Jonathan Giezendanner

PhD, Engineer

Deep Learning · Remote Sensing · Environmental & Computational Sciences

Machine learning researcher specializing in environmental applications. Developing GNNs for weather forecasting and spatiotemporal deep learning fusion models for remote sensing. Experienced in processing large-scale geospatial datasets. PhD in environmental and computational science. Strong expertise in Python and deep learning frameworks.

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GieziJo
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cNxEnK4AAAAJ (Google Scholar)
En Fluent **Fr** Native **De** Native **It** Basic

Experience

Current 2024 **Postdoctoral Research Scientist**
Massachussets Institute of Technlogy (MIT), Earth Intelligence Lab — Boston, USA

- Developing Graph Neural Networks (GNNs) for local-scale weather forecasting:
  - Integrating reanalysis data and foundation model outputs from partners
  - Incorporating remote sensing data through vision-based algorithms
  - Adapting approaches for high-resolution local predictions
  - Optimizing computational efficiency for operational use
- Leveraging deep learning techniques to:
  - Improve accuracy and lead time of local weather forecasts
  - Generate predictions for locations with limited or no observational data
- Collaborating with meteorologists and climate scientists to enhance model interpretability and practical application

Current 2020 **Co-Founder & Developer** [part time]
Early Coffee Games SNC — Switzerland, Remote

- Co-founded Early Coffee Games in 2020, transitioning from hobby to semi-professional game development
- Leading development of “Hermit: an Underwater Tale”, a fast-paced action game with arcade elements
  - Secured ProHelvetia pre-production and production grants (2020, 2022)
  - Showcased the game as part of Swiss delegation:
    - Game Developers Conference (GDC) in San Francisco (2022)
    - Tokyo Game Show (2023)
- Developed "Chromatic Racing", an interactive art piece for Espace Jean-Tinguely Nicki de Saint Phalle museum (2021-2024)

› Managed collaborations with artists, musicians, and writers to create comprehensive game experiences
› Experienced in C# development for over 10 years, with strong skills in project structure and management

2024 Postdoctoral Research Scientist

2021 University of Arizona, Social Pixel Lab — Tucson, USA

› Led development of innovative deep learning models for environmental monitoring, including:
  · CNN-LSTM fusion for 20-year flood mapping (published at CVPR Earthvision 2023)
  · Deep vision models for global real-time flood monitoring with NASA
  · Long-term rice field mapping using Landsat and MODIS
› Engineered scalable pipelines for processing high-resolution satellite data and inferring flood maps using HPCs and Docker
› Developed Google Earth Engine applications:
  · Decision-support tool for local government
  · Visualization platform for flood event data
› Managed multiple projects collaborating with international partners (IRRI, NASA, FFWC Bangladesh), while supervising and training PhD students

2021 Research Scientist

2021 University of Bern — Bern, Switzerland

› Applied hydrological model to Panke urban watershed (north Berlin) using Earth Observation data:
  · Integrated satellite imagery for land use classification
  · Incorporated precipitation data
  · Analyzed urban features' impact on watershed hydrology
› Developed data processing pipelines for diverse Earth Observation datasets
› Collaborated with urban planners to assess flood risk management implications

2020 Postdoctoral Research Scientist

2020 Swiss Federal Institute of Technology (EPFL), Ecohydrology Lab (ECHO) — Lausanne, Switzerland

› Developed model combining metapopulation dynamics and scaling theory for river networks:
  · Analyzed species persistence under varying hydrologic connectivity
  · Incorporated seasonal fluctuations in drainage density and habitat quality
› Identified scaling properties of metapopulation capacity with network attributes
› Established links between ecological patterns and hydrological/geomorphological factors in river systems

2020 Co-Founder & Developer [part time]

2014 Sharped Stone Studios — Switzerland, Remote

› Developed multiple game jam projects, honing rapid prototyping and development skills
› Created interactive games for art installations:
  · Collaborated on three different exhibition projects
  · Translated artistic concepts into engaging interactive experiences
› Utilized Unity game engine and C# for all development work
› Managed client relationships and project deliveries for art installation contracts

2019 Doctoral Research Scientist

2016 Swiss Federal Institute of Technology (EPFL), Ecohydrology Lab (ECHO) — Lausanne, Switzerland

› Specializing in theoretical ecology, metapopulation dynamics and landscape ecology

- Developed advanced metapopulation models incorporating landscape-explicit information:
  - Extended classical patch-based models to include complex habitat matrices
  - Analyzed impacts of connectivity on mountain species under climate change scenarios
- Applied Earth Observation data to model spatial presence of carabid species:
  - Focused on Pterostichus flavofemoratus and Carabus depressus in Gran Paradiso National Park
  - Integrated dynamic landscape descriptors into species distribution models
- Investigated scale-dependency of metapopulation models:
  - Analyzed model consistency across different landscape resolutions
  - Explored extrapolation of local studies to larger regions
- Technical expertise:
  - Spatially-explicit ecological modeling
  - Geospatial analysis and remote sensing data integration
  - Climate change impact assessment on biodiversity
  - Statistical analysis of species-environment relationships
- Tools and software:
  - GIS software (e.g., QGIS, PostgreSQL, PostGIS)
  - Programming languages (e.g., C, R, Python, MATLAB)
  - Remote sensing data processing tools
  - High-performance computing for large-scale simulations
- Interdisciplinary research bridging population ecology, landscape ecology, and geomorphology
- Teaching experience:
  - Organized exercise sessions for MS class on Water Resources Engineering
  - Mentored students in computational methods and ecological modeling

2015 Computer Vision Scientist

2015 Insel University Hospital Bern, Support Center for Advanced Neuroimaging (SCAN) Bern, Switzerland

- Developed novel algorithms for image/spectral processing of radiological data:
  - Parallelized computation-intensive algorithm for image textural features using POSIX threads and CUDA
  - Enhanced JAVA plugin for metabolic map computation from MRSI data
  - Created tool for coregistration of longitudinal MRI examinations
- Implemented machine learning approaches:
  - Developed on-line learning algorithm for automatic optimal MRS-model selection
  - Created software for machine learning-based prediction of tumor progress in brain tumor patients
- Contributed to clinical routine and scientific studies:
  - Developed user-friendly, versatile patient reporting tools
  - Implemented interactive region of interest definition for medical images
- Collaborated effectively in an interdisciplinary team of medical and non-medical professionals

2015 Teaching assistant

2012 Swiss Federal Institute of Technology (EPFL) Lausanne, Switzerland

- Classes: signals, instruments and systems, numerical analysis, geomatics, analysis II

2013 **Engineering Intern**

2013 Emch+Berger Ingeneering Office — Bern, Switzerland

› Contributed to multiple urban planning and environmental projects:
  · ByPass Thun: Road drainage, sewerage system, pipe dimensioning, construction phase planning
  · Köniz - Ried: Drainage concept, routing, hydraulic calculations for rainwater and sewage systems
  · Einlausung Schwamendingen (EHS) - Aumühle: Drainage concepts, wastewater management for restaurant
  · GEP Stadt Bern: Hazard assessment report, risk analysis, disaster scenarios
› Developed skills in:
  · Urban drainage systems design and planning
  · Hydraulic calculations and dimensioning
  · Environmental risk assessment and management
  · Project-specific technical translations

2011 **Research assistant**

2011 Swiss College of Agriculture — Bern, Switzerland

› Key responsibilities included:
  · Maintenance and care of pot and field experiments on biochar
  · Setting up new pot experiments on the same topic
  · Data collection and preliminary analysis
  · General maintenance work in the tropical greenhouse and experimental fields
› Demonstrated skills:
  · Quick adaptation to new subject matter
  · Independent, focused, and reliable work ethic
  · Strong interest and motivation in assigned tasks
  · Excellent interpersonal skills with supervisors and colleagues

2009 **Caregiver Intern**

2009 Regional Hospital Moutier — Moutier, Switzerland

› Assisted nursing staff in daily patient care activities and medical procedures
› Provided personal care and support to patients, including mobility assistance and hygiene maintenance
› Monitored and reported patient conditions, contributing to the healthcare team's decision-making process

2009 **Group Leader, Sergeant**

2008 Swiss Armed Forces, Medics — Airolo, Switzerland

› Led and managed a team of military medical personnel
› Trained and mentored new recruits
› Oversaw emergency medical care operations in field conditions
› Coordinated team efforts in patient triaging and first response
› Ensured team adherence to military medical protocols and operational readiness

Education

2019 – 2016 **Doctoral Student**
Swiss Federal Institute of Technology (EPFL), Ecohydrology Lab (ECHO) — Lausanne, Switzerland

- Followed classes on mathematical modeling and data visualisation, and received mentoring from Prof. Dr. Andrea Rinaldo and Prof. Dr. Damiano Pasetto

2015 – 2013 **Msc Environmental Sciences and Engineering**
Minor in Computation Sciences and Engineering
Swiss Federal Institute of Technology (EPFL) — Lausanne, Switzerland

- Developed strong foundation in mathematical & environmental modeling and monitoring
- Major projects:
  - Master thesis: Rainfall Forecasting in Burkina Faso using Bayesian-Wavelet Neural Networks
    - Forecast rainfall at different lead times for weather stations in Burkina Faso
    - Developed a Bayesian Neural Network, a variation of Artificial Neural Networks producing a posterior distribution, allowing uncertainty estimates
    - Incorporated Wavelet Transform preprocessing to better characterize the temporal change
  - Computation Sciences and Engineering Semester Project: 3D Graph-Based Formation Odor Source Localization
    - Developed an algorithm for robots to move in formation to detect an odor source
    - Implemented both on real world robots and in simulation
    - Implemented TCP and UDP communication between the robots and a mechanical arm in a wind tunnel
  - Environmental Sciences and Engineering Semester Project: GPU-Parallelization of the Texas A&M Oil Spill Model
    - Ported existing oil spill modeling framwework from Fortran to Python
    - Parallelised particle (bubbles) simulation on GPU with CUDA
    - As each simulated bubble is independent, the model could be fully parallelised, seeing a linear improvement in computational time
  - Design Project: Fine Particle Distribution Estimation in Lausanne using the OpenSense Network
    - Model fin particle distribution in Lausanne based on data gathered on top of Buses, navigating the city

2013 – 2009 **Bsc Environmental Sciences and Engineering**
Swiss Federal Institute of Technology (EPFL) — Lausanne, Switzerland

- Developed strong foundation in environmental science, chemistry, physics, and mathematics
- Studied core environmental engineering topics including water management and treatment, air pollution control, waste management, remote sensing and environmental monitoring
- Gained practical skills in environmental sampling, data analysis, GIS mapping, remote sensing, database management, programming and mathematical modeling
- Participated in field studies and laboratory work, enhancing hands-on experience
- Engaged in interdisciplinary projects addressing real-world environmental challenges

Extracurricular activities

2016 **Chief Financial Officer**
2015 **Internal catering manager**
2014 **Electricity- and water-supply manager**
Balélec Music Festival

- Organisation of the Balélec Music Festival (15'000 People, 1 evening, 5 stages) on EPFL campus
- Chief Financial Officer: Managed overall budget, financial planning, and accounting, ensuring fiscal responsibility and profitability
- Internal Catering Manager: Provided food and beverage services for staff and performers, cooking for up to 450 people per meal wit a team of students
- Electricity and Water Supply Manager: In collaboration with campus staff, planned and implemented power and water distribution systems across the festival grounds, ensuring uninterrupted services for all event areas

2015 **Class Representative**
2013 Swiss Federal Institute of Technology (EPFL)

- Class representative at EPFL, defending the interests of the students in discussion with the school
- Served as liaison between students and faculty, effectively communicating class concerns and feedback to improve the academic experience

2014 **Founder and Vice-President**
2012 Environmental Sciences and Engineering Student Organisation (TREE)

- Goal: favor interactions between students in environmental engineering
- Organized academic and social events, fostering a collaborative learning environment and enhancing student engagement

Publications

Underscore: denotes equal contributions, *: denotes direct student supervision

In Prep. Urban Flood Observations (UFO): A global high-resolution hand-labeled training and validation dataset
Mukherjee R., Friedrich H. K., Tellman B., Islam A., Zhang Z., Lall U., Lakshmi V., **Giezendanner J.**

In Prep. Sensitivity to Data Choice for Index-Based Flood Insurance
Saunders A.*, Tellman B., **Giezendanner J.***

In Prep. VIIRS Provides Continuity from MODIS for Deep Learning Enabled Satellite Inundation Mapping
Saunders A.*, Tellman B., **Giezendanner J.***

In Prep. MODIS is dead, long live VIIRS: Global inundation maps for the future
Saunders A.*, Tellman B., **Giezendanner J.***

In Prep. Impact Evaluations in Data Poor Settings: The Case of Stress-Tolerant Rice Varieties in Bangladesh
Al Rafi, D. A., **Giezendanner J.**, Josephson A., Michler J. D., Pede V. O., Tellman B.

Under Review FloodPlanet: A Dataset to Assess Deep Learning Models Trained on Public versus Commercial Data for Inundation Detection
Zhang Z., **Giezendanner J.**, Mukherjee R., Melancon A., Gurung I., Lall U., Barnard K., Molthan A., Tellman B.

Accepted A globally sampled high-resolution hand-labeled validation dataset for evaluating surface water extent maps
Mukherjee R., Policelli F., Wang R., Tellman B., Sharma P., Zhang Z., **Giezendanner J.**

2023 A Comparison of Remote Sensing Approaches to Assess the Devastating May - June 2022 Flooding in Sylhet, Bangladesh
Saunders A.*, **Giezendanner J.***, Tellman B., Islam A., Bhuyan A., Islam A.K.M. S.
2023 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)

2023 Inferring the past: a combined CNN-LSTM deep learning framework to fuse satellites for historical inundation mapping
Giezendanner J., Mukherjee R., Purri M., Thomas M., Mauerman M., Islam A.K.M. S., Tellman B.
Computer Vision and Pattern Recognition Conference (CVPR), EARTHVISION

2021 A note on the role of seasonal expansions and contractions of the flowing fluvial network on metapopulation persistence
Giezendanner J., Benettin P., Durighetto N., Botter G., Rinaldo A.
Water Resources Research

2020 Earth and field observations underpin metapopulation dynamics in complex landscapes: Near-term study on carabids
Giezendanner J., Pasetto D., Perez-Saez J., Cerrato C., Viterbi R., Terzago S., Palazzi E., Rinaldo A.
Proceedings of the National Academy of Sciences

2020 Beyond the patch: on landscape-explicit metapopulation dynamics
Giezendanner J.
PhD Thesis

2019 On the probabilistic nature of the species-area relation
Zaoli S., Giometto A., **Giezendanner J.**, Maritan A., Rinaldo A.
Journal of Theoretical Biology

2019 A minimalist model of extinction and range dynamics of virtual mountain species driven by warming temperatures
Giezendanner J., Bertuzzo E., Pasetto D., Guisan A., Rinaldo A.
PLoS One

2016 Towards 3-D distributed odor source localization: an extended graph-based formation control algorithm for plume tracking

Soares J. M., Marjovi A., **Giezendanner J.**, Kodiyan A., Aguiar A. P., Pascoal A. M., Martinoli A.

IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

2016 Automatic quality assessment of short and long-TE brain tumour MRSI data using novel Spectral Features

de Barros N. P., McKinley R., **Giezendanner J.**, Knecht U., Wiest R., Slotboom J.

Proc. Intl. Soc. Mag. Reson. Med

2015 Rainfall Forecasting in Burkina Faso Using Bayesian-Wavelet Neural Networks

Giezendanner J.

Proc. Intl. Soc. Mag. Reson. Med