Xia CHEN

Research Associate

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Proficient in predictive modeling, data-based value proposition, AI for science; machine assistance for sustainable decision-making support in advanced human-computer interaction, uncertainty analysis, and causal inference.

Research & Work Experience

2020/07 - 2024/09 **Ph.D., Lecturer, Technical University Berlin/Leibniz University Hannover, Germany**

- Dissertation: *'Beyond Predictions - Alignment between Prior Knowledge and Machine Learning for Human-Centric Augmented Intelligence'*, with Honors*:* ***summa cum laude*****,** Supervised by Prof. Dr.-Ing. Philipp Geyer.
- Led Research Projects: German Research Foundation (DFG), FOR 2363 (2020-2023); German Federal Ministry of Education (BMBF), AI for Science, HyThroughGen (2023).
- Co-established and led an internal research team at LUH; Co-developed and taught courses; Initiated interdisciplinary research collaborations, including drafting funding proposals.

2024/01 - 2024/06 **Visiting Scholar, Center for the Built Environment, University of California, Berkeley, USA**

- Invited collaboration in causal inference embedded AI/ML in engineering.
- Advanced causal inference tool development for unbiased factor analysis.
- Machine assistance framework collaboration with industrial partners.

10/2017 - 12/2019 **Research Assistant, FCN institute of E.ON Energy Research Center, Aachen, Germany**

- Massive dataset analysis of renewable energy time-series within different EU sectors & predictive ML algorithm development.
- Economic analysis of German Energy Transition Innovation projects.
- Full-stack development for projects: *'Virtual Energy System Laboratory'* and *'Junior Professorship for Energy Resource and Innovation Economics'* (JERI).

11/2016 - Current **Co-founder, Joinergy Co. Ltd. (Jiaonengwang), Shanghai, PR China**

- Specialized in AI solutions and data-driven consulting within the energy digitalization, power market, and sustainability domains.
- Received funding from: Technology Entrepreneurship Foundation for Graduates (EFG), Shanghai, 2019; Tongji Eagles Foundation, Business Incubator of Tongji University Science Park, Tongji University, Shanghai, 2019; Talent Start-up Leadership Program, Suzhou, 2019.

Education

2015 - 2018 **RWTH Aachen University, Aachen, Germany**

- Master of Science in Sustainable Energy Supply Technology

2014 - 2015 **Beuth Hochschule für Technik Berlin, Berlin, Germany**

- Bachelor of Engineering in Building Engineering Technology (Dual Bachelor Program)

2011 - 2015 **Tongji University, Shanghai, PR China**

- Bachelor of Engineering in Building Facility Intelligence Technology, Faculty of Chinese-German University of Applied Sciences (CDHAW)

Technical Competency

02/2021 - Top 5% in *M5 (Makridakis Competitions) time-series forecasting competition*, Kaggle.

07/2021 - *AutoML Open Challenge: Artificial Intelligence Dependability Assessment (AI-DA)*, Siemens, Berlin, Germany.

- Finalist of *Siemens 'Hello Future' innovation challenge 2021*, Digitally-enabled Applications for Smart Districts, Berlin, Germany.

Technical Skills

Coding & Deployment - Expertise in Python and R with knowledge of mainstream frameworks in Data Science, Machine Learning, and Deep Learning (Pytorch); Expertise in different systems (Windows, Linux), servers (Google Colaboratory, Amazon AWS), and environments.

Development / Software - Expertise in Full-stack development: HTML with JavaScript & CSS, Vue, PHP, Python (Django); Knowledge in Autodesk suite; Sketchup, EnergyPlus; Citavi, LaTeX; Adobe suite.

Publications

Working on

1. Chen. X, Sun, R., Schiavon, S. & Geyer, P., Beyond traditional statistic: uncovering deeper insights of survey data with causal inference.
2. Chen. X, Lv, G., Zhuang, X., Schiavon, S. & Geyer, P., Integrating symbolic neural networks with building physics: a collaborative human-AI research framework.

Peer-reviewed Articles in International Journals or Open-source Platforms

1. Chen, X., Rex, A., Woelke, J., Eckert, C., Bensmann, B., Hanke-Rauschenbach, R., & Geyer, P. (2024). Machine learning in proton exchange membrane water electrolysis — A knowledge-integrated framework. *Applied Energy*, 371, 123550.
2. Chen, X., Singh, M.M. & Geyer, P., (2024). Utilizing domain knowledge: robust machine learning for building energy performance prediction with small, inconsistent datasets. *Knowledge-Based Systems*, p.111774.
3. Chen, X., Teng, X., Chen, H., Pan, Y., & Geyer, P. (2024). Toward reliable signals decoding for electroencephalogram: A benchmark study to EEGNeX. *Biomedical Signal Processing and Control*, *87*, 105475.
4. Chen, X., Sun, R., Saluz, U., Schiavon, S., & Geyer, P. (2023). Using causal inference to avoid fallouts in data-driven parametric analysis: A case study in the architecture, engineering, and construction industry. *Developments in the Built Environment*, 100296.
5. Chen, X., Abualdenien, J., Singh, M. M., Borrmann, A., & Geyer, P. (2022). Introducing causal inference in the energy-efficient building design process. *Energy and Buildings*, *277*, 112583.
6. Chen, X., & Geyer, P. (2022). Machine assistance in energy-efficient building design: A predictive framework toward dynamic interaction with human decision-making under uncertainty. *Applied Energy*, *307*, 118240.
7. Chen, X., Guo, T., Kriegel, M., & Geyer, P. (2022). A hybrid-model forecasting framework for reducing the building energy performance gap. *Advanced Engineering Informatics*, *52*, 101627.
8. Chen X., Zhang Y., & Cai X. (2022). Frontiers of carbon neutrality in EU-German building sector, *Heating Ventilating & Air Conditioning*, TU-023; X322.
9. Zong, C., Chen, X., Fatma, D., Johannes, S., Geyer, P., & Werner, L. (2023). A holistic two-stage decision-making methodology of passive and active building design strategies under uncertainty. *Building and Environment*, 111211.
10. Geyer, P., Singh, M. M., & Chen, X. (2021). Explainable AI for engineering design: A unified approach of systems engineering and component-based deep learning. *arXiv preprint arXiv:2108.13836*.

Peer-reviewed Articles in Conference Proceedings

1. Chen, X., & Geyer, P. (2023). Sustainability recommendation system for building design alternatives under multi-objective scenarios. In 30th International Workshop on Intelligent Computing in Engineering, EG-ICE 2023, London, UK.
2. Chen, X., & Geyer, P. (2023). Pathway toward prior knowledge-integrated machine learning in engineering. In 18th International IBPSA conference and Exhibition, Building Simulation 2023, Shanghai, China.
3. Guo, T., Chen, X., Geyer, P., & Kregel, M. (2023). Performance investigation of different topology organizations in district heating systems with component-based machine learning. In 18th International IBPSA conference and Exhibition, Building Simulation 2023, Shanghai, China.
4. Wang, S., Chen, X., & Geyer, P. (2023). Feasibility Analysis of POD and Deep-autoencoder for Indoor Environment CFD Prediction. In 18th International IBPSA conference and Exhibition, Building Simulation 2023, Shanghai, China.
5. Chen X., Cai X., Kümpel A., Müller D., & Geyer P., (2022). Dynamic Feedforward Strategy Development for Building Heating System based on AI Forecasting and Simulation. In Passive and Low Energy Architecture, PLEA 2022, Santiago de Chile, Chile.
6. Chen X., Saluz U., Staudt J., Margesin M., Lang W., & Geyer P. (2022). Integrated data-driven and knowledge-based performance evaluation for machine assistance in building design decision support, In 29th International Workshop on Intelligent Computing in Engineering, EG-ICE 2022. Aarhus, Denmark.
7. Chen, X., Guo, T., & Geyer, P. (2021). A hybrid-model forecasting framework for reducing the building energy performance gap. In 28th International Workshop on Intelligent Computing in Engineering, EG-ICE 2021. Berlin, Germany, 2021, special issue on Advanced Engineering Informatics.
8. Chen, X., Singh, M.M. & Geyer, P. (2021). Component-based machine learning for predicting representative time-series of energy performance in building design. In 28th International Workshop on Intelligent Computing in Engineering, EG-ICE 2021. Berlin, Germany.

Patent

1. Device and method for predicting power consumer demand based on weight, CN 202011575395.X · Issued Dec 28, 2020.
2. Automatic selection system and method for time series data prediction, CN 201911374036.5 · Issued Dec 27, 2019.

Teaching Record

- 2023 Summer (LUH): Lecturer *'Data Sciences for Design and Engineering'*, M.S. Lecture, Guest Lecturer 'Data Science and Simulation', B.A. Lecture.
- 2022 Winter (LUH): Co-teach *'Data Sciences for Design and Engineering'*, M.S. Lecture.
- 2022 Sommer (LUH): Teaching assistant for *'Data Sciences for Design and Engineering'*, M.S. Lecture.
- 2021 Winter (TUB): Lecturer *'Data Sciences for Energy-Efficient Design'*. M.S./B.A. Lecture.
- 2021 Sommer (TUB): Teaching assistant for *'Data Sciences for Energy-Efficient Design'*, M.S./B.A. Lecture.

Funding & Research Project

- *FOR2363 EarlyBIM (GE1652/3-2): Knowledge Base and Machine-Learning Assistance for Performance-oriented Building Design* - German Research Foundation (DFG), 2020–2023.
    - Led in the coordination of five Research Units (6 Ph.D. candidates) from Technical University Munich, KU Leven, Technical University Berlin, Ruhr University Bochum, and University of Duisburg-Essen; Finalized & with knowledge transfer funding proposal extension.
- *HyThroughGen (03HY108C): High-Throughput Material Performance Evaluation for Water Electrolysis* - Federal Ministry of Education and Research (BMBF), 2023.
    - Co-lead Researcher with Research Center Julich & Fraunhofer Society for the Promotion of Applied Research e.V., Germany, evaluate promising materials and components for suitability in water electrolysis within 2 to 3 years instead of the usual 10 years, Finalized & with new BMBF proposal initiation.
- *FOR 2363 Transfer: Translating Machine-Augmented Intelligence into Decision-Making* – DFG (2 years), Co-author, Pending.
- *Flexible, Scalable, and Efficient Machine Learning Models* – BMBF (3 years), Co-author, Pending.

Academic Services

- **Journal Reviewer:** Advanced Engineering Informatics (ADVEI), Energy and Buildings (ENB), Structures (STRUCTURES).
- **Conference Reviewer:** IBPSA, BS 2023(International IBPSA conference and Exhibition, Building Simulation), EG-ICE 2021/22/23 (International Workshop on Intelligent Computing in Engineering), PLEA 2022 (Passive and Low Energy Architecture).
- **Scientific Committee Member:** International Workshop on Intelligent Computing in Engineering (EG-ICE).

Invited Talks and Interviews

- "*Pathway toward Prior Knowledge-Integrated Machine Learning in Engineering*", Intelligent reconstruction of multiphysical fields, DigitalFUTURES workshop, Tongji University, Shanghai, China*,* 2024.
- "*Enhancing Plausibility in Parametric Analysis: Causal Inference for Augmented Decision-Making - Insights from Architecture, Engineering, and Construct*", Indoor Air, Honolulu, USA, 2024.
- "*Knowledge-integrated Machine Learning in Building Engineering*", WELL Seminar, Center for the Built Environment, University of California, Berkeley*, USA,* 2024.
- "*Knowledge Base and Machine-Learning Assistance for Performance-oriented Building*", Toward Habitable Future Lecture, Faculty of Architecture and Landscape, Leibniz University Hannover, Germany*,* 2022.
- "*Introducing Causal Inference in the Energy-Efficient Building Design Process*", WELL Seminar, Center for the Built Environment, University of California, Berkeley, USA*,* 2022.
- "*Causal Inference as a Method to Aid the Process of Sustainable Building Design*", Community workshop on causal tools, Microsoft*,* 2021.

Berlin, September. 2024