

BEICHEN ZHANG

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PERSONAL PROFILE

Ph.D. candidate at the University of Nebraska-Lincoln, studying impacts of climate extremes and climate change, with 5+ years of experience in geoinformatics (remote sensing, GIS, geospatial analysis) and applied climatology, and 4+ years in data science, machine learning, and deep learning using Python and R.

EDUCATION

Ph.D. in Natural Resource Sciences, University of Nebraska-Lincoln Expected Fall 2023
Specialized in Climate Assessment and Impacts, minor in Statistics
Dissertation topics: Monitoring and Assessing Drought Impacts using Machine Learning

M.S. in Natural Resource Sciences, University of Nebraska-Lincoln 2017 - 2019
Specialized in Climate Assessment and Impacts
Thesis: Investigation of GRACE-derived Information on Forest Drought Stress Across the Contiguous U.S

B.S. in Geographic Information Science, Northwest A&F University (Yangling, China) 2013 - 2017

RESEARCH EXPERIENCE

Graduate Research Assistant August 2022 - Present
Daugherty Water for Food Global Institute, National Drought Mitigation Center *Lincoln, NE*

- Research fellowship from the *Daugherty Water for Food Global Institute* and *Claire M. Hubbard Water, Climate and Health Program*. Developing research projects on associations between climate extremes and all-cause mortality using ML and causal inference, collaborating with researchers from environmental health and statistics.

Research Intern Jun 2022 - Aug 2022
Frontier Development Lab USA (Funded by NASA and DOE) *Mountain View, CA*

- The core researcher of an interdisciplinary research team studying wildfires using high-resolution multispectral satellite imagery and ML. This study built a self-supervised model (FireCLR) to detect changes of the burned areas and evaluate burned severity. The FireCLR was adapted from a contrastive learning architecture and trained and applied to wildfires in the western U.S. Check the FDL research [website](#) and the research paper at the NeurIPS 2022 [workshop](#) for more details.

Graduate Research Assistant August 2019 - May 2022
National Drought Mitigation Center *Lincoln, NE*

- Developed a study to investigate causal relationships between climate extremes and social unrest in South Asia. The research employed the frequency of protests as the potential outcomes and the demographic and remotely sensed data as the covariates for the regional social and economic character. The treatment was the occurrence of droughts. The preliminary work was presented at the [AGU 2022](#).
- Developed a study to identify multi-dimensional drought impacts on social and environmental aspects. The research employed text-based data collected from social media, news media, and media monitoring systems and applied natural language processing with deep learning (BERT) to identify the occurrence and the types of complex drought impacts. The preliminary research paper was accepted at the ICML 2021 [workshop](#) and is available at [arXiv](#).
- Developed a study to predict and assess complex drought impacts on multiple social sectors and ecosystem using the proposed explainable ML framework. The framework was built based on the XGBoost and SHAP, trained and fine-tuned based on the occurrence of seven types of drought impacts, climate indicators, remotely sensed land cover, and social vulnerability index. The preliminary research paper was accepted at NeurIPS 2020 [workshop](#) and is available at [arXiv](#).

TEACHING EXPERIENCE

Applications of Remote Sensing in Agriculture and Natural Resources, lab instructor Jan 2022 - May 2022

- Teaching the application of remote sensing in monitoring vegetation and ecosystem, including multispectral and hyperspectral image processing and analyzing using ENVI and ERDAS.

Introduction to Remote Sensing, lab instructor Aug 2021 - Dec 2021

- Teaching the concepts and mechanism of remote sensing by hands-on experiments of measuring reflectance and data processing using ENVI and ERDAS.

- Teaching the applications and processing of geospatial datasets using ArcGIS products, such as ArcMap and ArcGIS online.

PUBLICATIONS

Werum, R., Hayes, M., Schaefer, D., & **Zhang, B.** Climate Extremes and Protest in Asia: A Cross-Disciplinary Analysis of Protests in India, Pakistan and Bangladesh, 1995-2013 (*In Progress*)

Zhang, B., Abu Salem, K F., Hayes, M., Smith, K., & Tadesse, T. Explainable Machine Learning for the Prediction and Assessment of Complex Drought Impacts (*Under Review*)

Zhang, B., Wang, H., Alabri, A., Bot, K., McCall, C., Hamilton, D., & Ružička, V. (2022). Unsupervised Wildfire Change Detection based on Contrastive Learning . *NeurIPS Workshop on Artificial Intelligence for Humanitarian Assistance and Disaster Response*.

Zhang, B., Schilder, F., Smith, K., Hayes, M., Harms, S., & Tadesse, T. (2021). TweetDrought: A Deep-Learning Drought Impacts Recognizer based on Twitter Data. *ICML Workshop on Tackling Climate Change with Machine Learning*.

Zhang, B., Abu Salem, K F., Hayes M., & Tadesse T. (2020). Quantitative Assessment of Drought Impacts Using XGBoost based on the Drought Impact Reporter. *NeurIPS Workshop on Tackling Climate Change with Machine Learning*.

Tadesse, T., Hollinger, D. Y., Bayissa, Y. A., Svoboda, M., Fuchs, B., **Zhang, B.**, ... & Richardson, A. D. (2020). Forest Drought Response Index (ForDRI): A New Combined Model to Monitor Forest Drought in the Eastern United States. *Remote Sensing*, 12(21), 3605.

CONFERENCE PRESENTATIONS

"Explainable Machine Learning Applications to Predict and Assess Complex Drought Impacts based on a Multi-sourced Dataset" *AMS Annual Meeting*. January, 2023.

"Unsupervised Wildfire Change Detection based on Auto-Encoders and Contrastive Learning" *AGU Fall Meeting*. December, 2022.

"Can Causal Inference Help Investigate Drought Impacts on Social Unrest in India?" *AGU Fall Meeting*. December, 2022.

"Unsupervised Wildfire Change Detection based on Contrastive Learning" *NeurIPS Workshop Artificial Intelligence for Humanitarian Assistance and Disaster Response*. December, 2022.

"TweetDrought: A Deep-Learning Drought Impacts Recognizer based on Twitter Data" *AGU Fall Meeting*. December, 2021.

"TweetDrought: A Deep-Learning Drought Impacts Recognizer based on Twitter Data" *ICML Workshop Tackling Climate Change with Machine Learning*. July, 2021.

"Quantitative Assessment of Drought Impacts Using XGBoost based on the Drought Impact Reporter" *NeurIPS Workshop Tackling Climate Change with Machine Learning*. December, 2020.

"Evaluation of GRACE Data Assimilation Based on the Tree Ring Growth Index Across the Contiguous US" *National Soil Moisture Workshop*. May 2019.

HONORS AND AWARDS

Claire M. Hubbard Water, Climate and Health Fellowships, University of Nebraska	2022
School of Natural Resources and Graduate Committee funds, University of Nebraska	2018

ADDITIONAL EXPERIENCE

Team member of the Hydro90: media relations (Hydro90 is an NGO that consists of young hydrologists to promote hydrology knowledge for the public)	2021-Present
Outreach coordinator of the School of Natural Resources Graduate Student Association	2021-2022

TECHNICAL SKILLS

Statistics modeling and inference: regression analysis, multivariate analysis, spatiotemporal analysis, causal inference.

AI related: machine learning, deep learning, computer vision, natural language processing.

Geoinformatics: remote sensing, geographic information system, geospatial data analysis.

Programming languages: Python, R, Matlab, JavaScript, SQL.

Professional Software: ArcGIS, QGIS, ENVI, ERDAS, Google Earth Engine.

PROFESSIONAL MEMBERSHIP

American Meteorological Society (AMS), American Geophysical Union (AGU), American Association of Geographers (AAG)

LANGUAGE

English: Proficient; Chinese: Native