# ATHER ABBAS

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## Research Objective

I work at the intersection of water sciences and machine learning. I am interested in application of data-driven approaches to solve problems related to water resources with special focus on surface water quality, catchment dynamics and water treatment.

## Education

- **Doctor of Philosophy (PhD) Environmental Engineering** — *Aug. 2018-Aug. 2022*
  Thesis: "*Artificial intelligence for modeling of surface water resources: Application from streamflow to water quality*"
  Ulsan National Institute of Science and Technology, Ulsan, South Korea
- **Master of Science (MS) Hydrogeology and Environmental Science** — *Sep. 2013-Feb. 2017*
  Thesis: "*Estimation of hydraulic Aquifer parameters by integral transform methods applied to aquifer and river stream head responses (Leine River)*"
  George August University of Goettingen, Germany
- **Bachelor of Science (BE) Applied Geology** — *Sep. 2008-Mar. 2013*
  Thesis: "*Hydrogeological investigation of Munara area (Pakistan) and surroundings"*
  University of the Punjab, Lahore, Pakistan

## Research Interests

**Hydrological modeling**

- Modeling of surface water quality parameters such as pathogenic bacteria, harmful algal blooms, antibiotic resistance genes, harmful algal blooms.
- Modeling streamflow and groundwater flow at catchment scale
- Modeling interaction between surface water and groundwater

**Supervised and reinforcement learning**

- Development of machine learning and deep learning models for regression and classification problems
- Optimization of weir operations for improving water quality using reinforcement learning

**Wastewater treatment**

- Modeling pollutant removal efficiency from industrial wastewater
- Modeling biogas prediction from organic wastes

## Experience

- **Postdoc researcher**
  School of Urban and Environmental Engineering,
  Ulsan National Institute of Science and Technology, Ulsan, South Korea. *Sep 2022 - Present*
  **Responsibilities**
  - Water quality modelling using deep learning
  - Modelling of wastewater treatment using Machine Learning
- **Researcher**
  School of Urban and Environmental Engineering,
  Ulsan National Institute of Science and Technology, Ulsan, South Korea. *Sep 2017-Aug 2018*
  **Responsibilities**
  - Surface and ground water modeling using HSPF and heat equation
- **Research Analyst**
  G.E.O.S Ingineurgesellschaft mbH
  Schwarze Kiefern 2
  09633 Halsbrücke Freiberg, Germany. *Oct 2016- Aug 2017*
  **Responsibilities**
  - Numerical modeling of magma emplacement in MATLAB.
  - Modeling of reactive groundwater transport using PhreeqC and COMSOL
  - numerical modeling of groundwater flow, temperature distribution in crust using MATLAB
- **Jr. GIS Professional**
  The Urban Unit,
  Office No. 503, Shaheen complex, Edgerton Road, Lahore, Pakistan. *Jun. 2013- Sep. 2013*
  **Responsibilities**
  - Preparation of land-use maps using GIS
  - Preparation of flood inundation maps using GIS

## Technical Skills

**Programming**

- **MATLAB**: basic io operations, matrix manipulation, data visualization, solution of PDEs with finite difference method
- **Python**: object-oriented programming, data visualization, array manipulation, manipulation of spatial data
- **R**: statistical analysis
- **FORTRAN**: io operations, functional programming

**Operating System**

- Microsoft Windows
- Ubuntu

**Software**

- **HSPF**: surface flow and pollutant modeling at catchment scale
- **SWAT**: surface flow and pollutant modeling at catchment scale
- **MODFLOW**: modeling of groundwater

**Machine Learning Frameworks**

- Keras
- TensorFlow
- PyTorch
- Scikit-learn

flow and contaminant transport

- **ArcMap**: map creation and digitization
- **QGIS**:
- **LaTEX**:

## Python libraries

- **AI4Water**
  Framework for data-driven modeling of tabular data with focus on hydrology
  https://ai4water.readthedocs.io

- **AutoTab**
  Machine learning pipeline optimization
  https://autotab.readthedocs.io

- **SeqMetrics**
  Calculation of over 100 regression and over 20 classification performance metrics
  https://SeqMetrics.readthedocs.io

- **easy_mpl**
  Data visualization recipes
  https://easy-mpl.readthedocs.io

## Publications

**Journal Publications**

***** Co-first author

1. **Abbas, A**., Boithias, L., Pachepsky, Y., Kim, K., Chun, J. A., & Cho, K. H. (2022). AI4Water v1. 0: an open-source python package for modeling hydrological time series using data-driven methods. **Geoscientific Model Development**, 15(7), 3021-3039 **(IF = 6.9).**

2. Jaffari, Z. H., **Abbas, A**., Lam, S-M., Sanghun, P., Chon, K., Kim, E-S., & Cho, K. H. (2022). Machine learning approaches to predict the photocatalytic performance of bismuch ferrite-based materials in the removal of malachite green. Journal of Hazardous Materials, https://doi.org/10.1016/j.jhazmat.2022.130031 (**IF = 14.3**).

3. Son, M., Yoon, N., Park, S., **Abbas, A.**, Cho, K. H. An open-source deep learning model for predicting effluent concentration in capacitive deionization. **Science of the Total Environment** (Accepted)

4. **Abbas, A.,** Baek, S., and Cho, K. H. Deep learning-based algorithms for long-term prediction of chlorophyll-a in catchment streams. **Journal of Cleaner Production (IF = 11)**.

5. Kwon, D. H., Hong, S. M., **Abbas, A.,** Pyo, J., Lee, H. K., Baek, S. S., & Cho, K. H. (2023). Inland harmful algal blooms (HABs) modeling using internet of things (IoT) system and deep learning. **Environmental Engineering Research,** 28(1). https://doi.org/10.4491/eer.2021.280 (**IF=2.5**)

6. Lee, J., **Abbas, A.,** McCarty, Gregory W., Zhang. X., Lee. S., Cho. KH., (2022) Estimation of base and surface flow using deep neural networks and a hydrologic model in two watersheds of the Chesapeake Bay. **Journal of Hydrology**. (Accepted)

(**IF=6.2**)

7. Son, M., Yoon, N., Jeong, K., **Abass, A.**, Logan, B. E., & Cho, K. H. (2021). Deep learning for pH prediction in water desalination using membrane capacitive deionization. **Desalination**, 516, 115233. **(IF = 11.2)**

8. **Abbas, A**., Baek, S., Silvera, N., Soulileuth, B., Pachepsky, Y., Ribolzi, O., ... & Cho, K. H. (2021). In-stream Escherichia coli modeling using high-temporal-resolution data with deep learning and process-based models. **Hydrology and Earth System Sciences**, 25(12), 6185-6202 **(IF = 6.6)**

9. Yoon, N., Kim, J., Lim, J. L., **Abbas, A.**, Jeong, K., & Cho, K. H. (2021). Dual-stage attention-based LSTM for simulating performance of brackish water treatment plant. **Desalination**, 512, 115107. **(IF = 11.2)**.

10. Jang, J., **Abbas, A.*,** Kim, M., Shin, J., Kim, Y. M., & Cho, K. H. (2021). Prediction of antibiotic-resistance genes occurrence at a recreational beach with deep learning models. **Water Research**, 196, 117001 **(IF = 13.4)**

11. Yun, D., **Abbas, A**., Jeon, J., Ligaray, M., Baek, S. S., & Cho, K. H. (2021). Developing a deep learning model for the simulation of micro-pollutants in a watershed. **Journal of Cleaner Production**, 300, 126858. **(IF = 11).**

12. Jeong, K., **Abbas, A.*,** Shin, J., Son, M., Kim, Y. M., & Cho, K. H. (2021). Prediction of biogas production in anaerobic co-digestion of organic wastes using deep learning models. **Water Research**, 205, 117697. **(IF = 13.4)**

13. **Abbas, A.,** Baek, S., Kim, M., Ligaray, M., Ribolzi, O., Silvera, N., ... & Cho, K. H. (2020). Surface and sub-surface flow estimation at high temporal resolution using deep neural networks. **Journal of Hydrology**, 590, 125370. **(IF = 6.7).**

14. Umer, M., Umer, S., Zafari, M., H, M., Hajibabaei, A., **Abbas, A.,** Lee, G., Kim, K. S. (2022) Machine learning assisted high-throughput screening of transition metal single atom based superb hydrogen evolution electrocatalysts. **Journal of Materials Chemistry A,** 10 (12). https://doi.org/10.1039/D1TA09878K

## Language Proficiency

- **English**
- **German**
- **Persian**

## References

**Asad Mustafa Karim:** Research Professor, Department of Biological Sciences, School of Biotechnology, Kyung Hee University, Yongin, South Korea Email: asadkarim@khu.ac.kr Phone: +82 10 31605125

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