Chittaranjan Mandal.
A Value Propagation Based Equivalence Checking Method for Verification of Code Motion Techniques.
International Symposium on Electronic System Design (ISED), Kolkata, India, 2012, pages: 67–71.

32 Chandan Karfa, **Kunal Banerjee**, Dipankar Sarkar, Chittaranjan Mandal.
Equivalence Checking of Array-Intensive Programs.
IEEE Computer Society Annual Symposium on VLSI (ISVLSI), Chennai, India, 2011, pages: 156–161.

Others

1 Yash Bhatnagar, **Kunal Banerjee**, Anirban Chatterjee.
Adversarial Prompting Framework for AI Safety Assessment.
International Conference on Data Science (CODS), Pune, India, 2025.

2 Vishwas Choudhary, Binay Gupta, Anirban Chatterjee, Subhadip Paul, **Kunal Banerjee**, Vijay Srinivas Agneeswaran.
Detecting Concept Drift in the Presence of Sparsity - A Case Study of Automated Change Risk Assessment System.
Engineering Dependable and Secure Machine Learning Systems (EDSMLS)@AAAI, Online, 2022.

3 Abhisek Kundu, Sudarshan Srinivasan, Eric C. Qin, Dhiraj Kalamkar, Naveen K. Mellempudi, Dipankar Das, **Kunal Banerjee**, Bharat Kaul, Pradeep Dubey.
K-TanH: Hardware Efficient Activations For Deep Learning.
arXiv:1909.07729, pages: 1–11.

4 Dhiraj Kalamkar, Dheevatsa Mudigere, Naveen Mellempudi, Dipankar Das, **Kunal Banerjee**, Sasikanth Avancha, Dharma Teja Vooturi, Nataraj Jammalamadaka, Jianyu Huang, Hector Yuen, Jiyan Yang, Jongsoo Park, Alexander Heinecke, Evangelos Georganas, Sudarshan Srinivasan, Abhisek Kundu, Misha Smelyanskiy, Bharat Kaul, Pradeep Dubey.
A Study of BFLOAT16 for Deep Learning Training.
arXiv:1905.12322, pages: 1–10.

5 **Kunal Banerjee**, Chandan Karfa.
A Quick Introduction to Functional Verification of Array-Intensive Programs.
arXiv:1905.09137, pages: 1–7.

6 **Kunal Banerjee**, Evangelos Georganas, Dhiraj Kalamkar, Alexander Heinecke.
Optimizing Deep Learning LSTM Topologies on Intel Xeon Architecture.
ISC High Performance, Frankfurt, Germany, 2019, pages: 1, **(received Best Research Poster Award in "Artificial Intelligence and Machine Learning" track)**.

7 Alexander Heinecke, Evangelos Georganas, **Kunal Banerjee**, Dhiraj Kalamkar, Narayanan Sundaram, Anand Venkat, Greg Henry, Hans Pabst.
Understanding the Performance of Small Convolution Operations for CNN on Intel Architecture.
International Conference for High Performance Computing, Networking, Storage and Analysis (SC), Denver, USA, 2017, (Research Poster).

8 Abhisek Kundu, **Kunal Banerjee**, Naveen Mellempudi, Dheevatsa Mudigere, Dipankar Das, Bharat Kaul, Pradeep Dubey.
Ternary Residual Networks.
arXiv:1707.04679, pages: 1–19.
(Accepted as extended abstract in SysML 2018. Presented at Intel AI DevCon 2018.)

9 **Kunal Banerjee**.
An Equivalence Checking Mechanism for Handling Recurrences in Array-Intensive Programs.
Principles of Programming Languages (POPL): Student Research Competition, Mumbai, India, 2015, pages: 1–2.

Professional Memberships

IEEE   Senior Member
ACM   Senior Member

Tutorials / Talks

1 Compiler-agnostic Translation Validation, *Innovations in Software Engineering Conference (ISEC)*, Hyderabad, India, 2018.

2 Translation Validation of Embedded System Specifications using Equivalence Checking, *Tata Research Development and Design Centre (TRDDC)*, Pune, India, 2014.

3 Translation Validation using Path Based Equivalence Checkers Augmented with SMT Solvers, *Formal Methods Update Meeting 2014*, Kharagpur, India, 2014.

Technical Skills

Programming: C, C++, Java, Python, PL/SQL, Scheme, Prolog, Lisp, Visual Basic and others along with some scripting and markup languages
Tools: ACL2, Caffe, CUDD, CVC, ISL, PyTorch, TensorFlow, Yices, Z3
Languages: Bengali, English, Hindi